

TOWARDS SUSTAINABLE CO-MANAGEMENT OF MEKONG RIVER INLAND AQUATIC RESOURCES, INCLUDING FISHERIES, IN SOUTHERN LAO PDR

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ABSTRACT

Natural resource "co-management" is the cooperative and participatory process of regulatory decisionmaking among representatives of user-groups, government agencies and researchers. Between 1993 and 1998, 63 villages in Khong District, Champasak Province, southern Lao PDR, established co-management regulations to sustainably manage and conserve inland aquatic resources, including fisheries, in the Mekong River, streams, backwater wetlands, and rice paddy fields. Local government has endorsed these regulations, but villages have been given the mandate to choose what regulations to adopt based on local conditions and community consensus. Communities are also empowered to alter regulations in response to changing circumstances.

Villagers have widely reported increased fish catches since the adoption of aquatic resource co-management regulations. Improved solidarity and coordination within and between rural fishing and farming villages has also been observed. This paper presents historical information regarding the development of the aquatic resource co-management system in Khong District. While many of the lessons learned from the co-management experience in Khong are applicable to other parts of Laos and the region, unique conditions in different areas will require inventive approaches to meet local needs. Common property regimes can break down in crisis, but experience in Khong indicates that they can also be strengthened in response to resource management crisis.

Introduction

Natural resource "co-management" can be defined as, "the collaborative and participatory process of regulatory decision making among representatives of user-groups, government agencies and research institutes." (Jentoft et al. 1998). In terms of fisheries, co-management has been heralded as a tool for doing away with the distant, impersonal and insensitive bureaucratic approaches to management, which have dominated aquatic resource management systems in recent history. Co-management supports the decentralization of management responsibilities to resource- user groups, providing them with a certain level of autonomy within an overall institutional and government accepted framework. It provides opportunities for developing cooperative and interactive governance through the direct participation of users in decision-making processes involving natural resources, or through user representation at levels that transcend community boundaries (Jentoft et al. 1998).

Most of the aquatic resource co-management programs cited in the literature relate to coastal salt or brackish water environments (Kuperan and Abdullah 1994; Davis and Bailey 1996; Symes 1996; Pomeroy 1998; Finlay 1998). Institutionalized co-management programs for inland fisheries are apparently much rarer, and when they do exist, they often relate to natural and human-made lacustrine habitats rather than free-flowing streams and rivers (Petr 1985; Ali 1996; Donda 1998). The community-based aquatic resource co-management program in Khong District, Champasak Province, southern Lao People's Democratic Republic (Lao PDR or Laos) addresses issues related to natural inland riverine water bodies and associated wetlands. Aquatic resources managed in

Khong are largely sourced from the mainstream Mekong River and its immediate tributaries (Baird 1994b; Baird 1996; Baird et al. 1998a).

Between December 1993 and August 1998 a total of 63 villages in Khong District established sets of regulations to conserve and sustainably manage aquatic resources in the mainstream Mekong River, swamps, streams, and paddy fields. Wild-capture fisheries management has been the main focus. Like many other countries in the world, Laos is beginning to embrace the concept of natural resource co-management (Baird 1994b; Baird 1996; Noraseng 1998; Phanvilay 1998; Baird et al. 1998b).

This paper provides an overview of the aquatic resource co-management system in Khong District, its evolution, and the reasons for its apparent success. The paper presents lessons regarding aquatic resource co-management and considers how applicable they are for other parts of Laos and Southeast Asia.

Introduction to the Study Area

Siphandone Wetlands and Khong District

Khong is the southern-most district in Champasak Province, Lao PDR, bordering Cambodia to the south (Figure 1) Khong District is well known in Laos, as it covers most of the area commonly known as Siphandone, or the "four thousand islands." In this stretch of the Mekong River the waterway widens and diverges into a complex hydrological system of perennial and seasonal islands, channels and forested wetlands.

The People of Khong District

Eighty-four of the 136 villages in Khong are situated on islands in the middle of the mainstream Mekong River. Most of the remaining 52 communities are located along the west bank of the Mekong River. On 1 March 1995 Khong had a human population of 11 359 families, comprising 65 212 people (Baird et al. 1998a). The overwhelming majority of the population practice subsistence or semi-subsistence paddy rice agriculture as their primary occupation.

The vast majority of the people in Khong are from the lowland Lao ethnic group (referred to as the "Lao" from this point onwards). They have inhabited the area for hundreds of years (Baird et al. 1998a). Virtually all the inhabitants of Khong are Buddhists. However, animism has a great influence over the everyday lives of most lowland Lao villagers in Khong. Locals still follow many ancient rituals and customs designed to appease ghosts or spirits (*phi*).

People in Khong District have traditionally relied heavily on the aquatic wealth of the Mekong River and her tributaries to supply them with food, and fish has long been the most important source of animal protein in the diet of Khong residents (Baird et al. 1998b). Approximately 94% of the families in Khong participated in wild-capture fisheries for food in 1996, and 56% generated income from selling wild-caught fish. Approximately 78% of the animal protein consumed annually consist of fish products. The average annual catch for a family is about 355 kg, of which 249 kg is consumed (Baird et al. 1998a). Families generate a mean annual income from selling fish of the equivalent of US\$100 per year. Thus, fishing is not only the main source of animal protein in Khong, but is also the largest source of cash income (Baird et al. 1998a). However, most Lao people, including those in Khong, consider their main occupation to be farming, not fishing (Fraser 1974; Baird et al. 1998a). Although adult males are the main fishers in Lao society, children commonly participate in wild-capture fisheries from an early age. Women are generally responsible for fish processing, but also participate directly in certain fisheries (Fraser 1974; Baird et al. 1998a).

Khong is a rural district. There is no electricity or central water supply system in any of its villages. Most people drink boiled or unboiled water from the Mekong River. There is no sewage system, and very few families have toilets. Agriculture is a largely non-mechanized activity involving the whole family. Many native varieties of rice are grown, and until recently chemical fertilizers and pesticides were rarely applied to

crops. Most people live in traditional wood and bamboo houses with either corrugated iron or thatch *imperata* grass roofing.

Aquatic Resources Biodiversity in Khong District

The mainstream Mekong River runs approximately 4 200 km from its origin in Tibet; it is the 12th longest river in the world, and is the sixth largest in terms of total annual discharge. It passes through southern China, a small part of Burma, Laos, Thailand, Cambodia and finally southern Vietnam before converging with the South China Sea (Pantalu 1986a). The Mekong River basin supports one of the most diverse fish faunas in the world, and probably in Asia. About 1 200 species of fish occur in Mekong River basin, including brackish water areas, although many have not yet been taxonomically described (Rainboth 1996; van Zalinge et al. 1998).

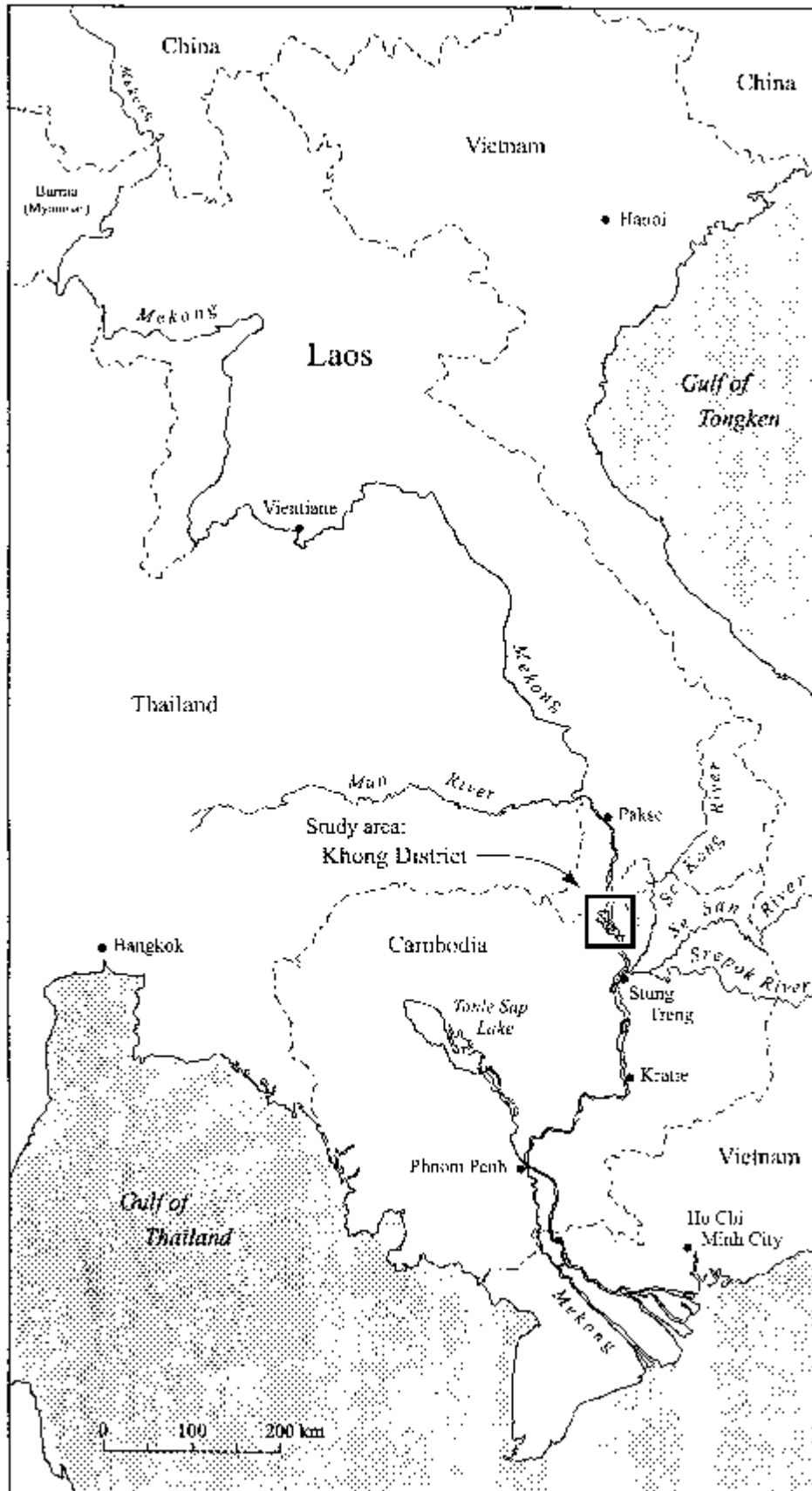


Fig. 1. Lower Mekong Basin

As of March 1999, 192 fish species had been identified from Khong District (Baird 1998a). Many species seasonally migrate long distances up the Mekong River from as far away as the Great Lake in Cambodia and the South China Sea in Vietnam (Lieng et al. 1995; Roberts and Baird 1995; Baird 1998a; van Zalinge et al. 1998). Other species are relatively sedentary (Baird 1998a).

Aquatic Resources Management and Resource Tenure in Khong District

Traditional Management

Up until the 1950s and early 1960s fisheries practices in Khong were largely traditional. Fishing was conducted almost entirely for subsistence purposes, with the exception of a small amount of barter trade for certain high quality preserved fish like *som pa eun* and *pa chao* (see Baird 1994a; Baird et al. 1998a). The human population of Khong was significantly lower than it is now, and virtually all types of fishing gears were smallscale and made of local materials. As a result, fish and other aquatic animals were extremely abundant.

The inland fisheries of Khong District have long been identified and managed as commons resources. The people of Khong have traditionally recognized access to fisheries and other aquatic resources as a fundamental right, but it would be a mistake to characterize the fisheries as entirely open access. Most of the limits on fishing and other aquatic resource harvesting activities historically imposed by people in Khong were related to reducing personal or societal risk from dangerous spirits (*phi*) or creatures like crocodiles (*khe*), large sting-rays (*pa fa lai*) or even serpents (*gneuak*). For example, certain deep-water parts of the Mekong River were traditionally off limits for fishing due to the fear of danger from mysterious creatures and other unknown entities. There was no need for villagers to fish those areas, since it was easy to catch fish in shallow water close to shore. Only in certain cases (e.g., with the management of large wood-fixed Mekong River wing and basket-filter traps (*li* and *tone*) in the Khone Falls area in southern Khong District (see Roberts and Baird 1995 for details) have complex individual and family tenure systems been developed to help divide up limited number of good trap setting sites (Roberts and Baird 1995).

Changes in Management

Over the last few decades there have been many changes in aquatic resource management patterns in Khong District, and Laos as a whole. The human population of Khong has increased rapidly. Lines and nets made of nylon, including mono- and multifilament gill nets, have become extremely common. In fact, gill nets are now the most important type of fishing gear in Khong. Baird et al. (1998a) found that approximately 71% of the families in Khong owned at least one nylon gill net in 1996. Nylon cast nets were also owned by 67% of families (Baird et al. 1998a). Nets made of natural fibers are no longer in use anywhere in Khong.

In recent years there have also been significant changes in Khong with regards to fish marketing and consumption patterns. Whereas fish had a low economic value in the past, they now fetch relatively high prices (see Baird 1994a). In the not so distant past, villagers caught fish almost exclusively to feed their families, but economic considerations now have a much greater influence over fish harvesting and management practices. Villagers have also begun to desire more cash to buy consumer goods, which have become more visible due to the expansion of market activities.

The rapid increase in the use of motorized boats over the last decade has significantly increased the mobility of both fishers and fish traders, and has resulted in the increased need to generate cash income in order to cover engine, fuel and maintenance costs. Transportation links between Khong and the commercial center of Pakse have also changed. Whereas it was extremely difficult to transport fish to market in the recent past, it is now relatively easy to move fish to buyers via passenger buses that run between Pakse and Khong on a daily basis. Finally, widespread access to block ice for storing fresh fish has greatly influenced fish marketing dynamics. Until about a decade ago, ice was virtually nonexistent in Khong, but now most fish traders now have coolers, which makes it possible for them to buy fresh fish and transport them on ice to markets in Pakse and even Thailand (Baird 1994a).

The fisheries management situation in Khong District was in great flux in the early 1990s when co-management organizing began. Human population had risen, gill net use had increased, and fish trading was up. Villagers were reporting sharp declines in fish catches. Some species had become very rare and locally extirpated. Changes were occurring rapidly, and while most villagers were becoming aware of the over-harvesting problems facing their fisheries, only limited action had been taken to reverse the perceived downward trend in aquatic animal population.

The Aquatic Resource Co-management Program in Khong District

The Lao Community Fisheries and Dolphin Protection Project (LCFDPP) was established as a small, NGO-supported, government project in Khong District in January 1993. Between December 1993 and June 1997 a total of 59 villages requested and received assistance in devising their own unique sets of co-management regulations (Baird et al. 1998a).

In July 1997 the Environment Protection and Community Development in Siphandone Wetland Project (EPCDSWP) took over the responsibilities of the LCFDPP. Between July 1997 and August 1998 an additional four villages established co-management plans and associated regulations, bringing the total to 63 villages with functioning co-management systems for stewarding natural aquatic resources.

The Development of the Aquatic Resource Co-management System in Khong District

Unlike conventional science-based approaches to fisheries management, one of the hallmarks of co-management systems is that they recognize that fisheries management is as much a people-management problem as a biological or economic one (Clay and McGoodwin 1995).

Over the last six-and-a-half years the aquatic resource co-management program in Khong has grown and evolved. After almost a year of initial research into aquatic resource management issues in the southern part of Khong District, the first district government recognized village aquatic resource co-management plan was created in Khong for Ban Hang Khone village. Before long, the LCFDPP was receiving requests from numerous village leaders in Khong who were interested in establishing their own village-based aquatic resource co-management systems. The motivation of villagers was mainly based on the recognition that fisheries resources were in decline and that something needed to be done to stabilize and eventually reverse the trend.

In 1994 the LCFDPP cooperated with Agriculture and Forestry Office (AFO) of Khong District and the Agriculture and Forestry Division (AFD) of Champasak Province to determine how to respond to the great interest shown by villagers in co-management. A process for extending the work of the project was agreed upon.

The Aquatic Resource Co-management System Establishment Process in Khong District

Initiating the process. The system for working with villages to establish co-management plans is based on the principle that villages should not be forced or pressured into establishing aquatic resource co-management regulations. Instead, villages should only be assisted in establishing co-management strategies after they have requested assistance in doing so.

The process for establishing aquatic resource co-management systems in villages always begins with the village and its leaders. Communities generally learn about opportunities for establishing co-management systems from neighboring villages, friends and relatives, or from government officials who visit their communities. If community leaders are interested in establishing an aquatic resource co-management plan, they are required to write a short letter to the Khong District AFO in order to request permission to do so.

Preparing for the establishment of aquatic resource co-management regulations. Once requests have been received by the district, the AFO compiles them and prepares a letter to the AFD of Champasak Province

in order to request official permission for the aquatic resource co-management process to proceed. The district chief and the AFD authorize the letter. Up until 1996 Champasak Province required that the provincial governor also authorize documents related to fisheries co-management, but the government has since decided that it is no longer necessary. This indicates that they have become more comfortable with the process.

During the period in which government permission is being sought, extension workers from the LCFDPP or the EPCDSWP make contact with the village leadership. It is important that communities are provided with advice regarding the process for establishing co-management systems early on. An early start helps ensure that villagers have adequate time to make preparations. Information needs to be collected regarding what village leaders expect to achieve by establishing aquatic resource co-management regulations. Extension workers also need to determine what steps have already been taken at the community level. It is preferable if the whole community is asked to decide on whether co-management regulations should be established prior to a village request for assistance being submitted. However, village headmen sometimes make the decision before the whole community has been consulted.

One role of the extension workers is to encourage community leaders who have not consulted with their constituents to do so promptly. Another role is to explain to village leaders what kinds of regulations have previously been established in other villages in Khong, and how the implementation and enforcement of those regulations has developed. The leaders are advised to meet with fellow villagers to draft a list of co-management regulations that the community favors. Advance discussions are important, because villagers feel more comfortable if regulations are discussed and debated within the community before any outsiders become involved. Villagers also need ample time to carefully consider the implications of establishing particular regulations. Co-management is not as much about the regulations established as it is about the communicative and collaborative process through which regulations are formed (Jentoft et al. 1998).

Village aquatic resource co-management workshops. Usually about a month or more is allowed after the extension workers visit a village before a formal aquatic resource co-management workshop is organized in a community. These one-day workshops represent the most important official step in establishing government recognized co-management regulations.

All the adult members of the community are requested by the headman and his assistants to attend formal aquatic resource co-management workshops. However, it is usually not possible for everyone to attend, and it is standard practice for one or two members of each family to participate. Apart from villagers, staff of the LCFDPP or the EPCDSWP and officials from the AFO of Khong District also attend. The district chief or his designated representative and AFD provincial officials sometimes attend. It is also extremely important that village leaders formally invite the village headmen from neighboring communities to participate, because the success of a village's co-management plan is often predicated on how well the community is able to coordinate and communicate with its neighbors.

Workers from the LCFDPP or the EPCDSWP and AFO officials generally arrive at villages organizing co-management workshops the day before they are scheduled to take place. Because community leaders have never organized co-management workshops, they generally appreciate advice and it takes a number of hours to make all the necessary arrangements.

Since villages initiate the co-management process, the government of Khong feels strongly that communities should also control workshop proceedings. Government and project guests are required to act mainly as observers and facilitators and not as active participants. Officials are concerned that problems could arise if villages become overly dependent on government support, leading to a lack of village initiative. They want villagers to own the process.

Village headmen chair co-management workshops. A village headman generally opens the proceedings by explaining the main objectives of the workshop. The village headman then explains how the workshop will be organized. AFO officials and LCFDPP or EPCDSWP workers make short presentations regarding the reasoning

behind establishing co-management regulations for aquatic resource, and the experiences of other villages in Khong.

The village headman then presents the draft of the co-management regulations developed by the community prior to the workshop. After presenting the draft to the workshop, the community is divided up into two separate gender groups for open and informal discussions regarding the draft regulations. Apart from considering what regulations to endorse, the groups are also required to consider what level of punishment should be mandated for those who break the regulations. Villagers are free to make recommendations regarding management strategies, but they are not allowed to advocate regulations that either conflict with already-established national laws, result in increased degradation to natural resources, or cause serious conflicts between or within communities. The Khong AFO acts as watchdog to ensure such problems do not arise.

There is no definite time limit for how long villagers have to discuss the proposed regulations, but discussions generally last between one and two hours, depending on how much preparation has been conducted prior to the workshop, and the level of internal controversy regarding the management strategies being considered. The discussions, which are not attended by government officials (the officials sit away from the groups until they are ready to present the results of their discussions) or other guests of the workshop, are generally spirited and lively, and broad villager participation is the norm.

Most villagers in Khong possess a great deal of knowledge regarding aquatic natural resources. This high level of traditional ecological knowledge (TEK) makes it possible for villager discussions to deal with quite detailed and specific aspects of management. It is also difficult for individual villagers to mislead others regarding certain aspects of management because most villagers know enough to easily recognize when somebody is not being truthful. Pomeroy and Carlos (1997) have also pointed out that community members can play an important role in supporting the co-management process due to their indigenous knowledge of local conditions.

When group discussions have ended, the men and women rejoin government officials and other guests in the main meeting area, which is generally the village school or the main hall of the village Buddhist temple. Representatives of each of the two discussion groups present their respective conclusions, including recommendations regarding management regulations proposed by the village, and additional regulations which were not considered in the original draft of the management plan. Men generally concentrate their regulation-making efforts on considering management issues related to large bodies of water and large and valuable fish species. Women tend to focus their attentions on issues related to small water bodies and aquatic life in streams, ponds and rice paddy fields. This gender-related divergence of special interest generally helps balance and broaden the final content of management plans.

After the group presentations, all the participants debate which regulations to adopt. If the recommendations of the women differ from those of the men, or if one or both groups have ideas that conflict with those of the original proposal, discussions continue until consensus is reached. While Lao villages are not without conflict, they are typically governed by consensus (Ireson 1995). If disagreements cannot be resolved, the AFO representative generally recommends that the issue be deferred until later, so as to allow time for resolving any differences that remain. Interestingly, nobody has ever suggested that a vote be taken to determine whether a regulation should be adopted. This is probably because villagers do not want to cause rifts within the community by emphasizing differences. Consensus, on the other hand, helps maintain village solidarity.

Government officials and LCFDPP or EPCDSWP representatives sometimes comment on various aspects of particular regulations during the final workshop discussions. They may also provide examples of how other villages have approached management issues. This input helps broaden the perspective of villagers. However, outside guests are generally mindful not to impose their viewpoint on the community, or to give the appearance of interfering excessively with the process.

Once a community has agreed upon a set of regulations, the host village headman asks village headmen from neighboring villages to comment on the appropriateness of individual regulations. Although guest village chiefs rarely object to the decisions of the host community, they sometimes suggest improvements to certain regulations by providing new perspectives. They also occasionally request that certain regulations be altered or

scrapped. If a neighboring village headman is able to justify a particular position, the host village will generally try to adjust its regulations in order to maintain good relations with its neighbors, which is an important cultural norm. However, if a request from a neighboring village headman is considered unreasonable, or is not based on socially-accepted TEK, villagers from the host community generally have no qualms about refuting the idea. The AFO sometimes acts as mediator.

When a final set of regulations has been agreed upon and recorded by villagers, the regulations are read back to all the participants one last time to ensure that documented information is representative of the decisions made by the workshop participants. Any errors in recording particular regulations are corrected as they are read out.

Before the village headman closes the workshop, the district chief generally states that the district endorses the decisions of the community, and supports all village initiatives to improve the management of aquatic resources for the ultimate benefit of local people and the nation. Government support for community-based management is important to villagers, and is certainly a major factor in successful co-management (Jentoft et al. 1998). Support from government both makes it clear to villagers that they are authorized to manage resources, and also helps reduce villager conflict because government support can be cited to justify villager actions and make it clear to other villagers that such actions are not based on personal conflicts or revenge.

Once all members of the village administration and the district have signed the aquatic resource management plan document, it is officially recognized as "village law" (see next section). Four copies of each plan are made. One copy remains with the village, one is filed by the AFO of Khong, one is given to the AFD of Champasak Province, and the LCFDPP or the EPCDSWP keeps one.

Because formalized aquatic resource co-management planning is unfamiliar to villagers who establish new plans, it is generally necessary for villagers to adjust regulations after having tried them out. Changing and adapting regulations is an acceptable and important part of adaptive management (Walters 1986; Jentoft et al. 1998), and it is important that villages develop the capacity to make well-reasoned changes. Lessons are invariably learned as time passes, and experiences generally indicate whether regulations should be softened or hardened. Village headmen have the right to change regulations, but they are supposed to organize village meetings to get prior approval from the community before alterations are actually made. Village headmen are also supposed to notify the AFO of Khong when changes are made. Experience indicates that while village headmen almost always seek a mandate from their fellow villagers before instituting changes, they rarely inform the AFO. However, they apparently have no intent to keep the changes from the district, and when officials visit, village leaders generally have no apprehensions about informing officials about regulation changes.

Ireson (1995) claims that in general, lowland Lao regulations related to natural resources are directed toward claiming a geographically-defined portion of the resource for exclusive use by one's own village, while not limiting the extraction rates of village households. Although villagers in Khong sometimes want to claim resources for their own community's exclusive use, the AFO of Khong has shown considerable wisdom by ensuring that villages do not establish regulations that only discriminate against other villages. Khong District has a policy that villages are not allowed to restrict outsider-fishing activities unless they are willing to enforce the same restrictions on themselves. However, if a village bans a fishing method in their area of jurisdiction, outsiders are expected to abide by the ban in the same way as local fishers. The "non-discriminatory regulation" policy of the district helps to maintain good relationships between villages. It also helps the co-management program retain a good reputation amongst villagers. Outsiders are much more willing to abide by the regulations of host villages when they realize that local villagers are abiding by the same regulations. In contrast, Isaac and Ruffino (1998) reported that conflict between fishers in the Amazon has increased as a result of problems related to communities of fishers dividing up the rights to use resources amongst themselves and excluding disadvantaged outsiders.

Village Law in the Lao Context

It is important to understand the legal context in which the aquatic resource co-management system in Khong District has been incorporated. From the beginnings of the program, it was recognized that co-management had more chance of succeeding and being sustainable if it was incorporated into the existing Lao village

administrative structure. No attempts were made to establish new levels of bureaucracy at the village level, although certain villages have established their own informal or ad hoc working groups to deal with particular issues. Regulation implementation and enforcement is left up to the community.

From a legal perspective, Khong District administrators consider that the aquatic resource co-management regulations of villages fit well into what is known as "village law," or *kot labiap ban* in Lao. The legal system of Lao PDR allows villages to make certain regulations regarding local issues, provided that they do not conflict with national laws or the constitution. However, in the past village regulations have rarely been utilized to deal with natural resource management issues. Instead, "village law" has generally been used for designating regulations related to security issues, or the tying up or releasing of water buffaloes. However, Khong District officials believe that the system accommodates the aquatic resource co-management system well. There is undoubtedly a great deal of yet unrealized potential for utilizing "village law" for dealing with other village-related natural resource management issues in Laos.

A fundamental issue with regards to any aquatic resource co-management program relates to boundaries of management jurisdiction between villages (Seixas and Begossi 1998). Surprisingly, over the last five years there have been no major conflicts between villages with regards to village boundaries as they relate to aquatic resources. In fact, villagers appear to have a clear sense of aquatic resource territoriality. Territories are known to help manage conflict and conserve resources (Seixas and Begossi 1998), and the ease in which the concept of human territoriality is grasped by the Lao indicates that past management has not been simply open access.

Community Structure

In Laos, social organization must be understood first and foremost from the village level. Village structure has long been the foundation of ethnic lowland Lao society. Villages in Laos, perhaps more than any other region in Southeast Asia, can be characterized as self-sustaining communities relatively unconnected with larger political and social units (Ireson 1996). Lowland Lao rural communities have very limited social and economic stratification (Ireson 1995). In other words, the sense of social equality and unity between villagers is generally strong. Moreover, shared understandings and the social expectations of neighbors circumscribe the actions and decisions of villagers. High levels of cooperation and mutual dependence between villagers are characteristic of rural communities (Ireson 1996). The historical remoteness of villages in rural Laos, and the lack of strong central control throughout history, are probably the main reasons why village structure continues to be such an important factor in Laos.

Although conditions are relatively constant within single communities, disparities in wealth and power within villages are growing. These shifts in economic circumstances are greatly influencing the structure of Lao society. Nevertheless, even now concepts related to village identity and solidarity are strongly adhered to by villagers (Ireson 1996). McCay and Jentoft (1996) have pointed out that one of the keys to successful fisheries co-management programs is the ability for villagers to speak with one voice. This condition is generally met in Khong where locals strongly identify themselves as belonging to particular villages, or, when villages are separated geographically, people sometimes associate themselves with certain parts of the village. Villagers generally identify with elected or "natural" leaders in their communities whom they rely on to represent them when dealing with outsiders.

Olomola (1998) has stressed the importance of the cohesiveness of social, kinship, linguistic and cultural interconnections in determining the success of fisheries co-management programs. Ireson (1996) has pointed out that the social norm of taking care of each other can be significantly jeopardized by factionalism and conflict among cliques in villages. These points help explain why villagers in Laos tend to avoid excessive conflict.

The studies in Khong District concur with Ireson (1996) in his assertion that there are three interlocked and mutually reinforcing elements required to maintain Lao village cooperation and solidarity. They are, (1) a village ideology of mutuality, (2) successful events of cooperation, and (3) shallow socioeconomic stratification.

Aquatic Resource Co-management Plans

The Co-management Regulations in Detail

Between December 1993 and August 1998, 63 villages in Khong District established regulations designed to conserve and sustainably manage aquatic resources. The main regulations adopted by villagers in Khong are outlined below. Tables 1 and 2 summarize regulations established by villages in Khong. See Claridge et al. (1997) for detailed descriptions and illustrations of Lao fishing gears.

Table 1. List of community aquatic resource management regulations established by Khong District (Key for table 2)

1. Fish Conservation Zones - all year (✓✓/✓VV means two/three FCZs / -✓ means that part of the local river pool is being conserved)
2. Fish Conservation Zones - part of the year
3. Ban on stream blocking when fish are migrating up at the beginning of the rainy season
4. Ban on using lights at night to catch frogs in spawning season
5. Ban on chasing fish into nets
6. Ban on destroying flooded forests and forests at the edges of the river
7. Ban on using frog hooks and traps
8. Ban on catching juvenile rice-field fish and tadpoles
9. Ban on outsiders from sleeping on uninhabited islands at night
10. Ban on over-fishing by outsiders
11. Ban on fishing with lights at night
12. Ban on cast-netting in certain ponds and rice fields
13. Ban on bamboo shoot collection for sale
14. Ban on frog and fish catching in other people's rice fields unless owner gives permission
15. Ban on forest burning and indiscriminate tree cutting
16. Ban on stream blocking when fish are migrating out of them at the end of the rainy season
17. Ban on draining canals to catch fish
18. Ban on digging pits to catch small frogs
19. Ban on putting small frogs on hooks
20. Dates when aquatic resource management regulations were established (second date refers to revision of the regulations)

Table 2. Village-level aquatic resources management regulations developed in Khong District

| Community aquatic resources management regulations | | | | | | | | | | | | | | | | | | | | |
|--|-----|----|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|-----------------|
| Village | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Hang Khone | | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | | | | | | Dec 93 Dec 94 |
| Hang Sadam | ✓ | | | | ✓ | ✓ | | | | ✓ | | | | | | | | | | Dec 93 Dec 94 |
| Houa Sadam | ✓✓ | | | | | ✓ | | | | | | | | | | | | | | Dec 94 |
| Khone Tai | | ✓✓ | | | ✓ | ✓ | | | | | | | | | | | | | | May 94 |
| Khone Neua | | | | | ✓ | ✓ | | | | | | | | | | | | | | May 94 |
| Don Sahong | | | | | ✓ | ✓ | | | | | | | | | | | | | | May 94 |
| Don Som | ✓✓✓ | | | | ✓ | ✓ | | | | | ✓ | | | | | | | | | May 94 |
| Don En | | -✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | | May 94 |
| Don Det Oke | | -✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | | | | | | Dec 94 |
| Don Det Tok | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | | | Dec 94 |
| Deua Neua | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | | | July 95 |
| Deua Tai | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | | | | | | | | July 95 |
| Hang Xang Phai | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | | Oct 95 |
| Don Khamao Noi | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | | Oct 95 |
| Oupaxa | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | | | | | | | | Nov. 95 |
| Tha Pho Neua | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | | | | | | | | Nov. 95 |
| Houa Sen | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | Feb. 95 |
| Sen Neua | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | Feb. 95 |
| Nok Kok | ✓✓✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | | | | July 95 |
| Veun Khao | ✓✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | | | | | | July 95 |
| Nakasang | -✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | May 95 |
| Phon Pho | -✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | May 95 |
| Hat Khi Khouay | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | | | | | July 95 |
| Veun Kham | ✓✓✓ | | | | | | | | ✓ | ✓ | ✓ | | | | | | | | | Dec 93 Dec 94 |
| Don Xang | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | Dec 94 |
| Don Tholathi | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | | | Dec 94 |
| Veun Som | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | | | Feb. 95 |
| Som Tavan Tok | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | Feb. 95 |
| Hang Som | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | May 95 |
| Som Tavan Oke | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | May 95 |
| Tha Kham | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | Feb. 95 |
| Tha Mak Hep | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | | | July 95 |
| Tha Phao | -✓ | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | | | | | | | | Feb. 95 |
| Tha Pho Tai | -✓ | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | | | | | | | | Feb. 95 |
| Keng Koum | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | | | | | | | | May 95 |
| Don Nang Khout | ✓✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | Feb. 95 Feb. 96 |
| Nakhone | ✓✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | Feb. 95 |
| Khone Noi | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | Feb. 95 |
| Chok | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | | | Feb. 95 |

Table 2. Village-level aquatic resources management regulations developed in Khong District (cont.)

| Community aquatic resources management regulations | | | | | | | | | | | | | | | | | | | | |
|--|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----------|
| Villages | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Phon Than | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | | | | | | | | | Oct 95 |
| Houa Lopakdi | ✓ | | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | | | | | | | | | Oct 95 |
| Phiman Phon | ✓ | | ✓ | ✓ | ✓ | | | | | | ✓ | | | | | | | | | May 95 |
| Sala | | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | | | | | | | | May 95 |
| Mouang | | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | | | | | | | | May 95 |
| Tan Tavan Oke | ✓✓ | | ✓ | ✓ | ✓ | | | | | | ✓ | | | | | | | | | Feb. 95 |
| Tan Tavan Tok | ✓ | | ✓ | ✓ | ✓ | | | | | | ✓ | | | | | | | | | Feb. 95 |
| Sen Hom | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | | | | | | Feb. 97 |
| Xiang Vang | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | | | | ✓ | | | | | Feb. 97 |
| Don Chom | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | | | ✓ | | | | | | Feb. 97 |
| Kok Padek | ✓ | | | | | | ✓ | | | | ✓ | | | | | | ✓ | | | May 96 |
| Chan | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | | | | | | | | May 96 |
| Don Houat | ✓ | | | ✓ | ✓ | | ✓ | ✓ | | | | | | | | | | | | Feb. 96 |
| Kadan | ✓✓ | | ✓ | ✓ | ✓ | | | | | | | | | | | | | ✓ | | Feb. 96 |
| Khinak | -✓ | | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | | | | | | | | | Feb. 96 |
| Kong Keng | -✓ | | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | | | | | | | | | Feb. 96 |
| Phonsavanh | -✓ | | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | | | | | | | | | Feb. 96 |
| Photak | ✓ | | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | | ✓ | ✓ | | | | | | May 96 |
| Lopakdi Kang | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | | | | | | | | ✓ | May 96 |
| Don Peuay | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | | | | | | Feb. 96 |
| Tha Mouang | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | | | | | | | | | August 97 |
| Hat Xai Khoun | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | ✓ | | ✓ | | | | | | August 98 |
| Veun Thong | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | | | August 98 |
| Than Tavan Oke | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | | | | August 98 |
| Frequency | 61 | 10 | 53 | 54 | 55 | 12 | 24 | 29 | 18 | 11 | 44 | 2 | 3 | 8 | 3 | 1 | 1 | 1 | 1 | |

Key for Community aquatic resource management regulations

1. Fish Conservation Zones - all year (✓✓/✓VV means two/three FCZs / -✓ means that part of the local river pool is under conservation)
2. Fish Conservation Zones - part of the year
3. Ban on stream blocking when fish are migrating up them at the beginning of the rainy season
4. Ban on using lights at night to catch frogs in spawning season
5. Ban on chasing fish into nets
6. Ban on destroying flooded forests and forests at the edges of the river
7. Ban on using frog hooks and traps
8. Ban on catching juvenile rice-field fish and tadpoles
9. Ban on outsiders from sleeping on uninhabited islands at night
10. Ban on overfishing by outsiders

Fish conservation zones. The establishment of Fish Conservation Zones (FCZs) in parts of the mainstream Mekong River has been the most significant co-management initiative as far as villagers and local government officials in Khong are concerned. FCZs are basically year-round or part-year "no-fishing zones."

Between December 1993 and August 1998, 60 villages established a total of 68 FCZs. All are in operation today. Single villages established some, while others were the result of joint cooperation between two or three communities. The largest FCZ is 18 ha, the smallest is 0.25 ha, and the mean size is 3.52 ha. The deepest FCZ is approximately 50 meters in the dry season, the shallowest is about 2.5 m and the mean depth is about 19.5 m. Villagers in Khong have widely reported that the establishment of FCZs has resulted in increases in the stocks of over 50 fish species. Fish catches have also reportedly increased. However, the fish species that benefit from independent FCZs differ depending on the type of riverine habitat protected within an FCZ. It is also possible that series of FCZs provide accumulated and synergistic benefits for certain migratory fish species (Baird et al. 1998b).

Villager logic for establishing FCZs is based on TEK, which is accumulated through generations of fishing experience and the personal observations of fishers. Fishers believe that large numbers of individual fish species, and especially large ones, congregate in deep parts of the Mekong River at the height of the low-water season. Since the dry season is the main fishing season for most people in Khong (Baird et al. 1998b), and since water levels are reduced 30 fold and many meters in the dry season as compared to the wet season (Cunningham 1998b), it is also the time of year when many fish species are the most vulnerable to harvesting pressures. Villagers believe that by banning or significantly limiting fishing activities in key deep-water areas that serve as dry season refuges and sometimes spawning grounds for fish, the impact of fish harvesting can be reduced.

Bans on stream blocking. One of the most popular regulations adopted by the vast majority of villages in Khong relates to the blocking of small seasonal tributaries of the Mekong River at the beginning of the rainy season (*tan houay tan hong*). Every year in June or July small streams and channels come to life with the arrival of torrential rains, and many fish species migrate up the streams and enter inundated wetlands and rice paddy fields to spawn.

Historically, the people of Khong did not obstruct fish migrating from the Mekong River into seasonally inundated areas, but in recent decades there has been an increase in the use of basket traps (*lop and say*) and other fishing gears to block streams. Because these fishing gears catch a large percentage of the fish trying to move into seasonal wetlands, a reduction in the recruitment of many fish species has been identified as a problem.

Villagers believe that if streams are not blocked at the beginning of the rainy season there will be more fish for catching at the end of rainy season when wetlands and rice fields begin to dry out and fish migrate back to the

Mekong River. They also appreciate the convenience of being able to catch more fish when working in their rice fields. Although most villagers believe that channels should not be blocked when fish are migrating upstream, they approve of the setting of traps in small streams when fish are migrating out of wetlands at the end of rainy season. This is based on observations that more fish can escape from traps when they are moving downstream, compared to when they are moving upstream. Moreover, fish are not in spawning condition when they are caught at the end of the rainy season. At the end of the rainy season villagers also believe that fish are also big enough to harvest. It is crucial to recognize that most villagers consider early wet season stream blocking not to be a traditional activity.

Bans on 'water banging' fishing. Another regulation that is commonly adopted by villages in Khong relates to the use of 2.5 cm and 2.8 cm meshed monofilament gill nets (*mong soi*) to catch small cyprinids in the dry season, including the ubiquitous species, *Henicorynchus lobatus* (*pa soi houa lem*). In recent years some villagers have begun setting small-meshed gill nets in shallow waters and using various kinds of long poles with metal end pieces (*tho lek*) to bang the water near the nets to chase fish into them.

The main reason many communities have banned the practice is that those who set small-meshed gill nets but do not bang the water are unfairly disadvantaged by the minority of people who bang the water. Villagers also believe that banging the water scares fish away from the general area, resulting in smaller catches for everyone.

Bans on spear fishing with lights. The dry season use of single- and triple-pronged spears (*lem*) and powerful battery operated lights (*mo fai*) to locate and stab fish at night in the Mekong River is another heavily criticized fishing method in Khong District. However, those who use it can catch large amounts of fish. The use of spears and lights to catch fish was introduced in Khong relatively recently, and there are various reasons why it is unpopular. To begin with, only a very small percentage of villagers use the method, and older people almost never fish in this way. Secondly, some people believe the method is too effective in catching large fish that move into shallow waters during the night. Villagers believe the problem is especially significant for species which spawn in the dry season, such as *Chitala blanci* (*pa tong kai*) and *Channa marulius* (*pa kouan*).

Probably the most important reason why villagers oppose this fishing method is that those who engage in the fishery are often responsible for stealing chickens, ducks, live fish tied under water, and fishing gears when they pass other villages at night. The desire to not have outsiders passing through their villages at night has compelled many to support the banning of this fishing method.

Villagers in Khong do not seem to have any objections to the daytime use of spears to stab fish hiding amongst submerged vegetation during the rainy season, which they consider to be a traditional activity. Moreover, subsistence-oriented rainy season night-fish stabbing with lights in rice fields is generally acceptable to villagers, providing that rice plants are not trampled on.

Juvenile fish conservation. Another popular regulation established by many villages relates to the management of snakehead fish *Channa striata* (*pa kho*). While few people catch and eat the juveniles of this species within the approximately two-week period after they are born, some use fine-meshed scoop nets (*saving*) and wedge-shaped basket scoops (*sanang*) to catch them for food. Until many villages established regulations banning this practice, juvenile fish harvesting was apparently on the rise due to declines in other fisheries. Many villagers are now well aware that the harvesting of juvenile snakeheads is wasteful because whole schools are easily caught when they are very young. However, once juvenile snakeheads have dispersed and are no longer travelling in schools, villages are allowed to catch them using hooks-and-lines (*pet pak*), cast nets (*he*) and other locally-accepted fishing gears

Frog conservation and sustainable management. Khong District has been traditionally blessed with abundant populations of amphibians, including various frog species (*Rana* spp). Up until just a few decades ago most people in Khong did not eat frogs (*kop*), or if they did, it was only on rare occasions. This differs from many

other parts of Laos where frogs have long been a staple food. Nevertheless, as fish stocks have declined and human populations have increased, more people in Khong have begun to make frogs a part of their diet. There is also increased demand for frogs in local and distant markets in Pakse and even Thailand. Frog populations have been depleted throughout many parts of mainland Southeast Asia, and some villagers who now live in Khong moved there from northeast Thailand decades ago, largely because fish and frogs populations were already depleted around their former villages.

Whereas frogs had little or no value in Khong only a decade ago, they are now bought by the kilogram, and market prices are relatively high (5 000 kip = US\$0.60 wholesale in Khong). The price of medium-sized and large fish is still higher per kilogram than for frogs, but the gap appears to be narrowing. In northeast Thailand frogs are now more expensive per kilogram than most common fish species (*pers. comm.* Iain Craig). Traders are willing to buy frogs regardless of size, which further encourages the harvesting of juveniles. Increased market prices for frogs has certainly led to higher harvesting levels. Moreover, the ability of villagers to harvest large quantities of frogs has significantly increased as a result of the introduction of new technologies, the most important being high-powered battery-charged lights (*mo fai*). Now it is possible to see frogs up to 100 m away. Only a decade or so ago resin torches and charcoal lamps limited opportunities for finding frogs at night.

Some villagers favor allowing frog harvesting for subsistence food supply, and banning the selling of frogs year round. Others advocate regulating frog harvesting and allowing the selling of frogs during certain seasons. Generally, villagers believe that the most destructive time of the year to harvest frogs is during their spawning season, which is triggered by the first big rains of the monsoon season. During the frog-spawning season, which generally lasts about a week, the amphibians are very vulnerable to capture because they leave their hiding holes and croak loudly. If they are caught before they are able to spawn, reproduction potential for the species is reduced. Therefore, harvesting is often banned during this period.

Frog harvesting is usually allowed during the middle and especially the end of the rainy season when frogs have already spawned and juveniles have had time to grow. Villagers generally favor frog catching at the end of the rainy season because it is then sometimes difficult to catch fish in the Mekong River, and it is easier for villagers to catch frogs from the ricefields after long hours harvesting rice. Frogs are also said to be tastier at the end of the rainy season.

Many villages also ban dry season night-light frog catching along the edge of the Mekong River. During this season ricefields have dried up and most frogs have retreated to the banks of the river. Villagers believe that it is easy to over-harvest frogs during the dry season. Furthermore, like night spear-fishing for fish in the Mekong, the method is sometimes linked to theft.

Many villages ban certain frog catching gears such as frog basket traps (*say kop*) and frog hooks and lines (*bet kop*), because these gears are often used to intensively catch frogs. Some villagers also complain that rice plants are commonly damaged by *bet kop*. When a frog gets caught on a hook, it sometimes twists the line around clumps of rice stems, killing or damaging the plants.

Still others regulate frog catching by area, with varying restrictions according to designated harvesting zones. For example, the village of Ban Oupaxa bans frog harvesting for selling (only subsistence catching allowed) east of highway 13, but allows commercial harvesting on the west side of the road, where there are no agriculture areas.

Many villages also have regulations regarding the harvesting of tadpoles (*houak*). As with regulations banning the harvesting of juvenile *Channa striata* snakeheads, the logic behind this is that they are very vulnerable to over exploitation. Moreover, a large number of tadpoles need to be caught to provide enough food for a meal. However, if tadpoles are allowed to grow into frogs their end weight in harvested protein is likely to increase,

even when considering natural mortality. Fortunately, most people in Khong do not eat tadpoles, finding them repulsive. In other parts of Laos people commonly consume tadpoles, they seem to be most targeted in areas where other aquatic resources are not available, or population pressure is high. Different ethnic groups also have different preferences for tadpoles.

A few villages also ban the digging of deep holes or pits used to attract amphibians at the end of the rainy season. These pits, called *khoum khiat* in Lao, are capable of concentrating large numbers of frogs (*khiat*) into confined zones when surrounding areas dry out. This makes the frogs very vulnerable to over harvesting. *Khoum khiat* are also unpopular because water buffaloes and cattle have been known to accidentally fall into them and die. They are therefore considered a menace to the community.

One village has banned the harvesting of juvenile frogs for baiting longlines (*phiak*) due to the belief that too many were being harvested for that purpose.

Apart from wanting to conserve frogs in order to have an easily accessible source of food and income in times of need, villagers commonly express their desire to have frogs in their rice fields to help regulate insect and crab populations. When there are no frogs, damage caused to crops by crabs and insect pests is believed to increase. Therefore, frog harvest zoning by villagers is often based on the particular objective of protecting frogs in rice-paddy fields.

The regulations adopted by different villages with regards to frog harvesting vary more than for any of the other aquatic resource in Khong.

Management of aquatic animal harvesting in rice-paddy fields. Some villages regulate the harvesting of fish and frogs in rice-paddy fields (*na*). This is not only done to protect the animals, but also to reduce the damage done to rice plants by people who trample them while trying to harvest aquatic animals. Many villages specify that harvesters are not allowed to enter other villagers' rice-paddy fields until they have received permission from the owners of the fields. The harvesting of frogs and fish in commons areas outside of family-owned ricefields is generally not restricted, and frog and fish harvesting in fields is not restricted after rice harvesting, unless other frog harvesting restrictions have been adopted by the village.

Fishing in other village aquatic resource management areas. Villagers are generally allowed to fish in the resource management territories of other villages. In fact, most lowland Lao people believe that fishing areas should be open to all Lao people. However, most villagers also believe that outsiders should be restricted to the scale and types of fishing activities that they are allowed to participate in when visiting other villages. It is also true that villagers living close by are seen to have more resource-use rights in the host community than those from far away. Kinship links and social status also influence how resource extraction by outsiders is viewed.

Visitors are supposed to follow the management regulations established by host villages. Visitors are also required to harvest aquatic animals in a manner that is in keeping with host village practices, and are supposed to report their arrival and departure from the host village. Some villages do not allow outsiders to sleep on islands out of view of the host village because visitors are often accused of stealing agricultural products cultivated on the islands. In those cases visitors are asked to sleep in the host village or another place agreeable to the host community. Guests are also generally not allowed to spend many days in host village areas if they are fishing for commercial purposes. It is common to allow guests to catch enough fish to fill two or three jars of fish paste (*pa dek*), which is considered to be a subsistence right of all Lao people.

Pond management regulations. Villagers in Khong have long managed the harvesting of aquatic animals in natural depressions or ponds (*nong*). Some *nong* occur in rice-paddy fields and others are found in nonagricultural commons areas. The most common traditional practice related to the management of ponds is called *pha nong*, this restricts aquatic animal harvesting in natural ponds at the beginning and middle of the

rainy season. In most cases, harvesting is restricted until near the time when the pond is going to naturally dry out, which varies depending on the pond. Each year, the village headman, a village elder, or an individual owner or guardian of a particular pond announces a day, based on animist traditions and the lunar calendar, when everybody in the village, and sometimes people from neighboring villages, are allowed to communally harvest fish from the area. *Pha nong* systems are often related to spirits and animist rituals. For example, in Ban Hat Khi Khouay, Khong District, the village elder responsible for animist ceremonies in the community manages a large natural pond.

In some cases village leaders, elders and pond owners are given a share of other people's catches as a kind of resource rent. However, individual fishers are generally allowed to take home most of their catch. Following the designated day for harvesting, everybody is allowed to fish the pond until it dries out.

Nevertheless, there is significant variation in how *pha nong* is implemented in different villages in Laos. In some cases absolutely no harvesting is allowed before the designated day. In other cases limited harvesting is allowed. For example, putting hooks-and-lines (*pet pak*) along the outer perimeter of ponds is often permitted, provided that the center of the pond is not disturbed. In some cases trap fishing and castnetting are permitted around the perimeter as well.

The practice of *pha nong* has declined in Khong over the last few decades, and many villages have discontinued the practice altogether. In many cases ponds, which were previously managed under the common property *pha nong* system, are now managed by individual families or have become open-access areas. This is unfortunate, as the practice of *pha nong* can help build village solidarity, protect fish brood stock, and allow juvenile fish a few months to grow before they are harvested.

Despite the advantages of adopting the *pha nong* system, it is interesting that only a few villages in Khong have incorporated *pha nong*-related regulations into their aquatic resource co-management plans. However, some villages, like Ban Don Chome, have designated particular ponds for year-round or seasonal protection from harvesting, without referring to the term *pha nong*. Many villagers appear to feel that the practice of *pha nong* is old-fashioned or too closely linked to animist practices to warrant reviving. It appears that the Government after 1975 discouraged the practice.

Sometimes ponds near Buddhist temples are protected by monks who encourage villagers to rescue fish from them and return them alive to the Mekong River before the ponds completely dry out at the height of the dry season. A good example of this practice exists at Ban Don Det Tavan Oke.

Despite the rich traditions of common property pond management in Khong, there is a general trend towards greater private ownership of ponds in which other villagers are never allowed to harvest aquatic animals. This is probably largely related to the trend in increased social and economic stratification, and associated changes in marketing and consumption patterns. It may also be associated with land and resource pressures.

One interesting example of how private ownership of ponds has intensified relates to villager interest in freshwater finfish aquaculture. In Ban Oupaxa one pond was actually fenced off to prevent other members of the community from using it after it had been stocked with non-indigenous fish fingerlings. The act of stocking a small water body with fish fingerlings apparently often results in strong private ownership of all aquatic resources in and around the pond. However, finfish aquaculture is still very rare in Khong.

Other restrictions with regard to fish harvesting also exist in relation to other pond uses. For example, many ponds cannot be fished during the early part of the rainy season because their "owners" have planted lotus flowers in them, and do not want anybody to disturb their crops before they are harvested. However, fishing is not restricted after the lotus seeds have been harvested.

Bans on explosives, chemical and electricity fishing. The government of Lao PDR has banned the use of explosives, chemicals and electricity for fishing since 1975. Although these methods are not used in Khong District, they are still commonly used in bordering parts of Cambodia (Casey 1993; Baird 1998a) and other parts of Laos (Baird 1997; Baird 1998b). Explosives fishing and insecticide poison fishing were also common in Laos prior to 1975 (Fraser 1974). Many Lao villagers are extremely critical of these fishing practices and believe that they have greatly contributed to declines in fish stocks. Therefore, a number of villages in Khong have reaffirmed their desire to ensure that these destructive methods are totally banned by including a clause in their management regulations reinforcing the government ban on their use.

Miscellaneous regulations. There have also been various other regulations established in individual or small groups of villages in Khong. No two villages have ever adopted the exact same set of co-management regulations. The ability for the system to adapt regulations to meet specific circumstances is one of its greatest strengths. Examples of unique regulations adopted by villages in Khong include the limiting of bamboo shoots harvesting for sale in Ban Senhom, the creation of a seasonally protected man-made pond in Ban Khinak, the limiting of the number of gill nets that can be used per family per day in Ban Tha Kham; and the banning of flooded-forest tree cutting on sand islands near Ban Don Det Tavan Tok. Many villagers have also adopted regulations designed to protect riverine forests, which they recognize as being important aquatic habitat.

Implementation of Aquatic Resource Co-management Systems

Different villages in Khong District rely on different strategies for implementing their respective aquatic resource co-management systems. Considering the relative remoteness of many communities, and a long tradition of only limited central or regional government influence over village affairs in Laos (Ireson 1996), variations between villages are not surprising. However, the overall framework under which all villages in Khong operate is basically the same. The methods used by individual villages are largely dependent on the values and personalities of village inhabitants, the ecological conditions near the village, and the views of village headmen and other community leaders. Factors related to the customary practices and the social norms of individual communities are also important. For example, some villagers are more accustomed to stricter interpretations of regulations, while others are used to a more relaxed attitude to regulation enforcement but a greater emphasis on village awareness raising. Local realities and pragmatism are important factors influencing the implementation of village aquatic resource co-management strategies.

It is generally up to the village headmen to organize regulation implementation. Most communities rely on a mixed strategy that includes enforcement of regulations and awareness raising. It appears that both factors are equally important. On the one hand, villagers are generally critical of village leaders whom they believe have not been stringent enough enforcing regulations. However, villages that enforce regulations effectively but fail to emphasize awareness raising tend to have problems maintaining systems over a long period of time. If villagers are not convinced that having regulations are beneficial, they are unlikely to abide by the regulations when enforcement becomes lax.

Yet regulation enforcement is generally only emphasized by villages at initial stages of implementation. The pattern in Khong has often been that villages hand out a few warnings and fines in the first year of regulation implementation in order to let everybody know that the village is serious about implementing the regulations. They then find that by the second year much less regulation enforcement is required. By then locals are usually familiar with the regulations, and have come to clearly understand why they have been adopted. But villagers are also effective enforcers of regulations when necessary. In Ban Kokpadek and Ban Chan, the villages' FCZ has so many fish in it that there is now a great deal of incentive for people to illegally fish there. It is possible to make large amounts of money by gillnetting in the area for just a short period of time. Therefore, both villages have organized patrols to watch over the FCZ during the dry season. In Kokpadek seven groups of four or five people have been organized by the village without any outside support. Each of the groups is responsible for

watching over the FCZ for one day a week, resulting in 24-hour protection. In Ban Don Tholathi villagers were smart enough to recognize that poachers might be setting gill nets and long lines in their FCZ without using floats, in order to avoid detection. They therefore developed a method for finding and removing unmarked gill nets and long lines. Every few days an anchor is dragged through the FCZ (at mid-water level). Any unmarked fishing gears are snagged and confiscated. Other villages have also learnt from Ban Tholathi and adopted similar methods. In Ban Tha Kham, villagers have tied clumps of twigs and thorns onto stone weights and set them at mid-water level in their FCZ to discourage poachers from fishing in the area.

Villagers are pragmatic people. Therefore, they tend to feel more positive about co-management regulations if they begin to see positive results. Fortunately, villagers often report increases in fish stocks and catches outside of FCZs even after just a year of implementation, as well as positive results from other regulations as well. If regulations are not working, villagers tend to alter or abandon them. It is encouraging that the system is still dynamic and running strong after over five years. Many villages claim that they will continue implementing their co-management systems into the future, regardless of whether there is a project supporting their work or not. This is certainly a very positive sign, and indicates that the regulatory framework is likely to be sustainable over the long term. Yet some villages probably continue to require support because they are still learning how to effectively implement their plans. However, many villages and subdistricts in Khong have developed inventive processes for addressing problems and resolving conflicts within and between villages which have helped improve the efficiency of management. Regular community discussions about co-management has been identified as a key factor in reducing conflict and improving management conditions.

Punishment for Regulation Violators

The Khong District recommended system for punishing regulation violators requires that first-time violators receive a warning at the subvillage level. Second time violators receive a warning at the village level and also sign a document in which they agree not to break the regulations again. Third time violators are fined 5,000 kip and/or have their fishing gear confiscated. Fourth time violators are sent to the district so that legal charges can be laid against them.

However, there is more to punishing violators than meets the eye. The Khong AFO recommends that the first person who violates a particular regulation be considered the only first-time offender. The logic is that if every person is not fined until he or she has been caught violating a regulation three times, hundreds of individuals in a village could theoretically violate a regulation and only receive warnings, and by the time fines started the resource would already be depleted.

While the four-tiered punishment system has been adopted by most villages in the district with co-management regulations, the system is generally adapted by village leaders to meet local conditions. For example, 5 000 kip was worth about US\$7 in 1993 and 1994, but the value of the Lao kip has declined dramatically in recent years. Today 5 000 kip is worth just US\$0.60. Therefore, many villages have raised their fines. For example, Ban Phiman Phon recently decided that fines of 5 000 kip should be increased to 50 000 kip. Other villages have done the same, and more adjustments are expected in the near future.

It is interesting that villagers often advocate heavier fines than headmen or district officials. It appears that most villagers feel strongly that those who violate regulations and hurt the interests of the whole community should not be let off lightly. However, most village headmen are hesitant about issuing large fines or imposing heavy punishment. Handing out punishment as community work is an option that is sometimes utilized. Enforcing regulations is especially difficult for headmen when relatives are involved. In some cases deputy headmen have had to enforce regulations with regards to the relatives of chief headmen.

Apart from fines, most villages also confiscate any aquatic animals illegally harvested by regulation violators. Although only small amounts of money are normally generated from collecting fines from violators, it is important that whatever is collected becomes the property of the whole community and is used for communal activities, agreed upon in village meetings in which all families are represented. However, it is often quite acceptable to communities for funds to be used to buy gasoline for those who are responsible for patrolling FCZs. Villager satisfaction is generally based on the communicativeness of the village headman.

In some cases, those responsible for catching violators are given a portion of the fine money collected as an incentive to help enforce regulations. Many villages have altered their co-management plans so that confiscated fishing gear is given to those who are responsible for catching offenders. Although this system of rewarding enforcement could potentially be abused by vengeful or dishonest individuals, there have been no reports of problems in Khong so far. Instead, most villagers think the system works well.

Village leaders are almost always extremely reluctant to invoke the fourth stage of the punishment measures recommended by the government. Headmen generally do not want to send violators to the district as long as they are able to control the situation themselves, which is virtually always the case. Therefore, village headmen have always opted for continually repeating stage three of the punishments (fines and confiscation) rather than moving on to stage four. Nevertheless, stage four remains a final option for village leaders in case all other strategies fail. Village headmen generally have no qualms about using their discretion when deciding how to punish regulation violators. The severity of punishment generally depends on the will of individual village administrations and the overall opinion of the community.

Regulations are often enforced more leniently with regard to outsiders than they are when it comes to host villagers. It is generally assumed that residents are more aware of village regulations than outsiders, and therefore have less excuses for breaking them. If regulation-violating villagers are from far away, they are initially assumed to be ignorant of the regulations of the host village. Therefore, they are generally let off lightly and warned at least once before being fined.

Village chiefs sometimes also send word to outside violators' home villages. Maintaining good village-to-village relations is important, because rivalries and bad feelings between villages can lead to conflicts and social problems damaging to communities. Experience in Khong has demonstrated that it is preferable when punishments against outside violators are enforced by the headmen from the home villages of the violators. If the host village headman imposes a punishment, there is a risk that the punished outsiders, and others from their villages, will resent the regulation-enforcing village. Village-to-village conflicts arising from the enforcement of co-management regulations are extremely undesirable in the Lao context, and this indigenous conflict resolution method seems to be the most efficient in reducing them.

Some villages virtually never resort to fining violators, but are glad to have that option available. Most would rather solve their problems through exerting social pressure on those who do not respect the will of the community. Fortunately, powerful social mechanisms act as strong disincentives to those who might be inclined to violate village regulations in Khong. Therefore, the overall use of fines as a primary deterrent is low in Khong.

Monitoring and Evaluation

Monitoring and evaluation are important aspects of any natural resource management program. One of the roles of the LCFDPP and later the EPCDSWP has been to assist in monitoring and evaluating village aquatic resource co-management systems in Khong District. This includes assessing increases in aquatic animal stocks in cooperation with villages, and assessing whether regulations have been effectively, equitably and fairly enforced by villagers. Khong District officials also play an important role in monitoring and evaluation.

Informal Monitoring

The LCFDPP and EPCDSWP have approached the monitoring and evaluation process for aquatic resource co-management systems from various directions. Informal monitoring has certainly been the most important tool for both projects. This kind of monitoring has been effective because both projects have had community development components. Although some of the community development activities supported have been seemingly unrelated to aquatic resource management issues, their implementation has provided important opportunities for conducting monitoring activities in relation to aquatic resource management issues. Rural development activities have included community school and well construction, small-scale agricultural credit programs, women's activities, sustainable agricultural training, and other social and economic capacity-building activities. Since the same project officers who have participated in aquatic resource management activities in villages are also responsible for various aspects of other community development activities, they have had many opportunities to informally monitor aquatic resource management activities when they visit the villages to work on different community development activities. Sometimes villagers approach them to discuss problems or successes related to co-management, and project officers often make inquiries about aquatic resource management issues when visiting villages for whatever reason.

It must also be recognized that all the Lao people working in the field for the EPCDSWP reside with their families in villages in Khong District with aquatic resource co-management regulations. Most were born in Khong and therefore have a good understanding of local conditions and practices. They are also spread throughout the district, which helps to provide a broad scale of coverage. They reside in the villages Ban Hang Khone, Ban Som Tavan Tok, Ban Deua Neua, Ban Hat Xai Khoun and Ban Khong Tai.

The projects have also relied on other informal sources of information, such as information received from villagers, and from government officials. Creating good communicative relations with a large number of people is the key.

Formal Monitoring and Evaluation

Apart from informal monitoring, the LCFDPP and the EPCDSWP have also relied on more formal monitoring and evaluation processes. For example, in July 1997 the LCFDPP invited two independent monitors to spend two weeks each in Khong District to evaluate the aquatic resource co-management program there. During their stay they worked with project officials, district government officials and villagers from 21 randomly-selected communities with government-sanctioned aquatic resource co-management regulations. A wide range of people from each of the communities visited were randomly selected and interviewed by the evaluators.

This was followed up by discussions between the evaluators, project officials, and village leaders regarding community commentary encountered by the evaluators. Village leaders were also asked to self-evaluate their own co-management experience, and to consider ways in which lessons learnt could be used to improve management practices in the future. Village leaders reported that the exercise was useful in facilitating communities in self-evaluating themselves and finding ways of improve the implementation of their respective aquatic co-management systems. Khong District government and the project also benefited from their participation. The exercise provided project and local government officials with an opportunity to hear an objective external opinion of the village co-management program.

As a result of the success of the first external evaluation conducted in July 1997, the EPCDSWP and Khong District decided that it would be useful to conduct a second round of evaluations with the remaining 38 villages with aquatic co-management regulations. This phase took place between September 1997 and March 1998. It was conducted entirely by project officials.

The second evaluation phase was successful in strengthening local co-management systems. It also provided the project and local government with valuable information about the status of village co-management systems. Most village leaders visited reported that it would be ideal if the project conducted evaluations for each village at least twice a year. However, the project has encouraged village leaders to not rely on project officials too much for monitoring and evaluation. They were encouraged to initiate self-evaluation activities on a regular basis on their own. The project officers have also had many discussions with the district regarding their role in monitoring and evaluation, and the need for local government to take an independent role in order to avoid over dependence on the project for support. District officials understand that they have the long-term responsibility for maintaining an effective monitoring system.

Monitoring by Government

The Khong District government has conducted its own informal monitoring activities of co-management systems, and while little documentation of this monitoring is available, senior district officials often have up-to-date information on the status of aquatic resource co-management systems in villages. The government relies on the project for information, but they also take advantage of other sources of information in and around the villages. Khong District also occasionally sends out notices to all the villages in Khong in order to inform, or re-inform, villagers regarding the importance of respecting village aquatic resource co-management regulations, especially those related to FCZs.

The district has also made various resource management decisions based on information they have received through monitoring co-management activities. For example, Khong District was one of the first districts in Lao PDR to ban the export of frogs to markets outside of the district. This decision was made by the district without consultation with the project. The decision was based on the attendance of district officials at meetings with villagers in which frog depletion in Khong was discussed in detail. In many cases, this frog-export ban has helped to support village co-management regulations, since many villages had already banned frog selling prior to the district directive being issued.

Fish Conservation Zone Monitoring

Another of the formal forms of monitoring and evaluation that the project has participated in relates to ecological and biological factors affecting the establishment and implementation of Fish Conservation Zones (FCZs). Studies have been conducted to look at the relationship between habitat protected by FCZs and the fish species which have apparently benefited from FCZ establishment. This process began when project officials and the external evaluators visited the 21 villages in Khong in July 1997. At that time they noticed that there were differences between villages with regards to the species of fish believed to have benefited, or increased in number, as a direct result of the establishment of certain FCZs. Further investigations revealed that there is at least some association between the type of aquatic habitat protected by FCZs and the species of fish reported to have benefited the villagers. During the second phase of evaluating the remaining 38 villages, additional effort was put into collecting detailed information regarding the species of fish believed to be benefiting from individual FCZs, and the habitat contained in individual FCZs. Some of the previous 21 villages included in the first stage of the evaluation were also revisited during the second phase so that a full set of data regarding all the FCZs in Khong could be compiled and statistically analyzed. Villagers from the 59 communities surveyed reported that a total of between 53 and 61 fish species had benefited from FCZs. The species most commonly reported as having benefited from FCZs included *Morulus* spp. (*pa phia*), *Chitala blanci* (*pa tong kai*), *Chitala ornata* (*pa tong khouay*), *Micronema micronema* (*pa nang*), *Hemisilurus mekongensis* (*pa nang deng*), *Belodontichthys dinema* (*pa khop*), *Boesemania microlepis* (*pa kouang*), *Pangasius pleurotaenia* (*pa gnone thong khom*), *Hemibagrus wyckioides* (*pa kheung*), *Cosmochilus harmandi* (*pa mak ban*), *Pangasius conchophilus* (*pa pho/pa ke*) and *Probarbus jullieni* (*pa eun deng*) (Baird et al. 1998b).

This data was validated between May and September, 1998, and resulted in some revisions to the original data, based on recommendations by villagers. More detailed data regarding the habitat contained in FCZs was also collected. Although this data validation process did not result in any major changes in the fish species villagers reported as benefiting from FCZs, or the types of habitat originally reported as occurring in FCZ areas, it did help to refine the data and clarify some previously reported inconsistencies.

After the fish species lists and FCZ habitat parameters had been revised, various tests were conducted on the data to determine the level of correlation between the occurrence of certain habitat types and the fish species that are likely to benefit if that type of habitat is protected. Although some significant correlations have been noted, the complex ecological and biological conditions of the Mekong River has made it quite difficult to isolate relationships between habitat and fish species believed by villagers to be benefiting from FCZs. The results of running a logistic model on the data have been marginal. However, work on this aspect of the project is continuing and more precise data is being collected in cooperation with villagers.

Village Self-monitoring and Evaluation

The EPCDSWP has also supported a pilot FCZ monitoring process in eight villages in Khong District, including Ban Don Tholathi, Ban Don Xang, Ban Tha Phao, Ban Nang Khouat, Ban Don Houat, Ban Kokpadek, Ban Chan, and Ban Oupaxa. All of the above-mentioned villages have reasonably efficient systems for managing FCZs under their jurisdiction, and have reported increased fish catches in areas surrounding their FCZs. The villages are also spread geographically throughout the district, making the group more representative of the whole district, except for inland villages away from the mainstream Mekong River, which were not represented in the exercise.

The EPCDSWP has worked with each of the eight villages to set up specific monitoring programs appropriate for each community. The villagers, project and local government agreed that it would be useful to try to quantify the progress and success of the FCZs in the villages through collecting data regarding the fish species and quantities caught. A catch-per-unit-effort (CPUE) methodology was adopted. The goal of the research was multifold. On the one hand, the villagers wanted more data to validate the successes of their FCZs. Secondly, the project and district government wanted to get more data regarding FCZs for planning and evaluation purposes. Thirdly, it was recognized that provincial and central government agencies required some sort of quantitative data in order to confirm to them the value of the fish conservation work already implemented.

Since no quantitative data regarding fishing activities and fish catches was collected in any of the villages in Khong prior to the establishment of FCZs, the project realized that there was not enough quantitative data to back up villager claims that fish catches outside of FCZs had increased since the establishment of FCZs. It was recognized that fish catch data from the present period could be collected and compared with pre-FCZ period anecdotal data. Moreover, it was also recognized that data could also be collected and compared with present catch data if the same methodology is again at the same locations in the future. Finally, fish catch data could also help indicate which fish species are the most important for the specific communities and habitats, and whether those species are likely to be ones that would benefit from FCZs. This data could also indicate whether the fish species villagers report as increasing in their catches are actually being caught in large numbers.

The first stage of the exercise involved project officers sitting down with groups of experienced fishers in each of the communities in order to discuss and consider which species the villagers believed had benefited most from FCZs. After a list had been compiled, the villagers were asked to consider the following questions: What are the most important fish species to collect data about? What fishing gears should be used to catch the target fish species? What seasons would be the most suitable to collect data? For example, villagers from Ban Don Nang Khouat selected three groups of species. *Morulius* spp. (*pa phia*) was selected by villagers as the most

important species to monitor. It was decided that it would be best to collect data on the abundance of this species in the dry season using cast nets. Another important species identified for monitoring was *Chitala blanci* (*pa tong kai*). However, dry season castnetting was not deemed a suitable method for monitoring the abundance of this species in fish catches. Instead scoop netting in the rainy season was chosen for collecting data about this species. Finally, women in the village pointed out that *Pristolepis fasciata* (*pa ka*) and other small species caught with hooks-and-lines near the shore had also benefited from FCZs. Therefore hook-and-line catches were also monitored.

Once village priorities for research had been established, village leaders, and especially village headmen, recommended groups of five or six individuals from the village to collect fisheries data regarding each of the fisheries of interest. In some cases just one key fishery was researched by a village, while in other cases up to four or five were considered. The selection of village researchers was based on (1) the ability of the villager to skillfully use the fishing gear selected for monitoring, (2) the frequency of fishing by the villager, and (3) the level of interest and willingness of the individual to participate in the research.

The project then assisted the village researchers by providing them with training in data recording methods. Note books and pens were distributed to each of the village researchers, and they were taught to record individual fishing outings. Data recorded included: the date, the time period, the number of hours spent fishing, the gear used, the species caught, the number of individuals of each species caught, and the weight of the catch by species. The researchers were then left to fish as they normally would, recording data on a daily basis. This activity started at Ban Tha Phao and Ban Nang Khouat in mid-1997, and expanded to the other six villages in January 1998. The first phase of the work was completed by June 1998. During the data collecting period village leaders and project officers occasionally visited the data collectors, helping to clarify issues regarding data recording methods when there was confusion. In some cases, such as with women hook-and-line fishers from Ban Don Nang Khouat, the children and grandchildren of the data collectors actually recorded the data for the researchers since most of the women using hook-and-lines are illiterate. However, most of the researchers were men who had at least basic literacy skills and were able to record their own data.

Once the data had been collected, the project organized meetings in each of the eight villages so that the data could be reviewed before being formally compiled. All village researchers and headmen attended these meetings. Project officers reviewed each of the researcher's data sets, and tried to resolve problems related to incomplete or unclear data with individual fishers. While some methodological problems did emerge, most of the data was well collected and easy to compile. Since villagers are generally very familiar with fish species in the Mekong, identification was not a problem, although some species lumping was required at the genus level. Weights of individual fish were sometimes quite accurate, especially when they were weighed on scales before being sold to traders, but in many cases villagers had to estimate weights. Nevertheless, villagers are skillful at estimating fish weights because they often catch and sell fish by weight.

Once the raw data had been reviewed at the village level, the project transferred the log-book data on spread sheets to facilitate analysis. The project also provided each informant with a mosquito net and blanket, as a token of appreciation for large amount of time the villagers had devoted to the work.

After all the data for each village had been compiled by project officers, the villagers were presented with the compiled and summarized results for analysis. For example, on 16 March 1999 data collected by six cast-net fishers from Ban Don Houat between 18 January 1998 and 30 June 1998 was reviewed at a village meeting. The fishers had recorded data regarding a total of 468 fishing trips and 1 073 hours of fishing. Most fishing took place during the daytime using 4-10 cm meshed cast nets. A total of 1 688 kg of fish were caught, representing an average of 1.58 kg of fish per hour of castnetting. A total of 36 nominal species of fish (possibly up to 40 scientific species) were recorded in catches. *Morulus* spp. (*pa phia*), the most often reported beneficiary of FCZs in Khong District (Baird et al. 1998b), made up 67.8% of the total catch by weight. *Chitala blanci* (*pa tong kai*), another very commonly reported beneficiary of FCZs (Baird et al. 1998b), was the second

most abundant species in catches at 4.3%. Many other species commonly reported to be beneficiaries of FCZs were also found to be prominent in catches. It is highly significant that nine of the 10 most important species recorded in fish catches are believed by villagers to be either basically sedentary or only slightly or moderately migratory. This data has helped to support the claim by villagers that many of the species they rely on most are not strongly migratory, and therefore have the potential to be beneficiaries of FCZs. Moreover, it has helped to show that in the case of Ban Don Houat the sedentary and slightly migratory species which are the most likely to benefit from FCZs are in fact the most abundant species in cast-net catches in the Ban Don Houat area. However, the situation in Khong varies from village to village, and some communities rely more on migratory fishes than others. In any case, villagers from Ban Don Houat plan to conduct the same research again in the year 2000 so that they can compare the data they have collected already with new data.

This data collection and monitoring exercise has proven to be very useful in terms of raising awareness amongst villagers regarding the importance of FCZs. In many ways the exercise has strengthened the ability of villagers to analyze fisheries management issues, and make appropriate management decisions. It has helped strengthen TEK. It has also provided the project and government agencies with useful quantitative data. More participating monitoring needs to be done in the future. It has an important role to play in helping to develop the capacity of villagers to manage fisheries sustainably in cooperation with government. Monitoring needs to be based on the local conditions, and directed towards answering specific questions of local interest. Moreover, research needs to be done in the context of adaptive management. This is the kind of action research that really interests villagers and government officials. It is not advisable to simply conduct a lot of research without indicating the practical value of data collected in terms of management.

Promoting the Conservation and Sustainable Use of Natural Resources

It is useful if natural resource co-management programs are complimented by nonformal education activities at the village and the local government levels. The LCFDPP and the EPCDSWP have supported a number of environment-oriented awareness raising activities over the years. A number of calendars, posters, cartoon books, handbooks, brochures and videos promoting the conservation and sustainable use of natural resources have been produced and distributed in Khong over the years. The projects have also worked closely with teachers and students to support various environmentally-oriented education activities (see Baird et al. 1997). The importance of these activities in terms of strengthening co-management systems should not be underestimated.

Discussion

The ability of villagers to effectively use and adapt TEK has been one of the main reasons communities in Khong have been relatively successful with managing aquatic resources (Cunningham 1998a and 1998b). Because TEK is a dynamic rather than a static system, villagers are able to integrate new information with already existing TEK to improve their capacity for managing resources.

It is interesting that community-based management strategies for tropical riverine fisheries tend to differ fundamentally from approaches adopted by their respective governments. While community-initiated fisheries management in the Mekong River in southern Laos and the Amazon River in Brazil emphasize restricting fishing effort during the low-water season, when fish are most concentrated and vulnerable, government legislation in Brazil, Laos and Cambodia focuses on implementing seasonal closures during the spawning season, despite the natural protection afforded to fish by flooding (Isaac and Ruffino 1998; van Zalinge et al. 1998; Baird et al. 1999).

The willingness and ability of villagers to adjust resource management strategies to meet local conditions has also been a critical reason why the aquatic resource co-management program in Khong has been a success in the

eyes of villagers. Having the freedom and ability to be flexible with regards to management approaches is one of the biggest advantages of decentralized management systems. It encourages dynamic adaptive management and keeps regulations relevant.

Certainly, experiences in Khong have shown that it is at least as critical to understand kinship, religious, linguistic, social, economic, political and cultural factors that affect natural resource management practices than it is to understand ecological processes. Villagers generally have an integrated and holistic way of viewing nature, and therefore have a lot of natural potential to come up with good management ideas, provided they are given the support and encouragement they need.

Social indicators from Khong are strong. Outside cultural influences have been relatively few, and Khong people almost all have the same first language. Most people consider themselves to be Buddhists, and kinship links in communities are often extensive and complicated. Khong also has relatively few problems related to community rifts arising from vast differences in occupation, class and wealth. Finally, almost the whole population of Khong come from the same ethnic group. All the above factors certainly help to explain why co-management systems in Khong have largely been successful. However, relationships between communities in other parts of Laos are likely to be more complex and therefore require more consideration.

Interestingly, there also appears to be a correlation between those villages which have done a good job with implementing aquatic resource management, and those which are relatively remote with a high level of community spirit and solidarity. It appears that activities and conditions that increase solidarity at the village level also indirectly benefit community-based natural resource management. When solidarity increases as a result of co-management, there are also many spin-off benefits in terms of community development. These benefits are clear to the Khong District government, and that is one important reason why the local government in Khong views co-management as being an integrated part of their "community development" strategy.

Another important factor linked to the success of the co-management system in Khong relates to the emphasis that has been put on developing close working relationships with district authorities. While it is true that central and provincial agencies have more authority over broad policy issues, day-to-day management activities invariably are the responsibility of district governments. Without their support, recognition at higher levels of government is unlikely to result in the successful implementation of management strategies. This is not to say that provincial and central government agencies do not have important roles to play, but their limitations need to be recognized.

Many natural resource managers have used the "tragedy of the commons" (Hardin 1968), "the prisoner's dilemma" (Dawes 1973) and "the free rider" (Olson 1965) models to justify centralized natural resource management structures (Ostrom 1990). Natural resource management theory based on the assumption that individuals do not generally act for the good of the whole have resulted in a perceived need for impartial agents of authority with national or collective, rather than personal or local interests at heart. Unfortunately, these conclusions have often resulted in an underestimation of the capacity of local bodies to sustainably manage natural resources, especially at the village level. At the same time, the capacity of central authorities to effectively manage resources has generally been overestimated. In many cases the result has been the creation of costly and ineffective bureaucracies. Often the increased role of centralized authority in managing resources has resulted in the traditional local management authority losing influence over management decisions related to the resource (Kuperan and Abdullah 1994). One only has to consider the state of fisheries around the world to see the weaknesses of centralized fisheries management systems. It is now generally recognized that centralized management systems for natural resources, including fisheries, have failed more often than they have succeeded. The three models above have come under heavy criticism (Ostrom 1990; Kuperan and Abdullah 1994; Jentoft et al. 1998).

The central authority in Laos responsible for wild-capture fisheries management has historically been very weak or even nonexistent in remote areas like Khong. This factor has certainly contributed to the relative ease in which fisheries co-management has been accepted in Khong. In the eyes of local authorities, there was not really any competing centralized fisheries management system to obstruct the establishment of a co-management system, and therefore there was not much to lose by abandoning ideas of centralized management. Co-management has also been attractive because it is much less costly to the state (Cunningham 1998a and 1998b). This is important since Khong District generates almost no revenue from fisheries, except for a licensing fee from traders, and considers fisheries to be a fundamentally important commons resource that all Lao people should have access to for subsistence purposes.

Another fundamentally important problem with "the tragedy of the commons," "the prisoner's dilemma" and the "free rider" models is that they all fail to consider institutional arrangements in terms of the "imbeddedness" perspective. Humans are not fully "rational" beings. Instead, human behavior is embedded in social relations. People do not only make decisions with individual gain in mind, and even when they do, the perception of gain is defined by cultural and social forces rather than simply individual benefits. The role of people in social groups, communities and organizations fundamentally influences the decisions of individuals. Individuals often conceptualize choices that result in "we" decisions being taken rather than "I" decisions (Jentoft et al. 1998). As is generally the case in Khong, individuals often identify themselves as an inseparable part of a community, which is symbolized by the village institution. Most villages in Khong have been established for a long time, and most people were either born in the villages they live in or have moved into them from nearby villages as a result of marriage. Therefore, most people consider village problems to be problems for themselves as individuals. As long as the feeling of community remains strong, collective decisions are likely to dominate.

Concluding Remarks

In recent history Khong District has been faced with dramatic changes in fishing and fish-marketing practices. Initially this has involved apparent declines in fish and frog stocks which were thought to be due to over harvesting and destructive resource-use patterns. However, experience in Khong has illustrated that common property regimes do not always just break down when faced with crisis. People in Khong recognized that collective organization was necessary to address increasingly important issues regarding the management of natural resources and responded by strengthening their management systems to ensure that aquatic resources were managed more sustainably.

The aquatic resource co-management program in Khong has been successful in improving management strategies and practices related to aquatic animal harvesting. The main successes, as viewed by Khong District and villagers, have been (1) increased village solidarity, (2) increased natural resource management capacity at the government and village levels, and (3) observed and/or perceived increases in fish and frog stocks and catches.

Yet it is much less clear how useful the lessons from Khong are in terms of managing aquatic resources in other parts of Laos and the region. Certainly social conditions in Khong are quite amenable to supporting successful fisheries co-management. What about other parts of Laos where the history of community change has been more tumultuous and unstable, and where social, religious, kinship, ethnic and linguistic conditions are less homogenous? Certainly not all of the lessons from Khong are applicable to other parts of Laos or other countries in the region, but recent experiences in Khong at least indicate that co-management maybe a viable option for at least some other parts of the country, and other countries in the Mekong River basin.

Provided that co-management systems remain flexible and can adapt to social and institutional circumstances unique to particular areas, they represent an important option for improving the management and equitable distribution of natural resources. Natural resource co-management systems that allow for the full participation

of villagers and government should receive increased attention and support. The process of developing appropriate aquatic resource co-management systems in Lao PDR is off to a strong start, but is still evolving and much more work remains to be done.

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