

Fish Production, Consumption, and Trade in Sub-Saharan Africa: A Review Analysis

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Fish to 2030: Sub-Saharan Africa Fish Trade in a Changing Climate



Abbreviations and Acronyms

ACP	Africa-Caribbean-Pacific
CFA franc	The currency of the African Financial Community
c.i.f.	cost, insurance, and freight
COMESA	Community for East and Southern Africa
DRC	Democratic Republic of Congo
EU	European Union
FAO	Food and Agriculture Organization (of the UN)
SADC	Southern African Development Community
OECD	Organisation for Economic Co-operation and Development
UN	United Nations

All dollar amounts are U.S. dollars unless otherwise indicated.

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I. Introduction

Objective

This analysis is an output of *Sub-Saharan Fish Trade in a Changing Climate*, a World Bank–funded study conducted in 2010–2011 by WorldFish. Its overall objective is to develop an understanding of the supply and demand for low-value, regionally and domestically traded fish, which are important in the diets of lower-income urban and rural consumers in Sub-Saharan Africa, to inform cooperation on trade and food security and projection of regional trends in supply and demand for food fish.

The project seeks to categorize and evaluate factors influencing fish trade in Africa, with a focus on fish consumed by African populations and low-income groups in particular. Based on available data and studies, it aims to describe the patterns and quantities of supply and assess the factors that influence fish supply, demand, and trade.

This report is complemented by more detailed country-level analysis for Ghana and Uganda, and evidence from Senegal based on secondary data (Gordon and Pulis 2012), and by reviews on fish in the nutrition of the poor in Africa (Finegold 2012a), with specific analysis for Ghana and Uganda (Finegold 2012b).

Background

Fish products are highly traded, and developing countries are among the most important exporters. According to FAO (2009), developing countries accounted for 49 percent of world exports by value and 59 percent by volume in 2006. With growing trade in fish products¹ there is growing concern about the possible effects on developing country consumption and nutrition (for example, Delgado and others 2003; Allison 2011; Béné 2008). This is particularly the case in Sub-Saharan Africa, where there is persistent poverty and food insecurity, low per capita levels of apparent food fish consumption² but historically high dependence on fish as a source of animal protein in some countries.³ Moreover, projections suggest that African nations may be among the most vulnerable to climate-induced changes in the fisheries sector.⁴

Analysis of these production, consumption, and trade issues is complex and is exacerbated by patchy and sometimes unreliable data—in part a consequence of the informal nature of Africa’s largely artisanal fisheries and much of its intra-regional fish trade. There are also problems relating to data collection, particularly but not only in its important inland fisheries; the impacts of illegal, unreported, and unregulated fishing;⁵ and the relatively low profile of fisheries in Africa, compared, for example, to agriculture, particularly in policy and its implementation. In this study, data from various sources, including national and regional datasets, are compiled and analyzed. Primary data are utilized when reported in published reports. The findings from published research and technical

¹ In real terms (that is, adjusted for inflation), the global export value of fish and fishery products expanded by 103.9 percent between 1986 and 2006 (FAO 2009).

² In 2007, apparent consumption of food fish in Africa was 7.6 kilograms per capita, compared with a global average of 16.9 kilograms per capita.

³ In many sub-Saharan counties, fish contributes more than 20 percent of the animal protein supply; in Equatorial Guinea, The Gambia, Ghana, and Sierra Leone, fish contributes to at least 50 percent of total animal protein intake (FAO 2009).

⁴ “Half of the highly vulnerable countries (16 out of 31) were among Africa’s least developed countries” (Allison and others 2009, 13).

⁵ “[T]he small-scale [fisheries] sector [globally] has been left largely undocumented, unregulated and unsupported” (FAO and WorldFish Center 2008, i).

reports are presented and interpreted to piece together the larger picture of these important topics.

Fish to 2020: Implications for Sub-Saharan Africa

Although many authors raise concerns about trends in fisheries and their implications for poverty and food security (for example, Allison 2011; Béné 2008; Kurien 2005; Alder and Sumaila 2004; Kent 1997), there had been little rigorous analysis. To explore some of the potential interactions and outcomes, the International Food Policy Research Institute (IFPRI) and the WorldFish Center undertook a quantitative study of global trends in fish supply and demand using IFPRI's IMPACT model to forecast scenarios over a 20-year period, to 2020 (Delgado and others 2003). Key conclusions in relation to Sub-Saharan Africa included the following:

- Average per capita fish consumption would be unlikely to increase in Africa, although aggregate consumption (driven by population growth) will increase;
- Relative to the world average of 1.5 percent during 1997–2020, there would be higher predicted annual growth rates in supply for Sub-Saharan African production from both capture fisheries (2 percent) and aquaculture (5.8 percent) and an increase in Sub-Saharan Africa's share of global food fish production from 4 percent to 5 percent;
- Real prices of were expected to rise (and fish would be more expensive relative to meat and other food products); the most likely outcome would be for high-value finfish and crustacean prices to be about 15 percent higher in 2020 than the present, while the real price of low-value food fish would increase by 6 percent; the model's fish price forecasts were, however, very sensitive to assumptions on the health of capture fisheries resources and the speed of aquaculture growth; and
- The caution must be made that the outlook for food security of the poor would be "not especially good," citing the employment impacts of stagnant capture fisheries production in contrast to growth in aquaculture, as well as lower consumption of fish as a consequence of increases in its real price.

Regional analysis can, however, conceal sharp difference between and within countries, highlighting the need for analyses based on significantly richer data. With the most current data available and results from new research, the present study builds on the *Fish to 2020* work, exploring how effects might differ between countries or country groups in Sub-Saharan Africa. Where data permit, it explores how fish consumption varies between urban and rural communities, as well as trends in price and availability and how this is affected by international trade.

Data Used in This Analysis

The only comprehensive time series data on African fish production and trade is FishStat, the global dataset maintained by the Food and Agriculture Organization (FAO). Though utilized extensively in this study, these data should be interpreted cautiously because of well-recognized difficulties with fisheries data collection and trade reporting, particularly in developing countries. The FishStat data are widely used; for example, the analysis in both *Fish to 2020* and *Fish to 2030* was based on them. Subject to only small differences, the analysis covers the same countries as used in the *Fish to 2020* Sub-Saharan Africa list (Table A.1)⁶ and uses the same categorization for low-value fish (Table A.2).⁷

⁶ See Annex A for the full list; the only difference with the *Fish to 2020* list is the inclusion of Cape Verde, Equatorial Guinea, South Africa, and the Seychelles.

⁷ The present study avoids another definition (see, for example, FAO 2007, 116) for low-value/trash fish: "Fish that have a low commercial value by virtue of their low quality, small size or low consumer preference," as

Most food fish consumption in Africa falls into the “low-value” group, as defined in *Fish to 2020*. According to this classification, in 41 out of 49 countries, 70 percent or more by volume of all fish consumed is categorized as low value.⁸ This definition, with a significant focus on small pelagics and freshwater fish, is probably a more useful differentiator globally than it is in Africa, where even higher-income countries, such as Gabon, are important consumers of low-value species groups, and where relatively high-value export species, such as Nile perch, are also categorized as low value. Nevertheless, unless otherwise specified, reference to low-value fish is based on this categorization—though in this and the related reports, note is made of the specific importance of access to lowest value fish within this low-value categorization.

Although low-value fish as defined above represents a very broad grouping, FAO fish consumption data could not be used directly to identify low-value fish consumption, as these data do not distinguish between high- and low-value categories. Consumption of each fish group was therefore derived from the FAO datasets for production, trade, and non-food uses,⁹ matched and validated with overall consumption data.

Reference to net imports in the text means “imports less exports and re-exports.” Where exports and imports for the entire region are discussed, the total represents the sum of imports (or exports) for all countries in the region. Theoretically, intra-regional imports should be balanced by intra-regional exports, though this may not always be the case because of discrepancies in country trade data. Illegal, unreported, and unregulated (IUU) fishing can also give rise to informal intra-regional cross-border trade, which is usually extremely difficult to quantify. Possible IUU-related transactions include the following:

- Vessels catching fish in one country but landing in another, perhaps where it is easy to underdeclare catch, when higher prices are available for non-target species, or to avoid compulsory quotas that require a portion of the catch to be sold on the local market, rather than being exported; and
- Transfer of fish at sea from industrial vessels to artisanal craft, which could involve cross-border transactions.

In both cases, the catch, if reported, would show in the landings data for the country and craft that land it. There is anecdotal evidence to suggest that this type of fish trade is happening in parts of West Africa and may well be more widespread. This was not a focus for the present study, though the example emphasizes the potential constraints of formal data.

this definition includes fish used in fish meal and other nonconsumption uses.

⁸ The exceptions are Cape Verde, the Comoros, Djibouti, Mauritius, Réunion, São Tomé and Príncipe, South Africa, and Swaziland—suggesting that while income may play some role, tourism and the nature of the national fishery are also important (some island states tend to fish deepwater high-value species).

⁹ To check the calculation, the data were then summed and compared with the FAO consumption data; the two series were close for the region as a whole (with a difference ranging between 0.5 percent and 7.9 percent, depending on the year). For individual countries, the two time series were plotted to identify countries where the difference was large or where the time series data followed a significantly different pattern. The only two countries that are both important players in Africa’s fisheries sector (and whose data therefore weigh heavily in the regional results) and show important differences with the FAO consumption data were Namibia and the Seychelles. These differing results stem from difficulties in assigning live-weight equivalents to imports or exports (the convention in the consumption data is to report on a live-weight equivalent basis but traded fish is reported on a product weight basis and the relevant scalars differ between products and between countries). Where appropriate, Namibia and the Seychelles have therefore been excluded from the aggregate analysis and are discussed separately.

Although comparability with the *Fish to 2020* methodology and its results is useful, this study is primarily concerned with low-value fish, and particularly those that are important in the diets of the poor. Therefore, where country-level data permit, the review has sought to further distinguish and focus on those species that seem to be important to particularly vulnerable groups.¹⁰ Similarly, where sources of data permit, the analysis explores the implications of different production data. For example, the Big Numbers Project—a collaborative effort by the FAO, WorldFish, and the World Bank—seeks to address the lack of accurate and accessible disaggregated information on small and large-scale fisheries (FAO and WorldFish Center 2008). Some of its country case studies suggest significant differences with official data (for example, production data on Ghana’s freshwater fishery). Where appropriate, the report draws on some of those preliminary data or their implications.

Human population data are drawn from two sources: for historical data, World Bank data (World Bank 2011) are used; for population forecasts, UN population data are used (UN-DESA 2011).

Global Drivers of Change

Fisheries and aquaculture in Sub-Saharan Africa have and will respond to a series of external forces that shape supply and demand in the sector. In their study of global capture fisheries, Garcia and Grainger (2005) describe drivers in three categories useful for this study: ecological, economic, and social. Welcomme and others (2010) provides similar analyses of inland fisheries while Bostock and others (2010) and Hall and others (2011) do the same for aquaculture. In this section, we introduce these drivers and relate them to Sub-Saharan Africa. In the following sections, we continue to build on these with fisheries- and aquaculture-specific analysis.

Garcia and Grainger (2005) consider global economic development patterns, population growth, and the state of the environment as the main drivers. Globalization of markets affects trade and investment flows through factors such as trade alliances to remove barriers; low-cost transport; interconnections between product, labor, and financial markets; and deregulation of country economies. This set of factors affects fisheries and aquaculture. For example, direct access to European markets through low-cost transport and value chains governed by large European retailers and wholesalers has created and sustained the export market for Nile perch from Lake Victoria.

Hall and others (2011) mention growth in population, wealth, and urbanization as demand drivers. Population growth and urbanization are strong demand drivers as the total food need expands and urbanization changes diets and preferences. Urbanization and population growth are also significant contributors to pollution, and to competing water demands that can affect fisheries (Garcia and Grainger 2005). Economic growth leading to poverty reduction and increased incomes will shift millions of Africans toward diets both less reliant on cheap starchy staples and more diverse with animal source foods (Popkin 2008).

Garcia and Grainger (2005) point out environmental factors such as droughts could drive farmers off their farms toward open-access fisheries, increasing fishing pressure. Unfortunately, civil conflict can also frequently drive farmers off their land and into alternate pursuits where access is easy.

¹⁰ Another possible definition exists (see, for example, FAO 2007, 116) for low-value/trash fish: “Fish that have a low commercial value by virtue of their low quality, small size or low consumer preference.” However, this definition includes fish used in fish meal and, apart from countries such as Peru, where industrial fisheries of low-value species is specifically carried out for meal and oil production, this also covers countries such as China and Thailand, where fish meal conversion represents significant shares of recorded output.

Environmental pressures from pollution, acidification of oceans, and climate change can also drive changes in the fisheries and aquaculture sectors.

Population growth rates in Sub-Saharan Africa are among the highest in the world. Though declining, they remain well above world averages. Zuberi and Thomas (2012) report the rate of growth in the region reached a peak during 1980–1985: 2.82 percent per year. Global population growth rates during 2005–2010 were 1.16 percent per year, and that is projected to decline to 0.34 percent by 2050. The Sub-Saharan African population growth rates for the comparable periods are 2.45 percent per year and 1.68 percent, respectively. Zuberi and Thomas (2012) credit this to fertility decline. Despite the decline, the implications are an “overall larger demand for food with a larger population available for agricultural labor and a larger demand ... for agricultural output both domestically and internationally” (Zuberi and Thomas 2012, 5).

Rapid urbanization is also a remarkable characteristic of Sub-Saharan Africa. Currently it is the least urbanized region of the world at 37.2 percent, its urban population is growing at 3.7 percent per year (Zuberi and Thomas 2012). That was even higher during 1975–2005: urban growth rate in Sub-Saharan Africa was 4.39 percent (Fox 2011). In a global context, these rates are unprecedented. Zuberi and Thomas (2012) point out that historically national labor productivity increases with urbanization. Combined with globalization processes, however, the potential for productivity increases in African cities has become sensitive to shifts in the global economy. It is worth noting that many of the largest and fastest growing urban areas in Sub-Saharan Africa are coastal.

Sub-Saharan Africa has the highest number of people in the world living with HIV. This epidemic has seriously affected African development through declines in education and the mortality and morbidity of the agricultural workforce (Fortson 2011, cited in Zuberi and Thomas 2012). Torell and others (2007, cited in Te Lintelo 2008) suggest HIV/AIDS in fishing communities poses such threats to coastal fishery resources and biodiversity as “accelerated extraction rate for natural resources, decreased labor availability, reduced management capacity, and loss of traditional/indigenous knowledge and skills.” Te Lintelo (2008) concludes that though these appear plausible, there is little evidence to demonstrate it.

Devarajan and Fengler (2012) show that African economies have grown rapidly during the last decade, with Sub-Saharan African countries, excluding South Africa, growing at an annual rate of 6 percent. This has pushed a large number of African countries toward middle-income status. This growth in income is unequal and many Sub-Saharan African countries have very high levels of income inequality (Fox 2011). Combined with policies that have not favored urban development, this has left many urban migrants living on marginal incomes in vast slums (Fox 2011). Using FAO meat and fish consumption data, Speedy (2003) analyzed the relationship between eating meat and fish and gross domestic product (GDP). He concluded that wealth was the main determinant of per capita meat and fish consumption.

Rising global food prices have had an impact on food insecurity in many Sub-Saharan African states (World Bank 2012). An impact of the recent food price crisis was noted by Zuberi and Thomas (2012): globally the number of undernourished rose from 923 million in 2007 to over a billion in 2009, and sub-Saharan Africa has the highest rate of undernutrition, with 30 percent of the population chronically hungry.

The food price crisis of 2007–2008 affected regional economic growth. The International Monetary Fund data show 2009 real per capita GDP growth in Sub-Saharan Africa was 0.6 percent, compared to a growth of 2 to 3 percent in both 2008 and 2010—which was, nonetheless, down from annual average growth in real per capita GDP of 4.3 percent from 2004 to 2008 (IMF 2011).

Garcia and Grainger (2005) highlight that the state of the environment will also affect fisheries resources in terms of abundance, resilience, and quality. They list the end of water pollution, effective resource oversight, conservation of biodiversity, improved education, and better science among other environmental objectives that are feasible in the coming years. They note the effects of climate change possibly stressing marine stocks, increasing or decreasing local productivity significantly. Fisheries that cannot easily move, especially small-scale fisheries, would be most affected.

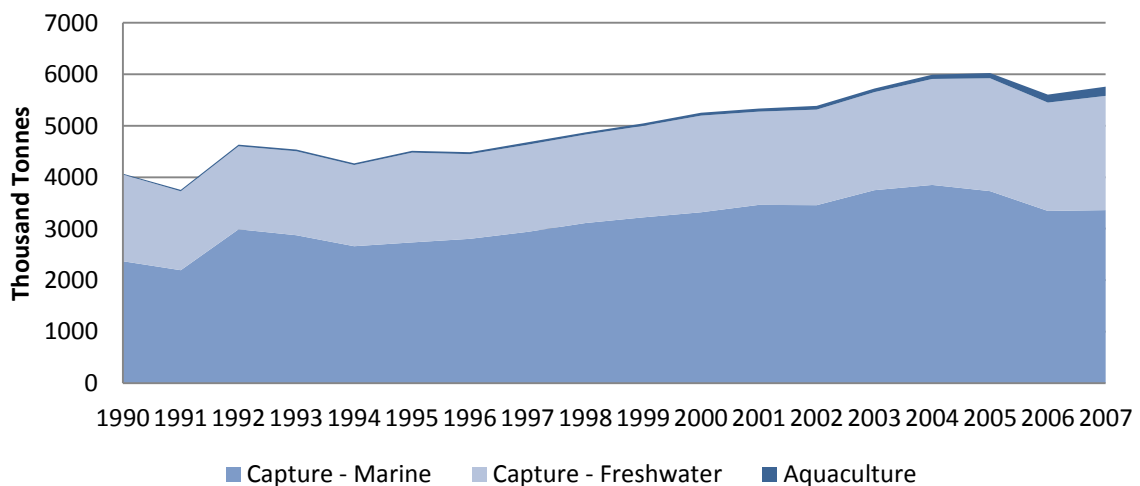
II. Patterns and Trends in Fish Production, Trade, and Consumption in Sub-Saharan Africa

This section, using secondary data and results from published research, reviews the state of Sub-Saharan Africa regional fish production, trade, and consumption.

Production

Figure 1 shows recorded production of all fish, including for food and feed,¹¹ in Sub-Saharan Africa over the period 1990–2007, broken down by marine and freshwater capture fisheries and aquaculture. Over the majority of the period, production grew in the three categories followed by a decline in marine capture fisheries output after 2004. Seven countries account for 59 percent of Sub-Saharan Africa’s production food fish: in order of importance, South Africa, Nigeria, Senegal, Namibia, Ghana, Tanzania, and Uganda. It seems unlikely that real growth in capture fisheries will occur in the region over the coming 20 years, given that 80 percent of the 523 world fish stocks for which assessment data are available are reported as fully exploited or overexploited (FAO 2009). This includes important southern African marine fisheries such as hake, pilchard, and horse mackerel.¹²

Figure 1: Total Fish Production in Sub-Saharan Africa, 1990–2007



Source: Own calculations from FishStat.

¹¹ The use of fish for feed in the region is not specifically recorded, but likely to be negligible.

¹² However, round herring is not fully exploited and improvements are also noted in the status of the southern African anchovy stocks (FAO 2009).

According to FishStat, total marine food fisheries production in Sub-Saharan Africa stood at 3.4 million metric tons in 2007 (Figure 1). Seven countries accounted for 74 percent of production: South Africa (20 percent), Namibia (12 percent), Senegal (11 percent), Nigeria (9 percent), Angola (9 percent), Ghana (7 percent), and Mauritania (6 percent). Total recorded freshwater fisheries production in Sub-Saharan Africa was 2.2 million metric tons in 2007. Five countries accounted for 62 percent of production: Uganda (23 percent), Tanzania (13 percent), Democratic Republic of Congo (DRC; 10 percent), Nigeria (10 percent) and Kenya (6 percent). The Lake Victoria fishery—important to Kenya, Tanzania, and Uganda—is not showing substantial signs of overfishing, although species distributions have changed and some commercially important fisheries have declined. Africa’s second largest water body, Lake Tanganyika, is generally not considered to be overfished either, but as with most other African freshwater resources, particularly those shared by several countries, availability of data on stock status and fishing activity is very limited.

Reported aquaculture production for the Sub-Saharan African region had reached nearly 180,000 metric tons by 2007 (Figure 1). The 2007 Sub-Saharan aquaculture output level corresponds to around 5.3 percent of reported marine capture fisheries landings, 8.2 percent of freshwater capture fish production, or 3.1 percent of total supply. In most cases, production has focused on higher-priced species, such as *Clarias* catfish, better quality tilapias, and shrimp, the last of which is primarily for export.

Capture Fisheries

Overall, the current status and trends in African capture fisheries landings suggest limited scope for significant expansion. Sub-Saharan Africa’s marine fishing fleets are mostly artisanal and focused on coastal area, while foreign, mostly developed-country, industrial fleets operate in deep waters (Chauvin, Mulangu, and Porto 2012). IAASTD (2009) reports that rural fishing communities in Sub-Saharan Africa are generally poorer than the national averages. One consequence of this is that these communities intensify individual fishing efforts with subsequent overcapitalization and overexploitation of capture fisheries. Without addressing management issues more proactively, a number of fisheries could decline further. Capture fisheries in many Sub-Saharan African countries are owned by the state but managed as “regulated open access,” thus fishers can harvest any quantity they want if they comply with regulations (IAASTD 2009). Policies and institutional capacity directed at Sub-Saharan African fisheries are generally considered too weak to design, implement, and enforce for industrial or artisanal fleets. Gutierrez, Hilborn, and Defeo (2011) point out that comanagement, where communities share management with government, can produce successful outcomes; key factors for success include leadership, social capital through community cohesion, and catch shares. Less is known specifically about the health of Africa’s inland fisheries, but evidence suggests that they experience similar resource exploitation pressures, lack effective management, and are unlikely able to deliver a significant and sustained increase in landings (Gordon, Dugan, and Egerton 2006; Welcomme and Lymer 2012; Westlund, Holvoet, and Kébé 2008; GTZ 2002). In the absence of effective and sustained management regimes in either fisheries system, any upward pressure on fish prices could also increase the incentive to overfish.¹³

Climate change can impact fisheries through various channels and through wider society and economic factors, including changing the production ecology, fishing operations, and communities’ livelihoods. (Daw and others 2009; Badjeck and others 2010). In a literature review of climate change impact on West African fisheries, Katikiro and others (2010) identified climate-related threats to both capture fisheries and aquaculture that are expected to bring changes in distribution,

¹³ The Fish and Seafood Model on which OECD and FAO (2011) base their projections only allows for 13 percent of world capture fisheries output to respond to price. Their argument is different (capture fisheries landings are controlled by quotas), but the implication of very limited scope for expansion is similar.

abundance, and productivity of fish species, thereby exacerbating local species loss. These include changes of sea surface temperatures, which could disrupt marine ecosystems. In turn, this could impact the migration of species and therefore catches in the zone. West African fisheries have social and economic relevance and climate change could be a significant threat for the livelihood of millions of people (Katikiro and others 2010).

Fishing effort across Sub-Saharan Africa follows a similar pattern and exhibits considerable adaptability in its mobility, the ability to increase effort as well as agility in targeting new species. That adaptability is seen in long-term shifts as in Ghana, where recent work by WorldFish shows how canoe fishers have maintained catch levels by sharply increasing effort over the last 15 years and in response to sudden changes that permit access to new markets. As Garcia and Grainger (2005) note, small-scale fisheries are typically less mobile. Thus developments in market access may create new or sustain existing fisheries. There are numerous examples: shark fin traders entering northern Mozambique once road infrastructure with southern Tanzania improved; road improvements in northern Ethiopia that opened up new markets in Sudan for hitherto unexploited catfish from the Lake Tana wetlands; and air services that permitted the export of prawns from Pemba in northern Mozambique to South Africa. Where fishers lack mobility but depend on fishing for their livelihood, pressure on resources is likely to be more intense but more geographically contained. Garcia and Grainger (2005) highlight the role of economic or civil disruptions leading to mass migrations into fisheries leading to various forms of over exploitation.

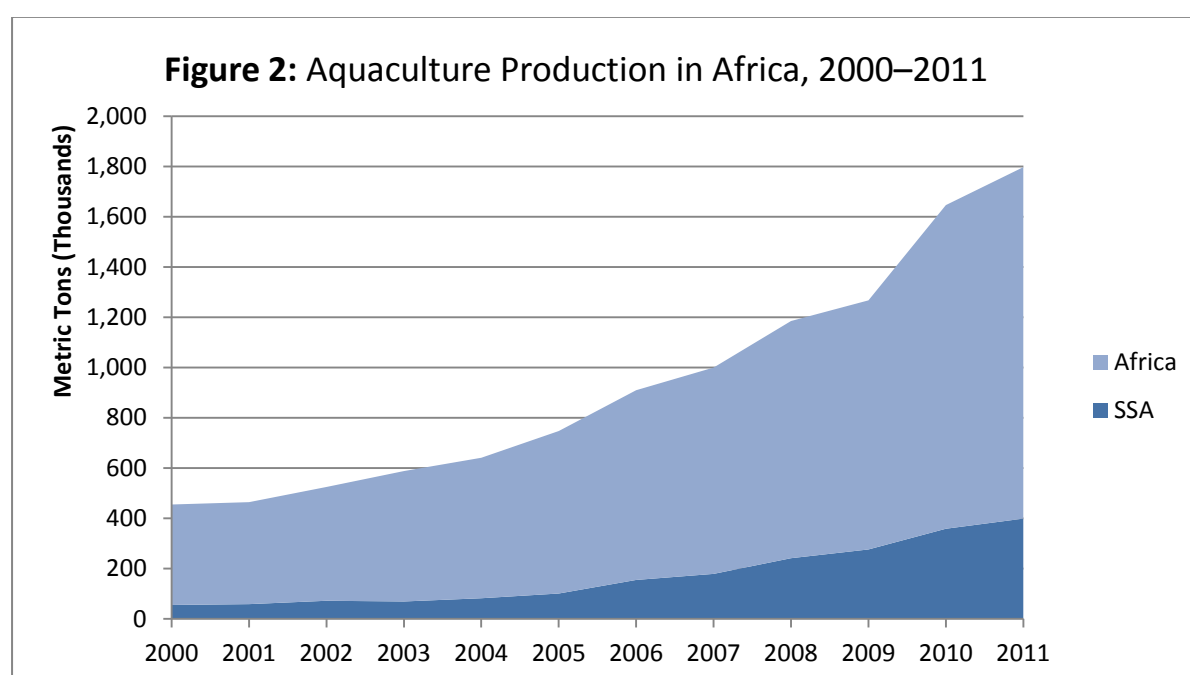
The sustainability of increased effort is variable, depending on the characteristics of the fishery. The latter depends on the target species (for example, large, slow-growing predator species are likely to be less resilient to effort than fast-growing, rapidly multiplying species), the nature of the ecosystem (for example, West Africa's marine fisheries have been relatively resilient because of continued upwelling enrichment and a relatively broad species base), and the importance of other factors (for example, many of Africa's inland fisheries have been more affected by changes in watershed management than by shifts in fisheries management (Jul-Larsen and others 2003; Njaya and others 2011). Economic drivers such as fuel prices also affect returns to fishing effort and, especially in small-scale fisheries, may lead to forms of fishing that demand less energy.

Welcomme and Lymer (2012) report inland catches in Africa increasing by 3.7 percent per year across the period 1950–2007. However, prospects for inland fisheries, which are particularly important in Africa, are less clear—partly because data collection is so problematic (Welcomme and Lymer 2012; FAO 2009). While there are many localized claims of overfishing, supporting data are often poor, contributing to a very uncertain assessment of how much growth Africa's inland fisheries can deliver.¹⁴ Inland fisheries are mostly nonindustrial, including the various subsectors of catching, processing, transportation, trade, and gear manufacture (Chauvin, Mulangu, and Porto 2012). What is also clear, however, is that fishing pressure in many inland systems is high and that water extraction, siltation, power generation, decadal-level climate cycles, and longer-term climate change all have potential to decrease output (Welcomme and others 2010). Overall, therefore, it is unlikely that much growth in output could occur, though as Welcomme and Lymer (2012) warn, data on catch and effort in most countries are judged unreliable, so predictions of future performance are speculative.

¹⁴ FAO (2009) refers to a Lake Victoria study by Kolding and Mkumbo that found no data to support claims that either the *dagaa* or the Nile perch fisheries are overexploited. Preliminary data from the Big Numbers Project (FAO and WorldFish Center 2008) suggest that the Lake Volta fishery could be significantly more productive than indicated by the official data. In their review of selected sites in the Congo Basin, Brummett, Russell, and Bondja (2010) found no sign of serious overfishing, with the important exception of *Hydrocynus goliath*, which was becoming increasingly rare in some heavily fished parts of the rivers and lakes.

Aquaculture

Aquaculture has grown very rapidly in some Sub-Saharan countries, albeit from a low base reaching 412 thousand metric tons in 2011. Figure 2 shows aquaculture production in Africa and Sub-Saharan Africa from 2000 to 2011, where production in Africa grew by an average annual rate of 12 percent and in Sub-Saharan Africa by 20 percent. North African countries report negligible production to FAO, apart from Egypt, so in Figure 2 the difference between Sub-Saharan Africa and Africa can be interpreted as Egyptian. In Sub-Saharan Africa, virtually all production is freshwater fish, dominated by tilapias, carps, and other finfishes. A very small proportion of shrimp is produced (Hall and others 2011). As illustrated in Table 1, Egypt is by far the largest producer, while among the Sub-Saharan countries Nigeria and Uganda account for almost 75 percent of production.



Source: Own calculations from FishStat, excluding aquatic plants.

Table 1: Top Aquaculture Producing Countries in Africa, 2011

Country	Metric Tons	Percentage
Egypt	986,820	70.6%
Nigeria	221,128	15.8%
Uganda	85,713	6.1%
Kenya	22,135	1.6%
Ghana	19,092	1.4%
Zambia	10,530	0.8%
Madagascar	8,835	0.6%
Tunisia	8,126	0.6%
Zimbabwe	7,602	0.5%
South Africa	3,573	0.3%
Others	24,539	1.8%
Total	1,398,093	100.0%

Source: Own calculations from FishStat, excluding aquatic plants.

Aquaculture has long been considered as a solution to augmenting fish supply in Sub-Saharan Africa and has received considerable attention from development agencies. Yet it still remains in the potential stage. Muir and others (2005) note that high production costs resulting in high prices reduce aquaculture's potential to compete with capture fisheries. Recently, high-level policy support has again been directed toward aquaculture development (NEPAD 2005). SARNISSA sponsored aquaculture policy reviews in 10 Sub-Saharan Africa countries. The reviews of Ghana, Kenya, Malawi, and Uganda all point to the existence of policy frameworks, sector regulations, and government ministries and agencies, but generally the sector development is limited by poor implementation exemplified by lack of coordination and insufficient funding (Abban and others 2009; Isyagi and others 2009; Mwale 2009; Ngugi and Manyala 2009).

In their review of cage aquaculture in Sub-Saharan Africa, Blow and Leonard (2007) note its development uniquely for tilapia production in freshwater sites. Ghana, Kenya, Malawi, Uganda, Zambia, and Zimbabwe are production centers mostly through small and medium enterprises. They consider the area of greatest potential to be in the Great Lakes region and West Africa. Constraints they identify include technical, economic, and policy issues. Several countries are reluctant to introduce high-performing tilapia species from elsewhere. High production costs due to limited extent of economies of scale and expensive feed also limit potential. Despite high-level policy endorsements from programs such as NEPAD, local applications of policy remain a constraint in many countries (Blow and Leonard 2007).

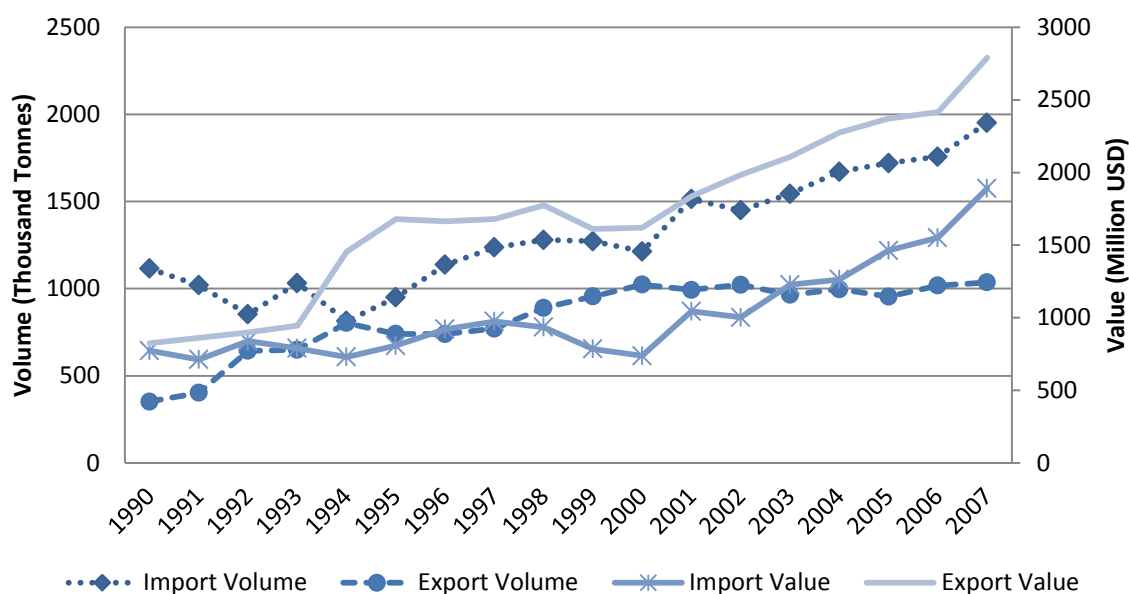
Aquaculture also has the potential to contribute to freshwater fisheries through restocking. GTZ (2002) examined the potential role of fisheries enhancement in the region using both traditional and modern practices. The study concludes that the potential for aquaculture is best captured through understanding traditional management systems and supplementing them. Success of traditional management systems have depended on well-established and understood property rights. Blending support from re-stocking via aquaculture and traditional systems face serious constraints in open-access settings (GTZ 2002).

If current rates of growth are maintained from their existing bases, and targeted toward supplying domestic markets, aquaculture could account for a larger share in African fish consumption. Extrapolating from existing aquaculture growth rates to 2011 and assuming similar per capita consumption levels, by 2017 aquaculture could potentially supply 12.5 percent of the fish consumed in Sub-Saharan Africa. However, much would depend on the ability to overcome practical supply and quality constraints for higher-quality feed and seed, an improved policy environment that facilitates small and medium enterprise development and market chain infrastructure. These enterprises can focus successfully on both the high-value and low-value fish markets with connections especially to urban centers.

Trade

Illustrated with Figure 3, Sub-Saharan African trade in fish products showed strong growth over the period 1990–2007. The region has a positive trade balance in food fish, with export value exceeding import value by about 6 percent in the early 1990s and rising to nearly 50 percent by 2007. However, throughout this period import volumes have exceeded export volumes (by roughly 70 percent by 2007). Despite the importance of imports to African food fish consumption, the region accounts for only 2 percent or less of global import volumes.

Figure 3: Food Fish Trade, Sub-Saharan Africa, 1990–2007



The unit value of exports rose by 0.82 percent per year in the period 1990–2007, and the share of low-value fish within total export volume also gradually increased, from roughly 35 percent to 60 percent. Without species-specific trade shares, this could imply the value of low-value fish has gone up or the value of high-value fish grew faster than the growth in the share of low-value fish in total export. The unit value of imports rose by 2 percent annually, while the low-value species share of import volume dropped from roughly 90 percent to 81 percent. It is unclear whether the reduced levels of lower-value fish were primarily responsible for the higher import prices.

Even with the growth, the low-value fish trade is the source of a small proportion of all fish consumed. For Sub-Saharan Africa as a whole, net imports (imports less exports) account for less than 20 percent of low-value fish consumption volume. Table 2 shows that food fish imports and values grew considerably faster since 2000, this trade growth coinciding with a period of higher economic growth rates in the region.

Table 2: Annual Growth Rates in Food Fish Trade, Sub-Saharan Africa, 1990–2007

	1990–2000	2000–2007
Import volume	0.8%	7.0%
Import value	-0.5%	14.4%
Import unit value	-1.3%	6.9%
Export volume	11.3%	0.2%
Export value	7.0%	8.1%
Export unit value	-3.9%	7.9%

Source: Own calculations from FishStat.

Fish Imports

Imports of fish in the region have been gradually increasing. Total imports of food fish rose from approximately 1.1 million metric tons in 1990 to nearly 1.9 million metric tons by 2007, growing at 7 percent per year. This is significantly faster than population growth, and despite an apparent

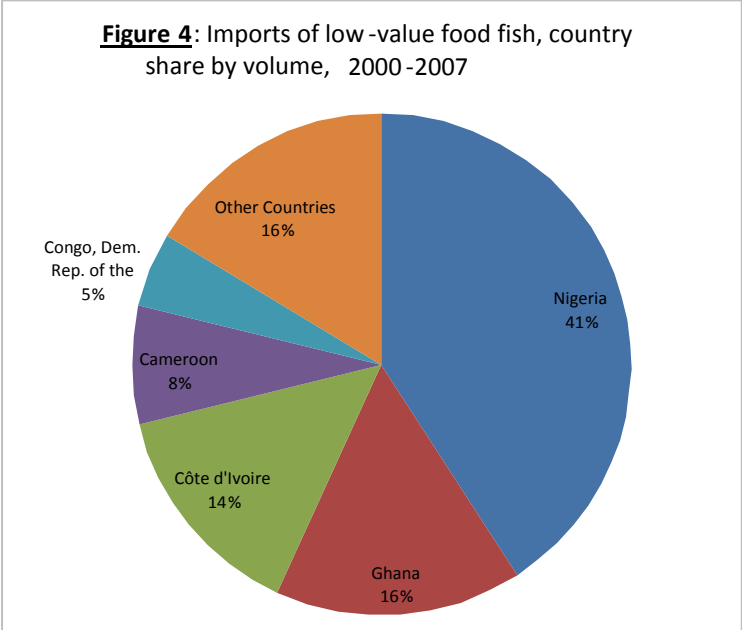
increase in output from both capture fisheries and aquaculture. Import volumes also grew despite unit values also increasing 7 percent annually over the same period.

Continental Africa’s imports of fish and fishery products (based on average c.i.f. values over 2006–2008) are sourced mainly from Europe (35 percent) and in roughly equal measure from Asia (22 percent) and other African nations (23 percent) (FAO 2010). Population growth and rising real incomes are positive drivers of this demand.

Africa’s fish imports are dominated by small pelagics, including anchovies, herrings, mackerels, and sardines. These are also the major species fished for non-food uses, including reduction into fish meal and fish oil for use in livestock and aquaculture feed. Price levels of fish species targeted for reduction tend to be significantly lower than those for direct human use. With low levels of aquaculture production, most of those imports are for human food consumption, not for conversion to feed, thus placing African consumers in competition with the global animal feed industry. Africa (including North Africa) accounts for 24 percent of global imports of small pelagic food fish by volume.

Notwithstanding debates in the literature on the food versus feed use of fish and the extent to which fish fit for human consumption ends up as an input to the feed industry (Tacon and Metian 2009; Naylor and others 2000), the increasing growth of aquaculture and its reliance to date on fish meal–dependent feeds may have exerted some upward pressure on traded values of the lowest priced small pelagic food fish. Future projections are, however, more difficult to make, given significant shifts to aquaculture species that can grow with lower animal protein content in their diets and with improved formulation of feeding regimes, and greater diversification into non-fish raw materials (Bostock and others 2010).

Five countries account for 84 percent of the import volumes of low-value fish: Nigeria, Ghana, Côte d’Ivoire, Cameroon, and the DRC (Figure 4). Important sources of exports to Sub-Saharan Africa include Namibia (Franz, Hempel, and Attwood 2004, cited in Tacon and Metian 2009), Morocco, Mauritania, and the EU, as well as South American, South Pacific, and Asian suppliers (Rondon and Nzeka 2010; DoF – Ghana 2003)..



Source: Own calculations from FishStat.

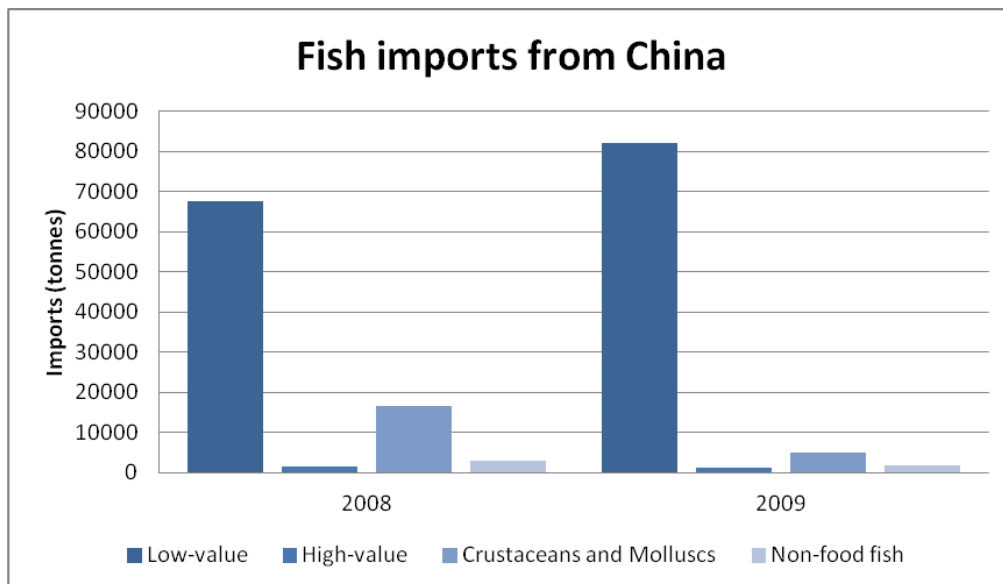
Based on 2006 data, Nigeria is the world’s single largest importer of small pelagic food fish. Ghana is the third largest, while Côte d’Ivoire and Cameroon rank 12th and 15th, respectively (Tacon and Metian, 2009). Frozen mackerel and herring account for 90 percent of this trade. EU countries, led by the Netherlands, supply 60 percent of the imports. Rondon and Nzeka (2010) report Nigeria importing 800,000 metric tons of frozen fish in 2009, mostly mackerel, herring, and croaker. Nigeria also imports 160,000 metric tons of higher-value frozen stockfish, mostly from Norway. Rondon and Ashitey (2011) project Ghana importing 250,000 metric tons of frozen fish in 2011, with the main imported species being frozen mackerel, horse mackerel, sardines, and sardinella. They note the main suppliers are, in order of importance, Mauritania, the United Kingdom, Poland, the Netherlands, and Belgium.

In recent years, there have been a number of reports of frozen tilapia from China (presumably farmed) being sold in African markets. Meador, Wu, and Han (2011) report growing Chinese exports to Angola, Cameroon, and Côte d’Ivoire. Analysis of the available data shows that China provides 4 percent of fish imported by Sub-Saharan countries (Box 1).

Box 1: Sub-Saharan African Imports of Fish Products from China

FAO data do not indicate that China is an important exporter of fish products to Sub-Saharan Africa. In 2009, over 90,000 metric tons of fish products were imported from China, with a total value of just under \$150 million. This accounts for just 4 percent of the volume of all Sub-Saharan African imports in 2007. Low-value fish constituted the largest portion of these imports (91 percent), followed by crustaceans and molluscs (5.6 percent), non-food fish (2.1 percent), and high-value fish (1.3 percent).

Of low-value fish, 27 percent was mackerel, the rest being sardines, processed fish, and frozen unidentified fish. The five main importers were Nigeria (55 percent), South Africa (10.5 percent), Côte d’Ivoire (6 percent), Cameroon (5.5 percent), and Ghana (4.5 percent).

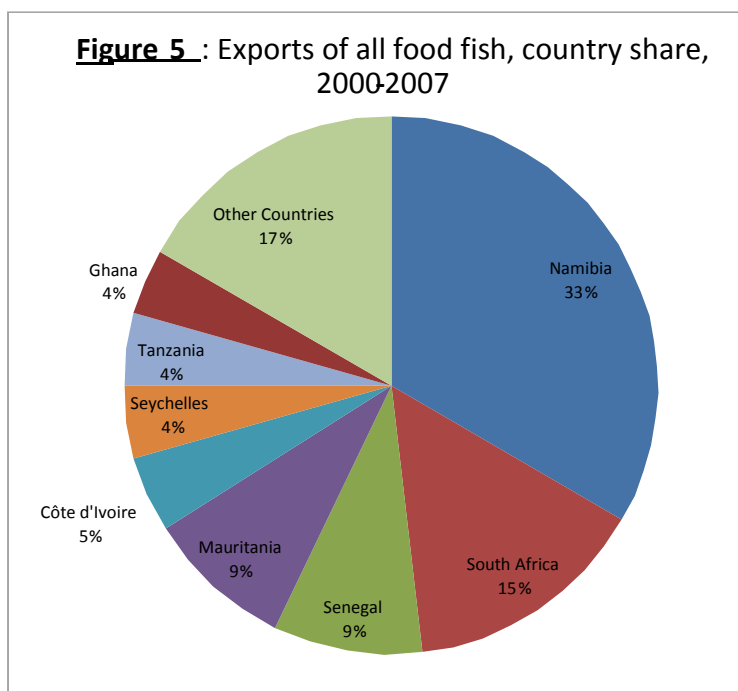


Fish Exports

The FAO data indicate that Europe is also the most important export destination of African fish exports, accounting for 70 percent of all exports based on c.i.f. values in destination country. Asia is the second most important destination with a 15 percent share.

Five countries account for 71 percent of Africa’s fish export volume: Namibia, South Africa, Senegal, Mauritania, and Côte d’Ivoire (Figure 5). Analysis by value reveals slightly less concentration, with seven countries accounting for 70 percent of export value; this group also includes Madagascar, Tanzania, and the Seychelles, but excludes Mauritania. Namibia’s exports are mainly small pelagics, most of which are destined for South Africa, particularly canned pilchards and anchovy meal or oil; it sends 70 percent of its horse mackerel to the DRC (Tacon and Metian 2009, quoting Franz, Hempel, and Attwood 2004).

As seen in more detail next, there is considerable intra-regional trade within Sub-Saharan Africa. For example, most of Senegal’s small pelagic exports are destined for other African countries as frozen or processed fish, notably to Burkina Faso, Cameroon, Côte d’Ivoire, the DRC, and Ghana (Démé 2008). By contrast, only a small share of Mauritania’s fish exports had been noted to route to Sub-Saharan Africa, mostly to Nigeria (Anon 2001), and only 3 percent of South Africa’s exports by volume were destined for other African nations (Yacob and others 2006).



Intra-Regional Trade

Namibia and Senegal therefore appear to be key players in the visible component of intra-regional exports, and Côte d’Ivoire, Ghana, Nigeria, Cameroon, and the DRC are notable importers. Those importing countries may re-export some of this due to their marine ports and relatively good connections for landlocked countries. However, Nigeria and the DRC are very large markets in their own right, pulling in fish imports across many of their borders. For Cameroon, a portion of imports could be destined for re-export, but the most likely market would be Nigeria, as Chad has its own fish supplies. This trade, however, is largely unrecorded as discussed in the section below.

Tsamenyi and McIlgorm (2010) examined fish trade among the Africa-Caribbean-Pacific (ACP) members of the Commonwealth of Nations and point out that this fish trade accounted for only 9 percent of the countries’ total value of fish exports. This, however, is a distinct improvement over 1996, when ACP countries did not have recorded fish trade with each other. Trade with the EU accounted for 57 percent of export value in 2007.

Tsamenyi and McIlgorm (2010) compared trade across regional groups (intra-ACP trade) and trade between countries in a region (within ACP region trade). Intra-ACP trade among the nations of the west, eastern, central, and southern Africa regions dominates ACP fish trade and illustrates the importance of fish trade among African countries. West Africa is the major regional importer for all other Sub-Saharan regions. Within West Africa, trade flows include frozen fish imports by Nigeria, tuna for canning in Côte d'Ivoire and Ghana, and fish imports by Senegal. The DRC imports fish and frozen fish. Intra-ACP trade includes West and East African imports of fish, frozen fish, and tuna from Namibia, South Africa, and Tanzania, all members of the Southern African Development Community (SADC).

Among exporters, the southern African states, with their rich fish stocks, are the leading intra-ACP exporters, sending fish to eastern and central Africa. Mauritius, the Seychelles, and South Africa export tuna. In West Africa, fish, frozen fish, and tuna from Ghana and Senegal lead the exports. In East Africa, Uganda exports fish and frozen fish from its freshwater lakes.

Senegal and Mauritius are the only notable re-exporters. Mauritius has established a Seafood Hub to add value to its fish industry through “trading, warehousing, processing, distribution and re-export of fresh, chilled and frozen or value added seafood products” (Bauljeewon 2011). The Hub has attracted investments from France, Italy, and Spain, particularly for tuna canning. The strategy is to add value to a broad range of seafood-related sectors from fishing, infrastructure for food processing and trading activities, and ship maintenance. Built on 592 calls of fishing vessels to the Hub, the value of its re-export was \$270 million based on about 105,000 metric tons in 2010. These were mostly frozen fish, distantly followed by tuna. Tsamenyi and McIlgorm (2010) report with 2007 data that \$62 million of the re-exports was intra-ACP trade. Virtually all of the remainder is destined for the EU. Senegal re-exports a more diversified set of products, led by tuna, mollusks, frozen fish, and crustaceans. In 2009, Africa became the largest export market for Senegal with 58 percent of the export market, or 96,000 metric tons. Europe dropped to second place with 38 percent.¹⁵ Re-exports represent only 30 percent of the total export value.

Tsamenyi and McIlgorm (2010) noted the paucity of detailed data, especially on fish types. They were, however, able to report by all trade by product categories for the SADC countries. Notable is the dominance, in order of importance, of South Africa, Namibia, Mauritius, the Seychelles, and Tanzania, accounting for over 93 percent of total exports. Interestingly, Mauritius is a leading importer, too, reflecting the role of its processing industry in adding value and re-exporting.

Informal Cross-Border Trade (ICBT)

There are also important trading corridors in Africa, particularly in inland areas, where trade is less likely to enter the official statistics. In some areas, fish is an important part of this trade, with the DRC and Nigeria being particularly important markets. Important suppliers for ICBT in fish are Lake Victoria and various coastal and inland West African countries (Gordon, Dugan, and Egerton 2006). Some of the informal cross-border trade follows historic trading routes, and the same country may be both an important importer in one district and an exporter from another. Data on ICBT are extremely poor and few relevant studies exist. However, one study points to the potential significance of such trade. Neiland and Béné (2004), cited in Neiland (2006), document trade flows of 100,000 metric tons per year of dried fish from the Lake Chad fishery to cities in southern Nigeria. Anecdotal evidence also reports significant trade flows from northeast Zambia into Lubumbashi in southern DRC, and similar flows are likely to cross borders in other locales in Sub-Saharan Africa.

¹⁵ <http://www.tradeafricablog.com/2011/06/africa-replaces-europe-as-prime-market.html>.

Nigeria's informal imports of fish products are almost exclusively smoked or dried, contrasting with officially recorded imports of low-value frozen pelagics from Mauritania, Namibia, and non-African suppliers, though there are imports of (dried and/or salted) stockfish from some European countries (Rondon and Nzeka 2010). Official FAO data attest to Nigerian imports of dried and smoked products from Mali, Niger, and Senegal; imports that enter via inland borders are, in particular, likely to be higher than those officially reported.

Fish has long been an important component of diet in the DRC. It too imports significant quantities of low-value frozen pelagics, but these are mostly, if not exclusively, destined for Kinshasa. Historically, for densely populated parts of eastern DRC, Lake Victoria has served as an important source of cured fish products, despite road conditions that, though since improved, had made this a very long journey.¹⁶ Nanyaro, Mbiliyi, and Medard (2003) reported that 64 percent of Tanzania's *dagaa*¹⁷ exports were sent to the DRC. Mwikya (2004) also suggested that the DRC imported dried fish from Lake Turkana, though other authors did not mention this. Southeastern DRC, however, was known to serve as a source of fish destined for Zambia's copper-belt towns.

In addition to Lake Victoria's extra-regional exports of frozen Nile perch fillets, the lake is an important producer and exporter of fresh and cured fish products (tilapia, other cichlids, and *dagaa*) for local and regional markets. According to van der Knaap (2008), virtually all the Nile perch is exported to extra-regional markets as frozen or fresh fillets¹⁸ but WorldFish work in 2011 also underlines the importance of the *carcasses* (that is, frames—heads, non-fillet flesh—commonly cooked and dried) in domestic and regional trade. *Dagaa* is exported to the DRC and Kenya, as well as Burundi and other countries in the region (Nanyaro, Mbiliyi, and Medard 2003).

The inland delta of the Niger River, in Mali (and in particular, Mopti), is also an important source of fish within the region. Previously this trade was almost exclusively focused on dried fish, but with improved road infrastructure, ice plants in Mopti, and rising incomes in neighboring countries, more fish is being traded in fresh or frozen form. Refrigerated trucks take fish from Mopti to Bamako and Sikasso in Mali, as well as to Bobo-Dioulasso and Ouagadougou in Burkina Faso.¹⁹ While this trend is not observed widely so far in informal and cross-border trade, it illustrates the potential for change, adding value and reaching into higher-value markets. Nigeria's trade data indicate some imports of cured fish from Mali, and dried fish from Mopti are even reported in markets in Kumasi in Ghana (Laila Kassam, pers. comm.).

Trade Policy

Tsamenyi and McIlgorm (2010) examined trade policy as it relates to fish using the African regional trade groupings, Community for East and Southern Africa (COMESA), SADC, and the Economic Community of West African States. They examined frameworks and facilitation rules for tariff and nontariff barriers. They found that, in general, the existing frameworks were not fish specific and thus failed to address industry-specific aspects of fish trade. They noted that policy was not harmonized among the different trading blocks. For tariffs, the trade groupings apply the most

¹⁶ Fieldwork by Gordon (present coauthor) in 1991 revealed salted dried and smoked split Nile perch being exported to the DRC from Tanzania (Lake Victoria) by road through Uganda's Kagera region, apparently destined for North and South Kivu. At this time, Tanzania and Uganda had very few factories producing frozen fillets for extra-regional export.

¹⁷ *Rastrineobola argentea*, an abundant small pelagic species, widely fished, commonly dried for use.

¹⁸ In addition, there has been an element of informal export, with Ugandan and Tanzanian Nile perch fishers landing their catch in Kenya or transferring their catch to the boats of Kenyan fishermen, in order to secure higher prices.

¹⁹ Observations from field research by Ann Gordon in 2008.

favored nation (MFN) treatment to the groupings of fish and fish products. The MFN tariff is a normal tariff charged on imports, but it excludes preferences granted under free trade agreements or other schemes. In addition, there are *ad valorem* (basically sales taxes) that range in ACP countries between zero and 40 percent. Complete tables by country are found in the reference. They show substantial and variable rates among countries. The range of these rates illustrates the lack of harmonization in trade liberalization in the region. The policies of the regional trade groups are to reduce and eliminate import duties. Lacking effective domestic tax collection capacity, many of the country governments rely heavily on trade taxes, so progress on trade tariff harmonization will probably be slow.

Nontariff barriers include any regulations to trade other than tariffs that are restrictive. They typically include legal, administrative, and bureaucratic rules, and sanitary and health regulations. Tsamenyi and McIlgorm (2010) compiled a listing of nontariff barriers in SADC and COMESA, noting that “the key message from the table is that there are a range of genuine and not so genuine reasons.” They detailed other factors not on the table, including political and civil unrest; poorly formed credit systems; difficulty in foreign exchange payments; inadequate fish trade infrastructure, which impedes achievement of good health standards; untrained workforce, and corrupt border officials.

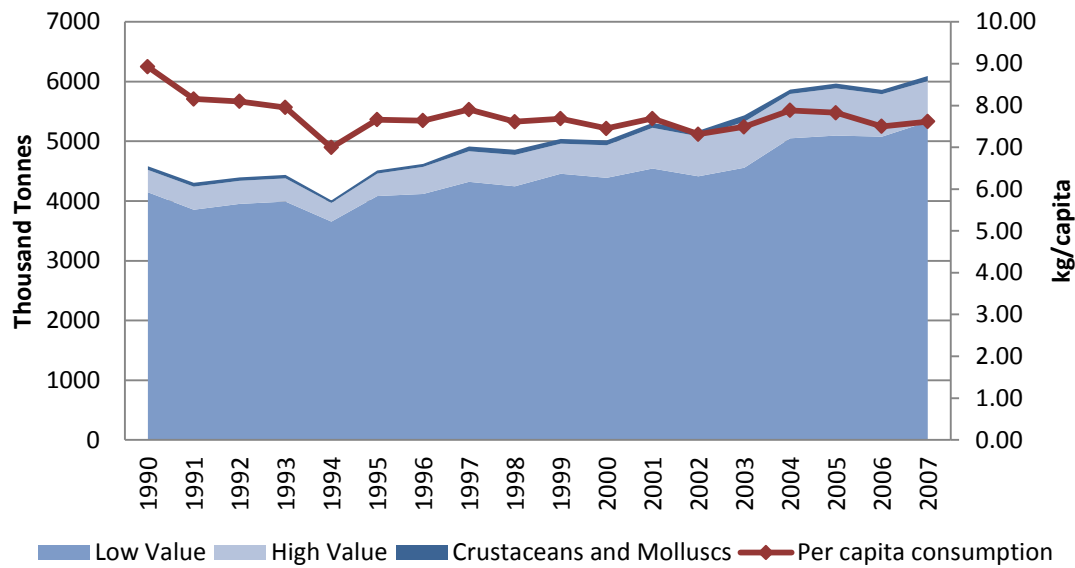
Consumption

Fish are the most important source of animal protein for millions of Africans. Tacon and Metian (2009) list 21 African countries where fish supply over 25 percent of animal protein. In the coastal nations of West and Central Africa, fish are particularly important. Leading the list is Ghana, where fish provide 62 percent of animal protein supply. Fish also occupy an important share in the populous nations of the DRC (41 percent), Angola (32 percent), Nigeria (28 percent), and Tanzania (27 percent). Yet many African countries have per capita consumption rates well below world averages, and those rates are declining. Further, the 21 high-share nations include some of the poorest countries in the world, where consumption of any animal protein is low, so the share of fish is compared to a low initial base.

In Figure 6, consumption of food fish in Sub-Saharan Africa (based on capture fisheries production and aquaculture, plus imports, less exports and non-food uses) was charted over 18 years (1990–2007), broken down by low- and high-value fish, as well as crustaceans and mollusks. Around 85 percent of the fish consumed is classified as low value according to the system described above and in Table A.2. Consumption of crustaceans and mollusks is relatively insignificant. Consistent with the *Fish to 2020* predictions, aggregate consumption over this period increased from around 4.5 million to around 6 million metric tons, while annual per capita consumption registered a slight downward trend of roughly 1 percent per year, falling from 8.9 kilograms in 1990 to 7.6 kilograms by 2007.²⁰ The divergence of these trends is explained by production and net import growth not keeping pace with population growth.

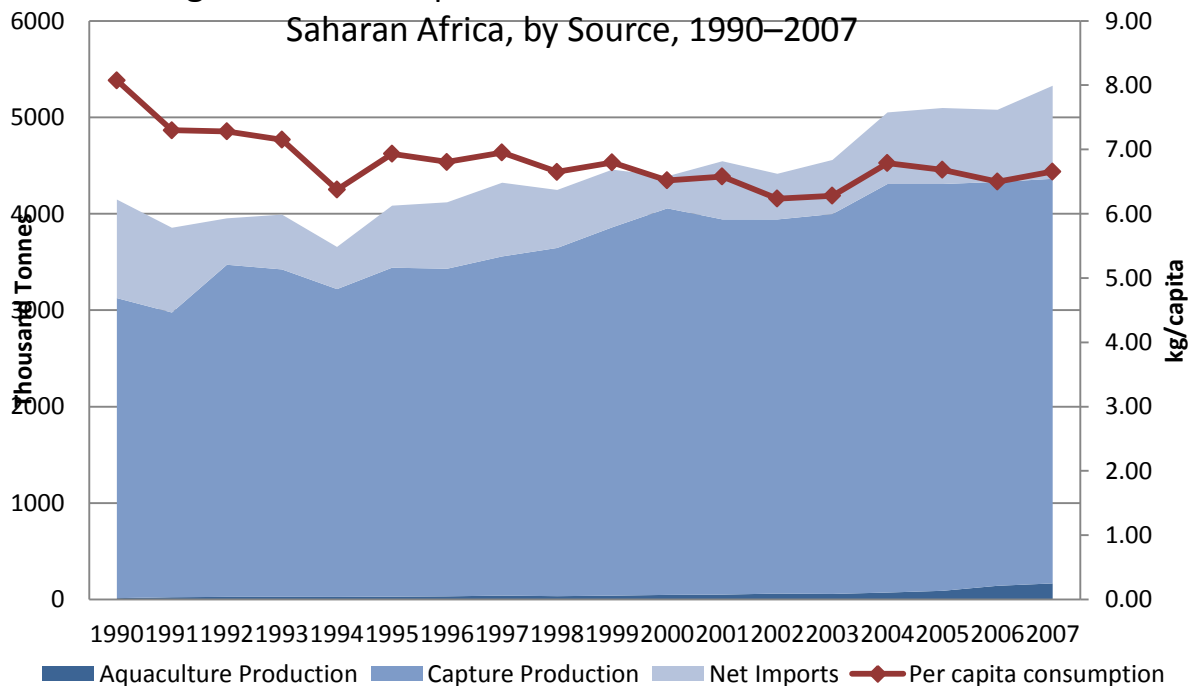
²⁰ This seems to follow a longer-term trend. For an earlier period (1975/79–1990/94), Delgado, Crosson, and Courbois (1997) used a semi-log regression to estimate the annual compound change in per capita consumption in sub-Saharan Africa, reporting a value of -0.9 percent.

Figure 6: Consumption of Food Fish in Sub-Saharan Africa, by Species Group, 1990–2007



For low-value fish consumed in Sub-Saharan Africa, Figure 7 illustrates the source: net imports, capture fisheries, and aquaculture. For the region as a whole, consumption of low-value fish over the period increased from roughly 4 million to about 5 million metric tons. Mirroring the trend from total food fish consumption, per capita consumption declined over the period from 8.8 kilograms per year to 6.7 kilograms per year. Total consumption growth appears to have come principally from growth in capture fisheries, though net imports have also increased.

Figure 7: Consumption of Low-Value Food Fish in Sub-Saharan Africa, by Source, 1990–2007



A review of the species group breakdown for the import and capture fisheries components of low-value fish consumption reveals that 35 percent comes from freshwater fisheries and 41 percent

from the two groups “sardine, herring, anchovy” and “miscellaneous pelagics.” This underlines the key role of small pelagics as well as the importance of freshwater fisheries in Africa. Globally, inland capture fisheries represent only 7 percent of production (FAO 2009), though this is probably an underestimate (FAO 2010). Africa possesses extensive freshwater resources, including lakes, rivers, and wetlands that are productive fisheries. Thus freshwater fisheries are likely to continue to supply a significant share of capture fish production in Sub-Saharan Africa.

As identified above, population growth in Sub-Saharan Africa will likely continue to be an important driver of fish consumption. Figure 8 projects fish consumption to 2030 on the basis of four different population growth scenarios, assuming that 2007 per capita consumption levels of all food fish are maintained. Different population growth rate scenarios show aggregate fish consumption will increase by 65 percent to 89 percent by 2030. The higher projection is based on current fertility levels and annual population growth in the range 2.65 to 2.85 percent over the 20-year period 2010–2030. The lower projection is based on the lowest of three alternative population growth scenarios, where annual population growth drops to between 2.27 and 1.83 percent.

Figure 8: Aggregate Food Fish Consumption Projections for Sub-Saharan Africa to 2030

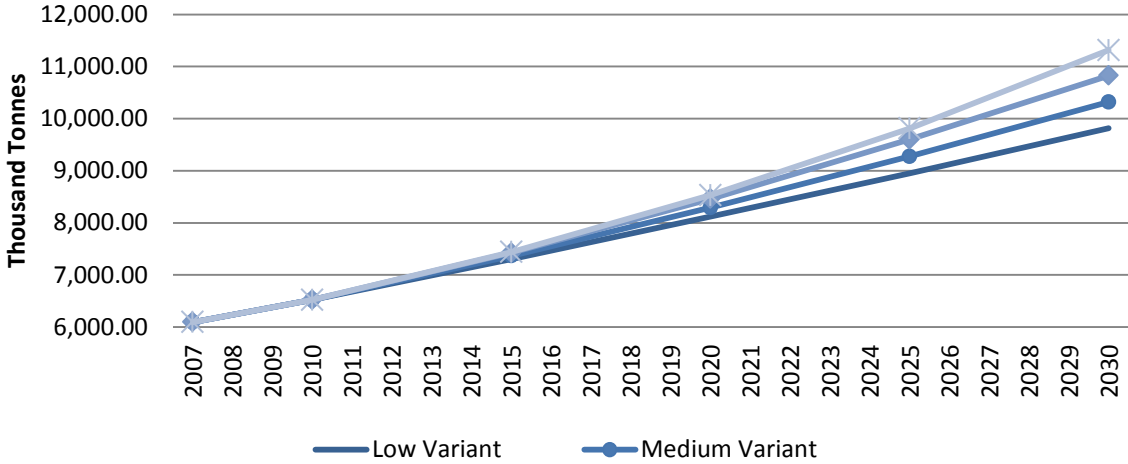


Figure 9 shows low-value fish consumption shares by country. Based on average volumes over 2000–2007, only eight countries account for a large share of low-value fish consumption in Sub-Saharan Africa. Nigeria, Ghana, Senegal, the DRC, Uganda, Tanzania, Cameroon, and Côte d’Ivoire account for 67 percent of consumption, with Nigeria and Ghana accounting for 33 percent. Those shares are not so surprising, as these eight countries account for 44 percent of Africa’s population.

Table 3 illustrates per capita consumption rates of low-value fish tracked over the period 1990–2007 for three country groups: average consumption level of more than 20 kilograms, of 10 to 20 kilograms, and of less than 10 kilograms, based on their averages during 2000–2007. See Table A.3 for the countries in each group.²¹

²¹ Data problems with Namibia and the Seychelles prevented their inclusion (see section I).

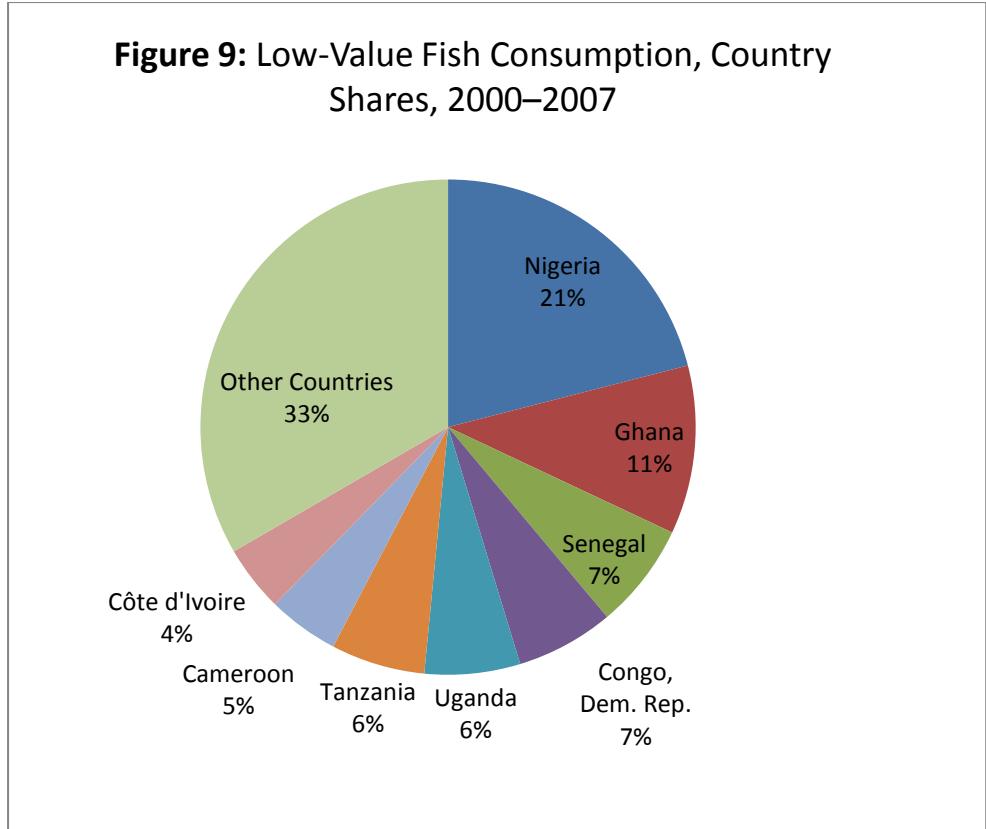


Table 3: Growth in Per Capita Consumption of Low-Value Fish, by Consumption Levels, Sub-Saharan Africa

Consumption level	1990–2000	2000–2007
>20 kg	1.6%	-0.1%
10–20 kg	-3.1%	3.2%
<10 kg	-3.0%	0.3%

Note: Countries allocated to each of the three groups based on average per capita consumption levels during 2000–2007.

The top eight consuming countries in Figure 9 are spread across the per capita consumption range. Ghana and Senegal consume more than 20 kilograms per capita a year; Cameroon, Côte d'Ivoire, and Uganda are in the 10–13 kilogram range; and finally, three populous but relatively low-level consumers—the DRC, Nigeria, and Tanzania—are in the low per capita consumption range of 5 to 8 kilograms.

Only 14 countries have per capita low-value fish consumption rates exceeding 10 kilograms per year (including a small group whose rates exceed 20 kilograms per year: Gabon, Senegal, Ghana, The Gambia, Mauritania, and Sierra Leone) and 21 countries consume less than 5 kilograms per capita a year. While all the big per capita consumers are nations with a significant marine fishery, not all of the latter are big consumers; Guinea-Bissau, Madagascar, and Mozambique all have consumption rates of 6.1 kilograms or less.

Table 3 shows that for the high-level consuming countries there is an erratic but slightly upward trend over the whole period; for the middle group, per capita consumption appears to initially dip and then gradually recover from the mid-1990s onward; and the low per capita consumer countries show a slight downward trend in consumption, dropping from 5.9 kilograms to 4.5 kilograms (not

shown in table). Over the period studied, notable declines are evident for several countries, including Kenya (8 kilograms to 3.5 kilograms), South Africa (9 kilograms to 3.5 kilograms), Liberia (7 kilograms to 3 kilograms), Togo (10.5 kilograms to 5 kilograms), Malawi (8 kilograms to 5 kilograms) and Tanzania (16 kilograms to 6.5 kilograms).²² As Table 3 shows, the average rate of decline in low-consumption countries leveled off after 2000, while consumption in middle-level countries grew more distinctly.

Table 4 illustrates the importance of fish as a source of animal protein in selected Sub-Saharan Africa countries. Though by global standards these countries have relatively low per capita fish consumption, low consumption of other animal proteins means that fish makes up over 30 percent of the total. Even these small amounts of fish provide essential vitamins, minerals, and fats in otherwise nutrient-poor diets. The relative accessibility of low-value fish to these groups makes even such small quantities of fish critical for nutrition and health.

Table 4: African Countries Where Per Capita Fish Consumption Is Below the Global Average, but Fish Protein Makes Up More Than 30 percent of Total Animal Protein Supply

Country	Annual per capita consumption (kg)	Fish as % of animal protein
Malawi	4.6	35.9%
Congo, Dem. Rep.	5.3	42.1%
Togo	8.1	42.9%
Nigeria	9	34.7%
Benin	10.3	31.8%
Guinea	11.1	38.6%
Uganda	11.5	34.3%
Cameroon	14.7	36.1%
Cote d'Ivoire	15	35.4%

Source: FAO 2009.

Prices

Price has an important bearing on household purchasing behavior, whether in relation to own-price elasticities or cross-price elasticities. Detailed and accurate time-series data on fish prices in Africa are difficult to obtain. The FAO's fish price index provides global coverage since 1994, and in its present form it represents about 57 percent of all fish traded internationally (FAO 2010). The fish price index indicates falling or steady global prices until an upward trend started in 2002. There was a spike in the index in 2008, followed by a 7 percent fall in 2009, but it returned a 9 percent increase in 2010 and 12 percent in 2011 (FAO 2012). The FAO trade data for Sub-Saharan Africa used in this report indicate that the annual increase in the nominal value of fish imports during the period 1990–2007 was 2 percent. The “low value” share in imports fell from 90 percent to 80 percent over the same period. The nominal value of fish exports rose by only 0.82 percent per year and the low-value share in exports increased from roughly 50 percent to 70 percent.

A similar trend was reported in the analysis of the unit value of global fish exports up to 2004, adjusted for inflation (World Bank and FAO 2008). However, an analysis of traded fish unit values for Africa during the period 2000–2007 shows a much more rapid increase (8 percent per year for exports and 7 percent for imports). Delgado and others (2003) reviewed trends in real export values for six different categories of fish: all were negative during two periods (1977–1985 and 1985–

²² For the other countries in this group, it is either difficult to discern a trend, or per capita consumption has increased, stayed roughly the same, or fallen only slightly.

1997), except shrimp, tuna, and cod, whose real value increased in the second period (though shrimp by only 1 percent). These results should be interpreted cautiously, however, since trade values are not always a good indicator of domestic market prices. These authors also reviewed price trends in the United States, noting that fresh and frozen fish showed a long-term increase in real prices since 1947, but real values of canned finfish products, less favored in developed countries since the 1970s, have declined since that period.

Delgado and others (2003) projected trends in real fish prices for 2020 under different scenarios. Their “most likely” scenario showed rising real prices for all categories of fish, relative to 1997 (and only a few exceptions, under alternative scenarios), but falling prices for other animal protein sources. The real price of low-value food fish was predicted to rise by 6 percent in the most likely scenario. OECD and FAO (2011), using a different model, also predicted rising real prices up to 2020.²³ However, although the FAO data for Sub-Saharan Africa show a steeper rise in real unit trade values for more recent years, it is difficult to discern the effect on consumption. As indicated above for the region as a whole, per capita consumption of all fish fell by about 1 percent per year over the period 1990–2007. This fall was fairly consistent, as consumption did not fall more steeply in the years 2000–2007, when real traded unit values appeared to be rising much faster. However, this also coincided with a period of stronger economic growth, and so may have interacted with income effects on demand.

Intra-Household Resource Allocation and Nutrition

Though food security is often conceptualized at a household level, individual consumption patterns and nutritional outcomes depend not only on the ability of households to secure food but also on how food is distributed within households (Haddad, Hoddinott, and Alderman 1997; Quisumbing and Maluccio 1999). While it is possible to make some broad generalizations at a regional level, patterns of intra-household food allocation vary among countries, subregions, and ethnic groups. Most of the literature describing this is ethnographic, focusing on qualitative features of social behavior rather than quantitative nutritional assessments. Though many of these studies discuss differences in the allocation of nutrient-dense foods, most do not discuss fish separately from other animal source foods, and some do not distinguish between different types of food at all. Findings from a selection of these case studies are summarized in Table 5.

Of particular interest is that intra-household allocation is relevant not only for the total quantity of food consumed by each household member but also for the allocation of different types of food. For example, non-staple foods such as low-value fish are more likely to exhibit disparities in intra-household distribution than staples (Gittelsohn and Vastine 2003). However, the divisibility of many low-value fish products may contribute to them being shared more equally than other animal source foods as shown by Thilsted, Roos, and Hassan (1997) in Bangladesh. Though she did not examine intra-household consumption patterns, Kawarazuka (2010) notes a similar dependence of the poorest households on consumption of small dried fish from inland fisheries in Sub-Saharan countries. These are sold in quantities of only a few hundred grams and served as side dishes to the main starchy staple.

The common perception of intra-household resource allocation is that females are disfavored in access to food, particularly nutrient-dense foods such as fish (see, for example, Sen and Sengupta 1983). Much of the research on this has been done in South Asia, however, and cannot be assumed to be universally applicable. Evidence suggests that patterns of intra-household food distribution in

²³ For the first time, fish and seafood markets are included in the OECD-FAO medium term outlook projections using a new dynamic policy specific partial equilibrium model, which has links to, but is not integrated into, the Aglink-Cosimo model used for the agricultural projections (OECD and FAO 2011, 155).

Sub-Saharan Africa appear to be relatively heterogeneous, varying between countries, ethnic groups, and even from household to household (van Steenberg and others 1984; Okeke and Nnanyelugo 1989; Akerele 2011). Factors that influence the quality and quantity of foods in the diets of different household members include age, status within the household, gender, and special nutritional needs related to life stages such as weaning and pregnancy. As in other societies, intra-household food distribution is also affected by external events and can be altered by economic or food crises.

To illustrate the heterogeneity found in the literature, Gittlesohn and Vastine (2003) report that in much of Africa, elders are often given preferential access to fish and other animal source foods and there are even taboos against the consumption of protein-rich foods by children. This is not universal, however; for example, in parts of rural Mali, fresh fish is seen as particularly good for babies and is one of the first foods they are given when weaned (Dettwyler 1986). In Uganda, soup and porridge made from small dried fish is used as a complementary food during weaning.

Adult women, on the other hand, tend to both consume less food than adult men in the same household and have less diverse diets, including lower consumption of fish products (Hyder and others 2005). In some cultures, men eat first (out of a common pot), followed by women and children (Hyder and others 2005), and even where all household members eat together out of a common pot, distribution (especially of animal source foods) tends to favor the head of the household and other adult males (Essuman 1992; Gomna and Rana 2007). In many places, however, there is also recognition that pregnant and lactating women have special nutritional needs, and their consumption patterns often differ from those of other women (FAO 2010).

Another factor that affects allocation of food is status within extended households. A major difference between Sub-Saharan Africa and South Asia is the widespread presence of polygynous (multiple wives) households in much of Africa, and status in the household hierarchy influences allocation of food both to adults and their children. A study in northern Ghana, for example, found that children of higher-ranking household members (head of household, first/only wife) had higher height-for-age measures than children of other males and junior wives, and that as household dietary diversity increased, children of high-status members benefitted much more than other children (Leroy, Razak, and Habicht 2008).

Though children are generally disfavored in access to fish and other animal source foods during normal times, there is also evidence of efforts to protect their consumption during times of crisis (Fouéré and others 2000). For example, as households reduced dietary diversity and cut back the number of daily meals in response to the 1994 devaluation of the CFA franc, exceptions were made for very young children and pregnant and lactating women, who continued to be fed three meals a day, including non-staples (Fouéré and others 2000). A study in Brazzaville, Republic of Congo, found that though the nutritional situation in the city worsened as a result of the economic crisis, rates of malnutrition among preschool-aged children remained low (Delpeuch and others 2000).

Table 5: Selected Characteristics from Case Studies of Intra-Household Fish Consumption in Sub-Saharan Africa

Country	Findings
Ghana (Essuman 1992)	Distribution of fish from the family pot favors the head of the household, with children disfavored in access to animal source foods.
Ghana (Leroy, Razak, and Habicht 2008)	In extended households, there is a positive and significant bias in height-for-age measures of children of high-status members (household head, first/only wife). While these measures improved with increased household dietary diversity for children of the household head, there is

	no correlation for children of other males. Children of high-status household members appear to be receiving both more food and more macro- and micronutrient dense foods, such as animal source foods.
Kenya/Tanzania (Hyder and others 2005)	Men eat first (men and sons in some households), women eat later with their children. The authors comment that there may be differences in quality and quantity of food consumed in addition to the order in which household members eat, but this hypothesis is based on evidence from Asia and was not directly addressed in their research.
Mali (Dettwyler 1986; Dettwyler 1987)	Households either eat together out of a common bowl, or if households are very large, the food is divided by the women and households eat the main meal at the same time out of multiple bowls. Children are served representative proportion of all foods, including fish, meat, and vegetables. When babies are weaned, they are given porridge accompanied by foods seen as “especially good and appropriate for babies,” including fresh fish. “We give fish to our children because it is our tradition, because we have always done it, because fish is good for babies to eat.” Other animal source foods are seen as good for babies, but too expensive; adult staples (rice and millet) are seen as “too heavy” to feed young children until the age of 12 months.
Mali (Pawloski 2002)	Households eat together out of a common bowl, and older household members are favored in access to preferred foods such as fish and meat.
Nigeria (Gomna and Rana 2007)	Heads of household consume 59 percent more fish per unit body weight than wives or children. When a large fish is shared within the household, distribution is typically the body for the head of household, the head for children, and the tail for the wife. Explained by most women as because husbands would be embarrassed to be given the head or tail, and children are less busy so have time to spend eating the head.
Nigeria (McFie 1967)	Intake of both calories and protein is found to be lower, relative to requirements, for children than adults, though diets of younger children (4 to 6 years) were more adequate than those of older ones (10 to 12 years). Dried fish were consumed in lower quantities but shared more equally than fresh fish, with adult males and females both consuming 7 to 8 grams per day of dried fish, while adult males consumed over twice as much fresh fish (110 g vs. 49 g) on average than adult females. The gap is even more dramatic when crab is grouped with fish: 130 grams per day for men versus 52 grams for women.
Sub-Saharan Africa (Svedberg 1990; Svedberg 1996)	Anthropometric status of female children is slightly better than that of male children, unlike in South Asia, where there is a bias in favor of boys. The difference is attributed to the economic role of women in agriculture (especially food crops) in Sub-Saharan Africa and the household/kinship structure: polygynous households, use of family rather than hired labor in agriculture, and payment of bride price rather than dowry make female children an “asset” rather than a “liability” as in South Asia.
Sub-Saharan Africa (Klasen 1996a; Klasen 1996b)	While not the degree of antifemale bias as in Asia, girls are disfavored in other indicators, particularly excess mortality and population indicators. Moreover, it is probably not appropriate to take Sub-Saharan Africa as a homogenous region, as it is likely that antimale and antifemale biases coexist at country level.

Consumption by the Poor

There are strong links between income, food security, and dietary diversity, and much has been written about the “nutrition transition” from diets based overwhelmingly on traditional staples to ones that incorporate increasing amounts of processed grains, animal source foods, fruits, vegetables, fats, sugars, and prepared foods (Popkin 2008). Gross domestic product growth and rising incomes are strongly correlated with this shift (Popkin 2008), and dietary diversity—particularly consumption of animal source foods—tends to be higher among high-income groups (Leroy and Frongillo 2007; West and Mehra 2010). Animal source foods in general are seen as “luxury goods,” whose consumption rises more than proportionately with income, and are consumed in relatively small quantities by the poor, who spend a large proportion of their income on staple foods (Leroy and Frongillo 2007). Though consumption of animal source foods has been increasing worldwide in the last decade as a result of accelerated economic growth in many parts of the developing world, consumption in Africa had stagnated (Delgado and others 2003).

As a relatively low-cost animal source food, whether consumed continuously or only during seasonal or other periods of abundant supply, low-value fish is consumed widely by the poor, and can be accessed in regions distant from fisheries or aquaculture production thanks to processing methods allowing for transport and storage in areas without refrigeration (Gordon, Pulis, and Owusu-Adjei 2011; Akande and Diei-Ouadi 2010). Studies in different parts of Sub-Saharan Africa (for example, Jolly and Clonts 1993; Gomna and Rana 2007; Fa and others 2009), controlling for affordability, found a strong preference for fish over other types of meat among low-income groups, though with relative consumption of meat increasing and that of fish decreasing in higher-income groups.

In areas where there is a cultural preference for fish, high-value and preferred species are consumed by higher-income groups along with other animal source foods, while low-value fish are consumed primarily by the poor. In Ghana, for example, some preferred freshwater species, such as Nile perch, are consumed by middle- and high-income groups in addition to meat, chicken, and eggs, while cheap marine fish such as anchovies and sardinella are consumed by the poor (Essuman 1992). The geographical distribution of markets for these fish reflects the purchasing power of consumers in different regions, with freshwater fish caught in the relatively poor north of the country being transported to markets in the richer south, and poor farmers and pastoralists in the north consuming cheap marine fish caught and smoked in the south and distributed widely throughout the region (Essuman 1992). The supply of fish from aquaculture—mainly tilapia—is now also affecting distribution within Ghana, with different preferences among ethnic groups in the more prosperous urban and peri-urban areas (Asmah 2008).

One of the characteristics of low-value fish that make it particularly accessible to poor consumers in Sub-Saharan Africa is that it can be purchased in extremely small quantities (Infofish 2008; Ssebisubi 2011), whereas meats may be sold in larger pieces (or whole animals, as is the case with poultry and many bush meat species). Poor consumers in Africa have the option of buying whole dried fish (for example, *kapenta* or *dagaa*), whole smoked fish (for example, sardines), chunks of dried or smoked fish of larger species, powdered dried fish, and fermented fish products, in almost any quantity. The divisibility of fish makes it accessible to people who have extremely limited income, as they can buy however much they can afford.

Traditional processing methods, such as smoking, drying, and fermenting, make it possible to transport, store, and market fish in areas without cold chain infrastructure, and for poor consumers without access to refrigerators and electricity to store fish in the home. This also makes fish more accessible to the poor than many other animal source foods, such as fresh meat or milk, though eggs are relatively less perishable. While some high-value fish products are sold fresh, particularly in areas where there is good cold chain infrastructure and a preference for fresh fish (Asmah 2008),

low-value fish products in Sub-Saharan Africa are typically smoked or dried, and are a practical option for the poor in areas where infrastructure is limited.

Various authors provide estimates of the scope of traditional processing. Case studies of Ghana, Mozambique, Senegal, and Tanzania (FAO 2009) show that 40 to 80 percent of total fish catch is smoked, dried, or otherwise processed by small-scale artisanal methods in those countries. Heilporn and others (2010) estimate 75 percent of production in Mali is dried via artisanal methods and Njai (2000) estimates the figure in The Gambia is 40 percent.

In addition to sustaining poor consumers who buy low-value fish and fishing households that reap the food security benefits of retaining part of their catch for home consumption, many African fisheries make it possible for the poor in many areas to supplement their diets and/or incomes through occasional fishing activity. In Nigeria, Gomna and Rana (2007) found particularly high fish consumption among groups with low purchasing power, such as subsistence farmers, concluding that this was probably because they were able to access fish at little or no monetary cost. Essuman (1992) also noted that fish consumption in Ghana is high among groups with largely subsistence livelihoods. The strategy by the poor or displaced to utilize fisheries during times of food scarcity is potentially risky if these fisheries are closed or are overexploited and depleted.

Fish Consumption in Urban and Rural Areas

Continental Africa is currently 39 percent urban and urbanizing faster than anywhere else in the world, at 3.65 percent per year overall. Nairobi, Niamey, Lomé, and Dar es Salaam have all grown at rates in excess of 4 percent over the 2000–2005 period. At this pace, half of Africa's population (1.2 billion) will be urban by 2050, representing 25 percent of the world's urban population (UN-HABITAT 2008). Sub-Saharan African cities are poor, with very unequal income distribution: in the poorest Sub-Saharan countries, more than 50 percent of the urban population lives below the poverty line, and 60 percent of urbanites are slum dwellers (UN-HABITAT 2008). Many countries in eastern and southern Africa, as well as Nigeria, have urban Gini coefficients of more than 0.5, and cities in Botswana, Kenya, Namibia, and South Africa all have extremely high income inequality.

Dietary changes with urbanization in developing countries are well documented (Teklu 1996; Smith, Alderman, and Aduayom 2006) (Table 6). This includes increased consumption of “preferred” staples, such as rice and wheat, relative to traditional staples, and diversification of diets to include more animal source foods, fruits, and vegetables, but also more sugars, saturated fats, and prepared foods (Ruel, Garrett, and Haddad 2008). These changes also highly correlate with rising incomes, and mirror the nutritional transition associated with rapid economic development, which has also been extensively documented (Popkin 2008).

Romanik (2008) provides a comprehensive review of rural-urban differences in food markets in Africa built on a literature review of country-level household consumption studies. In most cases, meat and fish are grouped in food categories for analysis. She notes studies from Burundi, Malawi, and Mozambique highlighting higher levels of expenditure on meat and fish in urban areas relative to rural. Chauvin, Mulangu, and Porto (2012) examine consumption trends based on household survey data in 19 Sub-Saharan countries. They identify greater expenditures for meat and fish by urban households than rural. They also identify greater purchased versus own-production by urban versus rural households.

Urbanization is known to affect food consumption patterns (Schmidhuber and Shetty 2005; Delgado, Crosson, and Courbois 1997; Teklu 1996). A wider range of services, better infrastructure, and economies of scale (or lower transaction costs) associated with large and densely populated market areas affect the availability and price of food products (Darnton-Hill and Cogill 2010). Ruel,

Garrett, and Haddad (2008) note dietary shifts toward preferred starchy staples and the increased presence of animal-source foods, fruits, and vegetables. Citing data from Cameroon, Kennedy (2003) shows urban dwellers tend to consume less varied and more energy-dense diets where starchy staples replace fruits and vegetables, compared to their rural counterparts. Urbanization also tends to be associated with increasing numbers of women employed outside the home and this, too, affects the demand for convenience or “more convenient” foods (Matuschke 2009). Some of these influences may be difficult to distinguish from price effects since most of Africa’s largest cities are coastal (with consequently the potential for lower-cost access to both local marine fish products and imported fish).

Table 6: Urbanization Effect on Diet and Lifestyle

Rural	Urban
Traditional staples – coarse grains (millet, sorghum) or starchy staples (yam, cassava)	Increased consumption of “preferred” staples (rice, wheat) – often imported
Poor dietary diversity, overwhelming reliance on locally produced staples	Increasing consumption of meat, fish, vegetables, sugars, fats
Partial reliance on own-production (though most of the rural poor are still net food buyers)	Dependent on market for access to food
Food prepared and consumed primarily in the home	Increasing reliance on prepared/fast/street food
Dwelling and place of work very close or in same place	Separation of dwelling/place of work – reduces possibility for food preparation and consumption during the day

Sources: Popkin (2008); Ruel, Garrett, and Haddad (2008); Teklu (1996); Smith, Alderman, and Aduayom (2006).

Though income clearly plays a key part in these changes, differences in consumption between urban and rural households of broadly similar socioeconomic status cannot be explained by income alone. Other factors likely to influence difference between urban and rural consumption patterns are availability of diverse food products, differences in relative prices between rural and urban areas, and the often-prohibitive cost of transporting and storing food products—particularly perishable food products—in countries with poor infrastructure (Teklu 1996).

Trade and rural-to-urban transport infrastructure also create differences in rural and urban consumption patterns. On the role of transport, in particular with respect to staples, Teklu (1996) notes that it can be cheaper in cities to import grains, even at an overvalued exchange rate, than to transport staples from the hinterland. Garcia and Grainger (2005), citing UNEP (2003), note that population drifts toward coastal megacities. This creates demand for large-scale food delivery systems, and the proximity to coast would increase demand for fish- and sea-related livelihoods (Garcia and Grainger 2005). A more general point is that the coastal location of many major African cities makes it relatively cheap and logistically easy to import food (increasing market dependency), but that the difficulties of transport in the interior make it relatively more expensive both to transport these goods inland and to bring food produced in rural inland areas to the cities. Locally produced traditional staples remain relatively cheap in rural areas but can become relatively more expensive in cities due to transport costs, while imports of preferred staples, including low-value fish, can be more accessible. For example, Tacon and Metian (2009) report that small pelagic fish are a major import item for many countries in Africa. The perishable nature of many animal-source foods, as well as fruits and vegetables, adds to the rural-urban divide in access to these foods, as cold chain infrastructure and storage facilities are all but nonexistent in many areas. However, processed fish is often much more accessible in such areas in Africa—both rural areas and urban

slums that lack electricity—than many other animal-source foods, as traditional processing methods such as drying and smoking make it less perishable.

Though there has been little specific research on differences in fish consumption between urban and rural areas of Africa, more is known about dietary diversity. A review of studies of food consumption patterns in Africa (Smith, Alderman, and Aduayom 2006) found that just over half of the countries examined had higher rates of food energy deficiency among urban than rural dwellers, but all countries except Ghana had much higher dietary diversity scores among urban households than rural ones, some strikingly so. Even where the urban poor are very food-insecure, as defined by energy availability, dietary diversity is generally higher than in rural areas. The purchasing power present in urban markets tends to attract a wide variety of food products produced in other parts of the country as well as imports, giving urban consumers more options in their food choices than rural consumers.

Household Consumption of Fish in Fishing Households

In addition to providing a critical source of cash income, fish plays a key nutritional role for fishing and aquaculture households in Sub-Saharan Africa. Fishers involved in capture fisheries bring home fish for consumption within the household, and small-scale aquaculture systems—often integrated with smallholder farms, though production is limited from these low-intensity ponds—can provide fish for home consumption as well as for sale.

Share remuneration systems are nearly universal in fisheries, with crew being paid with a share of the catch (either in fish or in cash once the catch has been sold), sometimes together with a fixed sum. In developed-country fisheries, this fixed sum is often paid in cash, but in most developing countries, it is typically a combination of food and drink while fishing, and a portion of fish for home consumption (Platteau and Nugent 1992). In the Ghanaian marine fishery, for example, fishers bring their food and supplies for fishing trips with them in a bucket, and at the end of the trip, the captain fills the bucket with “chop fish” (fish for cooking), and pays their share of the proceeds from the trip in cash separately each week (Overå 1993).

Though some of this chop fish may be exchanged or sold, this commonly results in fishing households having greater access to fish for direct consumption. A study in two fishing communities in Nigeria found that fishing households consumed over twice as much fish as non-fishing households (average 230 grams per day versus 111 grams per day), while the consumption of meat and other animal-source foods was similar between the two groups (Gomna and Rana 2007).

III. Estimates of Demand Elasticities

Population growth, unemployment, civil and natural disasters, globalization, economic development, income growth, environmental awareness, and food preferences were discussed as drivers of demand of marine and inland fisheries and aquaculture by Welcomme and others (2010), Garcia and Grainger (2005), and Bostock and others (2010). Delgado, Crosson, and Courbois (1997) note that “increases in per capita consumption of animal source foods are fastest where food consumption levels are low, wealth and urbanization is increasing rapidly, and domestic supply is also increasing.”

In this section, we review evidence from household expenditure surveys. We found seven recent studies that estimate household fish demand elasticities for Sub-Saharan African countries. The studies are listed in the Table 7 with basic descriptive information. Only the studies by Ecker and

Qaim (2011) and Yusuf (2012) estimate elasticities specifically for fish. The other five studies group fish and meat into a single food group.

With data from a 500-household food consumption survey in two regions of Tanzania, Abdulai and Aubert (2004) examine the implicit demand for nutrients in rural and urban households. They estimate income and price elasticities on food groups that are in turn used to estimate implicit demand for nutrients. Using data from the KwaZulu Natal Income Dynamics Study in South Africa, Bopape and Myers (2007) analyze “food expenditure patterns ... taking into account differences in demand across rural and urban households as well as across income groups.” Ecker and Qaim (2011) use representative household data from Malawi to examine the nutritional impacts of policies. They estimate income and price elasticities that are in turn used in simulations. Using their own survey of 812 households, focusing on Edo, Delta, and Lagos states in Nigeria, Ojogho and Alufohai (2010) compare food expenditure patterns across rural and urban households and by income class. Like the Malawi study, Ulimwengu, Roberts, and Randriamamonjy (2012) seek to model the demand for food nutrients in the DRC. They use the nationally representative 1-2-3 survey to compare household expenditures between urban and rural households by income groups. Following the 2007–2008 food price crisis, Ulimwengu and Ramadan (2009) use the Ugandan National Household Survey to examine the net consumption impact of rising food prices. They compare rural and urban households across income groups. Finally, Yusuf (2012) uses a 360-household sample in Ibadan, Nigeria, to examine the demand for animal protein. He compares rural and urban households.

Most of these studies use very large national household expenditure datasets from surveys conducted by government entities. The two studies in Nigeria and the one in Tanzania (Table 7) used surveys developed by the authors and have correspondingly smaller sample sizes. Two basic estimation methods were used in the studies, the Linear Approximate Almost Ideal Demand System and the quadratic version.²⁴ Based on the characteristics of the data being used and the research questions asked, there are various additional techniques for consideration for calculating the elasticities. These are described in the various articles.

Table 7: Studies of Food Demand in Sub-Saharan Africa

Author(s)	Country	Year published	Data source and year	Sample size (#HH*)	Estimation model
Abdulai and Aubert	Tanzania	2004	Own survey, 1999	500	QUAIDS
Bopape and Myers	South Africa	2007	KwaZulu-Natal Income Dynamics, 1993, 1998, 2004	2,181	QUAIDS
Ecker and Qaim	Malawi	2011	Malawi Integrated HH Survey, 2005	11,280	QUAIDS
Ojogho and Alufohai	Nigeria	2010	Own survey, date not reported	812	LA/AIDS
Ulimwengu, Roberts, and Randriamamonjy	DRC	2012	1-2-3 survey, 2004-5	13,688	QUAIDS
Ulimwengu and Ramadan	Uganda	2009	Uganda Integrated HH	7,400	AIDS

²⁴ LA/AIDS was widely used in the 1980s and 1990s for its linearity and flexibility, but in the 1990s it was criticized for producing biased and inconsistent estimates. Responding to that, a quadratic version, QUAIDS, was developed that allows for theoretically more realistic Engle curves.

			Survey, 2006		
Yusuf	Ibadan, Nigeria	2012	Own survey, date not reported	360	LA/AIDS

*HH = household

Income Elasticities

The income elasticity of demand is defined as the percentage change in consumption of a good in response to a 1 percent increase in a consumer's income. The studies in Table 7 all present analyses of fish, or fish grouped with meat, or meat and eggs in the context of the household food basket. The basket typically is constituted of a source of starchy staples—cereals or roots and tubers—animal-source proteins, fruits and vegetables, pulses, and meal complements such as edible oils or sugar. In many places meat and fish occupy an important share of the food expenditure. As a result, a change in price of these items would have a bigger impact on the composition of the household food budget than other items. In most studies, in urban households meat and fish contributed most to household's food expenditures, while cereals or root crops were the main expenditure item in rural households. Ulimwengu, Roberts, and Randriamomanjy (2012) note that "the cereals [and the main starchy staples] often have low expenditure and price elasticities because developing-country households consume them even when times are tough." Spending on other food categories, however, is expected to be more sensitive to income and price changes, and, in contrast to the starchy staples, the expenditure elasticities for categories such as meat and fish, fruits, and vegetables tend to "depend largely on the geographic and cultural context" (Ulimwengu Roberts, and Randriamomanjy 2012).

Among the expenditure elasticity estimates of fish demand reported in the various studies, the value for urban households in Malawi by Ecker and Qaim (2011) is the lowest and inelastic (0.57), indicating that little increase in expenditure on fish is expected for an increase in income among these households. More typical are the values from rural households in Malawi (0.86); Ibadan, Nigeria (0.75; Yusuf 2012); and Uganda (0.71–0.78; Ulimwengu and Ramadan 2009). Ecker and Qaim (2011) note that values such as these are high in an international context, but they reflect the generally widespread situation of food insecurity, especially in rural households, and the large share of food in the household budget. Other studies report elasticities over unity: the DRC (1.37 rural and 1.31 urban; Ulimwengu, Roberts, and Randriamamonjy 2012), South Africa (1.12–1.15; Bopape and Myers 2007), and Tanzania (1.04; Abdulai and Aubert 2004). In these countries, as households receive more income, they devote an increasingly larger share of income to fish consumption. In sum, the various estimates show that household expenditures on meat and fish are responsive to income increases. Where the studies differentiate, fish demand by rural households is relatively more responsive to income changes than by urban households.

Several older studies produce similar income elasticity estimates. In his review, Teklu (1996) cites work by Delgado and Sil (1994) in Burkina Faso that report income-elastic demand for animal proteins. Work by Nweke and others (1994) in southeastern Nigeria showed higher expenditure elasticities for fish among higher-income groups. These results are consistent with the earlier studies of Delgado, Crosson, and Courbois (1997):

The evidence overwhelmingly suggests that expenditure elasticities for animal proteins tend to be relatively high (0.8–1.7) ... The impact of income growth seems to be highest where urbanization is rapid, the initial income base is low, and domestic production growing rapidly.

Overall these studies suggest that demand for fish in Sub-Saharan Africa remains relatively income-elastic and becomes increasingly so with growth in incomes.

Muhammad and others (2011), based on 2005 International Comparison Program data, generated an average of 0.65 for expenditure elasticity for fish demand in low-income countries (less than 15 percent of U.S. income levels), which most sub-Saharan African countries were categorized. This would define demand for fish as being relatively income-inelastic, with less than proportionate increase in consumption as income rise. Values for middle- and higher-income countries (15–45 percent and greater than 45 percent of U.S. income levels) were 0.52 and 0.38, respectively, showing the typical reduction of elasticity with higher income. Only one Sub-Saharan country was in the middle-income group: Mauritius, with a value of 0.54. Elasticity values for meat and dairy product consumption in lower-income countries were 0.77 and 0.80, respectively, also below the unitary elasticity level.

In other developing regions, citing work by Huang and Bouis (1996), Delgado and Courbois (1997) reported expenditure elasticities for fish in China of 1.5. Westlund, Holvoet, and Kébé (2008) reported results from studies in Bangladesh showing values from 0.35 to 1.48, including values of 0.35 for poorer households and 1.02 for wealthier households, with an average of 0.67. This suggested that fish was more of a necessity for the poorer households. In Egypt, Alderman and von Braun (1984) illustrated differences in consumer behavior in relation to fresh and frozen fish between rural and urban areas and between different income groups and found generally inelastic demand for fish with respect to expenditure-related indicators. Results suggested that lower-income groups had higher expenditure elasticities for fish than higher-income groups, which is consistent with expectations for food in general, but not with the hypothesis that fish might be a “superior” or “luxury” good, with increasing elasticity for higher-income groups. In all but one case (lowest income quartile, demand for frozen fish), expenditure was inelastic (that is, had a value less than 1, so that as income grew, expenditure on fish would increase less than proportionately) and in one case negative (urban higher-income group for frozen fish demand). Fresh fish appeared to be preferred to frozen fish in urban areas, while the reverse was true in rural areas.²⁵

Price Elasticities

Own-price elasticity of demand is the percentage change in consumption of a good in response to a 1 percent increase in its price. The studies listed in Table 7 estimated fish or fish and meat price elasticities in Sub-Saharan Africa. Some of the studies report price elasticities based on uncompensated, or Marshallian, demand, where substitution among items in the household food basket is determined without consideration of wealth effects associated with price changes. Some price elasticities were calculated based on compensated, or Hicksian, demand with consideration of wealth effects.

The most inelastic Marshallian own-price elasticities of fish demand are reported for urban households in Malawi (-0.57) and households in Nigeria (-0.50; Ojogho and Alufohai 2010). Higher Marshallian elasticities are reported for meat and fish demand in Uganda (-0.66), and fish demand in rural Malawi (-0.89). The Tanzania study reports unitary price elasticity for the demand for fish,

²⁵ This study yielded particularly interesting results for frozen fish, for which higher-income urban groups have negative expenditure elasticities, while lower-income rural groups have strongly positive expenditure elasticities (1.82). Based on current attitudes to fish consumption in Egypt (present authors’ observation) this may simply reflect less confidence in the supply chain for fresh fish in rural areas (from a food quality/safety perspective) than for frozen fish, while in urban areas, with better developed supply chains, consumers may prefer fresh fish over frozen fish, which may be of less preferred/lower-quality imported species, as is the case in many countries.

meat, and eggs, while elastic responses are found in South Africa (-1.11) and Ibadan, Nigeria (-1.48). Several of the studies report both Hicksian and Marshallian elasticities and, where reported, the Hicksian elasticities are correspondingly lower. Ulimwengu, Roberts, and Randriamamonjy (2012) only calculated Hicksian price elasticities for meat and fish in the DRC and found little difference between rural and urban households (-0.74).

All the more recently reported elasticities show consistency with data reported 30 years earlier by Alderman and von Braun (1984), where the own-price elasticities for fish in Egypt were -0.84 in poorest urban households and -0.48 in poorest rural households.

Muhammad and others (2011) reviewed international demand data for 2005. They suggest an average Frisch own-price elasticity²⁶ value of -0.48 for fish for low-income countries (that is, a 1 percent increase in price will result in a 0.48 percent decrease in demand), which include all Sub-Saharan countries except Mauritius, for which the value was -0.396. Medium- and high-income country values were -0.38 and -0.27, respectively, as expected, showing the relatively lower demand response to price. Low-income country values for meat and dairy were -0.56 and -0.58, respectively.

IV. Conclusions

For Sub-Saharan Africa, although aggregate consumption of fish has been rising steadily, per capita consumption has decreased slightly over the period 1990–2007. The increase in aggregate consumption appears to be supported by increases mostly from capture fisheries, with net trade and aquaculture also making positive contributions. Aquaculture production in Sub-Saharan Africa remains negligible, but fast rates of growth in at least some areas suggest its potential for increased importance in the future. However, current production costs for aquaculture suggest that it is unlikely to compete directly with low-cost fish from capture fisheries.

Reported trade in fish has increased across the region and both exports and imports (in volume and value terms) grew during 1990–2007. Fish import volumes have increased sharply since 2000, despite an increase in their unit value over the same period. With similar or slightly lower levels of consumption of domestic landings, imports (possibly also including those from aquaculture outside the region) are likely to be the most important area of growth in short-to-medium-term supply in the region. Official data show intra-regional trade is growing in importance. There may be considerable intra-regional trade that is not documented.

Trade policy and facilitation regimes in the region do not specifically focus on fish trade, and there is a range of tariff and nontariff barriers. At present, there are limited means to address these effectively, for example through regional economic bodies, which may limit regional trade opportunities. There are a few examples of countries establishing an export processing industry in the region, but these are still relatively minor players, and much of the downstream value addition takes place in importing countries.

Where Is Fish Consumption Headed in Africa?

²⁶ Muhammad and others (2011) describe Frisch elasticities as “estimated at a point when the marginal utility of income is held constant. The values of the Frisch own-price elasticities lie between the values of the Slutsky own-price elasticities—when real income is held constant—and the Cournot own-price elasticities—when nominal income is held constant—and can be considered a reasonable estimate of the average own-price elasticities for the food subcategories” (p.18).

In aggregate terms, fish consumption in Sub-Saharan Africa is low and on a per capita basis over the last 20 years has declined at an average annual rate of roughly 1 percent, while consumption has steadily risen in most other regions. Aggregate figures, however, mask the considerable inter- and intra-country variation in consumption. Fish continue to be an important source of animal-source protein in many countries. However, reflecting the overall low level of animal-protein consumption in many countries, those countries with per capita consumption of less than 10 kilograms per year include many where fish is an important source of animal protein. Though there is little information specific to Africa on differences in fish consumption among different income groups and between rural and urban populations, those studies that exist, as well as findings in other regions, suggest that national averages of consumption conceal considerable intra-country variability.

Stalled economic growth in the 1990s coincided with stagnating or falling fish consumption. This was followed by some increase in fish consumption in the period 2000–2007, particularly for the middle country group, consuming 10 to 20 kilograms per capita a year. The increase in fish consumption was achieved despite much sharper growth in the prices of traded fish over the same period. Current projections by the IMF (2011) for the region suggest steadily improving economic growth, though with significant variations, linked with wealth of natural resources, political stability, and development policy, and with risks associated with climate change and other factors.

Together with rising populations, evidence from the large-scale household food expenditure studies discussed earlier suggests that income growth (and/or an improvement in income distribution) and urbanization will contribute to greater consumption and growing demand for food fish in the region. With income growth and rapid urbanization in Sub-Saharan Africa, the current supply trends suggest that demand growth would have to be met largely by an increase in imports and/or by expansion in aquaculture. Depending on shifts in relative prices, some of the current marine fish exports could possibly be diverted to domestic markets, although data suggest only limited scope, relative to the impending growth in demand. Increases in demand with constrained supply imply price increases, which may cause a demand-dampening effect. Export volumes in 2007 were roughly half those of imports and the lower-value share of those exports was around 60 percent. Higher-value fish are likely to find more remunerative markets elsewhere. Depending on the population, income, and consumption response, potential demand for both high- and low-value fish could rise significantly as population growth will likely add plenty of poor consumers, while income growth will likely expand the middle and upper classes. Based on population growth alone, regional fish consumption (which measured some 6.7 million metric tons in 2007) could easily exceed 10 million metric tons by 2030. If the region's fish consumption were to rise to current global average consumption levels, the regional demand could reach at least 20 million metric tons. In these circumstances, imports and aquaculture would have to increase from current annual levels of some 2 million metric tons (90 percent of which is imports) to more than 5 million metric tons, simply to meet demands associated with population growth.

One area where supply from capture fisheries could be improved is through reducing post-harvest losses and downgrading of fish to less remunerative use, including fish meal production. Post-harvest losses include the discard of by-catch at sea, which is often alleged to range between 25 and 35 percent of the total catch. However, many methods to reduce losses, such as better storage and handling, producing higher-value frozen products, onboard use of ice, and off-ground drying of fish, are economically infeasible for high-volume low-value fish due to high cost. However, with increasing scarcity of raw materials, price incentives are likely to result in the gradually increasing uptake of practices that reduce losses.

This study has focused on fish categorized in Delgado and others (2003) as low-value species, though as earlier noted this includes species that have relatively high current market prices and are

normally exported if produced in the region. The more detailed questions of future aquatic food access among poorer income groups are more difficult to address. Where opportunities for consumption are traditionally linked to fishing activity, increasing pressures on stocks may act to reduce access to food fish among the poor. For individuals that continue to engage in fishing or related post-harvest activities, improving market prices may increase incomes. The extent of access to food fish among those who are no longer involved in fishing will depend on alternative livelihood options, including those livelihoods associated with urbanization.

The study has based its analyses on more aggregate regional data, whereas a more complete assessment of supply and demand of lower-priced fish would require much more disaggregated assessments. Robust economic growth in Sub-Saharan Africa has contributed to economic stability in many countries. In turn, this is likely to provide a more secure environment for food security and access to fish across all income groups. Economic and population growth rates are also likely to vary widely across the region, and the continued emergence of food insecurity “hot spots,” with high levels of population growth, poverty, and undernutrition, is likely to remain an issue. Here the role of fish in food security varies widely, but it is often determined simply by access and, where there is access, low and stable prices.

Climate change is likely to have a negative impact on fish supplies. The potential for multiple, diverse, mostly negative impacts across a range of geographic areas and agricultural zones makes household and community resilience a key issue in future food security. Negative impacts in the agriculture sector can shift household food security strategies to exploit unregulated open-resource fisheries. There are likely to be unexpected and different impacts across otherwise similar contexts. The 2007–2008 food price crisis caused sharp changes in food prices in sub-Saharan African countries, demonstrating the impact of connections with global markets. Fish are highly traded, connected with the global economy; changing global food prices, import costs, and export values will certainly have local impacts.

Expanding Supply

In the future, Africa is likely to be increasingly reliant on imports and on aquaculture for its fish supplies, as there is only limited scope for increasing fish supply from its inland or marine capture fisheries. Possible climate change impacts may well reduce or at least destabilize landings from some capture fisheries, at the same time influencing global supplies and import options for Sub-Saharan Africa. Within Africa, the larger and wealthier markets, mainly in large urban centers, will likely be able to expand their imports from outside the region, while also draw in fish from important African production areas. For example, preliminary findings in this report suggest that Ghana, once a source of fish supply to Nigeria and inland countries, now imports fish from Mali, while its trade with Nigeria seems to be limited to a low-volume higher-value market segment. In spite of continued political instability, the DRC is a major consumer of Lake Victoria fish and is likely to continue to be so. Nigeria imports fish from all corners of the globe and remains an important market for intra-regional trade. Income growth in those large markets could have a major effect on imports, while also, in some cases, spur aquaculture development, particularly for medium- and high-value fish.

Intra-regional trade represents an important component of imports (ranging from 23 to 38 percent of import value, between 1998 and 2008, according to FAO data for continental Africa). In reality, this trade is likely even more important than the official data indicate, since much of it is informal, often escaping public scrutiny and records. Much of this trade appears to take place despite poor infrastructure and services. Improved and harmonized trade policies could have a marked positive effect on intra-regional trade volumes.

Organizations such as NEPAD have recognized the importance of this trade for income and food security with suggestions to support its regulation and growth. As described earlier, formal trade is constrained through various mechanisms. An improvement in the trade policy environment should emphasize pro-trade measures, such as improving information, transport and storage infrastructure, and handling, but recognizing of low government capacity to implement them. Measures such as strict phyto-sanitary regulations are attractive in selected trade markets, but the lack of regulatory capacity and unrealistic sanitary criteria could constrain trade. The role of intra-regional trade on local availability and prices of aquatic products is also important and, while facilitation of trade flows will create greater total value, the distributional effects on food access may need to be understood more clearly to ensure that vulnerable groups with high levels of fish dependency are not specifically disadvantaged.

The import of lower-priced fish from non-African sources and from major regional exporters such as Namibia and Mauritania will depend largely on availability and price movements for key stocks, particularly small pelagics. Their availability and price are determined in relation to rising global demand for direct consumption and are influenced to a partial extent by the market for fish meal and oil. However, a wide range of mid-value imports is also likely to be important, and the region would, for example, compete more widely for a range of whitefish stocks and products, including traditional products such as dried or salted cod and hake. Here also, aquaculture from low-cost global producers might also become more important, with species such as *Pangasius* catfish and tilapia, grown on simple terrestrially derived diets, potentially available in larger quantities in global markets.

Aquaculture itself is likely to expand in Africa, though it is uncertain, so far, that this expansion would meet substantial supply shortfalls as currently proposed within some countries. Expanding aquaculture output to 2.5 million metric tons by 2030, contributing 50 percent of the expected supply gap to meet population needs, would require an annual average growth rate of around 14 percent across the region. Many African countries have trends in demand that could favor aquaculture growth (historical fish consumers with traditional supply increasingly constrained, and countries with growing populations and experiencing income growth and urbanization). However, a number of widely recognized bottlenecks, such as lack of market infrastructure, investments in feed and seed supply, and limited technical capacity, act to limit the provision of necessary inputs and services to support the development of aquaculture and the marketing of its products, particularly for the small-scale sector.

Although Sub-Saharan African aquaculture is currently dominated by Nigeria and Uganda, the region has experienced very rapid growth in output, albeit from a very low base. Other countries are also likely to expand output, particularly where producers have good access to urban markets, and where key inputs of feed and seed can be provided at suitable price and quality levels. The role of larger-scale aquaculture producers is also likely to be particularly significant, and in many cases can be instrumental in building up enough scale or critical mass to justify investment in modern, well-managed hatcheries and fish feed plant. Nonetheless, a key role of aquaculture is likely to be that of providing middle- or higher-market products, rather than those that are directly accessible to poorer consumers. However, the market substitution effect, and the additional purchasing opportunities provided by secondary species and market rejects, will help to improve access to food fish by the poor.

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Appendix

Table A.1: List of Sub-Saharan African Countries

Angola	Congo, Dem. Rep.	Guinea	Mozambique	Somalia
Benin	Congo, Rep.	Guinea-Bissau	Namibia	South Africa
Botswana	Côte d'Ivoire	Kenya	Niger	Sudan
Burkina Faso	Djibouti	Lesotho	Nigeria	Swaziland
Burundi	Equatorial Guinea	Liberia	Réunion*	Tanzania
Cameroon	Eritrea	Madagascar	Rwanda	Togo
Cape Verde	Ethiopia	Malawi	São Tomé and Príncipe	Uganda
Central African Republic	Gabon	Mali	Senegal	Zambia
Chad	Gambia, The	Mauritania	Seychelles	Zimbabwe
Comoros	Ghana	Mauritius	Sierra Leone	

*A French territory

Table A.2: Fish Commodity Groups

Low-value finfish	High-value finfish	Crustaceans	Mollusks
Carp, barbels, and other cyprinids	Cods, hakes, haddocks	Crabs, sea spiders	Abalones, winkles, conchs
Herrings, sardines, anchovies	Flounders, halibuts, soles	Freshwater crustaceans	Clams, cockles, arkshells
Jacks, mullets, sauries	Redfishes, basses, congers	Horseshoe crabs and other arachnoids	Freshwater mollusks
Mackerels, snoeks, cutlassfishes	Salmons, trouts, smelts	King crabs, squat lobsters	Miscellaneous marine mollusks
Miscellaneous freshwater fishes	Sharks, rays, chimaeras	Lobsters, spiny rock lobsters	Mussels
Miscellaneous diadromous fishes	Sturgeons, paddlefishes	Miscellaneous marine crustaceans	Oysters
Miscellaneous marine fishes	Tunas, bonitos, billfishes	Shrimps, prawns	Scallops, pectens
River eels			Squids, cuttlefishes, octopuses
Shads			
Tilapias and other cichlids			

Note: Fish commodity groups were aggregated based on the FAO's International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP), as in *Fish to 2020*. ISSCAAP groups were further aggregated into high-value finfish, low-value finfish, crustaceans, and mollusks.

Table A.3: Country Groups, Per Capita Low-Value Fish Consumption

Below 10 kg		10–20 kg	Above 10 kg
Benin	Botswana	Angola	Gabon
Burkina Faso	Burundi	Cameroon	Gambia, The
Cape Verde	Central African Republic	Congo, Rep.	Ghana
Chad	Comoros	Côte d'Ivoire	Mauritania
Congo, Dem. Rep.	Djibouti	Equatorial Guinea	Senegal
Eritrea	Ethiopia	Guinea	Sierra Leone
Guinea-Bissau	Kenya	São Tomé and Príncipe	
Lesotho	Liberia	Uganda	
Madagascar	Malawi		
Mali	Mauritius		
Mozambique	Nigeria		
Réunion*	Rwanda		
Somalia	South Africa		
Sudan	Swaziland		
Tanzania	Togo		
Zambia	Zimbabwe		

*A French territory