



COMMUNITY-BASED AQUACULTURE FOR POVERTY ALLEVIATION AND SUSTAINABLE LIVELIHOODS

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Fish is a staple food for people in many parts of the world, particularly in Asia. It is an increasingly important source of protein, not only for food security but also as it is a fast renewable resource. Asia is the home of aquaculture, a practice which dates back to thousands of years. In the course of its development, the nature of aquaculture has become more intricate, intertwining with other food production sectors under the influence of political, social, economic, technological and cultural factors. With advancement of technology, the involvement of more aquatic species and farming practices has become possible, and more choices can be offered to the consumers. Population growth, economic growth and the development of disposable income and higher purchasing power, and social factors such as traditional fish consumption patterns, will shape future demand for fish and fishery products (Westlund, 1995). Issues of sustainability can also change our perception of desirable forms of aquaculture development and management (Roberts and Muir 1995). Under the evolving global trade negotiations and agreements, new ways of aquaculture may have to be adopted, so that the environmental and resource costs of production, as factors of sustainability, are kept within agreed limits. It could become increasingly difficult to pursue the traditional methods of aquaculture where a particular species is produced for a market, based exclusively on prices. Under the World Trade Organization, suppliers would have to satisfy a set of requirements to ensure sustainable development of aquaculture.

The sectoral review reveals the rapid rise of commercial aquaculture production, although the fast increase in the value of fish was attributed to a growing propensity towards high-valued commodities. Aquaculture exports have earned handsome amounts of foreign exchange for the producing countries, often at the expense of environmental degradation and loss of lives and property due to subsequent natural disasters and to resource-use conflicts. Aquaculture has been at the forefront in terms of natural resource-use conflicts, open access and weak political system, poor legislation and law enforcement. The sustainability of commercial aquaculture continues to remain in doubt as long as water pollution, environmental degradation and excessive use of finite natural resources are to be blamed on aquaculture.

As an optional food production activity, aquaculture involves various users, systems, practices and species. National planners assign a high priority in nation building to aquaculture, particularly when capture fishery is approaching its upper productive limit. Among all food production sectors, aquaculture has raised the hopes of national planners as a means to address the serious problems of hunger, poverty and unemployment.

Commercial aquaculture has little to do with food security, since it supplies food to the affluent sectors of society. Small-scale aquaculture practiced in harmony with the existing farming system makes quality daily meals more affordable for rural folk deprived by scanty infrastructure and by poverty. The synergy with other farming practices which small-scale aquaculture brings to deprived farming families translates into not only greater volumes of production but also a more balanced composition of the diet. It should become an important means to increase awareness of the value of land and water resources, for which heavy competition is in the offing.

The development of commercial aquaculture brings with it a totally different scenario and a different set of technical and socio-economic problems. The competition over common finite natural resources which commercial aquaculture will have to encounter in the future makes its development policy different from that of small-scale aquaculture. Technology will be required to maximize profits and sustainability: production of high-value commodities, measures to enhance

food safety as required by international standards, efficient use of farm inputs, biotechnology, etc. Commercial aquaculture must fend off the broadsides of environmental and consumer activists over production and trade issues.

As aquaculture continues to domesticate new aquatic organisms, the role of national research institutes must be promoted. The research areas in brood stock management, seed propagation, feed and feeding, diseases, farm management, etc, offer wide opportunities for almost any institution to participate. The promotion of aquaculture of indigenous species should be supported. Cooperation between the aquaculture industry and national research institutes needs to be strengthened, not only for the effectiveness of their endeavours but also for the safety of the consumers and the harmony of all socio-economic activities dependent on the common natural resource base.

COMMUNITY-BASED AQUACULTURE

Thai DOF has been responsible for rural fisheries development since 1982 under the Fifth National Economic and Social Development Plan (1982–1986). Many important projects, such as the Village Fish Pond Development Project (VFPDP) and several projects under royal initiatives have been carried out. The VFPDP is a state-sponsored initiative in support of community fishpond development projects, which has continued to date. Its objectives are to increase fish production for local consumption to generate local employment and to reduce malnutrition and poverty. Under the VFPDP, the mandate of DOF is to (i) support the rehabilitation or construction of village fishponds (reservoirs, swamps, and tanks); (ii) train local support personnel; (iii) increase the supply of fish seed or fingerlings; and (iv) provide technical advisory services. The rationale of VFPDP stems from aims to strengthen social cohesiveness and develop community awareness, and the fishponds generally serve as core facilities that provide self-help opportunities. Apart from generating direct benefits in terms of fish production and improved water supply, the VFPDP trains villagers to be self-reliant. The dissemination of fish farming technology has resulted in the establishment of many fishponds by private individuals and communal fishponds in villages. In 2001, the Government decentralized authority for management of natural resources, including fisheries in all community waters, to the subdistrict governments, locally known as Tambon Administrative Organizations (TAOs). TAOs have become local institutions responsible for rural development. In the context of these decentralization measures, the DOF's budget for village pond construction was being progressively transferred to TAOs during 2001–2004.

Water for small-scale rural aquaculture is generally available, especially in floodplain and irrigated areas. However, the water supply for aquaculture is restricted in drought-prone areas in the northeast where there is significant poverty, and in ponds inappropriately located in hilly areas. In areas where agricultural chemicals are used intensively, water is contaminated with pesticides at low concentration. Measurements in 25 river basins, including Bangpakong, Chaopraya, Kok, Pasak, Sakakrang, Songkhla Lake, Tha Chin, and Yom, showed them to have poor average water quality in terms of dissolved oxygen (DO), biochemical oxygen demand, coliform bacteria, and ammonia-nitrogen. The average DO levels in the lower Tha Chin River were reported to be as low as 1 milligram per liter, unsuitable for fish and aquatic organism. Water quality in the main rivers in the north (Nan, Ping, Wang, and Yom) remains generally good, especially in the upstream flow from the northern mountains, and the average concentration of DO was more than 5 milligrams per liter. Nonpoint source pollution became significant in many parts of the country during the late 1990s, especially in water from agriculture areas.

In some areas, especially in the northeast, saltwater intrusion has a strong effect on freshwater aquaculture. Water temperature is also important for rural aquaculture. In the winter in the north, temperatures may drop to less than 10 degrees Celsius and cause detrimental effects on fish culture. In newly constructed ponds, water turbidity is common.



The Government has promoted aquaculture for decades, through both research and extension services. The government strategy for promoting small-scale rural aquaculture in the past included the provision of subsidized inputs. The Government has provided substantial support and incentives to farmers by providing free advisory services for the promotion of aquaculture technologies, and subsidized inputs for pond construction, seed, feed, and lime to fish farmers. The Government has, however, realized that subsidies do not necessarily lead to sustainable aquaculture development, and that it is necessary to extend adequate and appropriate information on aquaculture technologies to targeted fish farmers effectively.

DOF has played an important facilitating role in rural aquaculture development, planning, and implementation. Its services include aquaculture extension and transfer of fish farming technologies to farmers. While fisheries organizations or cooperatives may be found in areas where there are considerable aquaculture activities, the roles of these farmers' organizations are primarily related to marketing, an area of common interest among farmers. DOF has not been able to mobilize the support of these organizations to deliver its extension programs because of various shortcomings affecting the farmers' organizations and the aquaculture extension services. Privately managed cooperatives in freshwater aquaculture have generally faced financial and human resource constraints. However, community participation in aquaculture development through village committees, district councils, or subdistrict TAOs has been evident. In this context, fish farmers and villagers participate in planning and making decisions on their community resource use and conservation.

The Government is attempting to make the extension system more responsive to farmers' actual needs, particularly by providing information more appropriate to farmers' conditions. In October 2002, it reorganized the overall agricultural extension system and the central responsibilities of DOF in terms of technology development and extension. These are now limited to training functions and providing assistance in the preparation of extension materials in the newly established Bureau of Fishery Technology Transfer and Extension.

Under the new extension system, the Department of Agricultural Extension has been mandated to be the sole government agency to organize training as well as farmer selection in all agricultural disciplines, including fish farming. Under the new arrangements, all training activities are decentralized and conducted through the Tambon Technological Transfer Center, which is meant to be a one-stop service center where farmers and local residents can get advice and information, and contact experts in various disciplines.

COMMUNITY-BASED RURAL AQUACULTURE DEVELOPMENT

Community-based aquaculture in Thailand has contributed to the development of selfhelp initiatives, local ownership, and decision making in the communities. DOF has promoted small-scale and community-based freshwater aquaculture for many years, including through the VFPDP, and there have been both successes and failures. The main factors that have influenced the success of community-based aquaculture are (i) the demand for and the extent of interest in fish farming; (ii) social capital, including organizational arrangements that contribute to strong community participation, sharing access to resources, and conflict resolution; and (iii) government assistance and partnerships with the communities. Drawing from experience, constraints to rural aquaculture include water shortages, unfavorable biophysical conditions, low natural productivity, and such farm management issues as stocking density, pond management, access to feed, and harvesting methods. Fish farming has also been affected by environmental degradation, limited financial and human resources, inappropriate links between extension and research, and external shocks such as the effects of the Asian financial crisis of 1997.

One of the most promising government support programs for poor communities to increase rural fish production is the School Fishpond Program (the Lunch Program) under Her Royal Highness Princess Maha Chakri Sirindhorn. The target areas are village schools, mainly primary and, to a

lesser extent, secondary schools, in remote areas. The main objective of this program is to improve the nutritional status of school children in these areas by providing fish for consumption through self-help initiatives in fish farming. The program, which began in 1992, includes construction of fishponds, aquaculture training, and provision of fish seed and technical advice to schools. The Lunch Program has also piloted an integrated fish-poultry farming project to increase fish production at low cost. Despite encouraging outcomes, constraints affecting the program include limited water supply, inadequate feed and other inputs, and limited knowledge in fish farming. There is scope for improvement and expansion to take advantage of the village schools as institutions that act as a focal point in remote areas at the grassroots level. There are opportunities for adaptive and hands-on learning in fishpond management and other aquaculture related issues. Through a series of simple activities involving village fishponds or small waterbodies, students and the communities can participate in an experiential learning process that actively demonstrates the potential benefits of improved fishpond management to livelihoods and human nutrition.

Table 3: Pilot Integrated Fish and Poultry Farming Project Production Statistics under the School Lunch Program in 2000

Region	Number of Schools	Chickens Layer	Number of Eggs Produced	Fish Production (kg)	Total Income (B'000)
Northeastern	4	1,250	351,852	405	598
Northern	4	900	246,145	421	459
Central	3	550	147,119	308	231
Southern	1	504	129,936	365	235
Total	12	3,204	875,052	1,499	1,523

Source: Department of Fisheries. 2002. Smallholder Aquaculture Research and Development. Bangkok, Thailand

DEVELOPMENT POLICY FOR SMALL-SCALE FRESHWATER AQUACULTURE

National development by the Government takes place through the National Economic and Social Development Plan (NESDP). The principal strategic objective of the NESDP is to promote economic development by utilizing natural and human resources to increase production, generate employment, and increase national incomes. The direction of rural aquaculture development has developed from the fifth to the eighth NESDPs. The relevant stated goals were to (i) alleviate malnutrition (NESDP 5, 1982–1986); (ii) accelerate fish culture activities (NESDP 6, 1987–1991); (iii) increase opportunity for establishment of individual fishponds (NESDP 7, 1992–1996); and (iv) increase human resource capacity in managing integrated community fishponds (NESDP 8, 1997–2001).

Thailand's National Fisheries Policy on aquaculture aims to (i) increase fish production to meet the demand for domestic consumption; (ii) increase income for fish farmers; and (iii) raise the standard of living of small-scale fish farming households, as well as to increase fish production as export products from coastal aquaculture. Current strategies focus on (i) developing and improving aquaculture techniques by conducting research to increase fish production and to reduce production costs; (ii) conducting research on fish species with high economic potential to improve their desirable characteristics, and to develop good practices for hatcheries and aquaculture farms; and (iii) providing technical services and certifying registered hatcheries and farms.

The National Fisheries Policy hinges on the assumption that future rural aquaculture development will remain at a small-scale and subsistence level, mainly for domestic consumption and local household food security, especially for the rural poor. This limits the scope for intensifying the systems. The major role of researchers, therefore, is to find innovative and viable low-cost, low-



input technology options for such conditions. Appropriate technology options for small-scale freshwater aquaculture have been developed in Northeastern Thailand.

The Government decentralized authority for management of fishery resources in all community waters to TAOs in 2001. TAOs had previously facilitated aquaculture development in their jurisdictions by requesting government support for fishpond construction, with DOF providing technical assistance. Achievements of these fishpond development initiatives have been variable. **Principal shortcomings were inadequate fishpond management, ineffective extension services, deficient co-management mechanisms and practices for common and shared assets, and poor access at the village level to information on aquaculture.** The TAOs still have limited experience in natural resources management and need to develop their credibility and establish the trust of the communities. In the past, the communities did not have the opportunity and experience to make appropriate and enforceable resource management decisions. The TAOs can, and increasingly must, play a role in arbitrating and facilitating the management of community natural resources. There are opportunities for capacity building and for forging close partnerships between the stakeholders in the communities and government services, including fisheries officers and TAO officials, through a participatory learning process and iterative improvements.

Currently, the Fisheries Act (1947) prohibits private pond construction in the public domain. However, fish farmers have rights to construct fishponds on their own land (property). Fish farmers can also operate cage culture in public waters. Such fish cage farms have to fulfill certain requirements for obtaining government permission, such as non-obstruction of waterways or transportation, non-disturbance to the public, a suitable location, and approval by district and provincial authorities. Licenses for fish cage farming are normally granted for 5 years. At present, sub-district governments, Royal Irrigation Department, Royal Forest Department, and the Electricity Generation of Thailand are also involved in authorizing cage culture in their areas of jurisdiction.

The Fisheries Act does not require freshwater aquaculture activities operating on private property to register and obtain permission. Nevertheless, the Government requires all aquaculture operators to register with the competent authority and get permission before operating. Fish farmers have traditional rights to access a water supply from rivers and reservoirs. Changes to the Water Law are being considered, with the possible introduction of charges for water, especially for recreational use, such as watering golf courses. Fish farmers have exclusive rights to produce. The Government has no policy to regulate fish producers, unless they farm restricted species, i.e., endangered species listed by laws. However, in the future, the Government will apply concepts and practices guided by the FAO Code of Conduct for Responsible Fisheries and associated guidelines. The code puts emphasis on environmental aspects (effluents and water discharge), drugs and chemicals used in aquaculture, improvement of quality of fish products, preservation of fish products after harvesting, and quality control of fish products.

SAFEGUARDS FOR FRESHWATER AQUACULTURE

Aquaculture Zoning

Aquaculture zoning can serve as a tool for planning and implementing aquaculture activities to mitigate adverse environmental impacts. For example, in the absence of zoning, the rapid expansion of marine shrimp farms into freshwater areas of several provinces in Central Thailand has generated conflicts in uses of land and water resources. Salinity intrusion was attributed to shrimp farming that affected freshwater ecosystems, ricefields, and orchards. This situation led to the enforcement, from December 1997, of Article 9 of the Environmental Act of 1996 to ban low-salinity shrimp farming in freshwater areas throughout the country.

Integrated Agriculture-Aquaculture.

Integrated agriculture-aquaculture has been practiced for almost a century, initially in Bangkok but at present throughout the country. The most popular systems are fish/poultry culture, fish/pig

culture, and mixed culture (fish, pig, and poultry). DOF has conducted several programs to increase fish production through integrated farming. The Bank for Agriculture and Agricultural Cooperatives (BAAC), with support from the Belgian Administration for Development Cooperation (BADC), developed guidelines for integrated fish farming in Northeastern Thailand. Integrated livestock/fish farming systems safeguard the environment because the livestock manure is used as organic fertilizer for the fish ponds, which also function as waste stabilization ponds. A technology divide has developed over the past decade in which traditional semi-intensive aquaculture using on-farm and locally available agricultural residues is being replaced by relatively high-cost intensive culture using formulated pellet feed. However, a third system—a semi-intensive system based on inorganic fertilization and supplementary feeding—can effectively intensify fish production for small-scale farmers and reduce the cost of production for large-scale producers. This system is more environmental friendly than intensive production that relies solely on pellet feed.

Biosafety and Disease Prevention.

Introductions and transfers of alien aquatic species have been made deliberately and accidentally. Alien species were introduced mainly for aquaculture and the aquarium trade and in many cases were imported illegally without adequate quarantine. Freshwater aquaculture is constantly exposed to the risk of possible adverse impacts from introductions of alien species and farmed organisms, particularly from the introduction of diseases and parasites. Enforceable and effective safeguards need to be developed, taking into account practical recommendations for biosafety measures. However, the implementation of aquaculture health management guidelines for transboundary movements of live aquatic animals (such as health certification, quarantine, and diagnostic procedures) farmers, researchers, and the general public, in order to minimize preventable and potentially damaging risks from irresponsible introductions and dissemination of alien aquatic species and farmed organisms.

Lessons Learned

Fish farming has developed rapidly over the last few decades, partly in response to a decline in capture fisheries and to a rising demand for fish. Small-scale farmers have benefited from the development of aquaculture, although existing data do not allow measuring the socioeconomic benefits to these farmers. Fish are an important component of the Thai diet and contribute significantly to national food security and human nutrition. Fish provide a traditional source of animal protein, fatty acids, and micronutrients. Fish marketing in Thailand is competitive and largely in the hands of the private sector. With good road networks, transportation, supporting infrastructure, and telecommunications, fish and fish products flow freely in the country. This enables Central Thailand to supply fish to deficit areas such as Northeastern Thailand where retail prices of fish are generally higher than in other parts of Thailand. Northeastern Thailand is home to the majority of small-scale farmers in the country, and these small-scale producers have faced increasing pressure to improve farm productivity and reduce production costs to remain competitive in a free market system.

The rural poor comprise producers and consumers, and suppliers of labor. In the context of small-scale aquaculture, the rising opportunity cost of labor because of rapid economic development and employment opportunities in Thailand as well as overseas has placed additional pressure on farm productivity, which must rise if fish farming is to remain an attractive livelihood option. This economic environment places restrictions on the appropriateness of technology for small-scale aquaculture. Low-cost and affordable technology does not necessarily provide high returns on labor inputs, while intensive farming can create a demand for financial and other resources that the poor do not have. In many areas of Northeastern Thailand, labor migration to urban areas, particularly to Bangkok and its vicinity, has caused farm labor scarcity. These conditions restrict farm households from adopting labor-intensive farming techniques.

DOF has played a major role in the development of aquaculture in the country over the last few decades. DOF started to promote farming of native snakeskin gourami in the 1930s, but did not



succeed due to low demand for farmed fish at that time and an abundant supply of and high demand for wild fish. Mozambique tilapia was promoted in the 1950s, but its culture did not succeed because of unfavorable characteristics that constrained on-farm productivity, and the species did not meet consumers' tastes and preferences. However, promotion of Nile tilapia since the 1960s has been a success, and it is now among the major farmed fish species in Thailand. These development milestones have emphasized the importance of demand, market conditions, and the appropriateness of the product to meet the demand. Introduction and promotion of fish species for farming require an astute demand assessment and the ability to sustain a viable supply. Nile tilapia meets the demand of Thai consumers, as well as the needs of farmers to produce fish at reasonable cost to generate attractive returns.

DOF has placed great emphasis on the development of fisheries stations, which have catalyzed the development of the private sector's dominant role in seed production and seed supply to support the increasing importance of fish farming. While the Government has played an instrumental role in placing the necessary facilities for initiating and ensuring seed supply to promote fish farming, its role has not hindered the private sector from developing and taking over the seed supply business. Overall, the private sector provides a reliable supply of seed in Thailand, with complementary development initiatives in the feed industry. Without a reliable seed supply, fish farming would not have developed into a major industry. Seed supply has been a major constraint to the adoption of aquaculture in many countries. The Government has sustained its research and development initiatives on fish breeding to maintain good quality broodstock to ensure open public access to farmed species and strains of good performance. The roles of the private and public sectors in seed production and quality assurance are complementary.

WAYS TO BENEFIT THE POOR

DOF also currently assists the rural poor through aquaculture extension services based on the distance extension approach, **using technologies appropriate for household-level and pond-based aquaculture**. Most local communities and individual farming households have limited resources at their disposal; thus, less technical but demand-led approaches are required to reach poor target groups. Nevertheless, challenges in developing viable technology options for aquaculture continue to emerge in the rapidly changing rural economy. In responding to challenges to make aquaculture benefit small-scale farmers, several factors should be considered: (i) livelihood options of targeted groups, including existing sources of household incomes; (ii) opportunity cost of labor, employment opportunities, and labor market characteristics, including labor migration; (iii) affordability and the extent to which targeted users of technology have access to livelihood assets for fish farming; and (iv) markets and marketing of farm inputs and outputs, and their specific relevance to fish farms. Responding to the challenges requires capacity building of local government agencies and local service providers. Adaptable approaches are needed without relying on rigidly predetermined packages of technology. Analyzing the characteristics of households or small-scale farmers and assessing the specific features of their operating environment are important elements in appraising ways to make aquaculture work for small-scale farmers.

Innovative approaches to enhance learning and community participation in the planning and use of water resources for integrated aquaculture-agriculture can improve livelihood options and enhance benefits for targeted groups. DOF could support such approaches by targeting agents of learning and information dissemination, such as teachers, students, community-based organizations, village leaders, and extension officers. Understanding relevant features of water resources management and their competing and complementary uses can prevent conflicts and mitigate adverse environmental impacts. Further, addressing issues related to common property rights and access to land and water resources may ease access gaps to critical livelihood assets for the poor to engage in small-scale aquaculture.

A promising way to alleviate malnutrition among poor children in remote rural areas is the School Fishpond Program mentioned earlier. While the program provides immediate direct nutritional benefits among students of targeted schools, the benefits go beyond the school boundaries; the program serves as a catalyst in the communities to promote the use of water resources for integrated aquaculture-agriculture. The schools act as a focal point, providing outreach to students, parents, and other members of the communities, and a hub for information exchange and dissemination.

Self-sufficient economy

- Attitude on the sustainable livelihoods.
- Self-sufficient economy is given by His Majesty King Bhumibol Adulyadej of Thailand.
- farmers, merchants, businessmen, government officials or others.
- means having enough to live on and to live for
- Being self-sufficient means to have enough to live on and to live for, and to refrain from leading a luxurious and extravagant life, just having enough
- Self-sufficiency, in English, means that whatever we produce, we have enough for our own use. We do not have to borrow from other people. We can rely on ourselves, like what people say, we can stand on our own legs. It means having enough and being satisfied with the situation. If people are satisfied with their needs, they will be less greedy. With less greed, they will cause less trouble to other people. Everything must be within its limits. Saying what is necessary, acting just to have enough which means being satisfied at a moderate level,

New Theory

- In 1992, His Majesty introduced the "New Theory"
- to be implemented at the Royally-initiated Wat Mongkol Chaipattana Area Development Project.
- to serve as a model of land and water management for the farmers.
- Theory; the land is divided into four parts with a ratio of 30:30:30:10.
- 30% is set aside for pond and fish culture,
- 30% for rice cultivation,
- 30% for growing fruit and perennial trees,
- 10% for housing, raising animals and other activities.

"New Theory" consists of the three following phases.

- **Phase 1** : To live at a self-sufficient level which allows farmers to become self-reliant and maintain their living on a frugal basis.
- **Phase 2** : To cooperate as a group in order to handle the production, marketing, management, and educational welfare, as well as social development.
- **Phase 3** : To build up connections within various occupation groups and to expand businesses through cooperation with the private sector, NGOs and the government, in order to assist the farmers in the areas of investment, marketing, production, management and information management.