

# CPWF Project Report

Community-based Fish Culture in Seasonal Floodplains  
and Irrigations Systems

Project Number CP35

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## **EXECUTIVE SUMMARY**

### **Background**

The past decade has seen the growing recognition of the crisis facing the world's water resources and thus the need for concerted efforts to use them more efficiently. It is well understood that the efficiency of water use, or water productivity, can be increased by either producing more output per unit of water used or by reducing water losses – or by the combination of both.

However, strategies (developed and applied so far) for increasing output have been limited to agricultural crop cultivation and have not fully taken advantage of increased water productivity by integrating fish and other living aquatic resources into the existing water use systems. Such opportunities of integration include community-based fish culture in irrigation schemes and seasonal floodplains.

### **Objectives of the Project**

The main objective of this five year action research project was to test technical and institutional options for floodplain aquaculture, implemented on a collective basis at selected locations in five countries, namely Bangladesh, Cambodia, China, Mali and Vietnam. The community-based fish culture model was originally developed in Bangladesh, building on three decades of research in community-based fisheries management and floodplain aquaculture. The project aimed to disseminate the model to other countries with extensive floodplain resources that could potentially generate important benefits for floodplain communities, addressing the following objectives:

1. To develop appropriate technical and institutional options for increasing water productivity at basin level through integration of community-based fish production into existing floodplain and irrigation systems.
2. To identify the most appropriate models of collective action for aquaculture under different socio-ecological contexts.
3. To assess the contribution of collective approaches to aquaculture for sustainable development of floodplain resources and irrigation systems.

In addition to these objectives, the project sought to apply a range of alternative approaches to monitoring and evaluation, including participatory video techniques.

## Research Findings

The implementation of the project has led to a range of outcomes, some anticipated and some unexpected. Collective approaches to aquaculture have met with variable success in each of the project countries, with the project delivering different levels of benefits both within and between countries. Negotiating access, management institutions and benefit sharing arrangements within a system where rights are dynamic, overlapping, and heterogeneous has created particular challenges for the development of the project. As a result, only sites in Bangladesh and China generated data over a number of fish culture cycles. Substantial improvements in resource governance were, however, seen in Mali, where the intervention showed strong potential for uptake and dissemination.

In Bangladesh, successes have been substantial at some project sites. Building on previous community-based fisheries management experience in the country, community-based fish culture has been introduced in floodplains subject to a complex array of administrative arrangements. The project was implemented in government *khas* lands leased to fishers, and in areas of private ownership. In each system, enclosures were created within floodplain depressions. Fish culture was managed by a Floodplain Management Committee made up of representatives from all communities surrounding the floodplain, with participation of fishers, landless non fishers and landowners. As described by Haque et al. (2008), however, the complexities of access and ownership to land, water, and fishing rights have created serious challenges to the project. Despite these challenges, the community fishers' society at Beel Mail, Rajshahi District, with the support of local authorities, are in the process of securing an extension to their current leasing arrangement allowing them to continue fish culture until 2013. Fish culture is now financed by savings from successful fish culture during previous years.

Fish culture activities in southern Vietnam have been introduced on a collective basis in flooded rice fields of the Mekong Delta. In contrast to Bangladesh, the flooded land is entirely under private ownership, with members of the fish culture group drawn from households whose land is situated within the flooded area. Where annual flood height is low enough to permit the creation of enclosures around individual household plots, there has been a general preference toward fish culture on an individual basis, or a third rice crop, and insufficient incentive for farmers to work together collaboratively to raise fish. Consequently, there have been high levels of discontinuance of community-based fish culture in these areas, although approaches to collective fish culture are now evolving amongst groups of households who favor fish culture in a small number of enclosed rice

fields. In the provinces of the Mekong Delta that border Cambodia, flood waters are deep, permitting only two rice crops each year. In these areas, the cost of creating individual enclosures, using fences of sufficient height to contain stocked fish, is prohibitive, making collective fish culture a more viable option. Benefit-sharing arrangements, management, and leadership of fish culture in community groups and fish marketing present significant challenges to the success of the approach.

In Cambodia, establishing community groups to successfully manage fish culture within flooded areas has proved problematic. Fish culture activities were introduced in open access reservoirs and flooded rice fields. Initially, households were keen to participate in the project. Farmers have since demonstrated a preference for fish culture on an individual basis, introducing the technology instead on their own homesteads and private plots. As in Vietnam, in some areas there was a move toward collective fish culture amongst smaller fish culture groups of 10-12 households who practice fish culture in 3-4 enclosed rice fields. Members of these fish culture groups took action to improve the rice field environment for fish culture by creating ditches along the rice field perimeter to act as refuges when waters are shallow. However, the approach did not prove successful in either Takeo or Prey Veng provinces. The reasons for this can be attributed to a number of factors, including unpredictable flooding events, a lack of quality seed inputs and poorly developed markets for aquaculture products. Economic migration during the flood season also limits the availability of labour in the community, and weak social capital and aversion to collective action resulting from the trauma of the Khmer Rouge era also undermine community institutions for fish culture. Floodplain refuge ponds were introduced as a possible alternative to community-based fish culture.

Farmers in China adopted a different approach to collective fish culture than their counterparts in other project countries. The project was implemented in two provinces, Yunnan and Jiangsu. In Jiangsu province, fish culture was introduced into irrigation canals. In Yunnan, fish were stocked in flooded rice nurseries that are also used for the production of lotus. In both cases, management of fish culture was entrusted to an individual who acts as a caretaker, feeding and guarding the stocked fish. In return, they receive a larger proportion of the benefit from production, with the remainder shared amongst project participants and local community funds.

Fish culture is a new activity in Mali, creating a new set of challenges in addition to those faced in the Asian countries. Fish were stocked in triangular enclosures in '*mares*', or floodplain depressions, which are generally managed by one community. Caution was needed to ensure that the introduction of fish culture does not undermine traditional

access to the water, subject to multiple uses by a variety of resource users, or that the change in value of both the water resource and fish production transforms the management and allocation of rights to water and fishing. A detailed analysis of access rights and institutions was undertaken prior to fish stocking.

### **Outcomes and Impacts**

The outcomes and impacts of the project are, as described above, highly variable, yet we were able to see impact and change occurring at a number of levels, from the individual to the institutional. At the community level, fish culture on a collective basis had a significant impact in communities in Bangladesh, China and Mali. In Vietnam and Cambodia, research furthered our understanding of the conditions for collective action, and specifically for community-based fish culture, that will contribute directly to the development of locally appropriate and technically feasible fish culture systems in both countries. In Cambodia, the project responded to government commitments to establish Community-based Fish Refuge Ponds (FRPs) in every village in the country, by providing best-practice guidelines for FRPs.

In Bangladesh, stocked fish production reached 400 kg/ha at Beel Mail, representing an increase of 133% compared to the baseline. This increase in fish production brought significant changes to the community, who relate the story of their village in the community-produced film 'The Island of Dreams and Success'<sup>1</sup>. During focus group discussions and Most Significant Change interviews, beneficiaries also reported that cooperation in the community has increased. Prior to the intervention, households fished individually from open waters and competed with one another for the fish catch. Since the introduction of fish culture on a community basis, households have to work together to manage fish culture activities and to protect the fish stock. The increased cooperation and communication in the community is beneficial for other aspects of community life. Beneficiaries in Melandi reported that their lives are transformed in particular for the duration of the fish harvest, which can last up to 110 days. At Kalmina Beel, the fish harvest, and associated benefits, continued for 95 days in 2009. Although the fish catch is lower on some days than it was in the past, the overall effect is one of income smoothing and the generation of income that permits households to afford education for their children, or to purchase assets such as mobile phones and televisions, technologies that are important in providing rural households with access to information.

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<sup>1</sup> <http://youtube.com/watch?v=fgitqImT420&feature=related>

Although relatively modest levels of fish production were achieved in Yunnan province, contributing little to total household incomes, fish production still provided significant benefits to the participating communities. In Taiping village, in particular, beneficiary households preferred to receive their share of production in the form of fish rather than in cash. Taiping is a relatively poor village, and fish is considered a luxury source of protein. As a result, households eat fish less than 10 times per year. Fish production from community-based fish culture led to a significant increase in fish consumption in the community. The additional fish that the project provided for home consumption was a sufficient incentive for the community to continue fish culture.

In Mali, outcomes and changes in community behaviour to protect fish culture enclosures and the mare environment far exceeded expectations, particularly as substantial delays in the implementation of the fish culture intervention meant that the first culture cycle took place only in the final year of the project. The impacts of constructing the aquaculture enclosures in "Mama Pondu" mare go well beyond that of the fish production within the enclosures. Most significantly, all focus groups described a number of ways in which this projects' focus on development and management of the mare resources has increased the community awareness of their reliance on this common resource, and their commitment to improve mare resource governance overall. Consequently, livestock herders have taken greater care in tending their flocks, fishers have limited their poaching during the closed season, and farmers have reduced the amount of vegetation that they extract as fodder for small livestock. Together, these self-imposed measures are expected to have significant impacts on the amount of fish landed during the collective fishing event to be held in June, as well as the productivity of agricultural fields in the area. Community focus groups were also uniformly supportive of continuing these improved governance norms during the years to come.

At the institutional level, NARES partners also reported important changes in their working practice and research knowledge and skills. In China, partners reported that they have a greater interest in the socio-economic conditions of the communities in which they work, and are keen to learn more about the institutional and policy environment of their research. Participatory research methods were new to research partners at FFRC when the project began. The application of PRA methods has expanded the scope of their research beyond a simple analysis of fish productivity, and consultation with farmers at the local level to understand their needs and preferences has also increased.

The opportunity to build international partnerships was also cited as an important outcome of the project, particularly amongst NARES partner participants in China. The

increased visibility of local departments, through the connections established through the project, have led to further funding for national level projects in areas that previously received little attention from national level agencies.

Capacity building in the form of new skills training was of importance to research partners from the Department of Aquaculture of the Fisheries Administration, Cambodia. Compared to other projects supported by international donors and network organisations, the principal investigator from the FIA appreciated the degree of autonomy and independence he was given to develop his own ideas, to brainstorm and to discuss ideas and make decisions in collaboration with other members of the team. The value of new skills in field observation, discussions with community members and the use of maps to discuss ideas with project participants at the community level were emphasized.

### **International Public Goods**

The dissemination of the community-based fish culture model, developed in Bangladesh, to other countries in Asia and Africa represents an important contribution to a suite of aquaculture technologies currently available to rural households across the world. Testing the CBFC model in a range of environmental, social and economic contexts has provided important insights into the conditions that support community-based fish culture and where such an intervention is both appropriate and likely to generate benefits for rural communities. Joffre and Sheriff (2010) provide a detailed analysis of the conditions which either supported or constrained CBFC in each of the project countries, going on to define the type of locations in which CBFC may provide an appropriate livelihood option and, in contrast, the type of environments where CBFC is likely to fail. This analysis can feasibly support the identification of promising locations for CBFC in Asia, and possibly Africa.

The project has generated a series of reports and papers outlining important lessons learned with respect to the technical and institutional design of fish culture in seasonally flooding areas. In addition, the research has made significant contributions to our understanding of collective action and property rights in floodplains, where institutions governing resource use, access and ownership are both complex and dynamic. Unlike the many studies that focus attention on one location, the project provided a unique opportunity to contribute to the body of literature on technology adoption, collective action and property rights based on a comparative analysis in five countries.

Alternative approaches to Monitoring and Evaluation, and to assessing impact, are becoming increasingly popular in development research. In an attempt to understand impact and change beyond a traditional analysis of fish production and household income, the project applied Most Significant Change and Outcome Mapping methodologies to determine the extent of project impact, and unanticipated changes in particular. The findings have been presented in Sheriff and Schuetz (in press) and the lessons learned disseminated through a series of information sheets outlining the advantages and constraints of applying each of the methodologies in a research for development context<sup>2</sup>.

The impact of introducing participatory video techniques in Bangladesh has been two-fold. Firstly, by putting the camera in the hands of the community, PV is enormously empowering for the project beneficiaries, particularly for the women involved in the video production<sup>3</sup>. The video produced by the people of Melandi, 'Island of Dreams and Success', reflects the message that the community wanted to convey. As an M&E tool, PV can also flag the issues of most importance to the community, as the team discusses their preferred themes for the video. Secondly, the video is publicly available online, and reached over 31,000 viewers within 24 hours following posting on the independent, online Malaysian news portal Malaysiakini. The video conveys information about the project approach as well as the response of villagers whose lives have been affected as a result of the intervention. The value of the participatory video approach over traditional documentary film, written and filmed by outsiders has been communicated throughout the WorldFish Center and the CPWF. Furthermore, the communities involved in the PV process have continued to produce video films as a result of the relationships established between the community video team and Bangladeshi film maker Mustafa Sayeed, of Proshika<sup>4</sup>, who aims to establish a network of community film makers throughout rural Bangladesh.

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<sup>2</sup> See Appendix for information sheets. Pilot testing of Outcome Mapping in Vietnam was supported by ICT-KM of the CGIAR as part of the Knowledge Sharing in Research project (2008-2009).

<sup>3</sup> See 'Putting the Camera in Archana's Hands' (<http://www.malaysiakini.tv/video/18376/-putting-the-camera-in-archanas-hands.html>).

<sup>4</sup> Proshika is one of the largest NGOs in Bangladesh.

## Recommendations

- Community-based fish culture provides a great opportunity to maximize productivity from seasonally flooding environments, for the benefit of rural communities, with potential for positive impacts on productivity, income, food security, livelihoods and resource governance demonstrated across a wide range of countries and conditions.
- Aquaculture has the potential to bring considerable benefits to rural Cambodia but further development of the sector will be needed before sufficient infrastructure, inputs, market linkages and extension services are available to support the community-based fish culture model. The current initiative of the Cambodian government to develop community fish refuge ponds represents an important step towards building capacity and infrastructure for fisheries and aquaculture development. Further research and testing is needed to improve the productivity and sustainability of these systems, building on the knowledge generated by the CBFC project.
- Experiences in Mali indicate that CBFC has the potential to improve *mare* productivity through aquaculture and improved *mare* governance. However, further research is needed to establish whether the same outcomes can be replicated at other locations, and to evaluate opportunities for out-scaling the approach in other areas of the Inner Niger Delta. Research demonstrated the importance of providing a platform for dialogue amongst all *mare* resource users, whereby aquaculture became a catalyst for improved management of all *mare* resources, both aquatic and terrestrial. The approach adopted within the CBFC project provides a potentially useful model for *mare* management throughout the region.
- The CBFC model in private and public floodplains has been successfully proven in Bangladesh. However, further research should focus on the environmental impact of CBFC, particularly the relationship between fish culture and rice cultivation, and downstream impacts resulting from changes in the water management regime. The potential of the approach in coastal areas should also be explored. A suite of technologies has now been developed in Bangladesh, based on decades of experience in community-based fisheries, permitting the selection of the most appropriate technology to suit the location and local needs. Future interventions should draw on this vast body of knowledge to ensure the most appropriate technology is selected to suit local conditions and preferences.
- Community Based Fish Culture has a high potential in the floodplains of Vietnam, but further modifications to the model tested in this study are required for CBFC to generate greater benefits. Smaller groups facilitate participation in the collective fish

culture. Smaller production units will also help to develop alternate marketing strategies (including delayed marketing, with fish fattening in ponds) to improve economic return of the technology. Integration of fish culture in a rice-based agro-system is facilitated if the collective approach includes both types of production (e.g. fish and rice) in order to limit conflicts for water management and the rice culture calendar.

- Exclusion is a common feature of resource management interventions based on resources held in common by a defined user group. However, the potential for negative consequences to arise and impact resource users must be given full consideration before introducing a new technology. The approach undertaken in Mali is recommended, whereby a detailed investigation was undertaken prior to the introduction of fish culture to understand patterns of resources use and access, to assess the potential for negative consequences and conflict, and to ensure that all user groups were included in the development and implementation of fish culture (See Russell et al, in prep).
- The costs and risks associated with fish culture can be reduced using various strategies, besides the pooling of land and water resources, such as marketing strategies and the purchase of inputs. The emergence of alternative options to help communities maximize the benefits from seasonally flooding areas is best supported through a flexible research approach and the acknowledgement of the critical role of national research partners in leading the development and testing of new technologies. The CBFC project benefited from such an approach, particularly in Mali, Cambodia and China, which promoted the emergence of more innovative options, relevant to local preferences and conditions, as well as opportunities for capacity building amongst local staff.
- A range of conditions that support and constrain community-based fish culture was identified during the course of the research. Careful selection of locations where these conditions prevail, and consideration of the social, political and historical context could lead to a considerable improvement in uptake and adoption of community-based fish culture, and other related technologies, with associated benefits to poor rural communities.