

## 4. Contribution to food security and access to food

### INTRODUCTION

Food insecurity remains one of the most visible dimensions of poverty and is generally the first sign of extreme destitution. “Food security”, defined by FAO as “a condition when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”, concerns not only food production and distribution but also has social, economic and institutional dimensions.

This chapter aims to elucidate and highlight the importance of fish and other seafoods in global food security using the information derived from regional aquaculture development trends reviews and FAO statistical data. While it would have been ideal to focus on the role of aquaculture in food security for the purpose of this synthesis, this was not possible since fish once traded are no longer disaggregated as to the source of production – aquaculture or capture fisheries – in the FAO statistical data. Therefore, in this chapter, fish<sup>1</sup> includes production both from capture fisheries and aquaculture and no attempt has been made to analyse the extent that only aquaculture production plays except where data and information were readily available. Considering the role that aquaculture currently plays in providing fish (aquatic food) to the world and the envisaged increasing role it will play over the coming decades, it is considered it appropriate to collectively discuss fish from capture and culture

### CONTRIBUTION TO NATIONAL FOOD SELF-SUFFICIENCY

Fish contributes to national food self-sufficiency through direct consumption and through trade and exports. In traditional fish eating countries in Asia and Oceania, annual per capita consumption is mostly above 25 kg. In some island countries in the Pacific the per capita consumption is above 50 kg per year or even as high as 190 kg as is the case in Maldives (see Table 1). In some countries in sub-Saharan Africa the balance in the export and import of fish more than adequately paid for the countries’ import bill for rice and wheat in 2003 (Table 2). In this instance much of the fish originates from capture fisheries.

The extreme importance of fish to food security and nutrition may be illustrated by assessments on the situation in Africa. FAO estimates that fish provides 22 percent of the protein intake in sub-Saharan Africa. This share, however, can exceed 50 percent in the poorest countries (especially where other sources of animal protein are scarce or expensive). In West African coastal countries, for instance, where fish has been a central element in local economies for many centuries, the proportion of dietary protein that comes from fish is extremely high: 47 percent in Senegal, 62 percent, in Gambia, and 63 percent in Sierra Leone and Ghana (Table 3).

Contribution of fish to the daily dietary energy supply is also important. Where there is a lack of alternative locally produced protein and/or where a preference for fish has been developed and maintained, fish can contribute a substantial share of the dietary energy. In low-income countries, staples such as rice, wheat, maize and cassava make up the bulk of the food consumed by the people, and they supply the majority

<sup>1</sup> Fish includes finfish and shellfish

TABLE 1  
Fish consumption in kilograms per capita, selected countries Asia and Oceania (original figures in grams per day from FAOSTAT 2006)

	1969-1971	1979-1981	1990-1992	1995-1997	2000-2002
<b>Oceania</b>					
Australia	15.0	15.7	19.3	20.8	22.3
Fiji Islands	23.4	36.9	33.6	25.5	33.2
French Polynesia	41.6	43.1	45.6	52.6	54.0
Kiribati	59.5	70.4	77.4	78.1	76.6
New Caledonia	4.75	23.4	25.9	25.2	28.8
New Zealand	16.4	15.7	20.4	23.4	26.3
Samoa	40.1	54.7	55.1	61.3	92.7
Solomon Islands	56.9	56.9	44.9	43.4	39.8
<b>East Asia</b>					
China	4.7	5.1	12.0	22.3	25.5
Japan	62.4	64.6	69.0	69.7	66.8
Korea, Dem. People's Rep. of	26.3	35.4	37.6	11.7	8.0
Korea, Republic of	20.4	42.0	46.0	49.6	54.4
<b>South Asia</b>					
Bangladesh	10.6	7.7	7.7	9.1	11.7
India	2.9	2.9	4.0	4.4	4.7
Maldives	90.9	87.9	110.9	152.9	190.5
Nepal	-	0.3	0.7	1.1	1.5
Pakistan	1.5	1.8	2.2	2.2	2.2
Sri Lanka	15.0	15.0	16.8	19.7	23.0
<b>Southeast Asia</b>					
Brunei Darussalam	29.6	47.1	29.9	44.2	29.2
Cambodia	8.8	5.1	10.2	8.0	25.9
Indonesia	9.9	11.7	15.3	18.2	20.8
Lao	7.3	7.3	6.9	9.1	15.3
Malaysia	25.9	42.0	50.0	57.7	58.4
Myanmar	13.9	14.6	15.3	13.9	19.0
Philippines	32.8	32.1	36.5	31.0	29.6
Thailand	23.7	19.0	24.1	32.8	31.0
Viet Nam	16.4	10.9	12.4	17.5	18.2

TABLE 2  
Balance in the trade of fish and staple cereals, selected countries in sub-Saharan Africa, 2003, in thousand US dollars (FISHSTAT Plus 2006, FAOSTAT 2006).

	Net receipts from fish trade	Rice import	Wheat import	Balance
Madagascar	69 664	48 693	13 534	7 437
Mauritania	97 381	13 739	40 873	42 769
Namibia	323 689	2 201	7 282	314 206
Saint Helena	5 309	9	57	5 243
Senegal	282 186	217 386	59 061	5 739
Seychelles	143 400	4 359	1 641	137 400
Tanzania, United Rep. of	133 732	34 064	77 074	22 594

TABLE 3  
African countries with per capita supply greater than 20 kg and/or a fish protein/animal protein ratio greater than 20 percent

Country	Per capita fish supply (kg)	Fish protein/ animal protein (percent)
Angola	6.6	27.1
Benin	9.4	28.5
Burundi	3.2	29.6
Cape Verde	25.3	30.6
Comoros	20.2	61.8
Congo D.R.	5.7	31.0
Congo Rep. of	25.3	48.8
Cote d'Ivoire	11.1	36.9
Equatorial Guinea	22.6	61.9
Gabon	44.6	35.0
Gambia	23.7	61.7
Ghana	22.5	63.2
Guinea	16.0	60.2
Liberia	4.9	23.0
Malawi	5.7	37.7
Oman	24.1	21.5
Sao Tome and Principe	21.4	61.5
Senegal	36.3	47.4
Sierra Leone	13.4	63.0
Tanzania, United Rep. of	10.3	33.6
Togo	17.3	50.2
Uganda	9.8	30.0

of energy and nutrients. But some essential nutrients are not found in these staples, or are found only in small quantities, for example, iron, iodine, zinc, calcium, vitamin A and vitamin B. These nutrients must be supplied by other foods. Fish contribution in the supply of these elements and fatty acids that are necessary for the development can be particularly important.

There is also evidence suggesting that fish can play an important role in maternal, foetal and neonatal nutrition. An adequate amount of essential fatty acids (EFA) is important to health and is particularly important prior to and during pregnancy and lactation. EFAs, particularly DHA and EPA, are 10 to 100 times more concentrated in fats from marine sources such as fish than from terrestrial sources. Some studies show that fish and fish oil consumption significantly improves the outcome of pregnancy and infant development. Although other studies do not show any association between fish or fish oil consumption and infant development, eating fish two or three times a week is being encouraged as part of a healthy balanced diet both for child-bearing women and the family as a whole (Elvevoll and James, 2000; Halwart, 2006).

While fish as a subsistence product is an important source of direct food security for fishing households, incomes derived from wages in the fisheries sector or from fish trade is often even more important as an indirect contribution to food security. Inland and coastal fisheries and related fish processing and trading provide full- or part-time employment to between 6 and 9 million people in sub-Saharan Africa. Using a (conservative) ratio of 1 to 5 for household size, a total of some 30 to 45 million people (men, women and children) in Africa therefore depend indirectly on fish for their livelihoods.

The increasing contribution of aquaculture to regional food security is demonstrated clearly for the Near East and North Africa. In 1994, aquaculture contributed just 4.5 percent of fish production for the entire region, this rose to 18.7 percent in



COURTESY OF MOHAMMAD HASAN

*Fish market in rural Africa. Although very simple and small-scale, these rural fish markets play a significant role in distributing fish among the local communities.*

2003. On an individual country basis in 10 of 17 countries the contribution of aquaculture increased in the decade 1994–2003. Furthermore, for several emerging producer countries, aquaculture did not contribute to national food security in 1994, but did so in 2003. Within the region, the relative contribution of aquaculture in 2003 varied sharply from country to country, being highest in Jordan, Egypt and the Syrian Arab Republic (57, 50 and 44 percent, respectively).

Products from aquaculture are not a significant factor in providing food for the poorer segments of society in North America. In fact, seafood consumption is highest among older more affluent consumers (Johnson, 2004). In general,

cultured products such as salmon and shrimp are some of the more expensive products, compared with catfish. One exception is frozen farmed tilapia which is imported at US\$1.19/kg (Harvey, 2005). Most seafood products sell for 2–4 times their import value. The least expensive frozen tilapia fillets from China are imported at US\$3.08/kg. With the availability of these inexpensive tilapia imports, virtually all of the tilapia cultured in North America is sold live to attract the premium price necessary to cover production costs.

### **Relative contribution of fish compared to other sources of 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 (Kent, 1997; Dey and Ahmed, 2005; FAO, 2003). The share of fish protein in total animal protein expenditure is higher for lower income groups, and poor people consume mostly low-price 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 comes from inland capture fisheries or cheap imports of frozen fish. In countries such as Iran (Islamic Republic of), Philippines and Viet Nam where inland capture fisheries has declined, aquaculture increasingly makes up for the gap and even begins to fill the increasing demand of an expanding population.

In most countries of the Near East and North Africa, consumption of fish is lower than that of red meat and poultry. The exception is Egypt, where consumption of fish exceeds that of red meat and poultry. The relative contribution of fish to total animal protein varies greatly from country to country, being highest (15–25 percent) in Egypt, Morocco, Oman and Yemen.

### **Comparison of aquaculture with agriculture and meat production**

In Western Europe, the value of aquaculture compared with that of agriculture or meat production is small at €4.9 billion in 2003. In the same period, the value of total agricultural and meat output at producer prices was €255 and 107 billion, respectively, representing a mean annual growth of only 0.7 percent for agriculture and a decline of 0.3 percent for the value meat since 1994. In contrast, aquaculture showed an annual increase of 4.5 percent. This stagnation in the former sectors resulted in aquaculture increasing its share from 1.4 to 1.9 percent of total agricultural value and from 3.1 percent to 4.6 percent between 1994 and 2003 (Figure 1).

In Western Europe fish has to compete with other animal proteins and food items and its consumption, therefore, is price sensitive. The cost and affordability of major food items has changed markedly in the region and in particular the rise in fish and seafood prices in the region is amongst the highest of key food types (Figure 2). Although the data used in Figure 2 are for the 25 EU countries it is indicative of Western Europe as the major consumer countries are common to both.

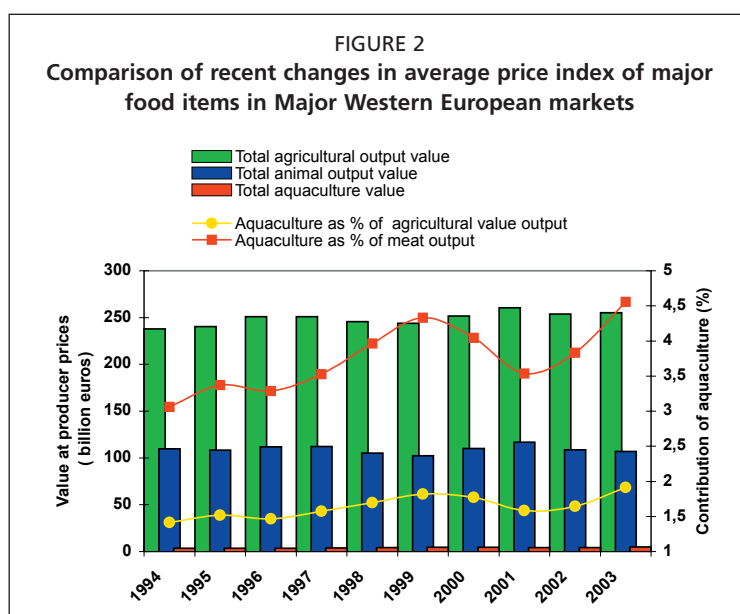
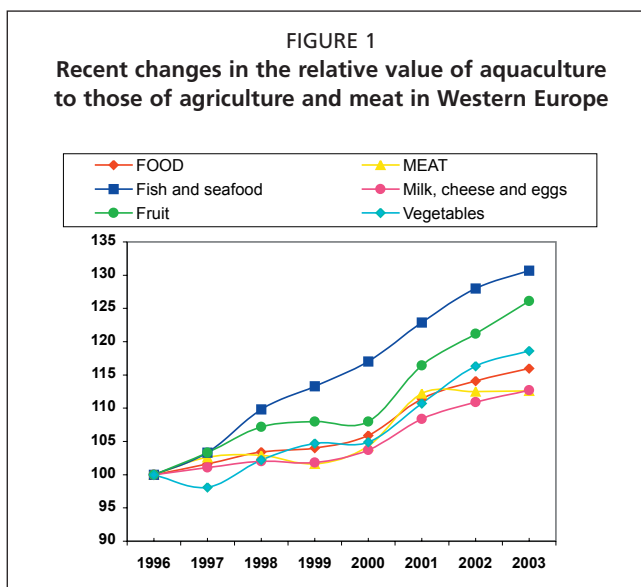
Between 1996 and 2003 (1996 = 100 percent) the relative cost of fish and sea food has risen by 30 points, almost by 2.5 times that of meat (112 percent). Also the relative price of meat has remained unchanged since 2000. These higher prices for fish and fish products are probably indicative of higher and rising demand and falling supplies of these products. Consequently, farmed fish is likely to remain a luxury commodity and its contribution as a food item to food security for poorer households within Western Europe is likely to decrease.

In Eastern Europe, however, consumption is increasing although slowly. One of the main factors which limit the consumption of fish and fish products is their relatively high price and the low income of the people, especially in rural areas. On the other hand, a

large amount of chicken, pork, veal, beef and other meat products are imported into these countries which is not the case with fishery products. As supermarkets are spreading in the region, however, the import of fish and seafood products is increasing.

North Americans are also major consumers of beef. The per capita consumption of beef and veal was 42.8 kg in the United States and 31.28 kg in Canada, in 2003 (FAOSTAT 2005<sup>2</sup>, Statistics Canada, 2005<sup>3</sup>). The per capita consumption of pork was 30.5 kg in the United States and 31.1 kg in Canada, while consumption of chicken broilers was 53.4 kg in the United States and 30.5 kg in Canada. Consumption trends for seafood products in 2004 were positive with increases in per capita consumption from 7.4 kg in 2003 to 7.5 kg in 2004. This is the third year in a row that United States per capita seafood consumption has increased. A record 1.9 kg of shrimp were consumed per person in 2004.

In Latin America as well, the value of aquaculture, which amounted to US\$3.9 billion in 2003, is comparatively very small, only 7 percent of total animal land-based



<sup>2</sup> www.faostat.fao.org/faostat/collection s ?version=ext&hasbulk=0&subset=agriculture

<sup>3</sup> www.statcan.ca/english/freepub/23-222-XIE/23-222-XIE2004000.pdf

husbandry products (including meat, poultry and swine production)., The participation of aquaculture in the GDP (gross domestic product), however, is more significant for individual countries such as Chile, Belize, Honduras and Ecuador (Morales and Morales, 2006).

FAO statistical data demonstrate that the contribution of fish to the protein supply of the people is less than that of different meats (poultry, pig, beef, mutton and goat) in most of the Eastern European countries (Table 4).

TABLE 4  
Fish and meat supply in Eastern European countries in 2002

	Fish, seafood supply cap/yr/kg	Meat supply cap/yr/kg	Fish, seafood as percent of total supply
Albania	4.1	39.3	9
Belarus	14.3	57.7	20
Bosnia and Herzegovina	4.4	22.6	16
Bulgaria	2.9	69.7	4
Croatia	11.9	31.5	27
Czech Republic	13.6	86.1	14
Estonia	21.2	64.7	25
Hungary	5.1	88.9	5
Latvia	11.1	45.9	19
Lithuania	59.8	50.9	54
Poland	13.1	73.3	15
Romania	3.4	54.1	6
Russian Federation	18.6	49.8	27
Serbia and Montenegro	2.0	77.9	3
Slovakia	7.3	66.3	10
Slovenia	7.7	88.3	8
The former Yugoslav Republic of Macedonia	4.1	40.7	9
Ukraine	15.4	32.0	48

Source: FAOSTAT Nutritional data, Food supply, 2005 (Last update 27 August 2004)

### Market prices of wild fish versus cultured fish species

In Asian countries, the general situation is that wild-caught fish fetch higher prices than cultured fish (for the same species, especially the reef fish). This difference is usually attributed to the taste, texture and other quality preferences of consumers. On the other hand, aquaculture can also have a big impact on wild fish prices due to the higher volume and greater reliability of supply and the degree of interchangeability between species. Cultured white shrimps from Asia are known to impact on the price of wild-caught shrimps in the United States to the extent that United States shrimp producers have levelled dumping charges against Asian exporters. Similarly, large volumes of *Pangasius* catfish from Viet Nam have affected the price not only of farmed channel catfish but also of any white fish in general since the fillet of *Pangasius* catfish can serve the same market.

A situation similar to Eastern Europe is evident in Albania, where the market price of wild fish can be twice as higher than that of farmed fish. On the other hand, in Estonia there is practically no "competition" between cultured and wild fish species on the domestic market. There is competition only between groups of fish of similar consumption profile.

In the largest producer countries in the Near East and North Africa, namely Egypt and Iran (Islamic Republic of), there are no clear price differentials between wild and cultured fish species. In other countries such as Libyan Arab Jamahiriya, Morocco



**BOX 1**  
**Viet Nam *Pangasious* catfish exports to European Union**

Year	2000	2001	2002	2003	2004
<b>Value (US\$)</b>					
Spain			355 150	2 472 409	21 895 270
Germany		186 120	4 178 648	6 651 024	22 470 124
Belgium			2 418 319	4 929 643	12 763 527
Italy			67 791	1 094 029	3 396 972
Netherland		38 822	728 542	1 877 629	2 467 615
France				19 204	1 480 168
Others	0	0	406 744	710 946	2 623 322.600
<b>Total</b>	<b>0</b>	<b>224 942</b>	<b>8 155 194</b>	<b>17 754 884</b>	<b>67 096 998.809</b>
<b>Quantity (Tonnes)</b>					
Spain		0	109	941	6903
Germany		60	1 296	2 494	7 396
Belgium		0	736	1 921	4 107
Italy		0	25	434	1 755
Netherland		10	216	631	763
France		0		9	544
Other	0	0	140	252	954
<b>Total</b>	<b>0</b>	<b>70</b>	<b>2 521</b>	<b>6 680</b>	<b>22 422</b>

*Pangasius catfish (basa) has now become readily available in the EU market. Pangasius used to be a significant export commodity to the USA. Information courtesy Viet Nam Customs.*

and Syrian Arab Republic, however, wild caught fish command a higher price than cultured fish. In Oman the opposite is true, with wild caught fish being less expensive than cultured fish.

### FISH CONSUMPTION TRENDS

Asia and the Pacific region represents the most important region for aquaculture production, and also has countries with the highest per capita consumption of fish. It is generally agreed that aquaculture production will continue to increase and that it is expected that fish supplies from capture fisheries have little room for further expansion.

The likely global trends for fish supply, demand and consumption have been forecast by the International Food Policy Research Institute (IFPRI) in collaboration with the WorldFish Center (Delgado *et al.*, 2003). The conclusions are that consumption trends show an increase in the demand for fishery products for food, partly due to changing food habits and the increasing purchasing power within several developing countries. In the Asian region, it is expected that there will be a shift from the region being a net exporter of fishery products to being a net importer. Developing countries are expected to remain net exporters overall, but the percentage of their production exported is expected to decrease due to rising domestic demand. While there is a trend of decreasing fish consumption in developed countries perhaps due to increased urbanization, this does not seem likely to offset the increased demand for fish in developing countries.

Per capita fish consumption figures for 2003 are available for Australia (10.9 kg), Indonesia (23.6 kg), Iran (Islamic Republic of) (5 kg), Myanmar (26.2 kg), Republic of Korea, (52 kg), Pakistan (2 kg) and the Philippines (36 kg for 1993). In the other countries, only the per capita fish supply or availability is reported (Table 5). With

the available figures from National Aquaculture Sector Overview (NASOs), and other sources, fish and other seafoods contribute 75 percent and 63 percent to animal protein intake in Cambodia and Bangladesh, respectively. In China fish contribute only 32 percent of total animal protein intake. In the Philippines, fish constitute 52 percent of animal protein intake (when milk and milk products are included).

TABLE 5  
Per capita fish supply (kg), selected countries in Asia and Australia in 2003

Country	Per capita supply (kg)			Per capita Consumption (kg)
	Capture	Culture	Total	
Australia	10.5	1.9	12.4	10.9
Bangladesh	7.9	5.9	13.8	14.0
Cambodia	30.3	1.5	31.9	1.6
China	12.8	22.1	34.9	36.2
India	3.4	2.0	5.5	8
Indonesia	19.3	4.1	23.4	23.6
Iran (Islamic Rep. of)	5.1	1.3	6.5	5.0
Japan	36.1	6.7	42.8	
Korea, Rep. of	23.1	0.9	24.0	52.0
Myanmar	27.0	5.1	32.1	26.2
Nepal	0.7	0.6	1.3	
Pakistan	3.5	0.1	3.5	2
Philippines	24.7	5.2	29.9	36 <sup>a</sup>
Sri Lanka	13.9	0.5	14.4	
Thailand	43.0	11.8	54.9	32 to 35
Viet Nam	19.9	11.2	31.2	

a) Food and Nutrition Research Institute (FNRI) Consumption Survey 1993.

TABLE 6  
Fish consumption in kilograms per capita, Western Europe (original figures in grams per day from FAOSTAT 2006)

	1969-1971	1979-1981	1990-1992	1995-1997	2000-2002
Austria	9.5	7.3	12.0	13.5	14.2
Cyprus	8.8	9.5	22.3	25.2	28.5
Denmark	21.2	27.7	26.6	25.2	24.5
Finland	23.0	28.8	34.7	34.3	32.5
France	21.2	24.8	31.0	29.6	31.0
Germany	12.4	12.8	15.3	15.	14.6
Greece	18.2	16.8	20.8	24.5	23.0
Iceland	70.8	87.2	94.2	93.1	91.6
Ireland	11.7	16.1	17.2	17.2	16.8
Italy	15.0	16.1	23.7	23.0	25.5
Malta	13.1	27.7	25.5	37.2	46.4
Netherlands	13.5	11.3	11.3	16.8	23.7
Norway	40.5	43.1	45.3	52.2	53.6
Portugal	65.3	28.1	59.5	64.2	58.0
Spain	29.9	32.8	36.5	43.8	46.7
Sweden	28.8	30.7	29.9	29.2	32.1
Switzerland	13.5	10.6	16.8	17.5	20.1
United Kingdom	21.2	17.2	20.4	21.5	22.6



Since landings from capture fisheries are stagnant and population has increased the share of aquaculture per capita, supplies are likely to have risen. The importance of fish and shellfish within the region, however, is markedly varied ranging from 14-16 kg/capita in Austria, Germany and Ireland to over 50 kg per capita in Portugal and Norway. In all countries (except Portugal), however fish consumption has increased during the last 40 years (Table 6).

For Eastern Europe, based on available data and estimations, it can be said that there was a decrease in fish consumption in most of the Eastern European countries after the early nineties, when production decreased significantly in these countries. There has been a gradual increase in fish consumption in recent years and there are some countries where fish consumption increased rapidly.

Per capita fish consumption, measured as kg/person/year, is increasing in 10 of the 11 Near East and North African countries for which data is available. In some countries the increase is significant, for example Algeria (3.0 kg/person/year in 1993 to 5.1 kg/person/year in 2003) and Egypt (5.5 kg/person/year in 1982 to 14.9 kg/person/year in 2003).

In Latin America per capita fish consumption varies from 2 to 59 kg/year but only 10 kg/year in most countries. The contribution of aquaculture to this consumption is probably very small since the larger part of aquaculture products are exported.

Fish consumption in the Near East has been very low in the past (1969-1971) at less than 5 kg in most countries. There have been sharp increases in most countries during the succeeding decades with only Sudan and Syria with fish consumption remaining low at 1.83 and 2.56 kg per capita, respectively, even up to the 2000-2002 period. The most notable rise was shown by Egypt which is now at 15.0 kg and Lebanon at 11.3 kg (Table 7). Iran (The Islamic Republic of) has shown a steady increase also from less than 1 kg to almost 5 kg. In Saudi Arabia, fish consumption has almost doubled during the last 30 years and as of 2000-2002 reached 7.3 kg. For Egypt the major reason for such an increase must be a greater availability of fish due to aquaculture which has shown tremendous strides. In Iran (Islamic Republic of) there is a conscious effort by the government to encourage people to eat more fish (by emphasizing its healthy attributes). In Saudi Arabia and other countries, the increased consumption may be partly due to the large number of guest workers from the traditionally fish eating countries of Asia.



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*Tilapia catch from a reservoir in Myanmar. Tilapias are not only produced by aquaculture, but also a major commodity of culture-based fisheries in many countries, especially in Asia. In some countries like Sri Lanka, tilapias dominate the reservoir fisheries catch.*

TABLE 7  
**Fish consumption, countries of the Near East countries in kilograms per capita (original figures in grams per day from FAOSTAT 2006)**

	1969-1971	1979-1981	1990-1992	1995-1997	2000-2002
Egypt	2.6	5.1	8.4	9.1	15.0
Iran, Islamic Rep. of	0.7	1.5	4.4	4.7	4.7
Jordan	1.8	3.6	3.6	5.8	5.1
Kuwait	9.5	12.4	5.8	12.4	8.0
Lebanon	4.0	0.7	2.9	7.7	11.3
Libyan Arab Jamahiriya	5.1	7.7	8.0	6.9	6.9
Palestine, Occupied Tr.	-	-	-	0.7	0.7
Saudi Arabia	4.0	9.9	5.8	6.6	7.3
Sudan	1.5	1.5	1.5	1.5	1.8
Syrian Arab Republic	1.5	2.6	0.7	1.5	2.6

### Comparative consumption of fish versus terrestrial meat

More than 200 million Africans eat fish regularly (see Tables 2 and 3). Fresh but more often smoked, dried or even powdered fish is an important source of dietary protein and micronutrients for many isolated communities in rural areas. Fish may also be the sole accessible source of animal protein for poor households in urban and peri-urban areas.

In most countries of Eastern Europe, pork and poultry are dominant on the meat market. Fish and fish products are in 3<sup>rd</sup> or 4<sup>th</sup> place in the total consumption of meat in these countries. On the other hand, there are positive examples too, e.g. Latvia, Albania and Croatia where fishery products take 2<sup>nd</sup> place or lead the meat market. A recent study in Hungary revealed that fish consumption is higher in those areas where fisheries and aquaculture have long traditions irrespective of whether the market is in a rural or urban area.

Within some countries in the Near East and North Africa, there are marked local differences in relative consumption of fish versus meat, and this is often linked to proximity to the coast. For example, in coastal regions of Iran (Islamic Republic of), fish consumption exceeds that of meat, whereas in inland regions, the opposite pertains. There are also differences between rural and urban societies, for example, in Egyptian rural consumption of fish exceeds that of red meat and poultry, whereas in urban societies the reverse is the case. This contrast is mainly attributable to costs of the different types of protein and income levels in different regions of the country. In contrast, in Libyan Arab Jamahiriya rural societies, there is more meat and poultry consumed than fish and in urban societies more fish is consumed than meat and poultry.

### RURAL POOR AND AQUACULTURE; OPPORTUNITIES AND CHALLENGES

Growing demand and expanding markets are expected to push fish prices up, and there is a need to increase the supply of low-value food fish to keep the price within the reach of both rural and urban poor people. Semi-intensive and primary production-based aquaculture (that 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 some countries (particularly China). It has emerged as an environmentally friendly production system that also supplies large quantities of low-value food fish. Small-scale integrated farming systems could, with improved infrastructure, availability of credit and greater assistance, provide many more economic opportunities for growing populations in rural areas, especially remote areas in Africa. In the increasingly competitive markets of today there are strong economic incentives for farmers to raise higher value fish crops that yield higher profit margins.

Polyculture or co-culture schemes involving both primary feeders and high value carnivores (confined in cages) in the same pond compartment, however, are possible and should be refined, disseminated and their application encouraged.

For women in particular, fish processing and trading provides a very important economic support. In West Africa and some southern African countries women dominate fish processing, retailing and local trading of fish. Many of the women are heads of households and fish trading provides the only source of income e.g. in western Zambia,

where three quarters of the women in fish trading are from single headed households.

In several countries in southern Africa, over 30 percent of the adult labour force lives with HIV. The pandemic affects the livelihoods of others who were initially depending on its labour force for their livelihoods. This situation is causing an increase in food insecurity in the entire region by breaking the already fragile balance between labour, work and food entitlements. Fish – in particular cultured fish – can play a mitigating role in this crisis as the work (especially in small garden ponds) requires low physical labour, the product is nutritionally rich and it can generate cash to purchase other food items and medication.

Fish consumption in sub-Saharan Africa is the lowest in all regions and is the only part of the world where it is declining. The main reason is the levelling off of capture fisheries production and the growing population. To maintain the current level of per capita supply in sub-Saharan Africa of 6.6 kg per year up to the year 2015, capture fisheries and aquaculture must increase by 28 percent over this period.

Since capture fisheries cannot meet the demand for fish in the region, aquaculture will have to play a pivotal role. But in sub-Saharan Africa, aquaculture contributes less than 2 percent to total fish supply. The potential for growth, however, is extremely high although the task is enormous: based on 1997 levels, aquaculture would have to increase by 267 percent by 2020 to maintain the current consumption level in Africa. The sub-Saharan Africa regional aquaculture trends review (Hecht, 2006) recommended that fisheries be given support in five major areas:

- a. support to small-scale labour intensive coastal and inland fisheries;
- b. promotion of rural and peri-urban aquaculture entrepreneurship;
- c. improvement of fish market chains through local investments;
- d. favouring local, national and intraregional fish trade within Africa;
- e. monitoring the above changes and feedback of information into decision-making processes.

The Pacific island nations have increasingly realized the role aquaculture can play in supplying fish protein, particularly for inland rural villages where access to fresh fish is limited and lack of electricity prevents storing food for a long time. 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



COURTESY OF MOHAMMAD HASAN

*Integrated aquaculture facility in Zambia. Integrated aquaculture, the farming of fish with livestock and agriculture, is largely an Asian activity. However, it is also practiced in Africa. The focus on integrated farming is increasing worldwide.*





COURTESY OF ROHANA SUBASINGHE

*Mangrove friendly crab culture in Palau. The government of Palau is promoting environmentally friendly aquaculture as a source of quality fish and shellfish. Crab culture is practiced in mangroves, with least impact to the environment. This pilot activity is proving its promise for future.*

essential cash needs (for school fees, social obligations and other expenditure items) and as a back-stop to declining fisheries revenues.

In Latin America and the Caribbean aquaculture carried out by poor households is oriented towards self-consumption and the local commerce of species such as tilapia, pacu, carps and catfish in freshwater and towards oysters in marine environments. In some countries, a certain degree of increase in fish consumption is recognized.

In many countries in the Near East and North Africa, aquaculture is seen as providing important opportunities to poor families; for employment and income and as a source of nutritionally

healthy and affordable protein. Algeria's five-year plan for the development of fishery and aquaculture provides priority to the improvement of living standards in disadvantaged rural areas, through income and job opportunities from aquaculture. In the Syrian Arab Republic, aquaculture activities provide better income compared with agriculture and thus is economically advantageous in rural areas.

### **Rural poor, aquatic production and international markets**

A general conclusion for trade is that income from exports is good for the economy. A different perspective however is raised by the WorldFish Center for Africa (Bene and Heck, 2005).

The situation is that sub Saharan-Africa has a trade deficit that is expected to worsen and exporting fish to other continents could undermine regional food security. In this context, two issues were raised. First, while the fish removed from African markets can, in principle, be replaced by imports and the foreign exchange earnings from exports can stimulate national economies, the benefits of international trade versus the stimulus to local economies through increased processing, and national and regional trades have not been fully analysed or demonstrated. Second, too strong a focus on international export can be detrimental to Africa's food security because it diverts policy-makers' attention, research and management effort, and donor support away from the small-scale fisheries which supply local, provincial or national markets and focuses these limited resources on the export-oriented industrial or semi-industrial fisheries.

Aquaculture currently competes with the livestock sector for fishmeal for feeds. If fish value increases, the "purchasing power" of aquaculture may draw this resource away from the livestock sector. There are calls for aquaculture to reduce its reliance on fishmeal and increase the efficiency of its utilization. Whilst more efficient use of fishmeal is possible, the reduced reliance may be more difficult. In the face of increasing purchasing power of aquaculture feeds, it may be the livestock sector which makes the greater progress towards reducing reliance on fish meals.

Low-income food-deficient countries (LIFDSs) 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. At the micro-level, fish and livestock are key sources of income and buffer against food insecurity during times of shortage. Aquaculture, however, can play a broader role in developing countries through poverty elimination and food security. (Dey and Ahmed, 2005).

In Latin America, aquaculture enterprises tend to place priority on foreign currency and employment generation. 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 emphasized food security. Indirectly, however, it has had a significant contribution to employment generation.

Aquaculture carried out by poor households is for self-consumption and the local market. Species are tilapia, pacu, carps and catfish in freshwater and oysters in marine environments.

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 improvement in overall food and fish consumption and more employment and cash incomes from fish farming (Asian Development Bank, 2004).

In all sub-Saharan African countries, non-commercial fish farms are reported to play an important role in contributing towards food security, improved nutrition and rural employment. Estimates of employment by the non-commercial sector per country range between 18 000 and 30 000 jobs. Non-commercial aquaculture plays an important role in rural livelihoods; 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. Given the current levels of production, however, the review suggests that non-commercial aquaculture is unlikely to make significant contributions to fish supply on a national basis in any of the countries in the short and medium term. Moreover, the contribution by the aquaculture sector to gross domestic production (GDP) in most sub-Saharan Africa countries is insignificant. Non-commercial fish farming in all countries is largely an on-farm diversification strategy, although all countries in sub-Saharan Africa consider it to have a positive effect on sustainable and improved livelihoods and poverty alleviation at the family level.

There is no doubt that Asian aquaculture is contributing to better nutrition, more food supply and employment. One issue, however, is whether fish is becoming a luxury item? The demand for fish in general and farmed fish in particular is likely to rise in the short and medium terms for the following reasons: in the countries that already have fairly high per capita fish consumption, the decline in capture fisheries has to be compensated for by increase in aquaculture production and where fish consumption is still very low, an increase in fish consumption under certain circumstances is a real possibility. Indonesia had a per capita fish consumption of only 12 kg as late as 1980. By 2002, fish consumption had doubled to 23 kg. The promotion of fish as health products (such as eel) has stimulated more consumption of fish, as has switching more to fish from red meat by the middle and more affluent segment of the population in the Republic of Korea (Bai 2006).

Thus far the trend in all major aquaculture species (cyprinids, tilapia, salmon, and shrimps) shows that the prices are declining over the years due to improved technology



*Fish market in Japan showing high diversity of fish and fishery products.*

COURTESY OF FLAVIO CORBIN

and greater availability of seeds and feeds, all leading to higher and more efficient production. An increase in prices is likely if aquaculture production fails to keep up with demand and production efficiency does not improve. Ultimately, in all countries, the increased contribution of aquaculture to local food supply will be driven by local preference and acceptance of certain products and the economic cost of producing them, as well as a growing purchasing power.

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