

THE IMPORTANCE OF FISHERIES AND AQUACULTURE TO DEVELOPMENT

Cambria Finegold

Abstract

Small-scale fisheries and aquaculture make critical contributions to development in the areas of *employment*, with over 41 million people worldwide, the vast majority of whom live in developing countries, working in fish production; *food security and nutrition*, with fish constituting an important source of nutrients for the poor and often being the cheapest form of animal protein; and *trade*, with a third of fishery commodity production in developing countries destined for export.

With most capture fisheries worldwide considered fully exploited or overexploited, aquaculture will be central to meeting fish demand, which will continue to increase with population growth, rising incomes and increasing urbanisation. As aquaculture develops, however, governments will need to manage its potential ecological and social impacts. African aquaculture, which has grown much more slowly than in other regions, faces numerous challenges, including resource conflicts and difficulties in accessing credit, quality seed and feed, and information. Also key to meeting growing demand will be improvements in post-harvest processing to reduce fish losses.

Both fisheries and aquaculture are often neglected in national development policy and donor priorities, as policy makers often do not have access to data which reflect the importance of fisheries and aquaculture to development. Appropriate policies and regulation remain important, however, both in managing capture fisheries and ensuring that aquaculture development is pro-poor and sustainable.

Fisheries, aquaculture and development – introduction

Despite the significant contributions that fisheries and aquaculture make to employment, nutrition, and trade in the developing world, they are rarely included in national development policy and donor priorities. This is largely due to problems with valuation of small-scale fisheries, as policy makers often do not have access to data which reflect the importance of fisheries and aquaculture to development.

The stagnation or decline of capture fishery production in many parts of the world underscores the importance of fisheries policy, however, as the current state of stocks can be at least

partially attributed to the difficulties of regulating fisheries and preventing their overexploitation. Even with improvements in regulation, however, pressures on capture fisheries will remain, due to continued population growth. Further development of sustainable aquaculture and improvements in the post-harvest sector to reduce losses could help to maintain fish supply and the contribution of fish to development.

Employment, production and trade

While data on fisheries in developing countries are often patchy¹, it is nevertheless possible to identify trends in the importance of fisheries and aquaculture for developing countries, particularly in the areas of employment, consumption, and trade.

Employment

Employment in fishing and aquaculture has grown rapidly over the past few decades, increasing more than threefold from 13 million people in 1970 to over 41 million in 2004 (Figure 1). Employment in the fisheries sector has grown more rapidly than both world population and employment in agriculture. Most of this growth is in Asia, where over 85 percent of the world's fisherfolk live, and is largely due to the expansion of aquaculture in this period (FAO 2006, FAO 1999).

While the number of people employed in fisheries and aquaculture in developing countries has been growing steadily, it has been stagnant or declining in most industrialised countries. This decline has been most pronounced in capture fisheries, while employment in aquaculture has increased in some industrialised countries.

Millions of women in developing countries are employed in fisheries and aquaculture, participating at all stages in both commercial and artisanal fisheries, though most heavily in fish processing and marketing. In capture fisheries, women are commonly involved in making and repairing nets, baskets and pots, baiting hooks, setting traps and nets, fishing from small boats

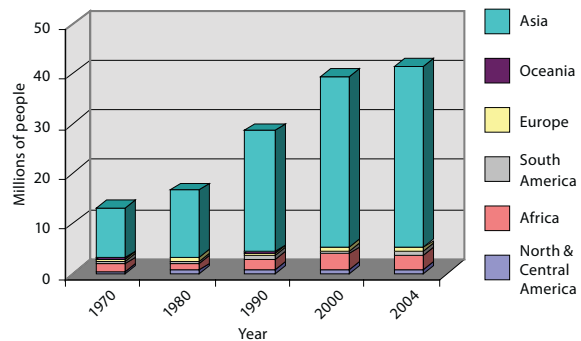


Figure 1. Employment in fisheries and aquaculture. Data for 1970, 1980 and 1990 are from FAO (1999), while data from 2000 and 2004 are from FAO (2006), and therefore may not be perfectly comparable.

1. Though many countries collect data on commercial marine fisheries and on fish exports, catches by artisanal and part-time or occasional fisherfolk often go unrecorded. The status of inland fisheries is also much more difficult to assess than marine fisheries, as fishing is often practiced in remote locations by poor small-scale fishers who target a wide range of species using several types of gear, and whose catches are rarely disaggregated by species if recorded at all. Data on fisheries in developing countries therefore often underestimate the numbers of people who depend on fisheries for their livelihoods and diets, and the actual contribution of fisheries to development is likely to be higher than is reflected in statistics.

and canoes, and collecting seaweed, bivalves, molluscs and pearls. They are rarely involved in commercial offshore and deep-water fishing. In aquaculture, women feed and harvest fish, attend to fish ponds, and collect fingerlings and prawn larvae. Women play a major role in fish processing in many parts of the world, both using traditional preservation methods and working in commercial processing plants.

In addition to affecting food supply, the status of fish stocks in capture fisheries is likely to threaten the livelihoods of small-scale fisherfolk and traditional fish processors as competition for limited resources increases. Larger-scale operators with greater access to capital and gear are already emerging in many areas, leading to changes in the structure and location of post-harvest activities and concentrating ownership and control of resources. In India, for example, fishing practices are changing with rising investment, and higher levels of mechanisation and motorisation are leading to greater centralisation of landings and competition over the catch. In the past, small-scale traders were able to purchase fish from local fishers at decentralised beach-based landings, sometimes accessing fish through husbands or taking the fish on credit and paying once they had sold it. The increasing centralisation of landings, however, has led to fierce competition at landing sites, favouring those with greater access to credit and infrastructure and marginalising traditional fish processors and petty traders (FAO 2007).

Production and consumption

Data on fisheries in developing countries often

do not fully account for artisanal and subsistence production, as the magnitude of the landings of these fisheries is not generally known by the responsible fisheries administration. It seems clear, however, that capture fisheries worldwide are currently being fished at or near capacity, and that further growth in fish production will come primarily from aquaculture. FAO (2006) estimates that marine capture fisheries production will remain between 80 and 90 million tons per year, and freshwater fisheries, which face environmental degradation and competition for use of freshwater resources from other sectors such as hydropower and agriculture, are unlikely to expand significantly either.

Per capita fish supply in low-income food-deficit countries (LIFDCs) (excluding China) has increased from 5.0 to 8.3 kg since 1960, due primarily to the growth of aquaculture and to increased production from inland capture fisheries in developing countries (FAO 2007). In sub-Saharan Africa, however, per capita fish supply is declining, dropping from a peak of 9.9 kg in 1982 to 7.6 kg in 2003. This is due to rapid population growth, stagnant capture fishery production, and the slow expansion of aquaculture in the region (FAO 2006).

Demand for fish continues to increase in most of the world – in line with population growth as well as increases in consumption of animal protein associated with urbanisation and rising incomes. In developed countries, demand for high-value carnivorous species such as salmon and shrimp has also increased, largely due to income growth and urbanisation, as well as a shift

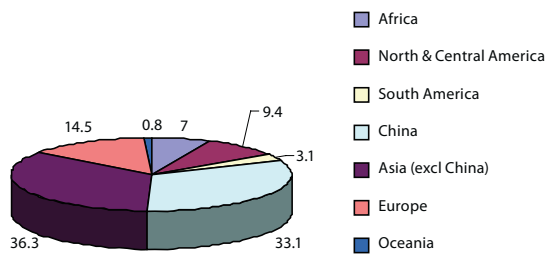


Figure 2A. Food fish supply in 2003 (million tons live weight equivalent). Source: FAO 2006.

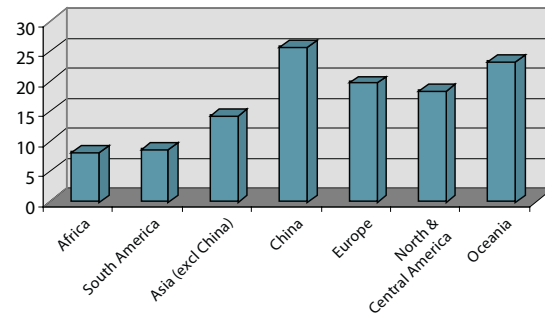


Figure 2B. Per capita fish consumption 2003 (kg/person/year). Source: FAO 2006.

in preferences away from red meat and towards fisheries products (Delgado, Wada, Rosegrant, Meijer and Ahmed 2003).

Trade

A large portion of fish production is destined for export, around 40 percent of global production being traded internationally, and exports from developing countries accounting for some 60 percent of this (see Ababouch, this volume). They are now net exporters of fish to developed countries, having shifted dramatically from being net importers (over 1.2 million metric tons in 1985) over the past two decades (Delgado *et al.* 2003).

Over 30 percent of fishery commodity production in developing countries is destined for export (FAO 2005a), and it is an important source of foreign exchange for many countries, including Chile, Mozambique, Senegal, and Thailand. While industrial fishing activity continues to produce a significant portion of fisheries

exports in some countries, much of the recent increase in exports from developing countries has come from small-scale fisheries. Much of this is driven by rising demand for high-quality demersal fish in developed countries. The rapid growth in contribution of fish to total export earnings in Uganda (from less than one percent in 1990 to 17 percent in 2002), for example, was based largely on artisanal fishing of Nile perch in Lake Victoria (FAO 2007).

An increasing amount of trade in fish products is between developing countries, however, rather than from developing to developed countries. Demand for fish in developing countries continues to grow, due both to population growth and increased per capita consumption, while overall demand in developed countries (including the USSR) has stagnated since 1985. While there is increasing demand for higher value fish in developing countries, low-value fish continue to make up the bulk of fish consumed there, and

they are projected to remain net exporters of high value finfish and importers of low-value food fish (Delgado *et al.* 2003).

International trade in fisheries products has been shown to have a positive effect on food security in many developing countries, stimulating increased production, generating foreign exchange which can be used for food imports, and enhancing the trade-based entitlements of people engaged in fishing and fish processing. Much of the discussion around the food security impact of international fish trade has focused on whether fish production for export reduces the amount of fish available for local consumption, presenting fish exports as a trade-off between foreign exchange earnings and domestic food security. Such a perspective, however, fails to take into account that foreign exchange from fish exports helps to finance imports of other foods, including fish products, and that production for export helps to raise the incomes of poor fisherfolk and people employed in fish processing, enabling them to achieve greater food security through enhanced purchasing power. In Thailand, for example, a decrease in rural poverty has been attributed to the export orientation of the fisheries sector and concomitant increase in the incomes of poor fishers. Fish processing for export can also generate employment, particularly among young women, though export-orientation in fisheries reduces the quantity of fish available to traditional fish processors (typically middle-aged women with little education), affecting their livelihoods.

Fisheries in development policy

The contribution of fisheries and aquaculture to development has consistently been underestimated both in national development and poverty reduction strategies and in international cooperation. FAO (2005b) identify two factors which influence the degree to which fisheries are included in development policy in a given country: the sector's contribution to foreign exchange earnings and its contribution to food security and nutrition (measured by dependence on fish protein). The more reliant a country is on fisheries for its foreign exchange earnings and food security, the argument goes, the more likely that policy makers will recognise their importance and that this will be reflected in development policy. As farming and terrestrial livestock often both generate more foreign exchange and are perceived to make a larger contribution to food security than other renewable resource sectors such as forestry and fisheries, they generally receive much more attention in national development strategies and donor priorities.

When faced with resource allocation decisions, many governments prioritise water use for human consumption, agriculture, hydropower, and industry over inland fisheries and aquaculture. This is largely attributable to the perceived contribution of each sector to development, but also to the prevalence of single water-use systems. Encouraging multiple uses of water, however, can increase its productivity and allow for simultaneous development of several sectors. Use of freshwater for aquaculture and agriculture, for example, is not necessarily mutually ex-

clusive, and integrated aquaculture-agriculture (IAA) systems have been shown to increase the productivity of agricultural activities on farms which have ponds. IAA ponds also contribute to the resilience of small farms, enabling them to maintain some degree of food production during droughts (Brummett 2006).

The data problems identified in the first section also contribute to poor recognition of the contributions of fisheries to development. Since data on artisanal, subsistence and inland production, fish-based livelihoods and consumption patterns in developing countries tend to be fairly sketchy, they often under-represent the contribution of fisheries to development. Thus the perceived contribution of fish to foreign exchange earnings and food security is often lower than their actual contribution, further reducing the chances that fisheries and aquaculture will be adequately addressed in development policy.

Development aspects of health and nutrition

Even when consumed in small quantities, fish often comprises a nutritionally important part of many people's diets in developing countries. It is a vital source of protein and micronutrients, and improves the quality of protein in largely vegetable and starch-based diets by providing essential amino acids. FAO (2006) has estimated that fish accounts for approximately 20 percent of animal protein consumption in LIFDCs. In some coastal and island countries (including Bangladesh, Indonesia, Senegal, and Sri Lanka), it provides

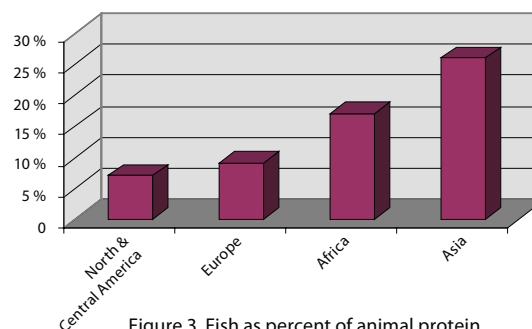


Figure 3. Fish as percent of animal protein. Source: Delgado *et al.* 2003.

over 50 percent of animal protein, and reaches 62 percent in Gambia and 63 percent in Sierra Leone and Ghana. It is a particularly important component of the diets of the poor, as it is often the most affordable form of animal protein.

Fish is also rich in iron, zinc, magnesium, phosphorous, calcium, vitamin A and vitamin C, and marine fish is a good source of iodine. Many of these vital nutrients are found only in small amounts, if at all, in staple foods such as maize, rice and cassava which make up the bulk of people's diets in developing countries. Fish are an indispensable source of these nutrients for many people, and small low-value fish, which are largely consumed by the rural poor, provide more minerals than the same quantity of meat or large fish, as they are consumed whole, with the bones intact. Fish also contain fatty acids which are essential for the development of the brain and body, and are particularly crucial for the diets of babies, children, and pregnant and lactating women (WorldFish Center 2005a).

Consumption of omega-3 fatty acids during

pregnancy reduces the risk of low birth weight, which is a key factor in both maternal and child mortality. These acids are also critical for the neurological development of infants, and are found almost exclusively in fish, making the consumption of fish during lactation and pregnancy especially important.

The nutritional benefits of fish consumption are also particularly important for people living with HIV/AIDS. Proper nutrition is essential for the effectiveness of anti-retroviral drugs, and fish has also been shown to contain combinations of nutrients which reduce susceptibility to secondary diseases.

Fish and the Millennium Development Goals

Fish, being a “rich food for poor people”, is well placed to make an important contribution to the Millennium Development Goals (MDGs). While the most obvious contribution is in terms of food security and livelihoods, it also has an important nutritional role in reducing child mortality, improving maternal health, and combating HIV/AIDS and other diseases. Fish also contribute indirectly to several of the other MDGs through improved nutritional status and enhanced livelihoods, and to gender equality through women’s fish-related livelihood activities (see box).

CONTRIBUTION OF FISH TO THE MILLENNIUM DEVELOPMENT GOALS

Goal 1: Eradicate extreme poverty and hunger

- Over 40 million people in the developing world are engaged in fishing and fish farming.
- Fish is an important and affordable source of protein, micronutrients and fatty acids for people in developing countries.

Goal 2: Achieve universal primary education

- Indirect contribution from improved child health and income for women.

Goal 3: Promote gender equality and empower women

- Women are heavily involved in fish-based livelihoods, especially in processing and trade.
- Fish is often shared more equally within the household than other protein-rich foods.

Goal 4: Reduce child mortality

- Fish provide fatty acids critical for brain development, as well as protein and minerals.
- Reduces risk of low birth weight, a key factor in child mortality.

Goal 5: Improve maternal health

- Reduces risk of low birth weight, a key factor in maternal mortality.
- Improved nutritional status of women.

Goal 6: Combat HIV/AIDS, malaria and other diseases

- Provides proteins and micronutrients essential for effective use of anti-retroviral drugs.
- Fishing communities are among the hardest hit by HIV/AIDS.
- Income from fish can enable the poor to access health services.

Goal 7: Ensure environmental sustainability

- Good fisheries governance can contribute to sustainable aquatic resource management.

Goal 8: Develop a global partnership for development

- Fish is one of the most traded agricultural commodities and a major export for many developing countries, offering an opportunity for trade agreements which contribute to the development of poor countries.

Small-scale fish farming requires less labour than many other livelihood activities, and can be carried out by female and child-headed households and people living with HIV/AIDS, providing them with fish to eat and sell without substantially adding to their labour burden. The income obtained from the fish which are sold can enable the poor to access health care services, including HIV/AIDS treatment (WorldFish Center 2005b).

Closing the supply gap

Though further increases in capture fisheries production are unlikely, demand for fish is projected to continue increasing due to population growth and urbanisation. This trend is likely to be particularly pronounced in sub-Saharan Africa where many capture fisheries have reached their limit, and aquaculture development is failing to keep pace with population growth. Per capita fish consumption in sub-Saharan Africa is lower than any other region, and it is the only part of the world where consumption is declining (WorldFish Center 2005a).

In order to meet growing global demand for fish, the further development of sustainable aquaculture and improvement in post-harvest processing deserve special attention (see also Subasinghe, this volume). Most capture fisheries are being fished at or above their maximum sustainable yields, and are not projected to produce any further productivity gains. Therefore much of the increasing demand for fish will have to be met by increasing aquaculture production and re-

ducing post-harvest losses.

Aquaculture is often easier to manage than capture fisheries, as aquaculture activities generally fall within national governance frameworks and do not face the same difficulties in resource management that transboundary fisheries do. Even fisheries which fall completely within national boundaries often face difficulties in managing levels of exploitation and controlling access, while property rights are much more clearly defined for aquaculture. Access to water is a key governance issue here, however, causing problems for landless wishing to farm fish in cages, for rice farmers wishing to abstract additional water for fish and for downstream users where large numbers of farmers wish to harvest rainwater for pond culture. Coastal aquaculture is often carried out in publicly-owned water bodies for which there are competing demands.

The challenges facing African aquaculture While much growth in fish production in recent years has been driven by the rapid expansion of aquaculture in Asia, it is developing more slowly in Africa. Asia and the Pacific accounted for 91.5 percent of world aquaculture production by quantity and 80.5 percent by value in 2004, while sub-Saharan Africa accounted for only 0.16 percent by quantity and 0.36 percent by value (FAO 2006). An expansion of aquaculture production in sub-Saharan Africa could allow the region to better meet its rapidly increasing demand for fish, though there are many impediments which would have to be overcome for it to realise its full potential.

The vast majority of African aquaculture takes place at a very small scale, with over 90 percent of African aquaculture production coming from farms with one or a few earthen ponds, constructed and managed using family labour. The ponds are generally under 500 m² in size, yielding 300–1,000 kg/ha annually (World Bank 2006). While the ponds represent an important source of food and income for the families that have them, they have not yet been adopted on a scale capable of closing the “fish supply gap” in sub-Saharan Africa. Nonetheless, there is growing evidence of strong commercial interest in aquaculture in several countries, including Nigeria and Ghana.

Among the challenges facing aquaculture in Africa are limited access to quality seed and feed, underdeveloped credit markets, conflict over use of land and water resources, lack of access to information (both market information and information needed for the adoption of new technologies), and underdeveloped or inaccessible output markets.

Adopting an ecosystem approach to aquaculture

Like any food production system, aquaculture can have negative environmental impacts. Particularly when undertaken at a commercial scale, aquaculture places demands on land and water resources, often uses feed (including intensive formulated feeds) produced outside the immediate area, introduces alien species, may increase sedimentation or produce anoxia of local bottom sediments, and can involve the use of chemicals for disease control.

Aquaculture interacts with capture fisheries in several important ways, due both to the inputs it requires and its potential effects on the surrounding environment. Harvesting of rainwater or abstraction of river water can affect environmental flows and aquatic habitats. Fishmeal and fish oil are key components of formulated feeds used for carnivorous and omnivorous species, placing further demands on marine capture fisheries. Cage culture in coastal areas competes for space with small-scale fisherfolk, often restricting their access to the fishery, and can affect the coastal zone or lake in which it is based through the escape of farmed fish, and through sedimentation and eutrophication from uneaten feed, fertiliser, and fish waste products.

It is worth pointing out that aquaculture can also provide environmental services. For example, integrated pond-based aquaculture increases access to water for irrigation during drought periods. Seaweed, oyster and mussel farming removes anthropogenically derived nutrients released into coastal waters.

While many countries now carry out environmental impact assessments and routine environmental monitoring on aquaculture developments, these often do not take into account cumulative effects in association with other sectors such as agriculture, industrial development, tourism or hydropower. An ecosystem approach to aquaculture (EAA) could provide a more holistic approach to managing the interactions of a wide range of human activities with the natural environment. Building upon the ecosystem approach to fisheries, FAO (2006) define EAA as follows:

An ecosystem approach to aquaculture (EAA) strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems including their interactions, flows and processes and applying an integrated approach to aquaculture within ecologically and operationally meaningful boundaries. The purpose of EAA should be to plan, develop and manage the sector in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by aquatic ecosystems.

This also allows for greater consideration of the social impacts of aquaculture, which are often overlooked when using a purely environmental approach. There is still a need, however, for any environmental planning approach to take into account the demands and impacts of all sectors, rather than taking an exclusively sectoral perspective, possibly through an integration of EAA with Integrated Watershed or Coastal Zone Management.

Social impacts of aquaculture development

The expansion of aquaculture production has profound implications for labour relations, rural poverty, and class formation. While fishing is often an employment of last resort for landless poor or an activity undertaken as one com-

ponent of diversified rural livelihood strategies, aquaculture requires access to capital for start-up and running costs, and thus has much higher barriers to entry than fishing in capture fisheries does. Even at a very small scale, as in the case of IAA, there is a need to buy simple tools such as shovels and buckets, as well as seed, feed, and fertiliser. Russell *et al.* (forthcoming) found that smallholder households adopting fish farming are often those who have start-up capital, raising concerns about equity. Aquaculture is also generally more profitable at higher levels of capital intensity, as larger commercial enterprises benefit from economies of scale, and compliance with often expensive environmental and documentation requirements allow greater access to lucrative export markets (Delgado *et al.* 2003). Furthermore, aquaculture is less labour intensive than, for example, rice production, and changing from rice cultivation to fish farming can affect rural labour markets and limit employment opportunities for the landless poor.

Despite the challenges, however, aquaculture holds significant potential for pro-poor rural development. Agricultural incomes of IAA households in Malawi, for example, are 60 percent higher than non-IAA households, and their income per hectare is 133 percent higher² (Dey, Kambewa, Prein, Jamu, Paraguas, Briones, and Pemsil 2007). Adoption of IAA by poor smallholders could therefore enable them to increase their income several times over. Aquaculture development at a larger scale could also gener-

2. While some of this is due to pre-existing inequalities (households successfully adopting fish farming tend to own more and better quality land and have greater access to family labour and resources such as water), the introduction of IAA was found to have increased the livelihood security and land productivity of adopting households.

ate increased employment opportunities for the landless poor³, if undertaken alongside continued or expanded agricultural activities rather than as a replacement for them. Most importantly, however, aquaculture can play a major role in terms of food security. As discussed above, fish comprises a nutritionally key part of the diets of the poor in many parts of the world, providing essential micronutrients and relatively affordable animal protein. As global population continues to grow with little prospect of further growth in capture fishery production, increased aquaculture production could help to keep fish affordable for the poor. In many parts of Asia, for example, there is significant aquaculture production of low-value freshwater fish, primarily for domestic consumption.

Improvements in the post-harvest sector

The post-harvest sector also provides an opportunity for both enhancing the livelihoods of the rural poor and meeting ever-increasing food needs. Post-harvest losses due to lack of adequate infrastructure, inadequate preservation technologies, and poor market access reduce revenues of fishers and traders and the overall food fish supply. In some countries in sub-Saharan Africa, an average of 30 percent of the catch is lost to bacterial and fungal infections or eaten by pests. Use of improved processing technologies such as screens against insects, improved 'chorkor' smoking kilns and mesh trays to elevate the fish off the ground can reduce these losses significantly, resulting in

greater food security for consumers and increased incomes for processors and traders.

The post-harvest sector is also important for the poor in terms of employment, with the ratio of fishers to people employed in the post-harvest sector generally estimated at approximately 1:3. Small-scale, labour-intensive processing of fish products can greatly increase the contribution of fish production to the local economy, particularly where processing and trading facilities are locally-owned and labour rights are strong. There is also a strong gender aspect to fish-based livelihood activities, with women heavily involved in post-harvest processing and marketing, making the post-harvest sector an important one for strengthening women's livelihoods.

Conclusion

Throughout the developing world, the fisheries sector provides the basis for the livelihoods and nutrition of millions of people, and constitutes a significant source of foreign exchange for many developing economies. Despite its considerable contributions to development, however, it is often not seen as a priority sector by policy makers or donor agencies, and activities such as aquaculture are frequently seen as relatively low-priority for the allocation of scarce resources such as water. This lack of attention to the sector is particularly problematic given that capture fisheries are currently being fished at capacity, and that further increases in production will have to come from

3. Particularly in Asia, as access to land is less of a constraint in much of sub-Saharan Africa.

expansion of aquaculture. There is, therefore, an important role for developing country governments to play, both in managing capture fisheries to prevent further stock depletion, and in regulating the development of aquaculture to ensure

that it is both environmentally sustainable and pro-poor. Under such conditions, fisheries and aquaculture can realise their potential as an important and growing source of economic development in rural areas.

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