

Changing Structure of Fish Supply, Demand and Trade in Developing Countries – Issues and Needs

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Abstract. There has been a structural shift in the global supply, demand and trade in fish and fisheries products since the early 1980s that has shattered the traditional dominance of the developed nations. Despite a declining trend in the global exports of primary products, the percentage contribution of fish has been increasing. Principal beneficiaries of the increase in fish exports are the developing countries in the tropics. This paper reviews the structural changes in the global fisheries trade, discusses the driving forces in the increase in supply of and demand for fish and fish products, and the economic and environmental implications to the fish exporting developing nations. The paper also raises issues relating to poverty and long-term food security of the poor people in the fish exporting countries.

Key Words: Fish trade, developed and developing countries, export growth, structural shift

1. INTRODUCTION

While the share of world export of non-fuel primary commodities has been declining every year, fish and meat exports increased at an average annual rate of more than eight percent during the last decade. The share of exports of the primary products in the world declined by more than 42 percent during the period 1980-1998 and the same declined by 63 percent from 50.8 percent in 1980 to 19.0 percent in 1998 in the developing countries (United Nations 2002). Despite the declining trend, the percentage contribution of fish in global export of primary products has been increasing and alone claimed 21.5 percent in 2000 that was recorded highest relative contribution (FAO 2002). Main drivers of this growth in fish export are higher income and urbanization in the developing countries, and changes in food preference in developed countries.

The growth in fisheries exports was made possible by rapid increase in fish production particularly from aquaculture. Simultaneously, the world has also experienced changes in the direction of movement of fisheries products in international trade. The developing countries, most importantly those in the tropics, have significantly increased their share of fish exports. For many developing countries, this has opened new opportunities to earn foreign exchange and especially improve their balance of payments with developed countries. On the other hand, the export of fish and seafood of the developed countries to the world have been declining steadily and

developed countries as a group have become net importers of fish since the mid-1980s. This paper reviews the structural changes in global fisheries trade, discusses driving forces of changes in international trade of fish and fish products and the economic implications to the developing countries. The paper also focuses on the issues relating to poverty and long-term food security of the poor people in the developing countries with the background of rapid growth in the exports of fish and fish products in these countries.

2. DATA AND METHODS

The paper draws evidences from the major fish exporting and importing countries of the world. Although the focus of the study is global, empirical evidences are concentrated on the developing countries of Asia and the developed north such as the USA, EU and Japan. The paper also provides some generalized analysis by comparing export and import performances and other attributes between developing, low-income food deficit (LIFDCs) and developed countries and between regions. The study uses both time series and cross section data for comparisons between time and space (countries and regions) with regard to supply and demand for fish, and export and import of the same.

3. STRUCTURAL CHANGES IN WORLD FISHERIES

3.1 Fish Trade and Demand

As indicated, the fisheries sector in the world has been experiencing a structural shift since the 1980s that has shattered the traditional dominance of the developed countries in production and exports. The export-import balance has been reversed in favor of the developing countries and the growth trend of both exports and imports of fish and fish products (Tables 1 and 2) is likely to continue in the coming years. The average annual growth rate of import is much higher than the average growth of exports in the developed countries between 1976 and 1999, while the opposite is true for the developing countries during the same period. Despite a better export performance of the developing countries, many fish producing countries of Asia also have higher growth rates in imports during the same period although the absolute value of exports is much higher than imports. The average annual growth rates of exports and imports in the developing countries were 31.59 and 26.83 percent, respectively. However, base import volume was much lower than the base export in these countries. The average growth rate of exports is much higher than that of imports in Africa and Latin America, contrary to the tropical Asia.

Table 2 presents regional contribution of fish exports and imports to the world total during the 1976-1999 periods. It is evident from the table that while the proportion of developed countries' import remained almost constant at 85 percent since 1976, the proportion of exports of fish and fish products declined significantly during this period. Developed countries' proportion of fish exports in value was 63 percent in the year 1976, 50 percent in the year 1995, and again increased marginally to 52 percent in the year 1999. However, on the

average, the trend is declining and it is expected that the developing countries have the potential to further increase their share of exports of fish and fish products during the next decade.

The most important contributors in the world export of fish are the tropical countries of Asia such as China, Thailand, Vietnam, Indonesia, and the Philippines in East and Southeast Asia; Bangladesh, India and Sri Lanka in South Asia. The value proportion of food fish exports from East and South East Asia was almost doubled between 1976 and 1999 from 10 percent to 18 percent. In China, the proportion in value increased by more than 15 percent during the same period. However, the proportion remained almost constant for South Asia, West and Central Asia, Africa and Latin America and the Caribbean countries (Table 2).

Although the proportion of imports of food fish remained constant over the said period both in developed and developing countries, there has been a significant realignment with regard to fish imports among the countries within each group. Most recently, the EU, USA, and Japan are identified as the major importers of food fish and these countries combined imported almost 77 percent of world total (FAO 2001). Fish imports have increased in many of the developing countries and in some other countries it declined. For example, like export, import of food fish increased significantly in most part of Asia such as China and East and South East Asia. In Africa and South Asia, the import of fish remained constant during the period, although South Asia imports a negligible amount. Oceania, Latin America and the Caribbean countries have experienced a severe decline in food fish imports during this period (Table 2).

The developing countries have also been experiencing a structural change in their export of agricultural products. Empirical evidence suggests that receipts from traditional export of tropical agricultural products such as coffee, sugar, tea, cocoa, etc. of the developing countries are increasingly being replaced by fish. Prices of these products have been declining while prices of fish and meat are increasing. Table 3 provides the most recent trend in the export of these products including fish and meat in percent of total value of agricultural exports. The table clearly shows that the combined proportion of beverage, coffee, sugar and cocoa declined from 17 percent in 1998 to 12 percent in 2000. Similarly, the proportion of cereals, oils and oilseeds also declined. Only the proportions of fish and meat increased from 19 and 15 percent in 1998 to 21.5 and 19 percent in 2000, respectively. Over the 1976 -1999 period, the net export in the developing countries grew annually at an average rate of 35 percent and in the year 1999 the net value of export of fish and fish products was more than US\$ 16 billion (FAO 2001).

Table 1. Average annual growth of fish export and import by region (1976-1999)

Region	Average annual growth rates	
	Export	Import
World	23.56	23.32
Africa	26.93	6.69
Asia	25.21	33.06
China	27.70	34.09
East and Southeast Asia	45.27	65.77
West and Central Asia	22.48	31.16
South Asia	21.45	86.45
Oceania	40.76	13.84
Latin America and Caribbean	23.95	17.24
LIFDCs	28.18	30.01
Developed	18.86	22.78
Developing	31.59	26.83

Source: Compiled based on raw data from FAO database (2001).

Table 2 Regional contribution of fish exports and import in the world (in percent)

Region	1976		1980		1985		1990		1995		1999	
	Export	Import										
Africa	4.36	4.00	3.46	5.30	4.76	3.29	4.15	2.22	5.10	1.68	4.89	1.58
China	8.03	4.15	7.57	5.20	7.89	7.54	9.12	4.42	9.51	6.10	9.23	5.77
East and Southeast Asia	9.91	2.04	10.89	2.00	13.41	3.03	16.96	4.59	19.20	5.25	17.67	5.20
West and Central Asia	0.50	0.55	0.61	1.23	0.74	0.90	0.59	0.42	0.50	0.58	0.48	0.70
South Asia	3.20	0.04	2.47	0.15	2.91	0.15	2.23	0.12	3.10	0.13	2.96	0.14
Oceania	2.06	1.54	3.38	1.66	3.68	1.63	2.95	1.16	3.46	0.99	3.33	1.01
Latin America and the Caribbean	20.54	25.66	23.39	20.25	25.05	24.11	23.66	16.75	22.20	16.15	20.84	19.99
LIFDCs	12.20	11.06	12.21	11.67	14.02	10.03	15.43	10.71	15.34	13.53	14.24	13.76
Developed	63.10	86.59	60.39	83.16	56.73	83.51	56.62	86.94	49.63	84.44	52.40	84.88
Developing	36.90	13.41	39.61	16.84	43.27	16.49	43.38	13.06	50.37	15.56	47.60	15.12

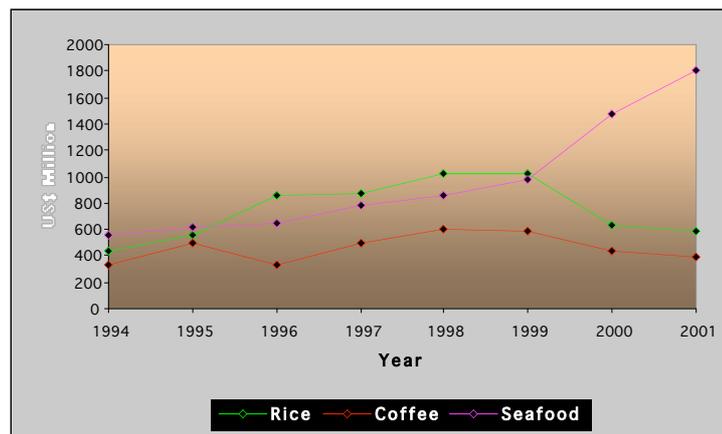
Source: Compiled based on raw data from FAO database (2001)

Table 3: Contribution of fish in world export of agricultural commodities (in percent)

Products	Percentage contribution of fish in world agricultural exports			Growth Trend
	1998	1999	2000	
Beverage, cocoa, coffee, tea and sugar	16.76	12.63	12.30	-
Cereals	14.89	14.03	13.94	-
Meat	15.30	18.52	19.03	+
Milk/milk products	9.97	9.59	9.81	+
Oils/oil seeds and meals	20.49	20.19	18.26	-
Other products	3.47	4.44	5.18	+
Fish	19.11	20.58	21.49	+

Sources: Fish export data were taken from FAO (2000) and the export data on other food items are taken from FAO (2001).

Figure 1: Values of exports of rice, coffee and fish in Vietnam (1994 -2001)



Source: Ministry of Trade, Vietnam (1994 – 2001)

In 2001, the prices of tropical beverages further fell by more than 20 percent with the highest decline in tea and coffee, and prices of oils and rice also continued to decline (United Nations 2002). Mostly, the developing countries in the tropics that export traditional agricultural commodities are affected by the structural changes in the international trade of primary commodities. These changes have enormous impact on the least developed

countries such as Bangladesh and Vietnam. Traditionally, Bangladesh earned most of its foreign exchange through exports of jute, tea and leather, and jute was ranked number one. Now, garment products and fish (mainly shrimps) replace these traditional export items. Fish now ranks the third highest in foreign exchange earnings. Similarly in Vietnam, foreign exchange earnings from rice and coffee have been declining while earnings from fish exports have been increasing every year. In 2000 and 2001, the value of fish exports was much higher than the value of rice and coffee exports combined in Vietnam (Fig. 1).

It is evident from the above analysis that tropical regions such as South Asia, Southeast Asia and China have achieved rapid development in fish production and exports, although some countries in these regions have experienced high growth in fish imports. Bangladesh, India and Sri Lanka, Thailand, Indonesia, Malaysia, Vietnam, Cambodia, the Philippines and China in the Asian region have by now established themselves as major fish producing and exporting countries in the world. Among these countries, Thailand and China are among the top ten fish exporting countries of the world (Dey et al. 2002). Only the developing countries of Asia and Africa were able to make surplus for exports. The net export of the countries of Southeast Asia and South Asia was more than US\$ 7 billion in the year 1999 (compiled from FAO database 2001). On the other hand, Latin America and Caribbean countries' export-import balance was almost negative in the same year.

Overall, net foreign exchange earnings from fisheries exports of the developing countries increased from US\$ 16 billion to US\$ 17 billion in the 1990s (FAO 2000). Fishing is also a major source of foreign exchange for the small island developing countries in the Pacific. The small Pacific island countries' access fees of tuna fishing from distant water vessels stood at 40-60 percent of their total foreign exchange earnings in 1999.

Low-income food deficit countries (LIFDCs) are seen as the major beneficiaries of growing fish trade. Fish is paying the foreign exchange cost of increasing food imports (Table 4). Simultaneously with the increase in food imports of the LIFDCs since mid 1970s, fish exports of these countries also have been increasing steadily (FAO 2002), and by the year 2000 almost 41 percent of the value of food imports were paid out of fish exports (Table 4). A similar trend was also observed in selected countries such as China, Indonesia, the Philippines, Cambodia, India, Bangladesh, Sri Lanka and Maldives in Asia (Table 4). Since 1970, the fisheries sector has increasingly been paying the imports of food of these countries, although it appears from the table that there are fluctuations in the proportion contributed by fish. These fluctuations in the proportions are the result of instability in food production or imports of these countries.

The contributions of the fisheries sector have been increasing steadily every year. For instance, China financed 1.77 percent of its food imports by fish exports in 1965 and the same increased to 62 percent in the year 2000. Similarly, countries such as Indonesia, the Philippines, Cambodia, Sri Lanka, and Maldives had zero contribution of fisheries sector in the year 1965, and in the year 2000 the contribution of fisheries sector to food imports became 63 percent, 22 percent, 8 percent, 12 percent, and 85 percent, respectively. Bangladesh and India were also able to finance food imports up to 31 and 54 percent, respectively by exporting fish and fish products in the year 2000 with a very low start in 1965. Thus, export of fish and fisheries products have been playing an enormous role in securing steady supply of food items in low-income food deficit countries. Table 5 provides per capita consumption of fish and fish products by region and country groups. The table shows that the annual per capita fish consumption in the world reached 15.9 kg in the year 2000 from 11.1 kg in the year 1970 and the same was doubled from the level of early 1950s (FAO 2002). The per capita consumption of fish in the developing countries was also more than doubled (13.8 kg) during 1971-2000, while it only increased by 1 kg in the developed countries during the same time period from 22.4 kg to 23.5 kg. Among the developing countries, the per capita consumption growth in China in 2000 is notable, which was almost six times the level of 1970. The per capita annual fish consumption is high

Table 4: Net fish export as percentage of food imports in selected tropical countries and LIFDCs (percent).

Year	1965	1970	1975	1980	1985	1990	1995	1999	2000
China	1.77	26.91	27.46	22.54	52.41	33.88	26.55	73.29	62.11
Indonesia	0.00	2.18	14.59	16.49	40.34	118.24	50.93	45.54	62.75
Philippines	0.00	2.56	6.01	32.96	34.68	39.88	28.04	20.40	21.86
Cambodia	0.00	0.00	0.00	0.00	0.11	1.69	16.07	7.80	7.80
India	1.88	8.72	8.02	19.81	20.63	61.69	74.02	36.33	54.27
Bangladesh	4.91	0.00	0.99	8.30	11.93	26.65	35.34	17.66	31.19
Sri Lanka	0.12	0.51	0.85	3.88	5.62	5.17	10.11	11.63	11.63
Maldives	0.00	0.00	32.28	72.26	237.67	177.00	83.83	84.83	84.83
LIFDCs	2.15	14.83	13.37	16.66	23.51	29.96	30.62	39.81	41.21

Source: FAO online database, Fishstat

Table 5 Trends in per capita consumption of food fish (in kg) between 1970 and 2000

Region/ year	1970	1975	1980	1985	1990	1995	2000
China	4.5	5.6	5.2	7.3	11.5	20.8	25
India	2.8	3.2	3.1	3.3	3.8	4.3	4.5
Other South Asia	6.2	5.1	5.1	5.3	5.3	5.9	7.1
Southeast Asia	16.4	16.4	16.5	18.2	19.4	22.5	23.2
Latin America	6.8	7.4	9.6	8.9	9.9	9.2	8.3
WANA	3.5	3.2	5.6	5.7	4.9	6.8	6.4
SSA	8	8.6	9.4	8.3	9.3	7.1	7.6
United States	14.7	14.2	15.8	19.7	21.1	21.7	21.4
Japan	63.4	70	64.8	69.7	71.2	71.3	64.8
Developing world	6.3	7.1	7.5	8.3	9.9	12.7	13.8
Developed world	22.4	24	23.4	26.1	26.1	23.5	23.5
World	11.1	11.8	11.7	12.8	13.8	15.2	15.9

Source: FAO (2002).

in the Southeast Asian countries. In 1970, the per capita consumption growth was recorded highest (16.4 kg) among the developing countries and reached 23.2 kg in 2000. Other Asian countries have moderate growth in per capita fish consumption while Japan remained almost constant with its highest level of fish consumption in the world, which was 64.8 kg in 2000. The West Asian and North African (WANA) regions and the USA also have impressive growth in fish consumption, although the per capita consumption level of fish is low in WANA region. During the 1970-2000 period, the per capita consumption in Latin America increased by only 1 kg and it remained constant in Sub-Saharan Africa (SSA).

The growth in exports of fish also follows a tremendous growth in the per capita consumption of fish and fisheries products in the world as a whole.

It is evident from the above analysis that per capita consumption of fish and seafood increased significantly in the developing countries, particularly in Southeast Asia. The main drivers of the growth in fish consumption are income growth and urbanization in the developing countries, and changes in food preferences in the developed countries. Although the relative income of the poor people of the developing countries has barely changed, perhaps even declined in many instances, the absolute income of these people has increased as new job opportunities are created partly by the outward-looking strategy of development inspired by globalization and partly due to the relentless efforts of the government and non-government organizations to change the livelihoods of the poor people. The income elasticity of fish and other essential food items within the lower income groups are high enough to have impact on the demand for fish consumption (Dey 2000; Ahmed and Lorica 2002).

The developing countries also have been experiencing forced urbanization due to an explosive rate of rural-urban migration. The overburdened rural sector in the developing countries are not able to provide food and shelter to many of its inhabitants, therefore, the rural landless and pauperized people are taking shelter in the urban slumps in the hope of being employed in the urban sector. The educated young people are also coming to hunt for limited jobs that are mostly offered in the cities due to the concentration of the manufacturing activities in the urban areas. Overpopulation is the general feature of the cities of the developing countries. These access populations who have left rural areas somehow manage their livelihoods in the urban areas that create an additional demand for fish and other food items, as they have to rely on markets for food items.

Thus, the producers and manufacturers of fish and fish products are able to sell fish and fish products in larger quantities at higher prices due to the higher consumer demand both in the domestic and international markets. However, higher prices and demand for food fish in the world market have several consequences. The domestic consumption of food fish may decline in many ways. Firstly, higher price elasticity of fish may result in lesser domestic consumption. Secondly, fishers and fish farmers may prefer to produce high value fish rather than low value fish in order to have better price in the export market. This will reduce the supply of low value fish for domestic consumption of the poor people who cannot afford a higher price. It may also affect the producers' own consumption as they will sell all of their production for cash income which they need the most. Another indirect consequence of an increase in food fish is the substitution effect on meat and meat products, which may also increase meat price.

3.2 Fish Supply and Role of Technology

The phenomenal growth in demand and trade were supported by a steady growth in fisheries production where new and increasing role of technology is clearly visible. During 1970-1999, the world total production of fish and aquatic animals was more than doubled from 67 million tons in 1970 to 137 million tons in 1999 while remaining almost stagnant (declined by five percent) during the same period for the developed countries. The most dramatic increase in fish production occurred in the low-income food deficit countries (LIFDCs) by almost 500 percent, and particularly in China by 980 percent during the same period (FAO 2002).

A large proportion of the world fish production came from developing Asia such as South Asia, East and Southeast Asia, and China. While the percentage contribution to world fish production declined significantly for the developed countries (from 51 percent in 1970 to 24 percent in 1999), the Asian contribution jumped from 35 percent in 1970 to 62 percent in 1999 and China alone contributed 36 percent, which is a tremendous jump from only seven percent in 1970. The contribution of the developing countries and the LIFDCs reached 76 percent and 51 percent, respectively in 1999 (Figure 2).

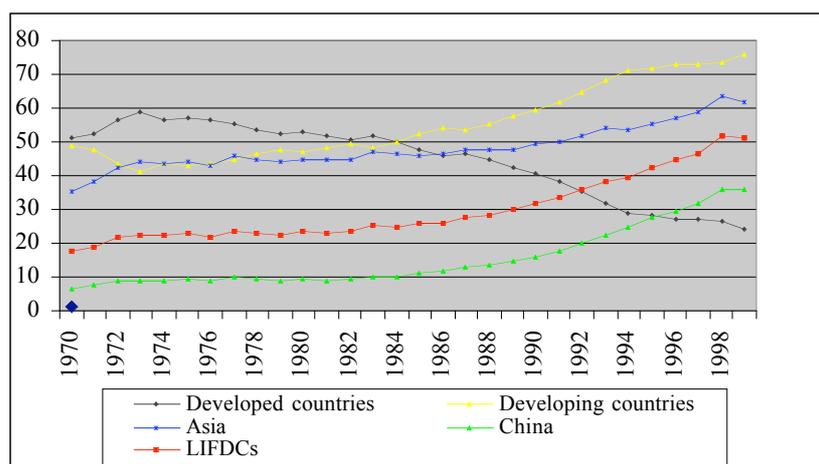


Figure 2 Contribution to the world fish production by country groups (1970-2000)

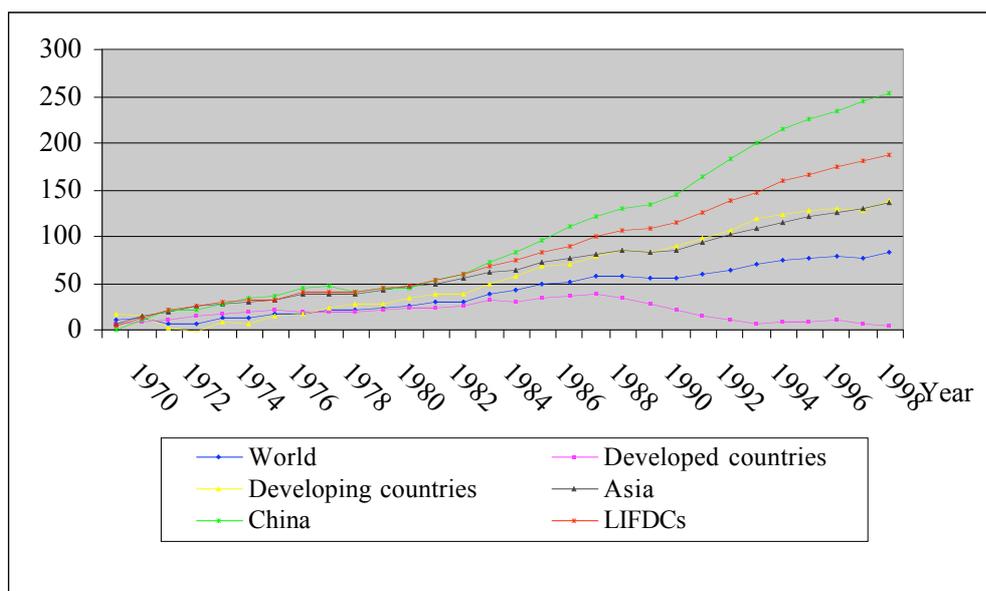


Figure 3 Cumulative growth rate of fish production by country groups (in percent)

Among the other Asian countries, Thailand, India, Indonesia, Malaysia, Bangladesh, and Vietnam are the top fish producing countries.

Figure 3 presents the cumulative growth rate of fish production by country categories and the world. It shows that until 1984, the growth rates of fish production in the world and in the country categories remained almost stagnant with nominal increase. The explosive growth in fish production started during mid 1980s in the developing countries, LIFDCs and in China. The increases are even higher during late 1990s. The developed countries reached its peak in the late 1980s and started to decline.

Along with this impressive growth in total fish production, the world also has experienced two opposite trends in global and regional production of fish and seafood. There has been a change in the composition of fish production by culture and capture fisheries. Capture fishery dominated the world fish production. Recent trend shows that it has lost its potential to increase production in the near future until there is some improvement in fisheries management and further breakthrough in aquaculture technology. Capture fishery's contribution was about 68 percent in the world production in 1999, compared to 86 percent in 1988 (FAO 2001).

Aquaculture production from both inland and marine waters continued to grow from around 18 million tons in 1994 to 32.9 million tons in 1999. Most of the aquaculture production over the years came from Asian regions of which China is the dominant country. The growth rate of aquaculture production is much higher than that of capture fishery in Asia, although the contribution of capture fishery production to the total fish production is still higher (62 percent) in the region. In China, the aquaculture production surpassed the capture fishery production in the year 1992.

Research and technological development played an important role in the development of the fisheries sector in the world and especially in the tropics where aquaculture production has been progressively increasing. Capture fishery production was enhanced in the 1970s and 1980s largely through development in fishing technology such as nylon fishing nets, electronic fish finding equipment, large power vessels, and storage facilities, etc. In spite of these development in fishing technology, capture fishery has become stagnant largely due to stock depletion for which overfishing and environmental degradation are the main reasons.

The development and extension of aquaculture technology for both inland and marine waters in various intensity and practices at the farmer level have made enormous impacts on the fisheries sector of the developing nations. The practices vary in terms of species type and combination, stocking density, and intensity in use of feed and non-feed inputs. The aquaculture technology has been further extended to apply it to wider water areas, such as rice fields, reservoirs and irrigation waters, and they hold significant potential for production increase in the future. The average annual growth rate of aquaculture production in the world was 10.7 percent in the year 2000 (FAO 2002). Most of the aquaculture expansion occurred in tropical Asia. Among the Asian countries, China, India, Thailand, and Vietnam are the leading countries in terms of growth in aquaculture

production. Bangladesh, Indonesia, and the Philippines are also important in terms of growth in aquaculture production.

Provision of diversified fish feed sources, supply of improved genetic strains and materials, utilization of indigenous and non-traditional water areas such as rice fields, reservoirs and irrigation waters, and use of polyculture to optimize primary production played dominant role in the increase in production from culture based fishery. The wider application and extension of aquaculture technology have developed links to industries such as fishmeal processing, fish breeding and hatchery techniques for producing quality fingerlings and fry. Simultaneously with these strategic developments in aquaculture management, the recent success in fish genetic research has increased the expectation that culture-based fishery may expand progressively in the coming years and will be able to produce better quality fish in higher quantity.

Systematic selective breeding has led to a tremendous gain in productivity over the last decades in terrestrial animals and finfish. The productivity of cattle and chicken increased by 200 percent, pig by more than 100 percent over the period 1940-1990. On the other hand, genetic research on finfish that started only in the 1970s has achieved significant increase in productivity for two important species, salmon and tilapia. Scientists from the WorldFish Center successfully improved productivity of genetically improved farm tilapia (GIFT) by 85 percent through accumulated selection over five generations. The same method enabled salmon productivity to increase by more than 60 percent and reduced the average cost of production significantly.

In addition to these breakthroughs in research and development, the emerging developments in biotechnology have shown the potential of further increase in aquaculture and culture-based fish production by genetically modifying finfish and shellfish species through methods such as gene transfer, cross hybridization and manipulating chromosome. However, application and advancement of these methods are under ethical and environmental scrutiny. Nonetheless, scientists have already identified several genes such as growth hormone, antifreeze protein and lysozyme that can increase growth efficiency, freeze resistance and disease resistance, respectively. Several countries, both developed and developing, have already tested some of these traits for use in aquaculture and have been successful in modifying at least 10 species for enhanced growth although none of these are approved for commercialization (FAO 2000).

Another significant change in the composition of tradable fish has occurred during the last decade. Historically, freshwater fish species are generally considered low value fish and not tradable internationally. Over the last decade, tilapia being a freshwater species, has been getting wider acceptability among the consumers of the major fish importing countries such as USA, Japan and the EU. USA is the leading importer of tilapia in different forms such as live, fillet and frozen. Main exporting countries of tilapia are China, Costa Rica and Ecuador (Dey and Paraguas 2001).

4. ISSUES IN FISHERIES TRADE

The expansion of fish production and fish trade in the world market raises many issues with regard to its consequences. Like many other agricultural commodities, trade in fish products in the international market is subject to price volatility. Due to the perishable nature of fish and seafood there is limited scope to create a buffer stock to have steady supply in the international market and it also requires appropriate technology to maintain quality of these perishable products. Bangladesh received 10 per cent less for its shrimps than its competitors because of perceptions that its shrimps are not clean. In 2002, this amounted to nearly 30 million dollars in lost revenue (Rahman 2002). As the world moves ahead in setting new parameters that include hygiene and food safety, human rights issue, fair labor practices and environmental practices, exporting countries have to capture the export market more vigorously by pursuing better quality management. There are also growing concerns about environmental costs incurred due to over exploitation of aquatic resources through irresponsible and destructive fishing that degrade fish habitats, coastal ecosystem and mangroves. Exporting countries have no mechanism and means to appropriate resource rent or regulate fisheries exploitation.

Intensive aquaculture has downstream externalities that negatively affect biodiversity and productivity as it destroys primary nursery and spawning grounds in the coastal environment. The demand for selective high value fish in the international market such as shark-fin, prawn and lobster, and live fish has in many instances mined down the resource stock to a fewer species as the producers and fishers continue to seek high value species that results in the destruction of the ecosystem and elimination of low value non-tradable fish.

Growth in fish trade has also a number of social and economic implications. The distribution of benefits may be realigned in favor of the rich farmers and traders at the cost of the livelihoods of the small farmers and fishers. Although the elimination of tariff barriers inspired by the WTO agreement have raised hopes among the developing countries' fishing communities of fair trade in the international markets, emerging non-tariff barriers may be so stringent and expensive that the small farmers and fishers may no longer find a profitable niche in the supply chain as they lack financial resources and technical knowledge to keep up with the new regulatory requirements by the major importing countries.

Two important questions that need to be answered are: (1) how sustainable is the growth in fish trade?, and (2) what does this mean to the poor who have traditionally been depending on fish for food and livelihoods?.

4.1 Is Growth in Fish Trade Sustainable?

In spite of the encouraging developments in fish production and trade in the world, there are many reasons to be skeptical about its long-term sustainability. Despite the steady growth in fish exports from the developing tropics, the global net supply from capture fishery has been almost stagnant over the last few years although in many of the developing countries it has been increasing due to the transfer of user rights in the exclusive economic zones (EEZ) from developed countries to the developing countries and also may be due to the combination of increased efforts and the optimum use of available technologies to enhance catch. Desire for increased exports may perpetuate the declining trend in natural stocks in coastal and inland waters as it will intensify over fishing, degradation of marine and coastal environments, and destruction of ecosystems and fish habitats such as coral reefs, mangroves and wetlands.

These negative impacts are the potential threat to the future growth of fish supply and trade. The production from capture fishery is likely to decline even if the concerned countries adopt strategic conservation policies that may include abstention from catch of certain species or from specific areas/zones to effectively manage and protect coastal resources. Expansion of international trade in fish has imposed threats on biodiversity and sustainability of aquatic resource stocks. Due to higher prices for certain fish species and sea foods, producers and fishers may concentrate on a few selective species that have high growth potential and high value in the international market. This may lead to the depletion of many species that are considered slow growing and low in value as in case of the long-lived orange roughy in New Zealand. This may also increase the environmental costs of by-catch and the pressure on endangered species such as seabirds, turtles, dolphins, etc. Thus, consumers in the importing countries and rich people within the exporting countries are benefiting at the expense of the developing countries' un-priced resource stocks that are affected due to environmental degradation and by-catch.

Aquaculture has been the main driver of growth in fish exports over the last few years raising hopes that it may ease the pressure on marine and inland water stocks. However, intensive aquaculture has so many negative effects on the environment that have raised concerns about its sustainability and overshadowed its massive potential to steadily increase developing countries' exports. Coastal aquaculture has enormous downstream externalities that have adverse effects on the marine ecosystems and capture fisheries habitat through pollution and mangrove conversion. Biodiversity and productivity of capture fisheries are affected, and natural spawning and breeding grounds are being destroyed. Due to the introduction of monoculture technologies in the coastal ponds, biodiversity in coastal wetlands are threatened. Indirectly, these costs are borne by the traditional fishermen who rely on these resources for their livelihoods.

4.2 Will the Poor Benefit from International Trade in Fish?

It is evident from the preceding discussion that the developing countries have the advantage in fish trade and their share in international trade in fish and fisheries products has been increasing. These developments, however, have both positive and negative impacts on the developing countries and on the livelihoods of the poor people. Apparently it shows that fish producers, processors, and traders in many developing countries have been benefiting from international trade. Many observers related to policy making in the fisheries sector cautiously raise the question, who are these beneficiaries? Many analysts have already expressed their views based on their research findings that in some instances, trade in fisheries may lead to increasing food insecurity for certain groups of people whose livelihoods largely depend on fisheries related activities (Ahmed and Lorica 2002; Kent 2003).

Kent (2003) in his most recent paper notes that the diversion of a significant amount of fisheries products from the local communities and the developing regions may have harmful effect on the poor people, children, and the fishing families. This deprives them from their traditional right to have cheaper source of nutritious food, especially when the diversion occurs without increasing the supply of fish within the local communities (FAO 2000). There are a few micro level studies that indicate a gloomy picture of the fishing communities in the developing countries. For example, more than half of the children of fishing families are stunted in Indonesia (Gross et al. 1993), and there exists a high level of infant mortality in Indian fishing villages (Kumary 1991). Both these countries are among the leading exporters of fish and fish products in Asia.

Evidence above suggests that a major realignment among the beneficiaries of the fisheries sector has begun in the developing countries and likely to be perpetuated in the future by the emerging structural changes in the production and processing of fish products. If the structural changes take an industrial form, then the traditional stakeholders may lose their dominance in production and processing and a new group of people is expected to take the lead in this endeavor. Perhaps this structural change will not reduce labor requirements in the sector as a whole but the traditional fishers and producers may lose their age-old ways of livelihoods. Even at the current level of development of the industry, one can observe that non-traditional producers who have capital and socio-political power dominate most of the aquaculture production system.

Non-traditional barriers to trade such as Sanitary and Phyto-Sanitary (SPS) and Hazard Analysis Critical Control Points (HACCP) may stimulate the structural changes by way of reducing competitiveness of the developing countries, as they will add costs in implementing the conditions. To remain competitive, producers and traders may sponsor a structural change in the fish-processing sector so that it becomes easier for them to make the existing long supply chain in the developing countries into an operational and efficient one. This may lead to mass processing of fish and fish products by using automatic machines replacing human labor including women who are currently earning their livelihoods from these activities. This process of transformation in the industry is likely to adversely affect small producers and processing units and there are reasons to believe that these poor people will be pushed out of the export supply chain, as they are unable to maintain product quality set by the WTO agreements and by the major importing nations.

Although the future growth of trade is largely dependent on aquaculture expansion and intensification, there are concerns that the excessive production of fish for foreign markets can lead to food insecurity in poor exporting nations (Kent 2003). Assuming that appropriate technology will be available within a short period of time to reduce the downstream negative externalities of aquaculture, its sustainability is still dependent on alternative fish feed and animal feed availability. High-value cultured products such as shrimps, salmon and animal fattening requires low-value fish and wild catches that would have been otherwise consumed by the poor people (Kent 1995). In 1999, 28.5 percent (26.5 million tons) of the total fish and shellfish catch was used for animal feed production (FAO 2002). However, this statistics excludes other fish scraps and processing wastes.

Thus, the growth of fish trade may increase food insecurity among the poor fish exporting countries directly by draining out high-value fish and indirectly by converting a large proportion of low-value fish into high value fish and animal meat to the developed nations. Fish that were commonly available for everybody in the country is now either exported or only affordable to the elites. For example, in Bangladesh shrimp, *hilsha* and other indigenous species were common fish food for all in the country but, now these are exported and few people can afford these within the country. Similarly in Senegal, species that were common and eaten by all are now either exported or available for few elites (Kent 2003, French 1993).

The poor subsistence fishers' diet usually includes low value food fish, which are rich in food value. This growth in fish trade might have significant impact on food security of the landless and subsistence farmers in the developing countries. The low value fish that were abundant locally was the only means of animal protein for these people. This is a way of deprivation from their age-old means of food security. Even in some instances these poor fishers are able to produce high-value fish, they are likely to sell all of it attracted by higher price to buy staples and other necessities. Therefore, expansion of high-value aquaculture needs serious policy considerations due to its likely affects on subsistence fishers, as the supply of low-value food fish will decline.

5. CONCLUSION AND POLICY RECOMMENDATIONS

As evident from the above discussion, over the last quarter century the world fishery has experienced tremendous growth on the one hand, and on the other hand it has generated a lot of externalities for the environment and fish habitats. The future of the fishery sector is largely dependent upon aquaculture

intensification, of which Asian countries will take the lead. China and India are the dominant countries endowed with vast potential to develop aquaculture. Capture fisheries have lost its growth potential and remained stagnant for past few years. Fish production in the developed countries has been declining and increasingly reliant on imports from the developing countries. Therefore, fisheries policy should address the improvement of fisheries management by developing and enforcing technological options towards reduction of by-catch and post-harvest losses and improvement of post harvest technologies such as storage, transport, processing, and inspection so that the value of landings can be increased substantially. Technological development may help to minimize adverse effects on the environment and fisheries habitats both in marine and inland waters, and advancement of fish genetic research to enhance growth. Technology development should be geared to replace the existing load on pelagic stocks that are used for fish meal and extracting oil of grain and by-products.

Policies at the regional and international levels should be geared toward cooperation for increased surveillance and monitoring of habitat destruction, damages to over-fishing and other human actions. Many of the problems in aquaculture can be removed by introducing effective management strategies such as water management, disease control, and land use. Research should be directed to the development of sustainable aquaculture sensitive to the environment and poverty reduction.

Policy changes in international trade are needed to improve domestic consumption of fish and overall food security of the poor people in the developing countries. Incentives and support services are needed to allow subsistence farmers and fisher communities to participate in fishing and aquaculture. Policy actions are needed to divert the benefits of rapid aquaculture development from the commercial fishers to the subsistence fishers and farmers. Ways to balance the terms of trade between human and nonhuman (fish and animal) consumption of fish must be found as the intensification and expansion of aquaculture are expected to increase many folds in the near future.

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