TOPIC AREA
TECHNOLOGY ADOPTION & POLICY DEVELOPMENT

Feed Technology Adoption and Policy Development for Fisheries Management

Technology Adoption & Policy Development / Activity / 07TAP01UC

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ABSTRACT

The fisheries resources in Cambodia and Vietnam are declining due to the rapid increase in population and illegal fishing activities. Many capture fisheries resources have been overexploited. There is increasing competition and conflict between the use of low value/trash fish for aquaculture feed and human consumption. The project entitled "Development of Alternative to the Use of Freshwater Low Value Fish for Aquaculture in the Lower Mekong Basin Cambodia and Vietnam: Implications for Livelihoods, Production and Markets" has the purpose to balance social, economic and environmental/natural resource needs between human consumption and aquaculture feed and will develop feed and feeding strategies for snakehead fish species. The cost-effective and high performing AquaFish Snakehead Formulated Feed (ASFF) was developed to bring less reliance on using small size fish and have lower environmental impacts. The small size fish/trash fish could be replaced by new AquaFish Snakehead Formulated Feed. Plant ingredients replace fishmeal and enzyme and provide supplement to the diet for optimum growth and survival of snakehead. However, this new developed technology cannot be transferred without making final testing and adoption by the farm trials and farmers.

INTRODUCTION

The Mekong River is one of the most productive aquatic resources in the world. The Mekong River is the main source of fisheries resources in Cambodia and Vietnam. Particularly in Cambodia, the seasonal and permanent wetlands cover more than 30% of Cambodia. The fisheries sector has for many years contributed significantly to the employment and livelihoods of the poor, to food security, and to GDP and foreign exchange balance. Cambodia's fisheries provide full-time, part-time and seasonal employment for up to 6 million people and the fisheries sector contributes very significantly to domestic food security, providing over 81.5% of the animal protein in the national diet and also forms a critical source of essential vitamins and micro-nutrients.

In addition, the capture fisheries production in Cambodia is estimated to be worth around US$200-300 million per year at the point of landing and fisheries harvesting, processing and

trade contributes 8-12% of GDP. The value of fish exports has been estimated to be as high as US$100 million per year (SPFF 2010-2019).

Fish are also part of Cambodia's cultural heritage. The complex and enduring linkage between fisheries and many aspects of the region's history, as shown by the archaeological finds of fish processing and trade through the region and the incorporation of fish scenes into the historic temples of the country, demonstrates the continuity of the importance of the sector both domestically and throughout the South East Asia region. The aquatic environment and the associated rich diversity of species also constitute a very important part of both the national and global natural heritage.

However, the fisheries resources in Cambodia and Vietnam are faced with declining fisheries resources due to the rapid increase of population and illegal fishing activities. Many capture fisheries resources have been largely overexploited and, as a result, development of aquaculture has been encouraged to provide the protein, income, employment and export earnings to substitute the natural fisheries resources. In Cambodia, for example, freshwater aquaculture production has increased rapidly over the last two decades, with an average growth rate of 16.3 percent. In 2004, aquaculture represented 8.3 percent of total inland fisheries production (So et al. 2005). In Vietnam, the annual growth of aquaculture has been about 10-13 percent during the last decade. The Mekong Delta region of Vietnam often contributes about 55-60% of the total aquatic production and more than 60% of total aquatic production for export of the whole country (Sinh 2005). Such a development trend implies that sufficient feed for aquaculture production will be available. One source of feed is low value/trash fish (Low value/trash is defined as fish that have a low commercial value by virtue of their low quality, small size or low consumer preference. They are either used for human consumption (often processed or preserved) or used to feed livestock/fish, either directly or through reduction to fish meal/oil (FAO-APFIC 2005)). There is a general lack of accurate information on how much low value/trash fish is presently used in Cambodia and Vietnam, but a conservative estimate of 25 percent for livestock and aquaculture feed has been put forward (FAO-APFIC 2005). The uses of low value/trash fish are diverse and include: (1) local consumption (e.g. fresh, dried); (2) direct feed (e.g. livestock, high value species aquaculture); (3) fish meal production (e.g. poultry, aquaculture); and (4) value-added products (e.g. fish sauce).

There is increasing demand and trade in the region for low value/trash fish for both aquaculture and animal feeds. In Cambodia, for example, it has been estimated that at least 62 freshwater low value or small-sized fish species are used to feed inland aquaculture. These fish species represent both adult species that are commonly used as food fish, and also juveniles of commercially important fish species. Cage culture uses as much as 50 percent low value/trash fish in the total feed (So et al. 2005). In Vietnam, at least 11 species of freshwater, and increasingly a number of marine, low value/trash fish are used to feed inland aquaculture. The price of low value/trash fish has tripled since 2001 and it is predicted to continue to rise as aquaculture expands (FAO-APFIC 2005). The use of artificial fish based feeds and/or fresh fish resources have further increased pressure on wild fish stocks. Inevitably, a dangerous spiral has evolved where the demand for low value/trash fish for aquaculture feed has supported increased fishing pressure on already degraded resources. It is predicted that as aquaculture grows in the region it will be difficult to meet the demand for low value/trash fish. There is a general concern that the rapid expansion of aquaculture may ultimately be constrained by the dependence on low value/trash fish and fish meal, popularly

referred to as the "fish meal trap". The Asia-Pacific countries may need to increase imports of fish meal from the global market for the aquaculture industry, or replace these with other feed materials. There is a need to address the increasing demand for low value/trash fish by aquaculture by improving feeds for aquaculture through changing over from direct feeding to pellet feeding and reduction of fish meal content by substitution of suitable ingredients in pellets.

There is also increasing conflict between the use of low value/trash fish for feed and for human consumption. In some cases, such feeds are comprised of fish species traditionally used as cheap food for people and this allocation of fish resources to aquaculture may result in negative impacts of food security and livelihoods. It is the economics of the different uses of low value/trash fish in different localities that direct the fish one way or the other. There are also trade-offs between direct food benefit and the indirect employment and income generation opportunities afforded by feeding to aquaculture. It has been argued that it would be more efficient and ethical to divert more of the limited supply to human food, using value-added products. Proponents of this suggest that using low value/trash fish as food for domestic consumers is more appropriate than supplying fish meal plants for an export, income oriented aquaculture industry, producing high-value commodities. On the other hand, food security can also be increased by improving the income generation abilities of poor people, and it can be argued that the large volume of people employed in both fishing and aquaculture has a beneficial effect. This raises some important questions regarding the social, economic and ecological costs and benefits of aquaculture, its sustainability and future trends.

In relation to the above mentioned challenging issues, the project entitled "Development of Alternative to the Use of Freshwater Low Value Fish for Aquaculture in the Lower Mekong Basin Cambodia and Vietnam: Implications for Livelihoods, Production and Markets" was implemented with 5 investigations. The focus of this project is equally on the aquaculture of carnivorous fish and the management of lower value/trash fish. Investigations 1, 2 and 5 addressed the uses and bio-ecological characteristics of low value/trash fish. Investigations 3 and 4 addressed alternative feeds for freshwater aquaculture and feed technology adoption.

Investigation IV is on the area of "Feed Technology Adoption and Policy Development". The objectives of this Investigation are to 1) apply the research results and disseminate appropriate technology to the end-users of aquatic resources and aquaculture practitioners, 2) train farmers in the project sites on farm made feeds and benefits of using alternative feed technology, 3) improve feeding practices and promote adoption and change behavior over alternative feeds, and 4) provide scientific-based strategy and information for policy makers to develop policy on aquaculture and aquatic resource management.

METHODOLOGY

This is an activity type of investigation to disseminate information and technology to the end users in form of workshops, conference organization, outreach documents and training sessions. However, the information and technologies cannot be sent effectively to the farmers unless we understand the problems encountered by farmers, what information/technologies farmers need to overcome the problems, and what is the best way to educate them to solve the problems. Therefore, The PRCA was conducted to understand the general characteristic of the farmers in the project sites to develop effective communication channels. Seven provinces, namely Prey Veng, Kandal, Kampong Cham, Kompong Chhnang, Pursat, Battembang, and Siem Reap province were selected for the targeted project sites to transfer the AquaFish Snakehead Formulated Feed.

Two types of data were gathered, primary and secondary data. Primary data was collected through interpersonal interview by using structured questionnaires which are designed to understand the general characteristics of the respondents and the most effective communication channels. Secondary data was collected by reviewing related literature relevant to fish process technologies and existing practical aquaculture technologies which have been successfully implemented by AIT Aquaculture Outreach Program and JICA Aquaculture Development Program in Cambodia. The review aimed to use the technological know-how and knowledge on local fermented feed made for small scale aquaculture development practiced in Cambodia to transform into printed media for dissemination.

Orientation within the investigation team members was conducted to internalize the team members to be aware of the project document and understand the requirements needed to accomplish the process of project implementation.

An inception workshop was conducted at IFReDI to provide awareness to the government fisheries officers, NGOs representatives, local communities, and other relevant stakeholders on AquaFish CRSP Project implementation, especially, to the other relevant stakeholders whose work related to the aquaculture development sector and to hold consultation with the participants for their suggestions and recommendations.

A consultation meeting with different team members from the three investigations in IFReDI was conducted to provide an opportunity to all members implementing the AquaFish CRSP projects in IFReDI to be aware of the process and procedure and also the goals and objectives of the whole project. The consultation established a link of each investigation in terms of its activities, planning, and implementation.

An orientation meeting of all US PIs and HC PIs was conducted in Phnom Penh City. The orientation brought all the US PIs and HC PIs to fully understand the process and procedure of project implementation. Several issues were discussed during the orientation such as: the activities plan, procedure, time frame, budgetary, and reporting system of each investigation. It also set out the mechanism for improving communication within the project teams through the use of Yahoo Messenger or Skype as a communication channel among the team members (Photo 1).

RESULTS

The main objective of the investigation is to transfer information, technologies and know-how from research results of the project to the fish farmer and end users of aquatic resources users in both Cambodia and Vietnam. Investigation IV was implemented and achieved the following result:

1.1 Institutional Capacity Building:

Conducted two trainings to build the capacity of the team members, 1) Training on “Development of Questionnaires and Design”, and 2) Training on “Data Encoding and Analysis”. The team members were provided on the job training to design questionnaires and do pre-testing of data collection method as well as encoding collected data into data form of SPSS computer program. These trainings were designed to strengthening and improve the institutional capacity of the Inland Fisheries Research and Development Institute staff to learn from the data collection to data entries and analysis.

1.2 Awareness Raising and Technology Transfer:

1.2.1 Awareness Raising: Investigation IV has carried out public awareness activities in the form of Inception Workshop, Dissemination Workshop, and Poster on Freshwater Small Size Fish Species in Lower Mekong Basin Cambodia-Vietnam.

- **Inception Workshop:** Conducted inception workshop at IFReDI to provide awareness on AquaFish CRSP project activities. More than 40 participants from both national and provincial government fisheries officers, NGOs representatives, local communities, and other relevant stakeholders participated (Photo 2&3). The workshop aimed to provide awareness and hold consultation among the participants, particularly the stakeholders whose work related to the aquaculture development sector and to obtain their suggestions and recommendations.
- **Dissemination Workshop:** Organized workshop to disseminate the research results of Investigation I &III to about sixty participants from researchers, provincial fisheries staffs, fish farmers, NGOs, and representatives from local community fisheries in all targeted project sites. The workshop provided awareness raising on the important role of small size fish in daily protein intake of local people and the competition between the human being and the aquaculture industry in Vietnam (Photo 4&5). The workshop also informed the diversity of freshwater small size fish species in Lower Mekong Basin Cambodia and Vietnam. Investigation III raised awareness on new alternative snakehead formulated feed developed by AquaFish CRSP (Photo 6. Feed Label).
- **Poster:** Published 5,000 copies of first series Poster on Freshwater Small Size Fish Species in Lower Mekong River Cambodia-Vietnam (Photo 7. Poster). The message in this Poster is to provide awareness to the audiences on Freshwater Small Size Fish species diversity in the lower Mekong River Cambodia and Vietnam.

1.2.2 Technology Transfer: Two forms of communication channel, Interpersonal and Printed Media (Poster/Leaflet), were used to transfer technology to the farmers and fishermen and other aquatic resources users in the targeted project sites.

- **Trainings:** Organized training on Farmer Field School (FFS) to the key fish farmers of the seven target provinces in Cambodia. The training provided an opportunity for the fish farmers to see hands on how to make traditional fish feed by the most successful fish culture farmers in Kandal Province. Twenty-Six key fish farmers participated in the training, among those participants, 11 were female.

  Organized Training of Trainer (ToT) to 21 participants, (3 participants from each province), from the seven targeted province project sites in Cambodia. The training was designed to build the capacity of the trainees to become a Trainer and also the Extension Worker in order to train other farmers who are interested in adoption of alternative feed for their fish culture. These 21 trainers/Extension Workers will play a very important role in dissemination and transferring of AquaFish Snakehead Formulated Feed developed by Investigation III to the fish

farmers in Project phase 2 after this new Formulated Feed is confirmed and adopted by pilot farmers.

- **Poster:** The publication of the poster on AquaFish Snakehead Formulated Feed has yet to be developed since the technology was not confirmed by farm trials and farmer adoption pilot. The experiments on farm trials and farmer adoption pilots will be conducted by Investigation 2 & 3 in second phase.

1.2.3 Institutional Research Collaboration: This project "Development of Alternative to the Use of Freshwater Low Value Fish for Aquaculture in the Lower Mekong Basin Cambodia and Vietnam: Implications for Livelihoods, Production and Markets" provided opportunities for international travel to participate in international conferences and workshops which provide an opportunity to not only built institutional and staff capacity, but also establish networking and linkages between and among the research institutes, universities, and development institutions around the world.

DISCUSSION

The main goal of this investigation is for sustainable freshwater aquaculture development and innovative fisheries management systems in the Lower Mekong basin region of Cambodia and Vietnam. This main goal takes into account that the main driver of this project is the continued expansion of aquaculture and its dependency on capture fisheries for low value/trash fish for feed. It also takes into account that: capture and culture fisheries continue to play an important role in the food security, poverty alleviation and economies of both countries; the strong interdependency between capture fisheries and aquaculture; management of these two sub-sectors cannot be carried out in isolation of each other; there is increasing local and intra-regional trade for low value/trash fish products; and there is increasing competition and conflict between the use of low value/trash fish for feed and human consumption.

Balancing of social, economic and environmental/natural resource needed between human consumption and aquaculture feeds are based on the development of feed and feeding strategies for other fish species, further on-farm trials of feed formulations, policy and technology for trade and value-added product development for low value/trash fish, development of farm made feeds, improved management strategies for capture fisheries, and policy development for sustainable aquaculture and capture fisheries.

Investigation IV was slowed by an underestimation of the time needed to develop the new technology for snakehead formulated feed. The development of AquaFish Snakehead Formulated Feed took a longer time than was our expectation. The Investigation III developed cost-effective and high performing compounded feed that had less reliance on using trash fish and which would have lower environmental impacts. The study was designed to determine if trash fish could be replaced by the new AquaFish Snakehead Formulated Feed in which other plant ingredients replaced fishmeal and enzyme or provide supplementation in the diet for optimum growth and survival of snakehead. However, this new developed technology cannot be transferred and publicized without making final tests, proving the technology, and farm trials and farmers pilot adoption.

The new AquaFish Snakehead Formulated Feed will be publicized for broader use by fish farmers, aquaculture practitioners, and commercial uses through printed materials such as poster, leaflet, trainings, and extension workers, as well as workshops to disseminate this new technology to peer and relevant researchers to achieve the overall objective of transferring the adoption of new feed technology to the end users.

CONCLUSSION

The project addressed a critical gap in terms of institutional capability of Inland Fisheries Research and Development Institute (IFReDI) to implement information and communication interventions targeted at specific users of fisheries resources who are causing fisheries resources degradation problems that affect fisheries and aquaculture productivity, profitability, and food security. The project has built not only institutional and staff capacity, but also established networking and linkages between and among the research institutes, universities, and development institutions around the world.

The project addressed urgent fisheries resources degradation problems which are related to improper use of feed technology in aquaculture development and other agricultural activities around the Great Lake, in particular, and in the Lower Mekong River Basin of Cambodia and Vietnam, in general. More than 10,000 farmers are aware of freshwater small size fish species diversity through the publication of the poster. The project provided awareness on the importance of balancing use of freshwater small size fish in the Lower Mekong River Basin in Cambodia and Vietnam. The project has established effective linkages between researchers and communicators. The research results were applied to develop appropriate technologies to disseminate technical information and provide awareness and better understanding of the importance of low value fish, feed meal technology and feeding practices to the fish farmers which significantly reduce dependence on capture trash fish for feed and feeding in aquaculture activities.

The project will produce more impact and benefit to farmers and users of aquatic resources after the new AquaFish Snakehead Formulated Feed has been tested, proven, and adopted by farm trials and pilot farmer adoption in phase 2 of the project implementation. The adoption of this new feed will lead to reduction in the utilization of small size fish for snakehead culture in both Cambodia and Vietnam.

ANTICIPATED BENEFIT

Investigation IV provided direct and indirect benefit to different stakeholders such as: group of fish feed producers, fish farmers, aquaculture specialists, extension workers, and the people who live in Mekong Delta. Especially, women, children, and elders whom often involved in fish made feeds and fish feeding practices.

More than 500 fisheries officers, NGOs representatives, local authorities, and other stakeholders worked related to aquaculture, fish farmers, and fishermen in the lower Mekong basin of Cambodia and Vietnam were aware and informed on the project implementation. Moreover, 47 fish farmers in Cambodia were trained on farm made feeds, feeds and feeding strategies and 21 key fish farmers were trained on training of trainers to become extension workers. More than 10,000 farmers were aware and gained knowledge on species diversity and composition of freshwater small size fish in Mekong River Basin of Cambodia and Vietnam through poster. More fish farmers and aquatic resource users will receive relevant information and appropriate technologies on AquaFish Snakehead Formulated Feed after the technology has been tested and proven adoption in the second phase of the project. On the

other hand, this investigation was not able to provide indirect impact and benefit yet to the fish consumers in the Mekong Delta from lower fish price due to the fat that the technology was not fully been tested and adopted by farmers. However, the technology will be widely disseminated to fish farmers, aquaculture practitioners, feed makers, and other aquatic resource users in the second phase of the project implementation.

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Photo 1. Project Team Members participated in Orientation Meeting in IFReDI, Cambodia

Photo 2. Inception Workshop to Lunching the Project Implementation in IFReDI, Cambodia.

Photo 3. Fisheries Official, Community Fisheries, and NGOs Representatives Participating in the Inception Workshop.

Photo 4. Dissemination Workshop in Cantho University, Vietnam

Photo 5. Participants in the Dissemination Workshop in Cantho University, Vietnam

Photo 6. AquaFish CRSP Snakehead Formulated Feed Developed by Investigation III.

Photo 7. Poster on Small Size Fish Species in the Lower Mekong River Basin Cambodia-Vietnam.

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