7. Social impacts, employment and poverty reduction

INTRODUCTION

A global review of aquaculture would be incomplete without dealing with the social dimensions. First, the objectives of governments of producing more food, earning higher incomes and improving economies have expanded to ensuring that enough food is produced and made accessible to the masses and that the poorer participants in the aquaculture sector gain a better livelihood. Second, as with other economic activities, the impacts of aquaculture range from those benefiting individuals to those benefiting entire communities. Third, the practice of aquaculture may also have its unintended and negative consequences which, if not dealt with, may outweigh its positive impacts.

The purpose of this chapter is not to balance, as in an accounting ledger, the positive impacts of aquaculture against the negative, the beneficial effects against the harmful. Rather, using the regional aquaculture trends reviews as source materials, this chapter is meant to enable an understanding of why and how these impacts are caused so that the positive are enhanced and the negative mitigated or avoided. One difficulty in dealing with social dimensions in a global review is that, more so than with bio-technical aspects, social norms, traditions and cultures vary from one region to another so that generalizations are not only difficult but also need to go beyond the social and political and delve into the ethical aspects. Regional examples therefore are provided to illustrate or highlight certain points or serve as lessons but are by no means intended to be applicable globally.

The positive livelihood impacts of aquaculture are well known and include provision of rural livelihoods, better income and new or alternative employment, additional income from rice farming systems or subsistence staple cropping systems, food security and better nutrition, and development of rural areas, the latter is also seen as a means to arrest urban migration. Another would be the opportunity for diversion and leisure to stressed citizens offered by angling.

Negative impacts of aquaculture arise due to the constant need to produce more by expanding the production area or by increasing the unit productivity. Under such circumstances conflicts arise which may be classified into three types, two of which are social in nature and the third related to the wider environment within which aquaculture operates:

(i) Conflicts among people or social groups that stem from competition for common resources as well as denial to some groups of access to resources.

(ii) Social inequities that are caused when benefits from aquaculture are not equitably shared or when some people or groups reap the benefits while others bear the cost.

(iii) Social impacts or conflict arising from the use of common resources by aquaculture operations, or damage caused to the ecosystem by aquaculture and the cost of mitigating the damage or restoring the ecosystem. In the short term, it is society that usually bears the cost of abatement or restoration although in the long term the benefit accrues to everyone, including the exploiters of the ecosystem.

HOW AQUACULTURE IS DELIVERING SOCIAL BENEFITS

To feed the growing population, there has to be a corresponding increase in food production whether from agriculture or aquaculture. There are basically two options to increase production in agriculture: (a) expansion of production area and (b) intensifying production. With increasing global population, the first option becomes less likely on land. However, aquaculture still has an advantage over agriculture as there are still the open waters of the sea to expand into. But as FAO (2004) has noted, "given the present and anticipated increases in world population, not to mention current and projected environmental problems and ecological stress from agriculture, further agricultural intensification will be needed." This applies as well to aquaculture. Intensification implies improved technology, improved strains but does not always mean increased amount of inputs. "For practical purposes, intensification occurs when there is an increase in the total volume of agricultural production that results from a higher productivity of inputs, or agricultural production is maintained while certain inputs are decreased" (FAO, 2004). How to enable farmers to intensify and enjoy the benefits of aquaculture and how to minimize and mitigate environmental problems are policy issues that need to be addressed.

Fish for the poor at an affordable price

Fish has always been recognized as a cheap source of animal protein. Countries with low per capita gross domestic product tend to have a higher proportion of fish protein in their animal protein consumption. Although less developed countries are not the biggest consumers of fish, they are the most dependent on it (FAO, 1993; Kent, 1997). The share of fish protein as a proportion of total expenditure on animal protein is higher for lower income groups, and poor people consume mostly low-priced fish. This shows the importance of low-priced fish as a primary source of protein among poor households in developing countries – although in many cases this low-cost fish is derived from inland capture fisheries. When inland capture fisheries decline, aquaculture increasingly makes up for the gap and even starts to fill the increasing demands from increasing populations. This suggests that freshwater aquaculture plays a significant role in the growth in per capita fish consumption and in keeping fish prices stable and at least as likely to be on the table as meat from livestock and poultry.

Growing demand and expanding markets are expected to push fish prices up, hence the need to increase the supply of low-value food fish to keep the price within the reach of the rural and urban poor. Semi-intensive and primary production-based aquaculture (includes culture-based fisheries) of low-value food fish has the potential to be adopted by millions of smallholders in Asian developing countries and is well established in several countries in Asia. It has emerged as an environmentally friendly production system that also supplies large quantities of low-value food fish. However, in the increasingly competitive markets of today, there are strong economic incentives for farmers to shift to higher value fish crops that yield higher profit margins.

As described in Chapter 4, low-income food-deficient countries or net food-importing developing countries that are also significant fish producers are generating large foreign exchange earnings from fish exports that help pay for imports of low-value fish and non-fish food commodities. Thus aquaculture can play a broader role in developing countries, through poverty reduction and food security. In sub-Saharan Africa, for instance, the non-commercial sector in many countries is recognized for its important contribution to household or community livelihoods, while on the other hand, countries such as Madagascar and Mozambique earn substantial foreign exchange from the export of premium quality shrimps.

This multilevel benefit is also recognized in Latin America and the Caribbean region; the countries have identified six main objectives for aquaculture, namely: (a) increase in export-derived income; (b) generation of employment; (c) increase in protein

consumption; (d) better food security; (e) poverty alleviation; and (f) stemming of rural migration. Due to the social and economic conditions in Latin America, aquaculture enterprises tend to place priority on foreign currency and employment generation; however, development of rural aquaculture is more directly related to food security and poverty alleviation. Unlike Asia, the historical development of rural aquaculture in Latin America has not adequately emphasized food security. Indirectly, however, it has had a significant contribution to employment generation (Morales and Morales, 2006).

COURTESY OF DORIS SOTO

*Rural aquaculture in Brazil. Culture of introduced tilapia and native tambaqui (*Colossoma macropomum*) is common in rural areas of northern Brazil. The families working on sugar cane industry receive additional income through this fish farming activity. This small-scale rural aquaculture practice is now expanding.*

In Latin America, extensive and semi-extensive aquaculture and culture-based fisheries contribute to fish consumption in rural areas, and to small-scale local trading. The establishment of intensive or industrial-scale fish, shrimp and mollusc farming in rural and coastal areas has a positive impact in the creation of jobs. Furthermore, the communities' participation through cooperatives and aquaculture associations allow for the development of these areas, guaranteeing the resources that ensure greater food security to their populations. Aquaculture carried out by poor households is for self-consumption and the local market and the species used are tilapia, tambaqui or cachama (*Colossoma macropomum*), carps and catfish (*Ictalurus* spp.) in freshwater and oysters in marine environments.

The Latin America and Caribbean regional review noted the lack of reliable data to enable more definitive conclusions on the contribution of aquaculture in the region's social and economic development. There is a consensus that the activity has generated rural and urban jobs as well as export products, creating income for the countries and maintaining domestic fish supplies, but the degree of investments created by this activity is not well defined, except for countries such as Chile, where precise numbers exist, for example, in jobs created. However, one clear indication of the importance of aquaculture in the coastal rural economy is the fact that, when shrimp farming crashed in Ecuador due to the white spot virus, some half a million jobs were lost and, in 2000, the government had to declare a State of Emergency in the shrimp producing region in order to extend assistance to the workers as well as the growers.

Wealth creation

Fish farming has evidently supported the creation of wealth in many countries. Commercial, industrial aquaculture of course operates as a business with maximizing profits in mind. This scenario is worldwide. There are documented examples of wealth creation or income generation through small-scale aquaculture in developing countries.

An evaluation of freshwater rural aquaculture projects in Bangladesh, Philippines and Thailand by the Asian Development Bank provides good examples of the positive social impacts of aquaculture that include accumulation of capital. Fish farming households in a large district of

COURTESY OF ROHANA SUBASINGHE

Trout farm in Iran. Iran is known for trout and sturgeon aquaculture. Trout farms are located in hilly areas and are fed with running water. The industry is expanding and the number of farms is increasing.

2.5 million people in Bangladesh "overwhelmingly perceived" that: (i) their overall food and fish consumption had improved, (ii) they had gained from employment and cash incomes from fish farming; (iii) the natural resource conditions for fish farming had improved; (iv) they had acquired means to finance fish farming; (v) their housing conditions had improved; (vi) they had gained access to fish farming technology; (vii) there had been an increase in the adoption of fish farming technology; and (viii) their access to credit had improved (ADB, 2004a).

On a national perspective, the last two decades have seen a dramatic increase in inland freshwater aquaculture production in Bangladesh: fish pond production increased from 123 800 tonnes in 1986 to 561 000 tonnes in 2000, and average national yields rose from 840 kg/ha to 2 440 kg/ha. With farmgate prices of farmed fish at about US$0.80/kg (Tk45–50/kg), freshwater aquaculture production contributes to the rural economy about US$700 million/year at farmgate value, or more than US$1 billion annually when post-harvest handling and marketing are included.

Diversification of livelihoods

Aquaculture offers opportunities for diversification of sources of livelihoods and farm enterprises. In sub-Saharan Africa aquaculture, particularly the so-called non-commercial or small-scale subsistence type is one of a variety of enterprises comprising the farming system undertaken to diversify production and income, improve resource use and reduce risks of such events as crop or market failure. It was also pointed out that the underlying motivation of "non-commercial" farmers is often similar to that of commercial farmers: earning income from sale of fish rather than producing fish for own consumption. Examples of aquaculture systems that offer diversification are seaweed culture to supplement artisanal fisheries and even crop farming, culture-based fisheries and integrated farming.

COURTESY OF SIMON FUNGE-SMITH

Kelp farmer in DPR Korea. Kelp is the largest produced seaweed in the world. It is farmed in many countries. Farming seaweeds like kelp is easy and requires little resources, however, it generates good income.

Seaweed is a crop that small-scale and poor coastal fisherfolk in the Philippines can grow as a supplementary or alternative source of income when the catch is poor. The rapid growth of the carageenan refining industry in China with its high demand for *Eucheuma* is fuelling further expansion in seaweed farming in the subregion. The buying price for *Eucheuma* has been going up in the Philippines, and the fisheries bureau has been promoting seaweed farming in more rural fishing communities. Outside Asia, the United Republic of Tanzania provides an example of successful diversification of aquaculture into seaweed.

Another form of aquaculture with a number of positive social impacts is culture-based fisheries. It has been enjoying renewed attention from governments and development agencies for several reasons (NACA/FAO, 2004a). It is mostly a rural artisanal activity catering to rural people, providing an affordable source of protein, employment opportunities and household income. Its added advantage is in being less resource-intensive and less environmentally perturbing. Furthermore, it does not allocate public resources to a few individuals and is therefore more equitable. Culture-based fisheries

can, however, succeed only with the proper institutional framework that recognizes territorial use rights for local inhabitants. One of the major concerns of stock enhancement of inland waters, however, is the possible effects of enhancement on biodiversity. There are two main reasons for this concern: (a) most nations depend wholly or partially on exotic species for stock enhancement; and (b) freshwater fishes are known to be among the most threatened vertebrates. Culture-based fisheries in sub-Saharan Africa offer an enormous potential to enhance fish supply. However, where they do exist they appear to be non-sustainable as governments do not have the resources for regular restocking.

The case for integrated farming draws support from evidence showing that the technological yield frontier has been stagnating with signs of a long-term decline (Sununtar, 1997a). There are also concerns of unforeseen high costs of intensifying aquaculture production in terms of adverse side effects on soil and water quality, human health, food safety and biological diversity. In this regard, attention has been renewed in integrated farming. Integrated aquaculture-agriculture is usually seen as a system to add value to water, recycle energy and farm waste in the system to produce more farm products, intensify the use of land and as an environmentally friendly practice. From the socio-economic, environmental and cultural standpoint it does provide much more benefit than conventional agriculture practices. A study by the Asian Institute of Technology (AIT) (Sununtar, 1997b) in rain-fed ecosystems in Northeast Thailand shows that fish farming integrated with livestock and crops has a highly significant impact on the welfare of farm families.

An economic analysis of a model 5-ha integrated farm carried over a 15-year time frame suggests that if the farmer opted to stay in agriculture, he would be much better off with an integrated farming system. The outcome of the analysis of this model has empirical support from an AIT survey that showed significant improvement in the quality of life of integrated farming households (Sununtar, 1997b).

In many sub-Saharan African countries, aquaculture was introduced at the turn of the century, mainly to satisfy colonial angling needs. Aquaculture for social objectives, such as improved nutrition in rural areas, generation of supplementary income, diversification of activities to reduce risk of crop failures and the creation of employment in rural areas, was introduced mainly during the 1950s, when many of the government fish farming stations were built. Today, in almost all countries, aquaculture is promoted under the relevant Poverty Reduction Strategy papers. This shows that governments throughout the region recognize the potential of the sector for development, in particular for rural development. The regional aquaculture trends review indicated that, in 10 countries of sub-Saharan Africa, there are nearly 110 000 non-commercial farmers[1] (Hecht, 2006).

Around 90 percent of aquaculture operations in these sub-Saharan African countries are rural based and generally referred to as small-scale or subsistence. Most fish farms are owned by individual families. Throughout the region, less than ten percent of ponds are owned by communities or farmer groups, although these are generally poorly managed. The only community-based operations that have worked in general are those where the community collectively develops the basic infrastructure such as roads and canals, but production systems are individually owned and managed.

[1] The African overview referred to "non-commercial" aquaculture as small-scale subsistence, small-scale artisanal or integrated aquaculture and is normally practised by resource poor farmers. Non-commercial producers may also purchase inputs, such as seed and feed, but rely chiefly on family labour and on-farm sale of produce. An additional feature of non-commercial aquaculture is that it is one of a variety of enterprises comprising the farming system; it is undertaken to diversify production and income, improve resource use and reduce risks of such events as crop or market failure. In reality, however, the underlying motivation of "non-commercial" farmers is often similar to that of commercial farmers, i.e. profit is more important than food security

COURTESY OF MOHAMMAD HASAN

Catch from culture-based fishery in Bangladesh. Stocking in floodplains and harvesting when the water recedes is a common practice in Bangladesh. Generally Indian carps are stocked and the harvest brings substantial income. However, as the land (floodplain) owners and fishers are generally not the same, there is an issue of equity.

Employment and gender

Employment figures in aquaculture are hard to come by. Most countries do not disaggregate aquaculture from agriculture or from fisheries. But estimates on the total number of workers involved in aquaculture are as high as more than 4.3 million in China and 4.36 million in Bangladesh (if the estimated 1.28 million post-larval and fry collectors are included) (NASO, 2006) and 2.38 million in Indonesia. Most of the other countries in Asia estimate the number of workers directly employed in aquaculture to be at the hundred thousand level of magnitude. The lack of accurate figures implies a lack of appreciation in most countries of the distinct nature of aquaculture as an industry, and this ought to be rectified.

Bangladesh provides a good picture of the diverse employment opportunities from freshwater aquaculture (ADB, 2004b). Apart from direct self-employment opportunities from fish farming, freshwater aquaculture offers diverse livelihood opportunities for operators and employees of hatcheries and seed nurseries, and for seed traders and other intermediaries. Labour is needed for pond construction, repairs and fish harvesting. The total number of people benefiting from direct employment in aquaculture is difficult to estimate because households are rarely engaged full time in fish farming. With as much as 400 000 ha under fish farming, direct, full-time employment may reach more than 800 000 people, assuming a minimum requirement of 2 persons/ha. Most of the work is part time, however, the number of people directly involved is probably much more than 2 million. When related services are included, freshwater aquaculture may benefit 3 million or more people and many more if their dependents were included as indirect household beneficiaries. Much of the employment benefits accrue in rural areas and include the poor. Thus, the contribution of freshwater aquaculture to rural livelihoods is far-reaching in Bangladesh (ADB, 2004b).

Several sub-Saharan African countries provided information on the role of women in fish farming and the data show that women play a minor role in fish production and own or manage approximately 16 percent of the farms (Hecht, 2006). The highest proportion of women fish farmers (30 percent) is in Zambia. All countries commented, though not quantified, on the important role of women in post-harvest activities, and particularly in marketing of the product.

In all countries, non-commercial fish farms are reported to play an important role in contributing towards food security, improved nutrition and rural employment. It was estimated that the non-commercial sector provides between 18 000 to 30 000 occasional jobs per country. Non-commercial aquaculture plays an important role in rural livelihoods, and fish farming families in general are better nourished than non-fish farming families. Cash income from fish ponds contributes to general household costs and living expenses and in most countries non-commercial farmers also use fish for barter and gifts.

Seaweed farming has given many families opportunity for entrepreneurship while commercial shrimp farms offer substantial opportunity for employment. For example, seaweed farms in the United Republic of Tanzania, Mozambique and Madagascar are family-owned businesses and more than 80 percent are owned and/or managed by females. In Mozambique, these farms provide some 2 000 jobs and in the United Republic of Tanzania the industry employs 3 000. Seaweed farmers are reported to earn around US$60 per month. Commercial fish farms in the region are owned by companies and individuals. In several countries, e.g. Zambia, Nigeria, Kenya and Uganda many

of the fish farms are part of larger commercial farming operations. Shrimp farms in Mozambique employ about 1 500 people and in Madagascar the farms provide 4 325 direct and 30 000 indirect jobs. In the directly employed labour force on shrimp farms, approximately 30 percent are women, whose jobs are in the post-harvest operations or in administration. Some 60 000 people gain temporary employment from aquaculture in Madagascar.

COURTESY OF DORIS SOTO

Salmon farming in large cages in the Reloncavi Estuary, Southern Chile. Chile is the second largest producer of salmon in the world. This industry which is largely based on introduced species now provides significant income and employment to rural communities in Southern Chile. By 2001, the regional workforce in this region employed by salmon industry reached 11%.

In Latin America, aquaculture directly employs an estimated 221 500 workers. These include professionals, mid-level technicians, administrative personnel, field labourers, small-scale producers, lake fishers and workers in related activities such as processing plants and feed mills. It is believed that half-a-million are indirectly employed. Of the directly employed, 75 percent are male workers and only 25 percent are female.

In a regional context, aquaculture in Latin America offers employment opportunities to rural populations. However, workers are being gradually affected by decreasing wages, particularly those that fall in the lower wage-bracket categories. Throughout the region, shrimp culture in general continues to offer the vast majority of employment opportunities, both direct and indirect, due to the intense degree of recurring investment. Regarding gender equity, only 5 percent of the jobs are occupied by women. This is also mainly in technical and administrative areas. Regional statistics on the participation of women in aquaculture employment are scarce, but their presence in the workforce is acknowledged to be low. Women are employed mainly in processing plants, where they represent more than 90 percent of the labour force. With regards to subsistence aquaculture, women and children perform various activities such as feeding, sampling and processing.

The contribution of aquaculture to employment in the Eastern European region varies greatly among countries. Although aquaculture does not have a significant role in the overall economy in several countries, fish farms and processing plants provide much-needed employment in rural regions, where work opportunities are otherwise limited or do not exist. The number of people involved in aquaculture production in Eastern Europe is relatively low. Most of the employees have primary or secondary school education but some have only a few years of primary school education. The percentage of employees with higher education is low. The relatively well-trained people are usually the farm managers. A key issue in the development of aquaculture in Eastern Europe is human resources development.

For some countries in Eastern Europe, e.g. Estonia, fisheries are still of significant social, cultural and economic importance. Angling is also an important activity supporting approximately 1 500 companies that provide angling-related services in Poland, where there are 1 million active anglers. Currently, there are 1 200 people working in aquaculture farms in Serbia and Montenegro, of which 85 percent work in Serbia. Aquaculture and fisheries also offer many job opportunities for fishermen in Romania. The primary industry and the upstream and downstream industries offer jobs in several countries, especially where marine fisheries and aquaculture have importance in the economy. Thus processing plants, input suppliers, engineering

companies and transport and trading companies provide employment for local people. Capture-fisheries production, however, has drastically decreased since 1988 and has led to unemployment and poaching. Some of the redundant fishers in Eastern Europe found new jobs in aquaculture.

In Eastern Europe women are poorly represented in the fish farming sector. Only 5-10 percent of all workers in fish farms are women in Bosnia and Herzegovina, Czech Republic and Serbia and Montenegro. The involvement of women in aquaculture is higher in Ukraine, where the share of total employment by women is about 20 percent. Estonia and Russia are somewhat different from other countries as far as the employment of women is concerned. In Estonia, the gender proportions in aquaculture are practically in equilibrium. In Russia, the ratio of women is up to 70 percent of the total staff in some fish breeding farms.

Across the Near East and North Africa, at least 86 400 individuals work in aquaculture, the greatest number of which, approximately 60 000, work in Egypt, the region's largest producer. In some countries, with low production, there may be less than one hundred individuals employed in the aquaculture sector. Within the region, aquaculture offers a diversity of employment opportunities, whether full time, part time or seasonal. Employees may work directly in the aquaculture facilities; in support activities such as feed mills, processing units and distribution; and in ancillary activities such as pond building and construction.

Across the Near East and North Africa region, women form a very small part of the workforce. In the thirteen countries for which gender distribution is known, women in aquaculture are represented in only seven countries. Within two of these seven countries, Egypt and the Syrian Arab Republic, women are commonly employed in aquaculture. Across the region, children form a negligible part of the workforce. Interestingly, shrimp aquaculture in Saudi Arabia and Iran (Islamic Republic of) has also created employment opportunities for thousands of workers from various Asian countries, notably India, Philippines and Thailand.

The two primary aquaculture sectors in North America have evolved in parallel fashion with regard to the consolidation of a number of small farms over time into fewer and more efficient larger operations. This has occurred with channel catfish and salmon, and follows the model observed across the terrestrial agricultural sector. Even in the organic movement, which once held small-farm status as part of its appeal, larger corporations are producing organic crops more efficiently and successfully competing in the marketplace. This evolution towards fewer and more efficient larger operations is driven largely by the need for economies of scale to lower production costs and remain competitive as production increases and aquaculture products make the transition from products to commodities.

COURTESY OF ZHOU XIAOWEI

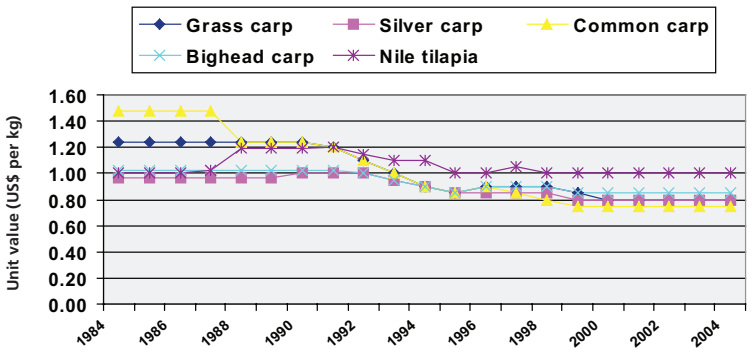
Oyster farming in China Xiamen, Fujian province, China. This popular culture practice in Fujian province not only produces a valuable commodity, but also helps to clean the water in the bay. Integrated marine farming which includes fish, molluscs and seaweed has proven to be highly environmentally friendly.

Women are capable of gainful employment in every sector of the aquaculture industry but are under-represented. There is a gender imbalance in the Canadian aquaculture work force with about 72 percent male and 28 percent female (Mathews, 2004). The situation in the United States of America is likely to be similar, but comparable data are not available.

Food security and better nutrition

The role of aquaculture in food security has been adequately discussed in Chapter 4. However, affordability of fish is central to its accessibility to the poor sector of the society. In general, due to the expansion of both scale and efficiency of aquaculture there has been a downward trend in the unit value of many locally consumed food fish species including cyprinids and tilapia, as has been the case in China (Figure 1). It should be noted, however, that the decline in value as reflected in FAOSTAT 2005 is in terms of United States dollars. In countries where there is depreciation in the currency, the wholesale price may actually show an increasing trend in terms of local currency as is the case in India for various carp species (Table 1).

FIGURE 1
Trend in the unit value of important food fish species in China



Source: Fishstat 2006

TABLE 1
Wholesale price changes of various carp species (Indian rupees per kilogram) during 1988-1999. (FAO, 2001)

Species/year	1988-89	1993-94	1998-99	% increase between 1988-89 and 1993-94	% increase between 1993-94 and 1998-99
Rohu	15.48	35.93	40.68	132.05	13.22
Catla	15.17	33.54	38.86	121.01	15.87
Mrigal	14.42	33.79	37.43	134.3	10.78
Other minor carps	12.36	31.61	35.49	60.9	12.29

Such downward trend in prices, while beneficial to the consumers in the short term also has its downside. The reduced unit value may not necessarily be attributable to lower production costs but may be due to increased supply. This would mean lower profit margins and would make small-scale operations less viable. When this happens, there will be a greater impetus to shift to high-value species that can return a substantially higher profit margin. This appears to be the case in China where there has been a surge in the production of high-value freshwater species such as mandarin fish, mitten-handed river crabs (*Eriocheir sinenses*), river prawns (*Macrobrachium* spp.) and even the Pacific white shrimp (*Penaeus vannamei*). In the Philippines most of the cage and pen grown milkfish are produced by large-scale operators who make up for the low margin by going into large volume production.

COURTESY OF SIMON FUNGE-SMITH

Aerial view of a large milkfish farm in the Kiribati. Philippines is the largest producer of milkfish in the world and the culture of this species requires very little input resources. Some Micronesian states are engaged in milkfish farming not only for food but also as bait fish for tuna fishing industry.

In South Asia, freshwater aquaculture is likely to continue, primarily for food rather than for cash (purely income generation) although much of the freshwater carp farming in India is market oriented.

The Pacific island nations have increasingly realized the role aquaculture can play to supply fish protein, particularly for inland rural villages where access to fresh fish is limited and lack of electricity does not allow the long-term storage of food. Some parts of the Pacific, particularly the large Melanesian countries are facing a food crisis situation from increasing population pressure, which is leading to poor nutrition and health. Generating another primary food source would help alleviate the reliance on imported processed, i.e. tinned, foods. Aquaculture is also seen as a viable alternative source of essential cash needs (for school fees, social obligations and other expenditure items) and as a back-stop to declining fisheries revenues and is also being integrated into tourism marketing campaigns.

There are examples where aquaculture has helped particularly vulnerable groups. For example, throughout sub-Saharan Africa small-scale fish ponds offer a valuable addition to the integrated farming systems without substantially adding to the labour burden, hence contributing to food security and improved nutrition at the family level. It has also been reported that fish farming may serve as a low labour solution for HIV/AIDS affected households (Bene and Heck, 2005).

IMPACT OF AQUACULTURE ON RURAL COMMUNITIES

Aquaculture development has been credited with stimulating the development of the rural communities in which they are located by direct employment of residents, and the generation of greater economic activity with the establishment of support services. Aquaculture development brings with it an infusion of cash to areas which may not merit consideration for other types of industry. Wages for local labour become part of the local economy as they are used to pay for local goods and services. Commercial-scale investment also spurs the government to provide or improve the infrastructure of an isolated area in the form of roads, bridges and often electricity.

The impact is even more pronounced if the farm is locally owned, however small, since income from sales of the harvest become part of the local cash flow. Such is the case in Latin America where, the production centres dedicated to rural or small-scale aquaculture are mostly family owned, carrying out small-scale operations to produce fish for household consumption.

In Eastern European aquaculture, pond fish farming has never been really small-scale in most of the countries. However, there is now a shift towards small-scale operations. Numerous relatively small pond fish farms have been established after the division and privatization of fairly large state-owned pond fish farms in the past ten years. The percentage of state-owned farms is quite low now compared with the total number of farms. Nevertheless, other types of ownership were also established and the form of ownership varies widely, i.e. specialized fish-breeding facilities in Ukraine and Bulgaria are open joint-stock companies, mixed ownership, cooperatives and limited ownerships in some countries; concessions in Hungary, Croatia, Slovakia and Poland; and a relatively large holding (including several pond fish farms) in the Czech Republic that controls a third of marketable fish production in the country (FAO/NACEE, 2006).

In Southeast Asia, the trend is expansion into open marine waters using sea cages. There are an estimated 1.12 million cage units in China, Malaysia, Thailand, Philippines, Indonesia and Viet Nam producing 550 000 tonnes of finfish, 85 percent of which are marine species. This has contributed to direct employment and ancillary enterprise employment and the development of coastal zones. A sobering lesson could be learned from the experience of DPR Korea, however. While it could have been exacerbated by cheaper imports of mariculture products, the explosive growth in mariculture

– encouraged by government incentives – led to overproduction, lowered the prices of products and caused bankruptcies among coastal farming communities (Bai, 2006).

In some countries, culture-based fisheries have been promoted for rural communities with mixed results. While there are successes, major issues have arisen with social conflicts, leasing and access rights and sustainability and questions over how to manage culture-based fisheries on a sustainable basis (with equitable distribution of benefits).

Bangladesh has a unique seasonal culture-based fisheries. Entire areas cannot be planted to crops during the flood season. Fish are stocked and the floodplains are surrounded by barrier nets so that fish can be caught by local fishermen. However, at the end of the rainy season the area reverts to the exclusive use of their respective owners, so the benefits are not necessarily shared optimally. In China, as well as in Thailand, it is common to have small impoundments managed like a fishpond but with everyone in the community having the fishing (or harvest) rights and is sometimes referred to as community-based aquaculture.

In a number of countries in the Near East and North Africa aquaculture is recognized as providing important opportunities to poor families; for employment and income, and as a source of nutritionally healthy and affordable protein. In Algeria, the national five-year plan for the development of fishery and aquaculture has as a priority: the improvement of living conditions in disadvantaged rural areas, via income and job opportunities from aquaculture. In the Syrian Arab Republic, aquaculture gives higher incomes than other agricultural activities, and thus is economically advantageous in rural areas.

Small-scale operations are actively encouraged in Lebanon, Libyan Arab Jamahiriya, Morocco and the Syrian Arab Republic, for their socio-economic benefits. In Egypt, employment in aquaculture compensates for some of the jobs lost from traditional lagoon fishing.

SOCIAL IMPACTS ARISING FROM ENVIRONMENTAL CHANGE

Environmental impacts of aquaculture development have received a high degree of attention typically where there is a strong element of conflict between resource users. Less well known are the cases of where aquaculture makes a positive contribution to the environment or where it can be used as a means towards reducing the negative impacts.

There are aquaculture systems that contribute to environmental rehabilitation. The most well-known are integrated farming systems. Less well-known is the fact that coastal aquaculture can also contribute to environmental improvement and thus to socio-economic improvement. Examples include: seaweed and mollusc culture, which remove nutrients and organic materials from coastal waters; mixed mangrove systems, which help restore mangrove habitats as in Indonesia and Viet Nam; coral reef fish mariculture, as an effective alternative to destructive fishing in coral reef areas; stock enhancement to rehabilitate fish populations; and aquaculture itself being an effective technique for monitoring environmental status (Kongkeo, 2001). Further examples are also available elsewhere in Asia and other parts of the world (see Chapter 5).

Negative social impacts

A discussion of the negative social impacts of aquaculture necessarily entails the consideration of environmental effects. Conflicts have been known to arise because of the pollution of water resources, blocking of access to the shore by aquaculture installations, salination of crop lands, encroachment, and decline in fish catch due to various aquaculture impacts including fish kills that also affect the wild fisheries and may lead to a reduction in biodiversity.

Food security, ironically, can also be negatively affected by some traditional and modern intensive aquaculture practices such as the use of small fish and trash fish for

fish feed. As one practice depends on small fish for fish feed and the other on high protein diets containing a significant amount of fishmeal, the result is a net loss of fish or protein. The impact is greater on the poor and needy as the market price of the potentially food grade fish is raised due to increasing market demands for them as fish feed (Edwards, 2003. cited in NACA/FAO 2004b). The other negative impact of certain aquaculture practices on food security is the depletion of wild stock because of poor practices in collecting wild seed for culture.

More serious social conflicts have been reported particularly by non-government organizations. These conflicts include violence between crop farmers and shrimp growers, between coastal fishers and shrimp growers, between artisanal fishers and cage and pen culturists, and even between those that want to raise fish in communal village tanks and those that only want the tank for water, and between small farmers and the bigger farmers. Major social conflicts can also arise because of competition for water at the small-scale level in sub-Saharan Africa, particularly between tobacco farmers and fish farmers.

Social impacts of brackishwater shrimp farming on rural fishing and farming communities, although at the time poorly documented, were cited by activists in their petition to the Supreme Court of India to shut down the sector in 1997. In this regard, a study on social impacts of shrimp farming in India (Patil and Krishnan, 1998) is illustrative of the need for good assessments of impacts to serve policy better.

The study by Patil and Krishnan (1998) enabled the government to identify the most pressing problems facing a group of villages and provide a guideline for arriving at a delicate balance between promoting the development of an industry that generates relatively good income and penalizing it for its associated negative impacts. It was able to expose the nature of each social impact and its magnitude to enable the development of effective legislation and other means to regulate shrimp farming impacts. Probably the most common and readily visible environmental impact that leads to negative perception of aquaculture is pollution of waterbodies and in shrimp farming, the salinization of freshwater bodies and crop lands. The principal causes include the poor siting of farms due to improper site selection or, fundamentally, lack of regulations and guidelines on zoning, poor feeds and feeding practices, and lack or weak enforcement of regulations on effluent standards and effluent discharges.

In a study supported by Australian Centre for International Agriculture Research (ACIAR) (NACA/DEAKIN/ACIAR, 2003), of three cascade reservoirs in Indonesia, it was found that uncontrolled development of fish cages led to intensified cutting of timber and bamboo in nearby forests which led to more rapid silting and flooding. The increased density of cages, increased stocking and poor feeding practices also led to frequent fish kills affecting even wild fish stock. This in turn resulted in poaching on the cages by poor fishers who had no fish to catch. The study points to the need for a better community-based reservoir management and sound technical advice on fish cage operation.

COURTESY OF SENA DE SILVA

Using trash fish in a marine cage farm in Viet Nam. Use of trashfish to feed marine carnivorous fish such as grouper and seabass is a common practice in Asia. However, this practice has been critisised due to use not only trashfish but also the cheap food grade fish to feed marine fish.

In other cases conflicts have arisen between farmers and fishers due to escaped fish. An example is the case of salmon farming in Chile where artisanal

fishermen have claimed lower catches, perhaps due to predatory effects of escaped salmon on the wild population. Although fishers like to gain the right to catch escaped salmon, it has been denied by the government due to the lack of an established salmon fishery policy in the country (Soto and Moreno, 2001).

Addressing the social impacts

Addressing the social impacts of aquaculture essentially means addressing sustainability issues, especially as social acceptance is one of the three elements of sustainability. The various strategies to address such impacts are described as below:

Internalizing costs

It has been argued that if blame must be assigned for the adverse impacts of aquaculture, it should be placed not on aquaculture itself but on the way it is undertaken (Anderson and De Silva, 1998). This implies, rightly, that better and more responsible management practices would avoid or mitigate the impacts. Such practices are enforced by legislation or adopted on a voluntary basis; they should have to be based on acceptable science-based standards, and subject to monitoring. Compliance with regulations and adoption of better management practices would necessarily entail cost to aquaculture. Having the aquaculturist shoulder the cost of preventing the farm effluent from polluting the environment is essentially not passing on that cost to society. Furthermore, authorities have averred that adopting such measures as better management practices actually pays for itself (Clay, 2004)

Adoption of better management practices

Adoption of better management practices for shrimp farming under shrimp health management projects in India and Viet Nam resulted in the following:

- India: reduction in disease prevalence by 65 percent, two-fold increase in production, 34 percent increase in size and improvement in quality of shrimps due to non-use of banned chemicals.
- Viet Nam: 1.5 times higher seed production by better managed hatcheries with 30 to 40 percent higher selling price for the fry, higher production and higher probability of making a profit, improved yields that were up to four times higher than non-BMP ponds.

Better yields and profitability apart, and contrary to a number of reservations that better management practices are a technical solution and ignore political and social issues in shrimp farming (Bene, 2005), the projects are providing indications that BMP adoption is not a problem for small-scale farmers that are organized. Being organized has enabled them to attain economy of scale to be able to adhere to best practices. Technical assistance from government is increasing their awareness and organizational capacity and, if not yet marketing skills. There is also the growing awareness that in being organized and responsible, they are in a stronger position to transact with suppliers and buyers. They are not yet participating in a certification and labelling scheme, but that is the next step envisioned for the project, and which the farmers themselves

COURTESY OF ARUN PADIYAR

A meeting of small-scale cluster shrimp farmers in Andhra Pradesh, India. Recent introduction of better management practices in small-scale shrimp culture in India, in particular in Andhra Pradesh, has been successful in reducing disease incidents and increasing culture period and volume of production.

have asked to be initiated. The above projects have arguably served to enhance trust and cooperation among the players in the market chain which includes hatchery owners, the farmers and processors and exporters. The basis for this proposition is that the supplier of inputs, the farmer, and the buyer of products stand to gain more from each other by behaving responsibly towards one another than by taking advantage of each other.

While Clay (2004) says that BMPs can pay for themselves, he advocates support for small farmers to make the transition into better management practices, rather than leaving this to the market alone. He thinks the government subsidies in the short term would provide incentives for their adoption, adding that regulatory and permitting systems can also encourage the identification and adoption of these practices.

Integrating aquaculture in rural development plans

There are negative consequences from aquaculture that are not the result of bad practices but are associated with power structures in the community and the capacities of institutions. Among these are the exclusion of the poor from taking part or in being physically removed from aquaculture; resource appropriation by elites and the politically powerful sectors; and conflicts and violence. The negative consequences associated with a weak institutional context include poor linkages; coordination and coherence between sectors; unclear or overlapping mandates; unclear public/private sector responsibilities; uncertainties in tenure, property and user rights; weak regulatory regimes and enforcement capacity, rent seeking; ineffective communication; and underinvolvement of primary stakeholders in policy and programme formulation concerning the sector. Without some form of intervention short-term financial perspectives tend to dominate environmental and social issues (Haylor and Bland, 2006).

In this regard, Haylor and Bland (2001) argue for such interventions to be strategically planned. A generic recommendation is to integrate aquaculture in rural development planning which should come with sound governance, strengthening of institutions including farmer associations, provisions for multistakeholder participation, be people-oriented and with a multisectoral agenda.

Creating opportunities for participation of the poor

Concerns have been expressed that aquaculture interventions have not always directly addressed the needs of the poorest people. Aquaculture, the argument goes, requires resources such as land, ponds, water, credit and other inputs, by definition those involved in aquaculture are not the very poor. In this regard, an FAO/NACA consultation in 2002 collated experiences that clearly demonstrate that if aquaculture is properly planned there are considerable opportunities for poor people's entry (Friend and Funge-Smith, 2002). First, the consultation agreed that aquaculture offers significant advantages over other activities such as livestock and crop farming for the entry of poor people because it entails low-cost technologies using available on-farm inputs, is a low-investment and low-risk activity, requires low labour inputs that fit with household divisions of labour, is easily integrated into other livelihood and farm activities, and low levels of production provide important sources of household nutrition and buffers against shocks.

From experiences and lessons derived from various development projects implemented by governments and civil society organizations in several developing countries (Bangladesh, Cambodia, India, Lao (PDR), Nepal, Philippines, Thailand and Viet Nam), the consultation recommended measures for appropriate targeting of poor people, targeting the landless, creating opportunities for the poorer people, targeting the women, strategies for collective action, caution in providing subsidies and gratuities and adopting livelihood approaches.

Few aquaculture development initiatives reach the poorest. When aimed at poverty reduction, development assistance should be targeted carefully by clearly defining the

intended beneficiaries and devising appropriate strategies to help them benefit. The assistance needs to recognize specific and prevalent features of poverty among the intended beneficiaries, including the means of overcoming key barriers for entry into aquaculture and adoption of technologies, and to mitigate risks to which the poor are particularly vulnerable. The ADB (2004b) studies of small-scale freshwater aquaculture in Bangladesh yielded strategies for targeting the small and poor households, as follows:

Access to land and water. Access to land and water is the key requisite for fish farming. Conventional aquaculture development initiatives that emphasize the promotion of technology and provision of targeted extension services are unlikely to reach the functionally landless and the extremely poor. Without access to land and water resource or water area, the poorest are unlikely to engage in fish farming directly. In Latin America and the Caribbean, a region without long tradition of aquaculture, ownership of the land has been one of the obstacles for the development of small-scale family-type aquaculture. The situation varies in different regions of the world.

Access to other livelihood assets. Access to financial and human capital assets is necessary for households to benefit from aquaculture. The ability to pay for pond development and fish farming, including seed and feed, requires financial capital, access to credit, or both. Human capital, in terms of basic education and capacity to learn, is required for people to gain from training and extension services.

Leasing a pond. When the landless gain access to waterbodies or ponds through lease or other access arrangements for fish farming, secure access rights are critical. Eviction is common when access is not secure, and interrupted operation can result in loss of investment that the poor cannot recover from. Demonstrated profitability of fish farming may also increase the lease price of ponds beyond the reach of the landless because of an increasing demand for fishponds. Further, the profitability of fish farming may entice landowners to operate fishponds on their own or through caretaker arrangements.

Pond sharing. With a large number of dependents per family (typically, a family has 5–8 members), land inheritance leads to a multiple ownership of fish ponds, presenting an array of issues related to co-ownership and collective action among shareholders. Cost sharing, benefit distribution and assignment of responsibilities and accountabilities for pond management become difficult leading to underutilization and even abandonment.

Living marginally with risks. Most direct beneficiaries of fish seed and growout technologies in Bangladesh are not the poorest people. Small-scale landholders with fish ponds may have limited assets and may not be categorized as marginally poor or the poorest, but most small-scale landholders are only precariously above the poverty line.

Labour and cash inputs. Some socio-economic constraints remain even for those able to secure access to land or water bodies: several hours of daily labour may be required for food gathering, preparation, and feeding; while returns from fish farming are often highly seasonal. Feed requirements cannot always be met by pond fertilization and collection of feed from the immediate vicinity. Supplementary feed may require cash outlays. Lack of cash and difficulties in accessing credit are major barriers for the poor to undertaking aquaculture on their own. Although labour may be shared and minimized through collective action among farmers, organizational arrangements are not easy to meet.

Theft. Fish pond owners and cage operators often face the threat of poaching. The risk of theft increases when fish ponds or cages are far from farmers' households. Surveillance requires labour inputs for which the returns are not immediate. These constraints have limited the feasibility of fish farming to some extent, especially among households headed by females, who, on their own, are unable to protect their assets against an unfavourable social environment.

Stakeholders' involvement in governance

Ultimately, preventing conflict is the most effective way of addressing social impacts. This brings into focus the concept and practice of stakeholder involvement in policy making, planning and management (Sen, 2001). Stakeholder involvement has arisen out of a new general development model that seeks a different role for the state, which is based on pluralistic structures, political legitimacy and consensus. In aquaculture it is expected to lead to more realistic and effective policies and plans as well as improve their implementation. The reasons for this are that greater information and broader experiences make it easier to develop and implement realistic policies and plans, new initiatives can be embedded into existing legitimate local institutions, there is less opposition and greater political support, local capacities are developed and political interference is minimized.

Enabling the small and poor farmers and aquatic users to have a voice in policy and planning mitigates the inadvertent effect of policies and programmes of marginalizing the poor and weak. This has been a keystone of the Support to Regional Aquatic Resources Management (STREAM)[2] Initiative (established in 2001 as a NACA primary programme element by a multi-agency collaboration that includes FAO, United Kingdom Department for International Development (DFID), NACA and Voluntary Services Overseas (VSO, an international NGO). A growing body of lessons is providing useful guidelines to governments and development organizations for building capacity to support aquaculture and living aquatic resources for rural livelihoods of poor people in the region.

The lessons have included effective ways to organize and strengthen organizations or groups of poor people so that they become partners to government, development agencies and civil society in identifying potentials and developing solutions to improve aquaculture and aquatic resources management. Approaches included rural organization, establishment of one-stop-aqua shops for farmers, application of livelihoods approaches in rural development planning and implementation, improving the capacity of institutions to work towards poverty alleviation, developing local-level institutional models to better serve the objectives of rural farmers and fishers and encouraging the development of policies that respond to the needs and support the objectives of farmers and fishers who are poor, using approaches to giving poor people a voice in policy development, and sharing of better practices appropriate to poor people in rural areas.

Well-defined rights

Finally, while the above refers to a stakeholder role of the state, it also highlights a fundamental role of governance, which is to ensure that basic rights of individuals and the welfare of the public take precedence over that of interest groups. Defining basic rules to impartially arbitrate among potentially conflicting interests may prevent many of the conflicts from arising in the first place (Bailly and Willmann, 2006). Legislation on integrated coastal area management, defining access rights and limitations to various types of activities, and recognizing basic individual rights such as access to shore or water with specific properties would help private and public promoters of aquaculture development plan their activities with more security and a more informed basis for decisions. Well-defined individual or collective rights act as incentive where those who have rights, either on the side of the aquaculture promoter or on the part of another interested party, can use them for persuasion or can claim them in front of jurisdiction capable of enforcement.

[2] www.enaca.org/stream

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