

- institutional infrastructure and capacity building; and
12. introduction of technological improvements and disease management.

Issues on and Need for Fisheries Policy Research

Policy measures to address many of the issues mentioned have long been identified and build on knowledge generated within the various disciplines of the natural and social sciences and technology. However,

where seemingly appropriate measures have been taken, experience shows that they have often failed to generate the results hoped for. This not only calls for a more systems oriented research within well established disciplines but for new holistic approaches which integrate the natural and social sciences. One such new area of research, which has a strong bearing on many of the key policy issues, is how humans interact with natural resource systems through property rights regimes (rights and rules). Most environmental problems

can be seen as problems of incomplete, inconsistent or unenforced property rights regimes. Other areas for fisheries policy research include the study of the impacts on fisheries of the increase in world trade in fisheries products and other macrolevel policy developments.

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Demand for Fish in Sub-Saharan Africa: The Past and the Future

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Abstract

The sub-Saharan region of Africa accounted for only 5.5% of the world's demand for fish from 1989 to 1991, in spite of comprising 9% of the global population. This study was carried out to determine the future demand for fish in the sub-Saharan region. Fish accounts for approximately 10% of animal protein consumed. It is prominent in the diet of the poor since cured and smoked fish is a cheaper source of protein than meat or eggs. The average per capita consumption in 1992 was about 8 kg compared to 13 kg globally. Fish is prominent in the diets of people near coastal areas and large inland water bodies and a total of 40% of fish consumed is freshwater fish. Consumption is rising in the coastal areas but falling inland, probably due to drought and overexploitation resulting in an inadequate supply. Aquaculture has not been widely adopted and does not contribute substantially to the region's supply. To determine future demand and trends, a regression analysis was carried out at the country level with FAO data on fish consumption from 1960 and 1992, using several proxies for disposable income, cost of fishery products, changes in tastes and national differences in the tradition of fish consumption. An aggregate increase in fish consumption of nearly 2.7% annually over the next few years was predicted with a strong correlation between increases in income, prices and population. Real income was a significant and positive determinant of fish consumption, even though consumption increased more slowly than income. Given the high projected rate of population increase, the growth rate in overall fish consumption actually implies a reduction in per capita fish consumption of 0.31% annually. If technological progress can improve production and supply, aquaculture could have a significant impact on fish consumption in the region.

Few studies address the current and future demand for fish in Africa, and the continent rarely gets much attention in the discussion of world fisheries issues. While the countries of north Africa are significant producers and consumers of fish, sub-Saharan Africa (hereinafter referred to as "Africa") is a very small participant in the world market for fish, consuming only 5.5% of global utilization in 1989-1991, in contrast

to its share of over 9% of global population. Its share of world fish consumption has remained fairly stagnant (5.2% in 1969-1971), although it did increase in the 1970s (6.1% in 1979-1981) during the period of economic growth. Africa's share went down again with the economic downturn of the 1980s. However, the future may show different consumption trends—with increasing population and income, the demand for fish will grow in the coming years

if the relative price of fish to meat does not increase.

According to data from the Food and Agriculture Organization (FAO), fish accounts for roughly 10% of the animal protein consumed in sub-Saharan Africa; 98% of this is finfish. Smoked or cured fish is a cheaper source of protein than meat and eggs and comprises over half the fishery products consumed, figuring especially prominently in the diet of the poor.

The main areas of consumption are west, central and southern Africa, as shown in Table 1. In inland areas, fish is important in countries with large waterbodies, such as Uganda. In the absence of adequate storage and transportation infrastructure, fish is more prominent in the diets of people near coastal areas and inland waterbodies. The average per capita consumption in Africa in 1992 was about 8 kg, having increased from an average of 7 kg per annum in 1969-1974. Southern Africa is a relatively large consumer, average per capita consumption being 10 kg per annum.

In many areas, such as Ghana, fish is more a poor man's food than for the non-poor. In the west African diet, there is a preference for chicken and lamb over fresh beef, fresh beef over frozen and beef over fish. Freshwater fish seems to be preferred over marine fish; consumption of other marine products such as shellfish, molluscs and seaweed is extremely small.

Pelagic fish, typically of lower value, is important as a food source in the coastal countries of west and central Africa. The share of pelagic fish in total utilization increased by about one-quarter since the early 1970s, while the share of the higher-quality demersal fish declined. Imported frozen fish is another source of pelagic fish in some areas. Southern Africa consumes more of the higher-value demersal species compared to the rest of Africa.

Roughly 40% of fish consumption in Africa south of the Sahara is freshwater fish, as compared to the global average of 25%. The share of freshwater fish consumption has been rising in the coastal areas but falling in inland countries, perhaps due to drought and overexploitation. In rural Africa, especially in inland areas, the consumption of fish is often constrained by inadequate supply. While there have been many attempts to promote aquaculture in farm ponds, especially in eastern and southern Africa, there has not been much success so far.

While west Africa is a relatively large consumer of fish in African terms, per capita consumption has not grown over the last 20 years. In eastern and southern Africa, although the current per capita consumption is lower, it has been growing more rapidly from 0.14% in the 1970s to 1.5% in the early 1990s. The main area of rapid growth in fish consumption is the coastal region of central Africa with a compound annual per capita growth rate of about 2% over 1969-1992. Most of the growth in fish consumption between 1969 and 1992 came from growth in consumption of pelagic fish rather than demersal.

Forecasting Demand

To get a view of the future direction of demand for fish in Africa and to establish the importance of various factors that are likely to affect the level

of demand, we conducted a regression analysis on aggregate national data and drew upon a few econometric micro studies on the demand for fish in Africa.

Some of the factors that can be expected to affect fish consumption include income, prices of fish, prices of fish substitutes such as meat, prices of fish complements such as rice, tastes and non-price factors that affect the transaction costs of purchasing and preparing fish: availability of cold chains, proximity of retail outlets, convenience of lot sizes, storage capability, etc. An analysis of the respective roles of these factors would require data on all the above factors at a sub-regional level over time, which is not feasible for a multi-country sample.

In the absence of such data, a regression analysis was undertaken at the country level using FAO data on fish consumed as food between 1960 and 1992. Gross Domestic Product at constant prices was used as a proxy for disposable income; commercial energy consumption was used to proxy reduction in the transaction costs of acquiring and using fishery products; the level of urbanization as proxy for changes in tastes, and the length of marine coastline represented national differences in the tradition of fish eating.

Fish and meat availability in west and central Africa tend to be seasonal and thus prices vary by season. World market prices of frozen pelagic fish have varied substantially over the

Table 1. Average annual utilization of marine finfish by geographic regions and time period, 1969-1992 (kilograms per capita).

Time period	West Africa ^a		Central Africa ^a		Eastern and southern Africa ^a	
	Pelagic	Other marine finfish ^b	Pelagic	Other marine finfish ^b	Pelagic	Other marine finfish ^b
1969-1974	3.58	4.01	3.57	2.98	.67	1.71
1975-1980	3.88	4.01	4.65	3.55	.73	1.60
1981-1985	3.95	3.70	5.71	3.66	.58	1.82
1986-1992	4.20	3.20	5.16	3.01	.89	2.21

Notes: ^a Regions are defined as follows:

Western Africa: Benin, Burkina Faso, Côte d'Ivoire, Cameroon, the Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Nigeria, Sénégal, Sierra Leone and Togo.

Eastern and southern Africa: Botswana, Ethiopia (PDR), Kenya, Malawi, Mozambique, Namibia, Somalia, South Africa and the United Republic of Tanzania, Zambia and Zimbabwe.

Central Africa: Burundi, Central African Republic, Chad, Congo, Gabon, Uganda and Zaïre.

^b Demersal species and other marine finfish.

Source: Computed using data from FAO Agrostat-PC: Food Balance Sheets Domain, 1994 and Population Domain, 1994. FAO, Rome, Italy.

period of analysis relative to the price of substitutes such as meat. Thus the changing relative price relationships between fish and its substitutes need to be taken into account in demand projections.

In the absence of location-specific price data, price effects were modeled using the world price of manufacturing grade frozen beef as a proxy for price of substitutes to fish. The impact of changes in fish prices were based on the deflated price of imported frozen pelagic fish into Côte d'Ivoire.

Regression Results

Real income is a significant, positive determinant of fish consumption in Africa, even though consumption increased more slowly than income. The relationship is especially positive for pelagic fish in western and central Africa. Population growth is positively related to overall fish consumption, as expected. The income elasticity of fish consumption is much higher for inland areas where fish consumption is low, suggesting that consumption in these regions may increase significantly in the future as income grows. Urbanization and energy use, which might be thought to lead to increased fish consumption due to the relatively greater availability of cold storage, do not emerge as significant factors.

The price of fish is negatively correlated with fish consumption in most regions and the price of beef is positively correlated with fish consumption (Table 2). Thus the consumption of fish can be expected to decrease with increasing fish prices and increase with increases in the price of beef. This substitution relationship does not show up for pelagics by themselves.

For fishery products as a whole demand increases with population growth. For pelagic fish population growth has a negative effect indicating that pelagic fish consumption over the period grew most in the less populated and slower growing countries of the interior.

Insights from Case Studies

Empirical work on price response and substitution relationships for fishery products was found to be very sparse in Africa south of the Sahara. However, case studies are available from Côte d'Ivoire, Sierra Leone, and coastal west Africa. These case studies confirm that the price of fish has a negative influence on consumption (elasticity of -0.75). This implies that a 1% rise in the price of fish, other factors being equal, will produce a 0.75% fall in the consumption of fish. The studies also suggest that fish behaves like a staple, with inelastic demand with respect to income (0.8 to 1.0). Thus a 1% increase in real income is associated with a slightly less than 1% increase in fish consumption; over time the share of fish in total expenditure will slowly fall. Furthermore, low-quality fish appears to be a substitute for meat in traditional food preparations since a 1% rise in the price of beef is associated with a modest rise (0.7%) in fish consumption.

Demand Forecast

Based on best guesses from the regression analysis on aggregate data, secondary information and the western African case studies noted above, the following demand parameters can

be hypothesized for sub-Saharan Africa in the absence of other information: own-price elasticity of demand for fish of -0.75, cross-price elasticity with respect to the price of meat at 0.7 and income elasticity of 0.75. Response elasticities can be hypothesized at zero for urbanization, 0.14 for growth in energy use and 0.28 for population growth. Thus, income and prices seem to be the main factors determining the demand for fish in sub-Saharan Africa, and future demand will probably depend largely on the trends in these factors.

Trends in the demand for fish over the next decade were forecast using the elasticities for determining factors hypothesized above and projecting the trends in these factors from historic trends, as shown in Table 3. These data imply an aggregate increase in fish consumption of nearly 2.7% annually over the next few years, with a large share of the increase due to increase in incomes. However, given the high projected rate of population increase, this high growth rate in overall fish consumption still implies a reduction in per capita fish consumption of 0.31% annually. Nevertheless, a projected regional growth rate in consumption of 2.7% is high compared to the historical growth rate of world fish consumption of less than 2% between 1970 and 1990. This suggests that it is likely that Africa's share of world consumption — about 8 kg per capita compared to 13 kg for the world as a whole at the present time — will grow slowly over time.

It seems likely that consumption of pelagic fish will continue to expand in the coastal countries of west and central Africa. Freshwater fish

Table 2. Determinants of aggregate utilization of fisheries products and pelagic fish in sub-Saharan Africa, 1970-1989.

Product	Elasticities					
	GDP in constant US\$	Overall population	Length of marine coastline	Price of beef	Price of fish	Adjusted R ²
All fisheries products	0.40	0.77	-0.18	0.09	-0.14	0.95
Pelagic fish	0.96	-0.51	0.23	-0.14	-0.50	0.90

Note: Includes 25 countries with complete data over the period. Energy use and urbanization were included as explanatory variables but were not statistically significantly different from zero.

Table 3. Hypothesis and future changes in aggregate utilization of fisheries products in sub-Saharan Africa.

Influencing variable	Elasticity of response	Hypothesized trend in variable (not in per capita)	Hypothesized net effect on aggregate fisheries utilization (percentage per annum)
Real income	0.75	1.6	1.20
Real fish price	-0.75	1.0	-0.75
Real meat price	0.70	1.0	0.70
Real price of starch	-0.70	0	0
Urbanization	0	6.0	0
Energy use	0.14	5.0	0.70
Population growth	0.28	3.0	0.84
Aggregate effect			2.69
Aggregate effect per capita with 3% population growth rate			-0.31

consumption is likely to continue to grow next to large inland bodies of water. If the real price of meat continues to rise in Africa, as it has for the last few years, the demand for fish will increase at an even more rapid rate. The consumption of fish in rural Africa is also constrained,

to a large extent, by production. Freshwater aquaculture has not yielded significant evidence of widespread replication in Africa at current fish prices and production costs. If this supply constraint is removed through technological progress, it may have a significant impact on the trends

of fish consumption in the region given the good demand prospects.

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The Role of Small Indigenous Fish Species in Food and Nutrition Security in Bangladesh

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Abstract

In Bangladesh, only 6% of the daily food intake is animal food of which fish accounts for about 50%. Rice is the mainstay, making up 60% of the daily food intake. However, many nutrients such as vitamins A and C, iron, calcium, zinc and iodine are not found in rice and have to be obtained from other sources. Small indigenous fish are a vital contribution to the diet of the rural poor in Bangladesh, where more than 30 000 children go blind every year from vitamin A deficiency and 70% of women and children are iron-deficient. Small fish, which are less than 10 cm in length and usually eaten whole with the organs and bones, contain large amounts of calcium and possibly iron and zinc. The larger fish promoted in aquaculture do not contribute significantly to calcium intake. Some species also contain large amounts of vitamin A. Much of the small indigenous fish (SIS) of Bangladesh are caught in floodplains and natural waterbodies. Small fish are eaten frequently in small amounts and are more equally distributed among family members than big fish of which men get the larger share. Unfortunately, overfishing and the deterioration of natural habitats have resulted in a decline in SIS. When measures are taken to improve food and nutrition security, there should be a focus on production of small fish so that greater quantities are accessible for consumption by the rural poor.