Guidelines for stocking community fish refuge systems

Sustainable Aquaculture and Community Fish Refuge Management Project

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Preface

In the Kingdom of Cambodia, flooded rice fields hold great potential for the spawning and growth of many species of fish and aquatic animals that millions of Cambodians depend on for their survival. During the rainy season, these fields remain flooded for about 6 months, providing a place for fish and aquatic animals to breed and grow. The fields are connected to community fish refuges (CFRs) through various channels, including passages, canals, creeks and streams. Together, these CFRs form a rice field fishery that provides productive fishing grounds that all Cambodians are free to use.

Based on the importance of this natural resource, the Royal Government of Cambodia issued a recommendation in 2007 to establish one CFR in each commune throughout the country. Good management of this system helps to protect and conserve sustainable fisheries resources.

Through the release of fish into CFR ponds, which is an important activity to help increase natural fish stocks, preserve lost fish species to ensure the sustainability of natural resources, the Fisheries Administration in collaboration with WorldFish and the the Sustainable Aquaculture and Community Fish Refuge Management project, document **Guidelines for stocking community fish refuge systems** for technical assistance. This document describes the importance of releasing fish, the steps in releasing fish, the species of fish that should be released, the sources of fish that should be released.

Our hope is that this guide meets the needs of the CFR management committees to implement interventions in their communities and serves as a document for policy makers and strategic planmakers to protect and conserve fisheries resources to contribute to the sustainable management of rice field fisheries.

Delegate of the Royal Government of Cambodia,
in charge of the Fisheries Administration

1. Introduction

1.1 What is a community fish refuge pond?

Community fish refuge (CFR) ponds, CFR communities and rice field fisheries (RFFs) are all interrelated.

A CFR pond is existing public properties in rural areas and in public water areas where the water does not dry out in the dry season and away from large natural water areas. These ponds can be connected to rice fields or floodplains and are either natural or humanmade. Types of CFR ponds include lakes, wetlands, waterholes, reservoirs, pagoda ponds and rice field ponds, which are far from large natural water body (rivers, streams, lakes, canals or adjacent canals).

A CFR community is a group of people, from all walks of life, who organize themselves to manage a CFR pond. It is recognized by the local authority, village, commune, district, province and competent agencies, including both the national and provincial level Fisheries Administration (FiA). A CFR community maintains fishstocks in the CFR pond during the dry season and manages fishing by the people who benefit from the surrounding rice field fisheries.

An RFF is a natural resource in which fish and other aquatic animals live in a rice field, floodplain and adjacent waterways, such as canals, creek and streams. For example, the RFF system around Tonle Sap Lake is an important source of fish and aquatic animals for approximately 60 percent of households living in the paddy field landscape around the lake (Freed et al. 2020). On average, an RFF produces anywhere between 42 and 160 kg of fish per hectare per year (Hortle 2007). They are especially important for poorer people, including landless households, who can earn a living from an RFF during the fishing season and benefit from this system (Ratner et al. 2014).

The RFF system encompasses CFR ponds, floodplains ricefield and channels.

- **CFR ponds** are natural waters that have existed for generations, while others are more recently constructed waterbodies that are co-managed by local communities and authorities.
- **Channels** include fish access to the CFR pond to the flooded rice fields.
- **Flooded rice fields** serve as breeding and feeding grounds for fish and other aquatic animals and are where most fishing takes place.

The system works as follows: At the start of the rainy season, a channel connects the CFR pond to the flooded rice field. Through this channel, fish and other aquatic animals move from the pond to the rice field to spawn. There, the young grow into juveniles, and at the end of the rainy season, the adult fish migrate from the rice field through the channel and back to the pond, where they take refuge through the dry season.

1.2 Risks with community fish refuges

Fish is a source of food and income for millions of people in rural Cambodia. However, there are many challenges facing the industry. Loss of habitat and biodiversity, illegal fishing, human population growth, increased demand for fish, use of pesticides (Brooks et al. 2015), climate change and rising demand for irrigation—they all threaten wild fishstocks, in terms of both volume and quality.

In 2016, for example, Cambodia experienced extreme drought and hot weather, which affected water temperatures and levels, as well as other resources (IUCN 2016). As a result, some CFR ponds dried out or became too shallow to maintain fishstocks.

Other threats include the need for more water to irrigate rice crops. There is also a general lack of understanding within the industry regarding the importance of effective water management, which can benefit both wild fish conservation and rice production at the same time. Stocking fish and other aquatic animals properly will become more important to ensure that fish stocked in a CFR pond can survive and breed annually, which will benefit local communities. (Hortle et al. 2004).

1.3 Contribution of the guide

Communities, local authorities (villages, communes, districts, provinces), provincial Departments of Agriculture, Forestry and Fisheries (PDAFF) and FiA (both national and provincial) need guidance on how to stock and restock CFR ponds properly. With no stocking guidelines for them to follow, we developed this guide as a resource tool for the 915 or so CFRs throughout the country (FiA 2021) and for the agencies, organizations, development partners and philanthropists that manage them. Our aim is to help them stock fish effectively to protect and conserve fish and their environment in order to make food security more sustainable for Cambodians in rural parts of the country. The guide also provides resources, experience and knowledge that can better inform policymaking and planning for fisheries.

In the context of the government's Strategic Plan for Fisheries 2015–2024, stocking local fish species has become an important practice to sustain CFRs. This activity represents an important custom for CFR communities. As such, this guide can help local practices comply with national standards and international standards, which include ecological safety policies and fish production, in order to meet the socioeconomic needs of those whose livelihoods depend on fisheries.

1.4 Methods

The guide includes information gleaned from the following sources:

- a desk study of the literature on capture- and aquaculture-based stocking
- two consultative workshops[1] held to gather experiences of local communities, FiA officials, private sector actors and nongovernmental organizations on proper stocking practices
- consultation meetings on the draft guide with national FiA officials in January and February 2023
- efforts to build on the stocking experience of various projects.

2. Stocking and restocking

2.1 Purposes

In general, there are five main objectives for stocking a CFR pond:

- Improve wild fishstocks in the rice field system as a source of food security.
- Increase the diversity of species in the system according to what the CFR community desires.
- Re-establish wild fish species that were once present in the CFR.
- Re-establish endangered or rare fish species that the CFR community values.
- Continue to manage the ponds and conserve natural resources in the rice field in a sustainable manner and enhance them further.

Box 1. Objective of fish releasing

In early September 2022, the Sustainable Aquaculture and Community Fish Refuge Management (SAFR) project released 26,000 hatchery produced seeds of *Chhpin (Barbonymus gonionotus)* into eight CFR ponds. The goal was to improve the fishstock for the local CFR community. In turn, this would ensure food security, re-establish the species into the CFR pond and RFF system, and continue the management activities of the CFR.

2.2 Benefits

Stocking a CFR ponds carries multiple benefits:

- It motivates the local community and fishers to stay involved in managing the CFR pond and RFF, as they will see an increase in the fishstocks and thus their catches after stocking.
- In releasing fish and saving wildlife, the community maintains its customs and beliefs.

[1] The first workshop was held on June 23, 2022 in the province of Kampong Thom and the second on May 30 2023. Participants included the director of the PDAFF, national and subnational FiA officials, aquaculture specialists from the private sector, CFR heads or representatives, and commune councillors.

- Stocking is one of many actions that can make an RFF more productive.

Box 2. Objectives of restocking fish

On July 1 of every year, the Royal Government of Cambodia, through the Ministry of Agriculture, Forestry and Fisheries, celebrates the release of a million seeds of fish and aquatic animals into natural waters. The aim is to increase fish as a food source and improve people's livelihoods and to promote sustainable management, protection and conservation of fish for future generations.

Source https://cambodianess.com/article/pm-marks-fish-resources-ceremony

2.3 Frequency

If a CFR is managed effectively, it is not necessary to restock the same pond multiple times a year or even once every year (Joffre et al. 2012). When sufficiently stocked, a pond can maintain a moderate fishstock year-round.

Sometimes, however, initial stocking is unsuccessful. Mortalities may be high, or perhaps no fish returned to the pond; the pond could have been understocked in relation to its size. If the first or second stocking is not successful, the pond may need to be restocked.

In CFRs, the FiA encourages communities to transfer stocks from drying ponds to another pond where they can maintain the water level. Although Cambodia does allow communities to transfer rare wild fish species between nearby CFR ponds, no guidelines or standards are currently in place.

After selecting a shortlist of species that the community would like to reintroduce into its CFR pond, the next step would be to understand, as far as possible, the likely reason(s) for the previous decline in these species. To do so, a team of informed members of the community need to discuss the situation with biologists. The team should explore the following questions: Was the decline a result of overfishing or habitat change? Or was it because of the introduction of an exotic species? Could the CFR create conditions that may allow some of these species to recover? How could the community modify the CFR to improve conditions for the species to be reintroduced?

3. Stocking procedure

3.1 Step 1: How to confirm if stocking is required

3.1.1 Communities

There are four ways that a CFR community can determine whether or not its pond need to be restocked:

1. Observe how many fish break the water surface to get a rough estimate of how many fish are in the pond.
2. Determine how many fish are caught from the rice field and channels.
3. Restock the pond if it has dried out completely.
4. Hold discussions with the CFR pond management committee and members, consult FiA cantonment officials regarding the sources, species, amount and timing of stocking, and incorporate the findings into community development planning.

3.1.2 Research institutions and organizations

There are many methods and tools available to help communities estimate the type, species and amount of stocking and determine which skills are needed to operate the tools and analyze the data. From experience, communities should consider two low-cost and simple methods:

1. Community, fisheries officials, villagers and stakeholders should hold group discussions to share their observations regarding how many fish are in the pond, which (if any) fish species have been lost, and whether there are any species they want to bring back.
2. Monitor the health of the fish and the current stock in the ponds. Conduct a field survey on how many fish the community catches and how the fish are used.

Box 3. Using research data for stocking

Under the SAFR project, silver barb fingerlings were stocked based on results from three research studies conducted in 2021 and 2022: (1) a fish biological monitoring (BiOM) study, (2) a study of catch, consumption, and employment (CCEM) and (3) a focus group discussion on lost fish species, the purpose for stocking and the community's preferences for species to restock.

3.1.3 Type, size, number and timing

Each CFR pond has unique characteristics that are different from other conservation areas and aquaculture ponds. Size and depth vary depending on the season. During the dry season, with less water available, ponds decrease in both size and depth; during the rainy season, however, many increase in size and depth because of flooding (Joffre et al. 2012). Later in the year, fishstocks swim into the flooded rice

fields. As a result, estimates of the type, density of stocking relative to water surface area and time are highly inconsistent.

Table 1 summarizes information gathered from various sources, including guidelines for CFR pond management, aquaculture, the experience of fisheries officials and discussions in the workshops. It shows the number of stocked fish and their size relative to the area of the water surface.

Table 1. Type, size, amount and timing of stocked fish.

Type	Amount	Size	Time	Area
Broodfish	50–320 kg	3–4 fish / kg	May, July, November, December	1 ha
Juveniles	2000–30,000 fish	7–12 cm		

- The amount of broodfish and juveniles should be proportionate to the surface area of the pond water, as this ratio affects both growth and reproduction. Stocking at a density that is too high will result in competition for space and feed.
- Stock only healthy and large juveniles to achieve a high survival rate (FAO 2015).
- It is also important to maintain a ratio of approximately 55–60 percent females to 40–45 percent males to ensure that spawning and reproduction are successful.
- Stocking time varies depending on its purposes, for both broodfish and fingerlings explained in step 7.

Box 4. Warning 

Stocking too many fish, regardless of surface area and water quality, especially in the dry season, can put the stock at risk of slow growth or loss. This can be due to many factors, including overcrowding, insufficient food availability, lack of dissolved oxygen, low water volume, and poor water quality, such as high temperatures and turbidity. If the pond environment is suitable, the stocked fish will enhance the existing fish population.

3.2 Step 2: Species for stocking

3.2.1 Suitable species

Plate 1. A farmer releases fish from rice field in a CFR pond.

When deciding which species to stock, CFR communities should consider the following:

- Ensure the CFR will support good growth and reproduction.
- Make sure the source and target environment are similar.
- Have a clearly defined objective to select the right species to stock.
- Be sure to stock a floodplain or stillwater species, not a riverine species.
- Stock an indigenous species that the community values.
- Select a species that is rarely caught or is completely absent from catches in the area.
- Choose a species that does not exist or is rare in the CFR.
- The species should be able to breed in the stillwaters of a CFR or the surrounding rice fields, and their eggs/larvae should be able to develop under these conditions.

In the wild, rice field fish live and breed in floodplain environments, such as a CFR pond, rice field, flooded plain, lake or canal. Species native to the environment are easily available locally, including striped snakehead, walking catfish and climbing perch, as well as other aquatic animals like snails, turtles and water snakes.

Communities should also consider the following species: climbing perch (*Anabas testudineus*), *Channa lucius, Channa limbate, Labiobarbus leptochilus, L. siamensis, Oxyeleotris marmorata, Mastacembalus erthtotaenia, M. armatus, Chital* sp., *Notopterus notopterus, Trichogaster pectoralis, T. trichopterus, Mystus* sp., *Clarias batrachus*, *C. microcephalus*, *Heteropneutus kemratensis*, *Kryptoterus* sp. *and Ompok bimaculatus*. Reptiles such as the soft-shell turtle (*Amyda cartilaginea*) can also be considered.

Communities should also consider stocking their CFR pond with fish from an RFF system, especially from local trap pond owners. The CFR by-laws should stipulate the contribution of catch from the rice field.

Communities should only transfer rare fish species between ponds when there is a mutual agreement in place between the relevant CFRs, with approval from the FiA. Stocking a CFR with silver barb (*Barbonymus gonionotus*), or other species from Cyprinidae family, is advisable to improve the productivity of the RFF (Kim et al. 2019). Cyprinidae fish include silver barb, *Esomus* spp*. Cirrhinus* spp*., Barbonymus* spp*., Amblyrhynchichthys truncates, Cyclocheilichthys enoplos, Leptobarbus hoeveni, Osteochilus* spp*.* (MAFF 2018).

Box 5. The basis for stocking.

The SAFR project decided to release hatchery produced silver barb juveniles for the following reasons:

- It is easy to access large numbers of wild silver barb juveniles at public and private hatcheries in the province and near the CFRs.
- Studies in 2021 and 2022 show that silver barb were not captured in test samples and represent only 1 percent of villagers' total catch from RFFs. Local people want to see silver barb returning to breed in their CFR ponds, as they are one of their favorite fish to eat.
- FiA officials and the community agreed to stock silver barb in the CFR pond.

3.2.2 Fish species not suitable for stocking in CFR ponds

It is important to avoid stocking certain species in a CFR pond, including some predatory fish, introduced fish, hybrids (of introduced parents) and farmed fish (of unknown source). Predatory fish, such as snakehead and Wallago Attu, will eat smaller fish, while introduced fish may carry diseases that can affect local species. If there are no predators, however, some non-native species, like tilapia (*Oreochromis niloticus*), can overpopulate waterbodies, which will affect indigenous species. Using farmed fish from an unknown source is also risky, as there is no way to ensure good growth, and they can carry infections.

3.3 Step 3: Recommended sources for stocking

Identifying reliable sources to stock a CFR is an important step to ensure a healthy supply of high quality wild fish and to obtain high survival rate. Communities should stock their CFR ponds with species from one or more of the following sources:

- small private ponds in a rice field system (not aquaculture ponds)
- rice fields and floodplains.
- canals, creeks, lakes and other waterbodies
- other CFR ponds, where CFRs share stocking species among them or where there is a need to save fish from a nonviable CFR pond, including dried ponds
- the Tonle Sap Lake and the Mekong River, restricted only to species that can adapt well to a CFR pond environment
- local private farms and hatcheries that produce or fatten breeds and seeds from local and wild broodstocks (from F-1 wild parents, in the case of seed supply)
- government research centers, including the Freshwater Aquaculture Research and Development Center in Prey Veng Province, Samdech Techo Hun Sen National Institute for Aquaculture Research and Development in Kandal Province, and the Upper Mekong Aquatic Research and Production Center in Stung Treng Province.

Ensuring a healthy supply of fish from a local source close to CFR will reduce the cost and length of transportation and increase the chance for a high survival rate.

Box 6. Stocking practices.

In early September 2022, through consultations with national senior officials from FiA, the SAFR project stocked 26,000 silver barb juveniles from a private hatchery in Kampong Thom Province. The seeds came from a trusted source that produced offspring of F1 wild parents and were delivered on time.

3.4 Step 4: Actions before stocking

Prior to stocking, it is very important for communities to check and investigate all aspects of the CFR, including inlets and outlets as well as the water quality.

3.4.1 Physical characteristics

- Check the amount of water in the CFR pond to ensure it is proportionate to the number of broodfish or juveniles, or both, planned for stocking.

- Look for information on how deep the water level is during the dry season. For broodfish, make sure the pond is at least 2 to 3 m deep. If it is less than 0.5 m, dig the pond deeper and leave it alone for one season (6 months) so that it can accumulate water from rains or floods that come through the channel.
- Keep aquatic vegetation in check, at less than 25 percent of the pond surface.
- Provide shelter or habitats for the fish to feed in and escape from predators. If the pond does not have enough on its own, use tree branches and stumps to add some more. For more information on the extent and the distribution of such shelters in a CFR pond, see the guidelines for CFR–RFF management in Cambodia.
- Keep the predator population in check.
- Maintain the environment in and around the pond to keep it free from waste, such as plastic bags and bottles, agricultural waste, toxic materials or litter that could harm the fish.
- Keep the inlet/outlets open and unobstructed so that the fish can move in and out of the pond. During the dry season, dredge the inlet/outlets, close all unwanted gaps and equip them with sluice gates or weirs as appropriate to control the water flow. During the wet season, check the inlet/outlets to make sure they can hold enough standing water and/or the water can flow and so that fish can move freely between the CFR pond and the rice field, and vice versa.

Box 7. Pond improvements.

In 2021, the SAFR project renovated eight CFR ponds so that they could hold more water. This included deepening and expanding parts of ponds, increasing access inlet/outlets and channels, removing aquatic plants and making other improvements. A year later, in early September 2022, the project stocked the ponds with silver barb juveniles.

3.4.2 Water quality

The quality of the water has a significant effect on the survival and growth of stocked species. During the dry season, be sure to check the water quality for basic parameters such as pH, turbidity, dissolved oxygen and temperature. A pH of 6.5–8.50, turbidity of 20–60 cm and a temperature of 23–32°C are best for stocking fish.

3.4.3 Stocking time

The best time for stocking is in the morning, between 07:00 and 09:00. At this time of day, the weather is cool, there is enough light, and the community has time to observe the juveniles and prevent them from being eaten by predators immediately after they are stocked.

3.5 Step 5: Transportation and delivery

3.5.1 Transportation

Various methods are available to deliver species for stocking, depending on the species and the type (broodfish or juveniles). If the supply is coming from a professional facility where proper packaging is available, transportation is less challenging. However, the community should consult fisheries experts when trying to determine which species and type to stock. This is especially important for stocking

airbreathing fish and the requirements for transporting them, such as the volume of water, number of fish per bag or container, oxygen supply and packaging.

Broadly speaking, there are two different ways to transport species for stocking: open and closed.

The open method is mostly used for delivering fish over short distances. Place the juveniles in an open container with air stones and a battery-operated air pump. A 30-L container can hold six or seven broodfish weighing 2 kg each. Do not place too many broodfish in each container, as waste from the fish during transportation can pollute the water and deplete oxygen levels, which will result in high mortalities.

The closed method works best for medium-length distances. Pack the stocking species in sealed plastic bags with adequate water and oxygen. For long trips, be sure to refill the bags with fresh water and monitor the temperature regularly. If transporting species with sharp spikes, make sure the packaging is not broken or pierced during transportation.

3.5.2 Delivery

When planning delivery, take into consideration the distance and ability of the community. If cool temperatures cannot be maintained during the trip, transport the fish at night so that they are delivered early in the morning and are available for stocking between 07:00 and 09:00. If temperatures can be maintained between 18°C and 22°C, the fish can be delivered at any time. If necessary, use ice or wet blankets, or even air conditioning, to keep the temperature low during transportation.

3.6 Step 6: Pre- and post-stocking

3.6.1 Pre-stocking

When **stocking** species from the wild, including those from rice fields, rice field ponds, floodplains, lakes and the like, the fish can be released into the CFR pond immediately, as the source and their new environment are the same or similar in nature.

When transporting fish from a hatchery, however, it is necessary to check the juveniles before releasing them into the CFR pond. First, place the containers or bags into the pond. Leave them in the water for 10 to 15 minutes, then open them and gradually splash water from the pond into the bags. This will allow the water in the bags to mix with the water from the pond before the fish are released into the pond.

During transportation, abrasive packaging materials, overcrowding and stress can injure fish. After opening the containers or bags, check the fish carefully. If any were injured during transportation, notify the supplier immediately to replace the lost or damaged fish with additional seed, receive financial compensation or just to learn what actions to take so that it does not happen again in the future. Do not release injured or unhealthy stocks into the pond.

After receiving juveniles from a hatchery, acclimatize them in a hapa placed in a corner of the receiving pond and provide the fish with enough food to last them a

week. Make sure the size of the hapa is proportional to the density of juveniles to avoid overcrowding and to ensure a sufficient supply of oxygen. This allows the fish to recover from the stress of transportation and adapt to their new water conditions.

It is important to determine the amount of time and labor needed to prepare for, take care of and feed the juveniles while they are in the hapa. If it is not possible to do so in advance, disregard the hapa option and instead obtain only large and strong juveniles from a nearby facility.

Do not release the fish all at one spot. Rather, disperse them in as many spots as possible to avoid schooling and evade predators. Be sure to release only healthy juveniles from the hapa into the pond.

Box 8. Coordination for additional technical support.

For transportation and stocking, the SAFR project collaborated with district and provincial fisheries officials, as well as a supply specialist, to provide field inspection and technical assistance, including on-the-spot training for the community at the time of stocking.

3.6.2 Post-stocking

As soon as the pond is stocked, observe the juveniles for 10 minutes to 1 hour to ensure they swim away from the shore. Remove any individuals that are weak or dead. Sprinkle the water to disperse the juveniles so that they do not form a large school, as this would leave them open to poaching or predation. Increase patrols to ensure that the juveniles do not congregate by the shore, and take action to drive them into deeper water.

3.7 Step 7: Stocking season

Whether using broodfish or juveniles, stocking should take place between May and December, depending on the arrival of the wet season, when the habitats in the CFR are well connected to rest of the system. The vast expanse of waters covering the rice field and floodplain will provide sufficient food and space for the newly stocked fish to feed, grow and reproduce.

However, CFR ponds can also be stocked during the dry season, between January and April, using fish from rice field ponds as well as catches from private ponds. During this period, though, the pond will have shrunk from lower water levels, and connections to the larger system may no longer be available. As such, any stocked fish will have to remain within the pond.

Box 9. Cooperation with professional officials.

At every step of the stocking process, communities should consult with FiA officials, from the national, cantonment or district level. Officials can provide expert advice on suitable seed types and species, identification of potential infections or parasites in the stocked fish, sources of wild seeds, procedures for acclimatization, and transportation and stocking methods.

4. Monitoring and evaluation

Monitoring and evaluation is required at all stages of stocking. Several basic and simple tools are available no matter how limited communities are in terms of their capabilities, ability and time.

After stocking, communities should assess their newly stocked species to learn from any successes or failures during the process and to document potential lessons. Whether or not the process was successful, an assessment will help the community understand how to improve its fishery.

The following are some methods for communities to use, depending on the capacity and objectives of the study, including preplanning and post-evaluation:

- After stocking, monitor the CFR pond regularly for several weeks to check for signs of feeding, estimate the amount of fish in the pond and remove any dead fish.
- Monitor fish catches from the rice fields on a regular basis.
- For researchers and research institutions, survey the catch from the rice field system. Conduct biological monitoring, and monitor the species and stocks closely. Install an underwater camera to observe the fish and determine how many are moving in and out of the CFR pond.
- Tag and sample the fish.

Box 10. Monitoring and evaluation.

The SAFR project conducted post-stocking monitoring and evaluation at both the community and project level.

At the community level, the CFR committee checked for the following:

- signs and causes of loss and the estimated percentage or number of fish
- presence of predators
- movement of the stocked fish from the CFR pond into the channels and rice field system
- movement of silver barbs returning to the CFR pond in the dry season months of December, January and February.

At the SAFR level, the project conducted the following:

- ongoing BiOM, counting fish nests, camera trapping at the entrance of the CFR pond to monitor the mobility of fish
- a CCEM and ongoing monitoring of the stocked species and catch by local people
- a group discussion to assess the impacts of stocking against the main objective as well as local expectations.

5. Recommendations

Post-stocking monitoring and evaluation can be very challenging and difficult. However, the following questions can assist users of this guide as well as researchers:

- Has a stocking guideline been developed for all species stocked in the CFR pond?
- Did stocking impact the local fish catch?
- Has an economic analysis of the stocking exercise been taken into consideration, as well as the costs and potential benefits?
- What, if any, was the environmental impact of stocking?
- What were the survival and mortality rates of the stocked fish?
- Which species usually die in CFR ponds after stocking, and what are the possible causes?
- Was there any evidence of spawning or reproduction among the newly stocked population?
- Was there any evidence of new recruitment in the CFR pond or in the associated floodplain?
- Did juveniles produced from the newly stocked fish in and nearby the CFR grow and continue to reproduce successfully?
- Was there any evidence of the young population of the second generation captured in the associated floodplain?

- Was there any evidence of the tagged fish grown and caught in the rice field?
- Was there a specific category of CFR ponds that stocked fish prefer and are highly productive nursery grounds for them to grow and reproduce?
- Was there a specific category of CFR ponds that is most suitable for reproduction among newly stocked fish (good floating nests, substrates, protection for nests and juveniles by parent fish)?
- Could site selection improve water connectivity to the CFR for the newly stocked species?
- Have more in-depth studies been pursued to develop stocking guidelines and determine the ecology of each category of CFR ponds?

Use the following questions to monitor and evaluate the success of reintroducing a fish species into a CFR pond:

- Did the broodstock or fingerlings survive reintroduction? Were there any dead fish of the newly introduced species after release?
- Did the species breed in the CFR? Was there any evidence of active spawning sites or breeding activity?
- Did the species breed successfully? After stocking, were juveniles seen in the CFR or in the surrounding floodplain?
- Did juveniles produced in and around the CFR grown to maturity and bred successfully? Were any sub-adults caught in the floodplain? Were any mature fish (untagged or of a different age class from those introduced) caught from the fishery?

Documenting successes (even partial) will increase the community's impression that the CFR pond has improved their local fishery.

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