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C E N T E R



COMMUNITY FISH REFUGES IN CAMBODIA – LESSONS LEARNED

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Fishermen using sein net in the rice field.

Y. Kura

1- Introduction

Importance of fish for food security in Cambodia

Cambodia's wetlands cover over 30 percent of the country's land area and support one of the largest, most diverse and intensive freshwater fisheries in the world. The value of freshwater fishery production is estimated at USD 1.2 – 1.6 billion per year, contributing up to 12 percent of the country's GDP annually (So & Touch 2011). Fisheries make a significant contribution to employment and livelihoods for the poor as well as to national food security. The sector employs up to 6 million people in full-time, part-time or seasonal work. Fish provides over 80% of the animal protein in the national diet and is an essential source of vitamins and micronutrients (Hortle 2007). Generating income from fisheries requires relatively little capital investment and no land ownership, which makes fishing a viable livelihood option for poor people. Fisheries can support a wide range of livelihood activities in farming communities and thereby provide insurance against the risk of agricultural failures and lean times between harvests.

Fishing in seasonally inundated rice fields is important for food and seasonal income, and virtually all rural households in Cambodia are involved in this activity (Hortle et al. 2008). Rice fields are estimated to yield 50-100 kg/ha/yr of fish for Cambodian farmers (Guttman 1999; Nao 2009). Families spend a substantial amount of time everyday searching for fish and aquatic plants for subsistence.

Rice fields (and the floodplain system) are used by fish as breeding, spawning, feeding and growth habitats and represent 16 to 28% of the inland freshwater fisheries sector (FiA 2010; So & Touch 2011).

Increasing need to sustain natural capture fisheries through stock enhancement

The fisheries sector faces a growing number of threats from within and outside of the sector: over-fishing, potentially damaging effects of hydropower dams, loss of critical fish habitats from wetland loss, environmental degradation from pollution and increased mining, sedimentation, and climate change. At the same time, fisheries face increasing demand from a population that is growing at around 1.54 percent annually as well as the pressures of continued economic development (FiA 2010).

In the flood season (July-February), the flood waters from the Mekong River and Tonle Sap Lake catchments create a vast open water system on Cambodia's lowlands. During this period, inundated rice fields become open access fishing grounds for local villagers and migrant fishers. Nao (2009) estimates the total area of inundated rice fields available for fisheries at almost 2 million hectares.

Fishing in rice fields and floodplain systems takes place throughout the flood season, but the peak season is when water is receding (from November to February). Around 70 different species of fish are harvested from rice fields using a wide variety of small-scale fishing methods including nets, traps and lines. Rice field fisheries are estimated to contribute up to 28% of the wild capture fisheries in Cambodia.

Within the Strategic Planning Framework for 2010-2020 (FiA 2010), rice field fisheries are seen as a promising sub-sector to increase fish catches and meet the domestic demand for food. Rice field fish catches are expected to increase by 15% annually and reach almost 500,000 tonnes per year by 2019 (compared to around 110,000 tonnes in 2000).

Despite its importance in Cambodia's rural livelihoods, this complex system of rice field fisheries has not been a focus of detailed research or NGO projects until recently, with the advent of the Community Fish Refuge (CFR) approach.

2- What is a Community Fish Refuge?

Concept of Community Fish Refuges

A CFR is a form of stock enhancement or a fish conservation measure that is intended to improve the productivity of rice field fisheries. The idea behind refuge ponds is to create dry season refuges or sanctuaries for brood fish in seasonally inundated rice fields. Refuge ponds can be man-made ponds or natural ponds that can hold water throughout the year. During the dry season, these refuge ponds become disconnected from permanent natural water bodies (See Figure 1).

Then in the flood season, they are connected again to these water bodies or large seasonally flooded rice fields. The system takes advantage of the natural flood pulse. When the water level goes down in inundated rice fields, fish migrate to deeper areas, such as ponds, and stay there until the next flood season. During the flood season, these fish can emerge from the refuge ponds to spawn and feed on the inundated rice fields.

Providing safe refuges for fish during dry season helps to stabilize fish populations in rice fields and can benefit rural households that are highly dependent on rice field fisheries as an open access resource. Thus, CFRs can be promoted as a poverty alleviation measure for subsistence fishers, though existing CFRs were not necessarily set up with specific beneficiaries in mind.

Fish refuge ponds are typically not privately owned, as the connecting rice fields become open access when inundated. Access to such fishing grounds and the resources found there can only be managed collectively. Therefore, using refuge ponds to enhance rice field fisheries requires a community-based approach rather than by one based on individual, household, or private sector initiatives.



Canal connected to the CFR enabling fish migration to the rice fields

A. Brooks



In the dry season, fishing is prohibited in the refuge pond until water level rises again during the next wet season.



When the water level is high and flooded rice fields are connected, fish spread out into the floodplain.



At the end of wet season, fish migrates back into the refuge pond with receding water, while villagers continue to fish in the floodplain.

T. Vallier

Figure 1: Illustration of a CFR in Cambodia

Origin

One of the recommendations from an earlier study on rice field fisheries in Cambodia was to develop refuge ponds for fish during the dry season (Gregory 1997). These ponds were first introduced to Cambodia in 1995, through the Aquaculture and Aquatic Resources Management (AARM) project supported by the Asian Institute of Technology (Meusch & Viseth 2001). Between 1998 and 2004, a total of 16 CFRs were set up in the seasonal floodplain region.

More recently, CFRs have been set up through the Freshwater Aquaculture Improvement and Extension Project (FAIEX 2005-2010) supported by JICA, and through other projects funded by DFID, Danida, FAO, or AECID. In 2009, 18 new CFRs were under development by FAIEX and 19 by DFID/DANIDA. A total of around 670 were recorded nationwide by the FiA as of July 2011, with a geographic concentration in the southeastern provinces, including Kampong Speu (155 CFRs), Prey Veng (59 CFRs), Kampot (53 CFRs), and Takeo (46 CFRs). In the northwest, Siem Reap province has 91 CFRs so far.



Bamboo fence blocking fish from migrating out of the refuge pond before flooding.

A. Brooks

Supporting the policy and legal framework

The “Statement of the Royal Government of Cambodia on the National Fisheries Policy” (May 15th 2005) stipulated that CFRs should be developed all around the country where environmental conditions are suitable. In 2007, the Prime Minister also declared that “the promotion of CFRs at the district and commune levels [should] be discussed so that these areas can be kept as state property and fish releasing activities can be organized in those areas” (CoM 2007). Consequently, the government has prioritized CFR development as way to enhance fisheries, with the Ministry of Agriculture Forestry and Fisheries launching an advocacy campaign, “One Commune, One Community Fish Refuge”. The implementation of CFRs falls within the legal framework of Community Fisheries (CFi)¹ and has been promoted by CFi organizations.

Individual versus community-based approaches

Compared to fish farming practiced by individual households, a community-based approach requires different governance mechanisms to ensure transparent management of community-owned resources such as fisheries. The change of access rights from open access to restricted or limited access is one of the main challenges. The management of large water bodies in a collective way requires local organizational arrangements to derive the desired benefits.

Stock enhancement in community-based fisheries

Fisheries enhancement using a community-based approach combines aquaculture technologies (releasing cultured organisms into natural environments) with fishing access regulations (seasonal no-take zones). The approach is common around the world and several examples can be found in Asia, including Bangladesh (Mustafa & Rahman 2006; Halls & Mustafa 2006; Thompson et al. 2003), Sri Lanka (FAO 1994; Pushpalatha 2001), Lao PDR (Saphakdy et al. 2009; Lorenzen et al. 1998), Viet Nam (Nguyen et al. 2001), and China (Li & Xu 1995; Middendorp & Balarin 1999).

¹ The Fishery Law (21st May 2006) includes chapters on Community Fisheries. Two decrees also address Community Fisheries: the Royal Decree no. NS/RKT/0505/240 29th May 2005 for establishment of Community Fisheries; and the Sub-decree no. 25 on March 20th on establishment of Community Fisheries.



Fisherman on his way to the fishing camp in the floodplain, Takeo province.

O. Joffre

Typically, community-based approaches can be divided into two main types: stock enhancement of wild fisheries in large water bodies such as floodplains (up to 400 ha) or rivers (up to 1,600 ha), as found in Bangladesh; and culture-based fisheries, usually found in smaller water bodies such as lakes, communal ponds, or reservoirs (perennial or otherwise).

Fingerlings and/or brood fish are stocked in these water bodies, sometimes with habitat protection. Successfully enhancing fish stocks requires far more than just producing and releasing hatchery fish that can survive in a new environment. Communities must collectively agree on a combination of regulations needed to manage water bodies and fishing activities.

These regulations may involve restricting certain types of fishing equipment, observing closed fishing seasons or setting aside fish sanctuaries.

Compared to fisheries in large water bodies, fisheries in small reservoirs have to be sustained through regular stocking (De Silva & Funge-Smith 2005). However, the environment is relatively easy to manipulate (for example, through fertilization of the pond) to improve natural productivity. Examples from various countries show similar stocking densities. In China, in a market-oriented culture-based fishery, reservoirs are stocked with indigenous species at 0.15 to 0.7 fingerlings per m².

In Bangladesh and Viet Nam, similar stocking densities (0.1 to 0.5 fingerlings per m²) have been reported in oxbow lakes (cited in De Silva & Funge-Smith 2005) and reservoirs (Nguyen et al. 2001). The main technical difference between these experiments seems to be the level of additional inputs before and after the release of fingerlings. In China, some reservoirs were designed for raising fish and others were prepared for fish stocking with improved habitat. In Viet Nam, additional feed was provided throughout the growth period of the fish. Stock enhancement in smaller water bodies is closer to extensive aquaculture practice, with the fish grown in a more confined environment and with a more controlled harvest. In large and open water bodies such as rivers, lakes or floodplains, stock enhancement is closer to wild fisheries management and governance.

The CFR approach encompasses both types of stock enhancement. In the dry season, brood stock and/or fingerlings of indigenous fish species are stocked in a small, confined water body that can be easily monitored. During the flood season, the fish migrate into the floodplain, which can be considered a large open access water body. Therefore, CFRs are a hybrid system, with attributes of both stock enhancement in small water bodies similar to aquaculture, and wild fisheries enhancement in open water bodies.

In some cases, stock enhancement can happen only once, during the first year of the CFR. After that, the brood stock population is regulated so that the pond does not become overpopulated, and no additional stocking is needed. Stock enhancement can also be used to re-introduce native species that have disappeared from a target area.

Community refuge ponds in Cambodia: a common approach?

There is no single blueprint for CFR development and implementation in Cambodia. However, some key features can be highlighted from the FAIEX and AARM projects and the FiA's experiences. There are generally 3 main steps when setting up a new CFR (Figure 2):

➤ **Step One:** Identify an appropriate site. This process includes consulting communities and local authorities (commune chiefs, commune councilors, local police, village heads) for their expertise, knowledge of the local environment and also what they want to gain from the CFR project.

➤ **Step Two:** Establish management institutions. CFR Committee members are elected at a general community assembly. The CFR Committee members produce a by-law clarifying the roles and responsibilities of the members (local volunteers) as well as CFR management rules. creation of a more specific management plan outlining the procedures for establishing a new fish sanctuary and releasing fish brood stock and fingerlings.

The main duties of the group in the FAIEX project are guarding the project at night, managing fish pathways, the pond and dikes, releasing the fish, and holding regular meetings. Members are not required to make a financial contribution, though the committee must perform annual budget planning and submit financial reports to the Fisheries Administration or other donor agencies for transparency. The CFR Committee and FiA also need to come to an agreement about the fishing area, with commune and district authorities as witnesses (Nao Thuok 2009; Viseth et al. 2010). Ideally, the CFR should be included in the Commune or District Development Plan.

➤ **Step Three:** Prepare the pond with technical inputs. Before stocking, the fish refuge pond needs to be constructed and/or the water prepared, securing appropriate fish pathways, water depth, or plant cover. Then brood stock and fingerlings can be released into the pond. Adult fish caught from the wild – snakehead (*Channa striata*), catfish (*Clarias batrachus*) and climbing perch (*Anabas testudineus*)² – are commonly stocked, as well as hatchery raised silver barb fingerlings (*Barboides gonionotus*). Stocking densities and the number of species stocked varies at each site. The AARM project, for example, stocked 750 to 10,000 juvenile/ha or 2 to 320 kg/ha of brood fish (Doi & Viseth 2006).

² The government promotes the release of native indigenous species instead of exotic species.

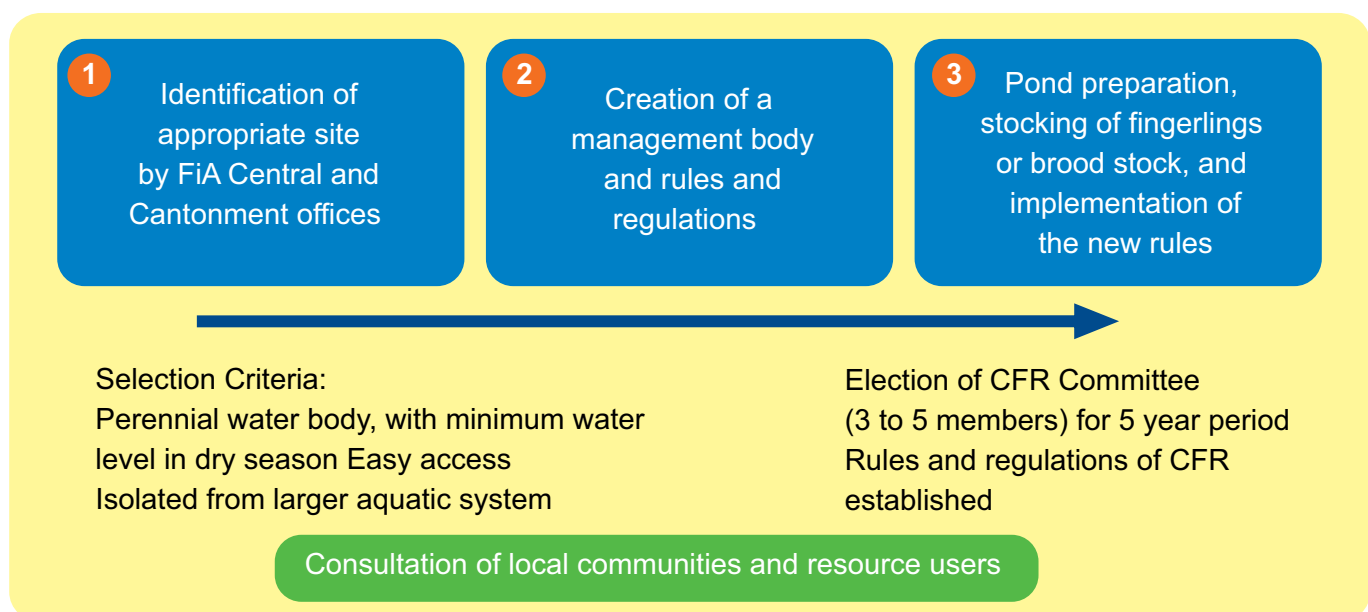


Figure 2: Main steps in CFR establishment



CFR in Piry village, Piry Meanchey commune, Kampong Speu province.

S. Pich

How successful has the approach been to date?

It is difficult to assess the effectiveness of CFRs in enhancing fish stocks because of the open nature of floodplain fisheries and the dispersal of fish. The approach has the potential to benefit many communities around the floodplain.

According to a recent evaluation of the FAIEX project, the CFRs there had the following outcomes: 1) they made it easier to catch fish, reducing the time spent fishing, 2) they made it easier to find fish for family consumption, and 3) they reduced illegal fishing practices after a few years (Viseth et al. 2010). CFRs can increase the average fish catch per person per year by 6 fold, up to 348 kg, and more than double incomes, based on a survey of 291 respondents living around 5 different CFRs (Nao 2009). In Piry village (Kampong Speu province), the CFR was found to be beneficial for household food security; 80% of the households reported that they no longer had to buy fish in the early dry season, and the increased fish catch at the village level reduced the average fish price at the local market.

On the other hand, a number of CFRs were found to be inactive. It is hoped that the CFR approach will improve with further experience, fueled by the political will to develop refuge ponds in every commune. Meanwhile, broad guidance on how to design and implement effective and sustainable CFRs is urgently needed. With numerous CFRs already operational in several places, such guidance should build on past experiences in the country.

About this study

To learn from previous experiences with CFRs, the WorldFish Center and the Fisheries Administration conducted a review with support from the CGIAR Challenge Program on Water and Food and the Japanese Ministry of Foreign Affairs. The review team organized a workshop in January 2009, which was attended by various individuals involved in CFR development, including FiA Central and Cantonment staff, NGOs and CFR Committee representatives. Additional survey and site visits were conducted at 11 CFRs that were supported by AARM, FAIEX projects, or the FiA in Svay Rieng, Takeo, Prey Veng, Kampot and Kampong Speu provinces. The selected sites included CFRs implemented between 1998 and 2008. During these visits, the WorldFish Center and FiA research team interviewed CFR Committee representatives and members, including village chiefs at six survey sites and commune chiefs at two survey sites. In addition, practitioners and aquaculture experts from the FiA and JICA were also consulted.

In the following section, we summarize the lessons learned from the review of experiences at the different steps of CFR development, from introducing the concept to rural communities to implementing it with a view to the future, from selecting sites to developing management bodies and governance mechanisms, and finally from providing technical inputs to resolving conflicts.

3- Lessons Learned from CFRs in Cambodia

Introducing the CFR approach to a new location

a. Identifying suitable locations

Although many existing ponds and small lakes are scattered around the country, not all of them can be easily converted into CFRs. Some ponds are too large and thus difficult to manage, or too far from the village to protect the fish from poaching. Thus, the availability of a perennial water body should not be the only feasibility criterion. Another important parameter to consider is the existing uses and users of this specific water body. The FAIEX project, based on the AARM results, developed the following criteria for site selection in collaboration with the FiA:

➔ Hydrological factors – presence of sufficient water all year round, presence of waterways, water management infrastructure, and sufficient flood level to allow fish migrations

➔ Topography of the water body – no direct connection with rivers and canals, isolation from larger aquatic systems

➔ Socio-economic factors – high demand for stock enhancement, resulting from reduced rice field fisheries and high reliance of local poor on fisheries

➔ Governance and social factors – presence of a communally managed pond and active community organizations and local authorities

Site selection also requires proactive involvement of local authorities (e.g. village or commune chiefs), who have a better understanding of the local environment, particularly in communes where there are several candidate ponds for CFR development.

AARM selected ponds up to 80 hectares in size at a few sites, but in most cases smaller refuge ponds (0.1 to 5 ha in dry season) were selected. Narith (2005) recommends ponds of at least 1 ha and 1 meter in depth, with plants covering 30% of the pond. When using a large reservoir or pond, only a smaller section of the water body is used as fish refuge, whereas smaller water bodies may be used in their entirety as fish refuges.



Fisher using a push net in floodplain.

E. Baran

Checklist for Site Selection

- Do local fishers have access to alternatives fishing grounds when access to the current fishing grounds becomes restricted for the CFR?
- Are chemicals for intensive agriculture or other sources of pollution present in the vicinity or within the drainage area of the selected water body?
- Is the investment to construct fish pathways and other start up costs acceptable for the local community?
- Is the refuge pond close enough to and accessible from the settlement for regular patrolling?
- Is the candidate refuge pond fully or partially used by private enterprises, for example, as a trap pond? If so, the change in the management regime (from private to community-based) may create conflict.
- Is the potential site being used by more than one village? Selecting a water body with the lowest number of preexisting vested interests may make the process of establishing and managing the CFR simpler.

b. Setting up institutional arrangements

When water is needed for multiple purposes in an area, all the resources users need to be consulted during the development of a new CFR in order to avoid conflict. Management rules have to be tailored for each location, taking into account the local character of the natural environment and existing water uses in the area.

Limiting access to the water body used as CFR may mean that some fishers lose income. This applies in particular to those fishers who have high fishing capacity or who own trap ponds. Therefore, it is important to consider these people when implementing the CFR, in addition to the full range of resource users and uses (fishing, irrigation, vegetable gardening, domestic water use, plant harvesting, washing/bathing for people and livestock) in order to reach a collective agreement related to CFR management.

Patrolling the pond for poachers is an important activity at CFRs, especially in the first few years, because many people will be unaware of the new access rules.

The community members have to decide how the patrolling duties should be shared, taking into account available human resources and the local situation (size of the area to patrol, existing fishing activities in the pond). In some cases, patrolling may be needed only during the early flood period, to prevent fish from being caught as they migrate through the pathway.

The CFR Committee consists of members from the community who have been elected because of their commitment to work for the CFR. Past experiences show that the members are generally selected among those living nearest to the pond, as this makes overseeing the pond easier.

At several sites, the Committee and CFR members also pointed out that including local administrative authorities on the Committee helped secure support from the commune, district, and pagoda councils for law enforcement and conflict resolution. The CFR management body may also find it easier to access to Commune Funds to finance the CFR by securing the endorsement of the Commune Council.

Checklist for setting up local management institutions

- Have you consulted local authorities about where and how the CFR should be set up? Local village and commune authorities should be consulted as part of the decision-making process.
- Do you need to create a new community-based organization to manage the CFR, or can existing institutions, such as the Farmer Water User Group or Community Fisheries, do the job?
- Have you considered the CFR by-laws when incorporating non-fisheries issues, such as water management and pond rehabilitation, and the full range of users?
- Did you inform downstream water users and neighboring communities who use the ponds about the CFR and the proposed changes in water management and access rights?
- Is the communication between the CFR Committee and local authorities (e.g. Fisheries Administration, Commune Councils) well established so as to strengthen by-law enforcement and facilitate conflict resolution?

Best Practices

When establishing two new CFRs in Takeo province – Thnal Dach (72 ha pond) and Khnar Rong (2 ha of sanctuaries within a 20 ha pond) – a number of villages that were not adjacent to the CFR were involved in the participatory process. All the resource users were consulted in order to avoid future conflicts caused by changes in pond access rights. In Khnar Rong, traditional users of the pond did not agree with the new fishing restrictions during the first year, but changed their mind one year later when they saw an increased fish catch from the rice fields.

Best Practices

In Thnal Dach CFR (Takeo province) the CFR Committee reported its activity to the Commune authority every month, including problems and conflicts caused by CFR development. In return, the local authorities helped ensure the by-laws were enforced when necessary. This constant interaction clearly showed that local authorities supported the CFR members and users of the reservoir. At this site, the CFR Committee was created within the existing Farmer Water User Group (FWUG) to facilitate the water management of the pond, enabling the group to limit conflict with downstream water users.

Similarly, in Khnar Rong (Takeo province), conflict between the CFR members and downstream water users (rice farmers) occurred in the first dry season. Rice farmers wanted to open the sluice gate to irrigate their rice, while the CFR members wanted to keep enough water in the pond for the fish. To balance the demand for water needed for rice irrigation and the fish refuge, the minimum required water level for fish in the reservoir was set, and no irrigation was allowed once the water level reached this mark.

In Kantout Praung (Svay Rieng province), the Committee asked for a district-level order to recognize the CFR (0.25 ha) as a common benefit to the community in order to gain priority for water use in the dry season (to guaranty a minimum water level) and thus limit conflict with rice farmers.

Implementing the CFR approach

a. Technical inputs to the pond

★ Construction and maintenance of the refuge pond

Preparing a pond to become a CFR requires the community to establish a channel connecting the pond with rice fields so that fish may migrate between them. This task may include installing culverts, raising dikes (to hold more water in the pond and to keep surface runoff from surrounding villages from getting into the pond), and cleaning the pond as a habitat for fish.

Some dredging may be necessary for a shallow pond, which can mean delaying fish stocking until the following season to allow the dirt to settle in the water. If heavy siltation occurs in the pond and fish pathway, additional dredging may be needed after a few years, and this can be time consuming and require the participation of the entire community.

★ Access to fingerlings and brood stock

A CFR can be stocked with wild brood stock fish and/or fingerlings that are purchased from local fishers. Obtaining inexpensive, quality fish seed is one of the main challenges for CFRs, much like other aquaculture practices. Ideally, the seeds should be chosen among indigenous species (exotic species should be avoided), but artificial seed production facilities in the country still do not produce enough local seeds. Seeds for CFRs are typically purchased from hatcheries in the same province, or from fishers and trap pond owners who collect them from the wild.

It is difficult to maintain stable stocking patterns, in terms of seed ratio, uniform seed size, and seed quality, and balancing these factors in most cases requires technical expertise from the FiA or NGOs. The accessibility of fingerlings and brood stock is determined by the price and by the proximity of suppliers to the CFR site.

Significant start up investment is needed to establish the project. Thereafter, there needs to be a way of covering operational costs, such as through assistance from the government or NGOs, as long as the CFR is not set up to generate cash revenue from its operations. In the medium-term, replenishing brood stock every year can be the most costly input needed for a CFR

★ Technical training for the participants

Another challenge for CFR management is maintaining a pond environment that can allow fish to survive and grow during the dry season. Although some CFR members reported that fish growth appeared to suffer from lack of natural food or from disease outbreaks in the pond, they did not know how to solve these technical problems. Some training for the CFR members is required during the preparation stage to help them gain basic knowledge of fish raising and avoid major fish losses. Information and knowledge sharing among a district or provincial CFR network can also improve the technical capacity of CFR members and their access to seeds and brood stock.



Group discussion develop a CFR implementation and management plan in Kampot village, Rohash commune, Roveang district, Preah Vihear province.

S. Chhiv

Checklist for technical design of CFRs

- Is the area of the fish refuge well demarcated? Is it located in the deepest area of the reservoir if it is a subsection of a larger water body?
- Are there CFR by-laws related to managing water during the dry season? Set a minimum water level necessary to provide habitat for fish during the dry season.
- Does the by-law forbid setting trap ponds along the fish pathway between the fish refuge and rice fields?
- Did the members receive appropriate training to prepare and maintain fish habitat and to monitor fish density in the pond?
- Have you discussed options for re-stocking the pond with CFR members, such as purchasing seeds or asking for donations of brood stock fish from fishers or trap pond owners?

Best Practices

A CFR (1ha) in Kandal village (Svay Rieng province) set up a by-law prohibiting trap ponds along the fish pathway so that fish could safely migrate between the fish refuge and rice fields. Trap pond owners in the village contribute to brood stock replenishment every year, as stated in the by-law. This arrangement has sustained the CFR operation from year to year, with no additional cash required to pay for restocking.

b. Implementing new arrangements and processes

★ Community participation

CFRs require active voluntary participation of community members. When CFRs were introduced to Cambodia, some communities had no prior experience in participatory community-based activities, no prior knowledge of how to operate and maintain a CFR, and no clear idea of the rationale behind the initiative. The lack of experience in community-based processes is a major challenge.

In the first years of CFR implementation, the Committee needs to concentrate on raising awareness of the CFR among the community. This includes showing people how it serves the interests of the whole community, and also establishing effective patrolling against poachers. In addition, the Committee needs to keep accurate records of activities and events to improve pond management. A lack of record keeping related to the project may lead to mistrust between CFR members.

Although the by-law states the need to reelect Committee members on a regular basis, no CFR has so far reported going through this process. This indicates that the participation of other community members is very limited.

Even when there are no cases of serious conflict or mismanagement, members of the CFR interviewed for this study acknowledge that Committee reelection is necessary, if only to replace inactive members and give other people a share of the responsibility and workload for the project.

★ Enforcement of new rules and regulations

Keeping the CFRs and Committee members active over many years is not easy without a visible increase in fish catches. Convincing the community to follow the rules takes continuous effort. Significant change in natural resource use, at the community scale, cannot be expected to happen overnight. At several sites, members reported that measures against poaching were necessary in the first years. But after a few seasons, the community members became used to the new regulations and regular patrolling became unnecessary, with declining reports of poaching. Regular site visits by FiA officials and other local authorities facilitate more effective law enforcement and prevents



Even small fish caught from rice field is important source of nutrition.

Y. Kura

poaching and infringements of by-laws. CFRs do not have legal authority to make arrests. Raising awareness of the importance and the benefits of CFRs has been shown to be effective in preventing poaching. Demonstrating the immediate benefits of the CFRs, such as increased fish catches, is a major factor in ensuring that local communities respect the regulations and in promoting the overall sustainability of CFRs.

★ Consultation and consensus building

If consensus at the community level is not reached, some conflicts may emerge when the CFR rules are put into practice for the first time. Some community members may be asked to change their fishing practices, costing them income, and others may simply be unable to switch to alternative methods in a very short time. Conflict can appear between different resource users. For example, rice farmers may want to prioritize using pond water for irrigation rather than as a fish refuge, and trap pond owners may not be willing to change the location of their trap ponds.

Water quality can become another source of conflict. Various uses of the pond may require different levels of water quality. For example, adding manure may lead to faster fish growth, but it will be a concern when the pond's water is also used for household consumption. Experiences at existing CFRs demonstrate the importance of using a participatory approach to establish common ground among various stakeholders when managing the pond and implementing changes to access rights.

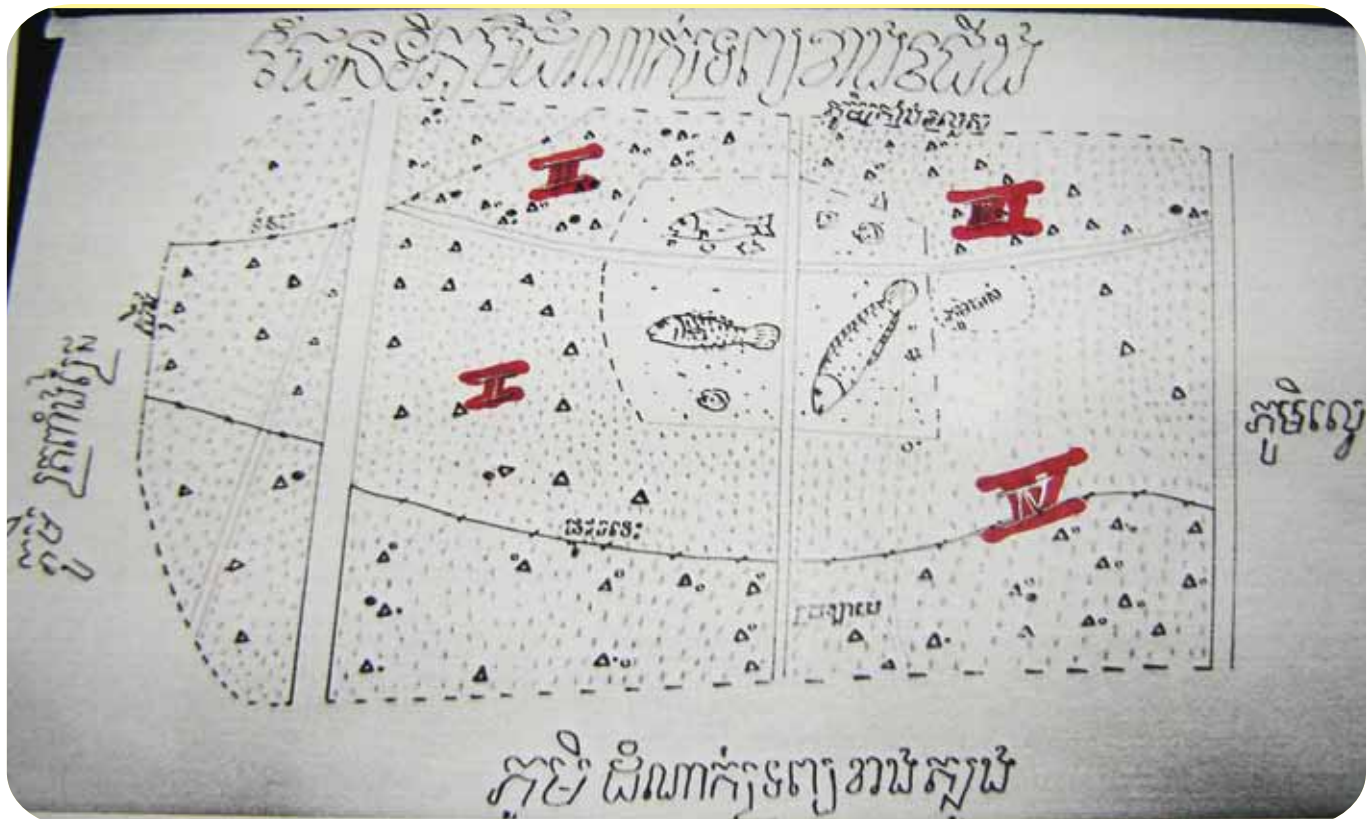
Checklist for technical design of CFRs

- Are there communication channels with local authorities to facilitate effective by-law enforcement?
- Are there commitments from local authorities, FiA officials or NGOs for regular technical services and support?
- Does the activity plan for the first few years include an awareness raising campaign related to the new access rights and regulations for pond management?
- Does the by-law specify the terms and duration of Committee membership?
- Has rotating Committee membership been ensured so as to maintain institutional memory and management capacity?

Best Practices

In Kandal village (Svay Rieng province), it took 6 years of local awareness building to make the entire community fully compliant with the new regulations, according to Committee members. For example, Committee members regularly reminded the community about the regulations during community events. Now villagers not only respect the regulations but also actively participate in guarding the CFR.

Conflicts in CFR management can arise from competing views on how to use the water body. In a dry year, the Committee may decide to allow water use for irrigation, as in the case of Chhouk Sar village (1.2 ha CFR), Kampong Speu province. The pond dried up and CFR activity was cancelled for that year.



Village resource map showing CFR location in Damnak Troap Khang Choeung village, Kampot province.

S. Chhiv



Villagers collecting lotus roots in a Community Fish Refuge.

O. Joffre

4- Conclusions

CFRs have the potential to sustain and improve the productivity of rice field capture fisheries in Cambodia. Establishing a CFR in a village can have a significant positive impact on local livelihoods, especially for households dependent on open access fisheries, typically the landless poor. However, implementing CFRs is not always easy because of their technological and institutional requirements, such as changes in access rights and water management. It takes continued effort to develop community-based approaches to fisheries management and to sustain them over the long-term. Thus, support from local authorities and external technical agencies is essential for building strong community-based organizations that can manage CFRs in local communities.

On a broader level, successful CFR models strengthen community-based organizations such as Community Fisheries or Farmer Water User Groups. The models do so by providing these existing institutions with incentives for active community participation, effective management and improved governance of fisheries and water. Participation in CFR projects can also strengthen the community leadership's capacity to take collective action and their ability to access external support for other community-based initiatives.

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Fisher gleaning aquatic resource in flooded rice field, Prey Veng Province

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