



Rice-fish co-production pathways for sustainable development in Cambodia



Introduction

Rice and fish are longstanding staple foods in Cambodia. The wild fish and other aquatic animals in rice field ecosystems are managed as rice field fisheries (RFFs). Well-managed community fish refuges (CFRs) support their productivity and provide a year-round aquatic habitat that is well connected to adjacent rice fields. These CFR-RFF systems provide benefits to rural communities that are not easily replaced, including supporting food and nutrition security and supplementary livelihoods. However, pressures from infrastructure development and increasing multisectoral demands on water, food and energy threaten these systems. Although it is essential to maintain CFR-RFF contributions to Cambodia's rural development, investment in complementary innovations could further advance the country's sustainable development objectives.

This brief outlines the demonstrated benefits of CFR-RFFs, the results from past investment and complementary innovations, and the potential benefits of additional such innovations. The selected innovations are drawn from experiences in Cambodia and elsewhere in South and Southeast Asia, focusing on those with the greatest potential to complement the benefits of CFR-RFFs.

Key messages and recommendations

- CFR-RFFs provide key benefits to Cambodia's sustainable development that complementary innovations can augment, as demonstrated in previous investments.
- Complementary innovations can stimulate technical, governance and/or value chain improvements through sequential or simultaneous integration into CFR-RFF systems.
- Innovations that are complementary to CFR-RFF systems include climate-smart and integrated farming practices, community-based aquaculture, domestication and/or breeding of small fish, the addition of fish into homegrown school feeding programs, and integrated water management.

Benefits

Well-managed CFR-RFF systems in Cambodia have had the following benefits:

- **Annual fisheries production has increased to 138 kg/ha.** CFR-RFFs in the rice-growing regions around the Tonle Sap supply local communities with finfish and other aquatic animals (Freed et al. 2020).
- **At least 158 aquatic species now live in a biodiverse habitat.** These species were harvested and/or observed over a 3-year study period across 40 CFR-RFFs around the Tonle Sap (Freed et al. 2020).
- **CFR-RFFs have averaged 3.1 kg of aquatic foods weekly per household for food and nutrition security.** Around 60 percent of fish and other aquatic animals consumed in the surveyed households came from CFR-RFF production. Especially remarkable was the persistence of contributions during the dry season, at 57 percent of household consumption. This runs contrary to the prevailing assumption that there is a lack of aquatic foods during the dry season (Freed et al. 2020).
- **Livelihoods have improved and supplementary income has increased.** Across 10 CFR-RFF systems supported by WorldFish and GIZ-SAFR, aquatic foods value chains now provide KHR 12.1 billion in annual income for men and KHR 2.5 billion for women, as well as employment equivalent to 1837 full-time jobs for fishers, retailers and input providers.
- **Communities have become more resilient to climate change.** Communities have noted the benefits that CFRs provide through water conservation and drought prevention. Climate resilience benefits are also distributed throughout the adjacent rice field landscape. To date, support from WorldFish, the United States Agency for International Development and GIZ for CFR-RFF systems has improved the sustainable management of over 10 percent (200,000 ha) of rice field landscapes in Cambodia.

Complementary innovation benefits

Previous investment has shown that CFR-RFF management and innovations in household visioning, home horticulture and caregiver training have the following complementary benefits (Shieh et al. 2021):

- **Women's income generation.** Following the household visioning, 60 percent of women respondents reported having more time to generate income. When household visioning was coupled with home horticulture activities, often women were able to sell surplus vegetables to earn money.
- **Women's participation in leadership.** Women also reported having more time to participate in community leadership capacities, such as serving on the CFR management committee.

- **Improved family life and home environment.** Over a 3-year study period, the cleanliness of home environments improved in households that participated in visioning as well as in other households in CFR communities. Those that participated in visioning reported other improvements in their households, including mutual understanding of each other's workloads and sharing household goals, responsibilities and tasks. This, in turn, led to improvements in their family life and happiness and reduced household violence.
- **Improved dietary diversity among children.** Over the same period, the proportion of children under 2 years old consuming a diet that met minimum dietary diversity requirements increased from 47 to 54 percent. However, more research is needed to understand the barriers and enablers to changing household dietary diversity, as women's dietary diversity decreased over that time.

Other complementary innovations

Six high potential innovations could potentially complement CFR-RFF benefits and further contribute to Cambodia's sustainable development objectives.

The following criteria were used to select these innovations:

- The innovation builds on strengthened capacities and coordination in CFR-RFF systems among producers and communities. This means that implementing it would require a low threshold of capacity strengthening and coordination.
- The innovation can be integrated with a series or suite of other innovations to make CFR-RFFs more efficient and increase return on investment; best practices are to integrate technical, governance and market or value chain innovations.
- Experiences in Cambodia or in South and Southeast Asia have demonstrated benefits.
- These benefits would enhance existing CFR-RFF benefits or provide additional ones across various dimensions for Cambodia's sustainable development.

A rice-fish innovation inventory for South and Southeast Asia provides additional options explore: <http://tinyurl.com/yv8x4f75>.

Climate smart dry season crops

In CFR-RFF systems, planting an alternative crop to rice in the dry season can diversify incomes, regenerate soils and save water. Among the many options are mung bean and watermelon (ADB 2019). In Cambodia, successful trials on these crops found that mechanization practices provided additional savings in labor and energy for these dry season crops as well as rice crops. However, income benefits of the dry season crops depended on their market prices and influenced farmer preferences. Farmers who participated in the study also expressed preferences for or already cultivated other dry season crops, including cucumber, cassava, pumpkin and eggplant.

Community-based aquaculture

In Bangladesh, community-based aquaculture reduced the vulnerability of poor and landless households and contributed to socioeconomic equity, food and nutrition security, and income (Haque and Dey 2016 and 2017). Communities that implement CFR management tend to already have the capacities and coordination necessary to develop the arrangements for community-based aquaculture. A participatory approach could identify and develop the aquaculture site as a “sister pond” to the community’s CFR. Coupling this innovation with domesticating and/or breeding small indigenous species (SIS) and developing the value chain could enhance the socioeconomic and food and nutrition security benefits. A recent theory of change that builds on rice-fish production for Cambodia’s sustainable development provides an example of this coupling (Freed et al. 2021).

Domesticating small indigenous species of fish

SIS fish are found in abundance for short periods during the flood season and are a key factor in improving food and nutrition security (Bogard et al. 2015) as well as farmer income (Bogard et al. 2015; Castine et al. 2017). They are easy to process and can be eaten whole, making them a rich source of micronutrients in a form that can prevent stunting and other forms of malnutrition in young children (Bogard et al. 2015). Small-scale market studies have found growing demand for SIS in Cambodia’s food markets, and WorldFish-led programs to boost SIS production in Bangladesh and India have had outstanding results (Saha and Barman 2020; Dubey et al. 2022). Research investment could help adapt the approaches for Cambodia. Improving value chains and market access would also be necessary to ensure farmer incomes and fish supplies for retail and childhood nutrition-focused products (Freed et al. 2021).

Homegrown school feeding programs

As shown in Ahern et al. 2021, homegrown school feeding programs (HGSFPs) can contribute to multiple development objectives, one of which is reducing hunger, especially among low-income families. This, in turn, supports small-scale producer incomes, stimulates local economies and

improves school attendance. To be effective, HGSFPs require partnerships across government ministries, food systems and education stakeholders, including school personnel and families with school age children. Such partnerships allow opportunities to share responsibility, maximizing return on investment and empowering various stakeholders. The fish available in CFR-RFF systems, as well as vegetables grown on the banks, could be used to supply HGSFPs. Including SIS fish in HGSFPs can further boost nutritional and economic benefits. In Cambodia, specifically, there is strong potential to deliver these benefits by domesticating and/or breeding SIS and including them in HGSFPs. Connecting schools and CFR-RFFs could also include education and student participation in fish production techniques, CFR-RFF system processes and CFR management.

Integrated farming

Using integrated farming to include vegetables or multiple aquatic species can provide better nutrition and/or increase income (Ignowski et al. 2023). The demonstrated results depend on the particular combination applied, but fish and other aquatic animals have high economic and nutritious value (Ignowski et al. 2023; Shepon et al. 2020). Trials on integrated farming systems in Cambodia have shown that relatively fewer farms integrate aquatic foods into their production practices (Sophea et al. 2023). Research to integrate aquatic foods into such farming models for Cambodia could ensure further benefits in food and nutrition security and farmer incomes.

Integrated water management

Recent experience in CFR-RFFs has shown that integrating water management practices can enhance the benefits from CFR water. A variety of such approaches have been implemented based on the local context: (i) contracting the use of water for agriculture by a private or farmer water user group, (ii) contracting use of the CFR to store water pumped from nearby streams or rivers that is destined for agriculture use and (iii) contracting water treatment facilities to provide clean water for drinking and household use. In each of these models, the contract can include terms and conditions to make sure the contracting parties contribute to CFR management and maintenance.



“ I am able to catch approximately 2 kg of fish per gillnet per night since the CFR was established. I use them for domestic consumption and to earn money to send my kids to school and purchase other foods to help pay for my kids’ education and other necessities. ”

**— Van Phea,
Fisher in Boeng Kaek Ngout**

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