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# Small Scale Fisheries and Fish Farming, Processing and Marketing in Sub-Saharan Africa: Implications for Poverty Alleviation, Food Security and Nutrition

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**Abstract:** ***The demand for fish is growing due to a combination of factors such as population growth, urbanization, and increasing wealth and incomes. Aquaculture is one of the few food production sectors worldwide where growth in production is outpacing growth in population. Fish farming or aquaculture includes the production and rearing of fish in freshwater ponds, in the brackish water of mangrove swamps, or in tanks and cages. Small-scale fisheries can give opportunities to the poorest, landless, food-insecure people and households, providing them a critical (and sometimes unique) source of income and livelihood. Fish in the human diet can help reduce the risks of malnutrition and of non-communicable diseases, which may occur when a too high intake of energy is combined with a lack of balanced nutrition. Farmed fish contribute to improved nutritional status of households, directly through self-consumption, and indirectly through selling farmed fish to enhance household purchasing power. Small-scale fisheries can provide a critical safety net for vulnerable households (even those who were not previously poor) when they face a sudden and unexpected decline in their incomes. At the national level, small-scale fisheries can contribute to poverty alleviation through economic growth via multiplier/ GDP effects, generation of tax revenues, and generation of foreign exchange. Small-scale fisheries and aquaculture face a number of challenges and constraints, including overfishing, pollution, competition for resources such as water, labour and land, poor access to markets, shortage of technical skills, availability and high costs of inputs such as seed and feed, poor access to credit, and lack of capacity and safeguards to deal with unfavourable climate change phenomena such as droughts, floods and storms. There is almost a consensus that women's roles in aquaculture and fisheries are not fully recognized, often go unrecorded, are undervalued, and are largely invisible in national statistics. Given the importance of small-scale fisheries and aquaculture in poverty alleviation, food security and nutrition in sub-Saharan Africa, governments should make fish an integral component of inter-sectoral national food security and nutrition programmes, with special emphasis on small-scale fish capture fisheries and fish farming or aquaculture projects. Stakeholders in these fish sub-sectors should support self-organized local professional organizations and cooperatives, as these strongly contribute to and foster the integration of small-scale operations into markets. State labour, finance, and policy formulation and implementation agencies, in collaboration with fisheries agencies, should improve national regulations for fish workers, including women workers in fish processing factories and markets, ensure that adequate and specific budget allocations are made for small-scale fisheries and aquaculture development, and facilitate the direct involvement of farmers and other stakeholders in the process of priority setting and choice of technology.***

**Keywords:** small scale fisheries, fish farming, processing, marketing, food security, poverty, nutrition

## 1. Introduction

Global fish supplies have outstripped population growth since the end of World War II, effectively increasing per capita annual fish supplies from 9.9 kg in the 1960s to 18.4 kg in 2009 (FAO, 2012). This growth has been fuelled by the rising demand for animal source food, including fish and livestock (Kearney, 2010). The demand for fish is growing due to a combination of factors such as population growth, urbanization, and increasing wealth and incomes (Kearney, 2010; Merino et al., 2012; Beveridge et al., 2013; Tacon & Metian, 2013; Waite et al., 2014). Initially, the growth in fish supplies was accounted for by capture fisheries up until the late 1970s when the majority of fish stocks from capture fisheries was fully or over-exploited (Arnason et al., 2008).

While aquaculture or fish farming accounted for only 3-6 % of global fish supplies in the late 1970s (FAO, 2012), in subsequent decades aquaculture has been the fastest growing animal source food sector, and the fastest food producing sector in the world (Townsley, 2013). Perhaps more significantly, it is one of the only few food production sectors worldwide where growth in production is outpacing growth in population (Townsley, 2013).

In 2010, aquaculture was credited with 40.3% of global fish production by weight and 47% of global fish supply (Townsley, 2013). To date, 50% of fish now consumed is farmed (World Bank, 2013; FAO, 2014); Waite et al., 2014). With only very modest increases in yields from capture fisheries, rising fish demand must be met from aquaculture. Because fish makes up a relatively high proportion of animal-source foods in sub-Saharan Africa (32%), food and nutrition security are especially vulnerable to changes in both demand and supply (SFP, 2014).

Aquaculture, in particular, has been widely seen as an engine for development since it enhances food security, alleviates poverty and improves nutrition (Delgado et al., 2003; Subasinghe et al., 2009; Belton & Little, 2011; Little et al., 2012; Waite et al., 2014). More than 95% of small-scale fishers and related workers in post-harvest sectors live in developing countries, including sub-Saharan Africa (Allison, 2011).

## 2. Aquaculture and fisheries

Fish farming or aquaculture includes the production and rearing of fish in freshwater ponds, in the brackish water of mangrove swamps, or in tanks and cages (FAO, nd). In all

cases the intent is to provide a regular, controlled supply of desirable species to supplement irregular quantities obtained from fishing. There are also some prospects of community-based aquaculture as an extension of the household farming system. Fish selected for farming must be able to breed and thrive under artificial conditions of environment and diet (FAO, nd). Some freshwater species are over-prolific in captivity. *Tilapia nilotica*, for example, breed more rapidly than they grow.

Aquaculture is distinct from fisheries in terms of produce, value chain structure and employment, as well as economic benefits to participants in the value chain (Beveridge et al., 2013; Belton & Thilsted, 2014). The stagnation of capture fisheries and the rise of aquaculture are shifting the main source of fish consumed in sub-Saharan Africa from marine to freshwater, and from pelagic species, rich in omega 3 fatty acids, to firm, white fleshed, less oily species (Beveridge et al., 2013). Aquaculture and fisheries value chains differ too, in terms of the numbers and types of actors (FAO/ WorldFish, 2015), often targeting distinctive markets and with different social and economic outcomes as a result.

**Aquaculture production systems/ types**

There are three main types or systems of aquaculture production in sub-Saharan Africa. They are the extensive, smallholder system; the semi-intensive production system; and the medium and/ or large size commercial fish farming system (SARNISSA, 2010). The extensive, smallholder system is found in rural or peri-urban areas with ponds of mostly between 100-200m$^2$ in area. Nile tilapia and African catfish are the most widely farmed fish, produced using on-farm resources (farm wastes and by-products), normally employing family labour (SARNISSA, 2010). Household food security and income generation are the key issues for this type or system of aquaculture. Yields vary from pond to pond and from country to country, but are commonly in the range of 1-2.5 tonnes per hectare per year (SARNISSA, 2010).

In the semi-intensive production system, fish farmers have received considerable training and technical assistance. Ponds are somewhat larger (around 400m$^2$) and more expensive inputs such as better quality feeds, fertilizers and seed (SARNISSA, 2010) are used. Under better management these relatively higher input systems have higher production which normally ranges between 3-8 tonnes per hectare per year (Poumogne & Diemuth, 2008). These small-scale fish farms employ a more market-oriented production system to produce fish for local and urban markets. Income generation and cash earnings are the main objectives of semi-intensive aquaculture production systems.

Medium and/or large scale size commercial fish farming has very high inputs and high production levels, and are often found around large cities (SARNISSA, 2010). Production systems consist of either tilapia production in lake-based cage farming systems (e.g. in Ghana and Zimbabwe), or large fish ponds (e.g. in Zambia).

In Southern Africa, commercial fish farmers have better-manured ponds than subsistence farmers, the most apparent reason being their more numerous farm animals such as cattle, goats, pigs and chickens that drop manure for fish feed (FAO, nd). Two harvesting strategies are practiced in small-scale fish farming in Southern Africa: major harvesting and intermittent harvesting. Major harvests are carried out either with the assistance of extension workers who bring in seine nets or by the households themselves using baskets managed by women. Nearly one-third of any major harvest is consumed by the household or given to relatives and friends for consumption (FAO, nd). The rest is used for sale (30%) or paid to people in exchange for work (20%) or for assistance during the fish harvest (20%) (FAO, nd). Fish farmers ensure a local supply of broodstock either by not draining the ponds during the harvest or by taking some fish aside to be returned to the ponds after completion of the harvest. Virtually all homestead fish farmers practice intermittent harvesting, mostly with hook and line (done mainly by children), followed by baskets (mainly done by women). Fish harvested intermittently is used exclusively for household consumption. Farmed fish has a greater significance as an additional food source for subsistence farmers than for commercial and semi-commercial farmers (FAO, nd). In some households in Southern Africa, fish is consumed more than once a week in quantities that appear to change very little over the year.

Some writers claim that the trend towards increasingly intensive production systems does not necessarily represent a threat to efforts to alleviate poverty. However, the overwhelming evidence suggests that the poorest are generally excluded from intensive aquaculture systems although there may be employment opportunities within the value chain (Arthur et al., 2013). Second, intensification seems to come at the cost of increased risk of stock diseases (aquatic and animal health) and environmental degradation (related to intensifying any agricultural food production system), which again may severely affect the poor (Arthur et al., 2013).

## 3. Fisheries, poverty and hunger

Poverty encompasses different dimensions of deprivation that relate to human capabilities, including consumption and food security, health, education, rights, voice, security, dignity and decent work (OECD, 2001). This multi-dimensional nature of poverty in fishing communities is now widely acknowledged and accepted. For example, Townsley (1998) points out those fishing communities are often characterized by overcrowded living conditions, inadequate services, low levels of education and a lack of skills and assets, particularly land.

Although many small-scale fishing communities are poor and vulnerable, it is widely acknowledged that small-scale fisheries can generate significant profits, prove resilient to shocks and crises, and make meaningful contributions to poverty alleviation and food security (Bene et al., 2007).

Fish and other aquatic foods are potentially important in two key ways with regard to the alleviation of poverty and hunger. First, fish is a nutrient-dense food, rich in highly bioavailable quality protein, essential fatty acids and micronutrients (Hambraeus, 2009; Beveridge et al., 2013;

Belton & Thilsted, 2014). These nutrients are recommended as an essential part of a balanced diet (Kawarazuka & Bene, 2010, 2011; FAO/WHO, 2011). Second, both capture fisheries and fish farming (aquaculture) create employment. Global full-time employment in aquaculture stands between 27 – 57 million people, and the bulk of these are in developing countries (including sub-Saharan Africa) which account for over 80% of world aquaculture production (FAO, 2010).

Small-scale fisheries contribute to poverty alleviation and reduction of hunger to the following groups of people: those involved directly with fishing (fishers and fish workers in both pre- and post-harvest activities); the dependents of those directly involved with fishing (households and communities); those who buy fish for human consumption (consumers); those who benefit from related income and employment through multiplier effects; and national societies in general and those who benefit indirectly as a result of national export revenues from fisheries, redistributive taxation and other macro-economic mechanisms (Bene et al., 2007).

Small-scale fisheries can give opportunities to the poorest, landless, food-insecure people and households, providing them a critical (and sometimes unique) source of income and livelihood (Kwarazuka and Bene, 2010). For example a study in the Democratic Republic of Congo among fishing communities along the Luilaka and Salonga rivers shows that the poorer the people in these communities are, the more likely they are to depend on fishing as a source of income, and the more important fishing is for their food and nutrition security, as well as for better health and sanitation conditions (Bene et al., 2009). Some fishers, living in isolated or remote areas under harsh conditions, can also be relatively well-off income-wise, due to the cash they derive from their fishing activities (e.g. Panayatou, 1985; Neiland et al., 2005; Bene et al., 2009). Even when fishing is not the primary source of income, it can still play an important role for food security (HLPE, 2014).

## 4. Aquaculture and Poverty

Few isolated case studies evoke the possibility that income and employment created by aquaculture can benefit low-income households participating in specific, often rural aquaculture activities in sub-Saharan Africa (Arthur et al., 2013). However, the overwhelming evidence from literature indicates that it is usually the better-off farmers and households who tend not just to benefit the most from aquaculture development, but are also able to take up the new technology and connect to the extension services where they are available (Arthur et al., 2013). The reasons for this include income and access to credit and information but also structural issues such as ownership or rental of land and water resources, which is still a considerable constraint for the poorest households in sub-Saharan Africa (Arthur et al., 2013). Overall, it seems that peri-urban fish farmers are more likely to generate higher incomes and net returns and longer-term financial viability, than similar producers in more remote rural areas due to access to both inputs such as feed and fingerlings, and higher value markets (Arthur et al., 2013).

There is strong evidence that fish consumption is highest in the tropical sub-Saharan African (and Asian) countries, lending weight to the adage that 'fish is a rich food for the poor' (Arthur et al., 2013). Aquaculture contributes to the livelihoods of the rural poor by providing the following direct benefits: high nutritional value food, especially for vulnerable groups such as pregnant and lactating women, infants and pre-school children; employment through fish farming; and income through the sale of relatively high-value produce (Edwards, 2013).

Indirectly, aquaculture contributes to the livelihoods of the rural poor by providing the following benefits: increased availability of low-cost fish in local markets; multiplier benefits, or employment, income and value benefits to local rural industries that supply inputs to aquaculture, or that market and process the output from aquaculture; benefits from common property resources, particularly the landless, through cage culture and enhanced fisheries in otherwise underutilized resources; and increased farm sustainability through construction of ponds which also serve as on-farm reservoirs (Edwards, 2013).

## 5. Fish, Nutrition and Human Health

A healthy diet has to include sufficient protein containing all essential amino acids, lipid with essential fatty acids (EPA/DHA), vitamins and minerals (HLPE, 2014). Provided its rich nutrient content is preserved (essentially through good quality processing or when eaten fresh), fish constitutes a rich source of these nutrients (HLPE, 2014). Fish in the human diet can help reduce the risks of malnutrition and of non-communicable diseases, which may occur when a too high intake of energy is combined with a lack of balanced nutrition (Allison et al., 2013; Larsen et al., 2011; Miles & Calder, 2012; Range-Huerta et al., 2012).

Fish consumption is generally good for health (Arthur et al., 2013). The literature indicates a large and consistent body of evidence demonstrating that indeed fish consumption does provide protective effects on a wide range of health issues, including incidence of stroke, high blood pressure, coronary heart disease, and possibly cancer (Arthur et al., 2013).

## 6. Fish, food and nutrition security

The relationships between fish and food security and nutrition involve many different pathways, direct and indirect, operating at different levels from households to macro-levels (HLPE, 2014). Some pathways combine their effects towards food security and nutrition as, for example, in poor communities where fish is at the same time a source of nutrition and a source of income (HLPE, 2014). Analysis of the different pathways from fish to food security and nutrition can be done along the four dimensions of food security, namely 'food availability', 'access to food', 'utilization', and 'stability' (HLPE, 2014). Food availability entails the production and use of fish as human food, especially in the context of a growing demand for fish. The second dimension is access to food, through the fact that fish and all related economic activities in the 'fish chain' represent an important means to generate jobs, income and wealth, with positive effects from the household level to

broader economic levels. The third dimension, utilization, is the contribution of fish to good nutrition. It entails the utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met (Townsley, 2013). The fourth dimension, 'stability', results from the combination of availability and access at the macro-level, which itself is a function of the sustainability of the sector, and of access, availability and utilization at the micro or household level (HLPE, 2014). This dimension stipulates that to be food secure, a population, household or individual must have access to food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity) (Townsley, 2013).

One fundamental contribution of fish to food security and nutrition derives from its 'cash crop' function for fish-dependent communities (Bene et al., 2009; Garcia & Rosenberg, 2010). Very few fishers and fish farmers consume the totality of their production or harvest; instead, fish has always been a traded commodity and most fishworkers work for the money from the sale of their share of the catch (HLPE, 2014). Employment and income are generated along the fish food chain from primary employment (e.g. fishing crew, pond labourers) to secondary employment (e.g. formal and informal fish traders, fish processing plant workers).

Farmed fish are expected to contribute to improved nutritional status of households, directly through self-consumption, and indirectly through selling farmed fish to enhance household purchasing power (Ahmed & Lorica, 2002; Dey et al., 2006; Jahan et al., 2009). For example, in Malawi it was observed that the frequency of fresh fish and dried fish consumption is higher in households with fish ponds (Dey et al., 2006).

While many countries and regions have made considerable progress in reducing food energy deficiencies, many others, notably in sub-Saharan Africa, have either experienced a worsening of food security or have only managed to display improvements through a greater reliance on food imports from developed countries (Bene et al., 2007). Small-scale fisheries development can contribute substantially to food supply in the region.

Millions of people in the sub-Saharan African region are undernourished through deficiencies in essential vitamins and minerals, especially vitamin A, iron and zinc (Allison, 2011). These deficiencies are especially important at key stages of human life, namely pregnancy, breastfeeding and childhood, and can have severe and irreversible impacts for health and physical and mental development (Allison, 2011). Fish can potentially contribute to reducing micronutrient deficiencies in the human body and reducing the health burden of malnutrition and physical and mental underdevelopment. Some fish species, in particular the small fish that are important in the diets of the poor, have a high nutrient content, including animal protein (Allison, 2011). The importance of fish as a crucial element in the diet of a population is therefore now highly recognized, especially for the diets of young children, infants and pregnant and lactating mothers (Kurien, 2005).

Nutritionally, fish is often an important source of dietary protein, especially where other sources of animal protein are scarce, as is the case in sub-Saharan Africa (Bene et al., 2007; HLPE, 2014). Millions of the region's poor in rural and urban areas depend on fish, much of it from small-scale fisheries and fish farming, as an essential source of proteins and micronutrients (Bene et al., 2007). Fish make a further contribution to food and nutrition security above that of their intrinsic nutrient content because the consumption of animal-source food facilitates uptake of nutrients from dietary components of vegetable origin (Leroy and Frogillo, 2007). Fish proteins are essential and critical in the diets of some densely populated countries where total protein intake levels may be low and is important in the diets of many other countries. For example in sub-Saharan West Africa, the proportion of animal protein consumed that is derived from fish and marine products is 48% in Senegal, 62% in the Gambia, and 63% in Sierra Leone and Ghana (Anon, 2000). Fish also contribute fatty acids that are necessary for the development of the brain and body. In terms of energy supply, fish may contribute 20 to 30 calories per person per day (Bene et al., 2007).

In low-income countries such as those in sub-Saharan Africa, staples such as rice, wheat, maize and cassava make up the bulk of the food consumed by people, supplying most of the energy and nutrients (Bene et al., 2007). However, there are some essential nutrients that are not found in these staples or found only in small quantities, such as iron, iodine, zinc, calcium, vitamin A and vitamin C (Bene et al., 2007). These nutrients must be supplied by other foods such as fish, which are particularly rich in them. Fish contributes to food security directly through subsistence mechanisms with high quality food, including animal protein and some important micronutrients, and indirectly through incomes and livelihoods to the fishers or the people working in related activities such as processing or marketing/ trading (Bene et al., 2007).

While some studies claim that international fish trade contributes to food security in sub-Saharan Africa through fish export revenues that are used to purchase non-fish food, other studies claim that international fish exports threaten food security at the local level by siphoning off the major source of food and income from local fishing communities (Arthur et al., 2013).

The role of small-scale fisheries to food security in sub-Saharan Africa can be divided into direct and indirect contributions to food security (Bene et al., 2007). The most direct contribution of fishing activity at the household level is through the consumption of the household's catch, also known as self-consumption. Empirical studies have shown that the proportion of fish retained by households for personal consumption, gifts or barter varies widely from a few fish to the entire catch. Indirect contribution to food security at the household level entails fish's contribution to food security through the generation of incomes from labour wages and fish commercialization. This is what is called 'food security through income security' (Bene et al., 2007).

The harvesting, processing and marketing of fish generates livelihoods, employment and income for thousands of households throughout the sub-Saharan African region. However, although fish is undoubtedly an important source of food directly or indirectly, it would be incorrect to say that fishery-dependent communities are less likely to suffer from food shortages or undernourishment than any other segment of the rural population. In fact, food security has long been identified as one of the main problems affecting fishing communities. For example, more recent poverty profiles in Cote d'Ivoire showed that food insecurity is endemic among artisanal fishers in terms of the availability of quality foods and diversification of diets (Pittaluga, 2003).

## 7. Small-Scale Fisheries and Economic Growth

At the national level, small-scale fisheries can contribute to poverty alleviation through economic growth via the following processes: multiplier/ GDP effects; generation of tax revenues; and generation of foreign exchange (Bene et al., 2007). Income multiplier effects can potentially trickle up to the national economy, ensuring that small-scale fisheries can support national economic growth by contributions to GDP through direct and induced impacts (Bene et al., 2007). The direct contribution made by the small-scale fisheries sector in sub-Saharan Africa typically ranges around 0.5 – 2.5% of GDP, but may be as much as 7% in some countries like Senegal (Bene et al., 2007).

Taxes provide the state with an opportunity to assist poverty alleviation initiatives. In many sub-Saharan African countries, tax revenues from small-scale fisheries are not ring-fenced for retention within the fisheries sector, but are deposited into national treasuries (Bene et al., 2007). Funds available to national treasuries can then be spent on redistributive mechanisms aimed at targeted poverty prevention on generic social support. But the funds might also be used to invest in and provide support for infrastructure and services that are vital for economic development (Bene et al., 2007). Examples include the construction of transport infrastructure such as roads to facilitate access to markets, and the provision of education and health care facilities. Taxes can, of course, also be used to support sector-specific development programmes and recurrent budgets in the small-scale fisheries sector, which might contribute to both poverty prevention and poverty reduction (Bene et al., 2007). However, the collection of taxes from small-scale fisheries in sub-Saharan Africa is not well-enforced due to the difficulties related to tax collection, such as geographical remoteness, mobility and reluctance of small-scale operators to keep sufficient records on the basis of which tax levels are calculated or estimated (Bene et al., 2007).

Export earnings from fisheries in some countries can contribute very large proportions of total export earnings. For example, in Mozambique, Mauritania and Senegal, fisheries have historically contributed as much as 50% , 40% and 37% respectively to national export earnings (Wilson, 2003).

## 8. Small-Scale Fisheries and Rural Development

Wealth generated through small-scale fishing or related activities such as fish marketing can also be a powerful factor in reducing poverty at the local level. Wealth produced by individuals, households or small-scale enterprises can make significant contributions to rural development through income and employment multiplier effects (Bene et al., 2007). Multipliers arise because fishing activities use the products of other industries to produce their own products, and because outputs from fishing become inputs to other industries or businesses.

The impacts of small-scale fishing activities on rural development can be direct and/ or induced (Bene et al., 2007). Direct impacts relate to sales, income and employment effects on the producers themselves, which result from changes in the demand or production of fish and fish products (Bene et al., 2007). Indirect impacts relate to the sales, income and employment effects on local rural businesses that supply goods and services to small-scale fish producers (e.g. vessels and gear, fuel, ice, food and bait, labour , financial services, and maintenance) or which market or process their products down the supply chain (e.g. design, processing, and equipment supply firms; transporters of fish from landing sites and to markets; and those which supply ice, knives for cutting, wood for smoking, salting and drying fish, and packaging materials and fish boxes. The former are termed 'upstream', and the latter, 'downstream' activities (Bene et al., 2007). Induced impacts are the sales, income and employment effects resulting from changed levels of income and expenditure throughout the local economy as a result of direct and indirect impacts. For example, fishing crew may use their earnings to purchase groceries or household items. Upstream and downstream activities are provided by small-scale businesses within the local rural area, thereby generating sales, income and employment, and contributing to poverty reduction and rural development (Bene et al., 2007).

## 9. Small-scale fisheries and household poverty alleviation

In many parts of sub-Saharan Africa, fishing is not a full-time occupation, but is part of a multi-activity livelihood strategy developed by individuals or households (Bene et al., 2007). The few studies that have attempted to estimate the contribution of fishing in these multi-activity based households have demonstrated that it can play a major role (Bene et al., 2007). In the Zambezi Basin for example, a recent study showed that inland fisheries, through their contribution to the households' cash income, generate more cash than cattle and sometimes even more than crops (Turpie et al., 1999). Other studies also emphasize how in floodplain areas, fishing fits within a flexible matrix of various activities that constitute the basis of a diversified livelihood strategy on which households rely in order to spread risks between various economic activities in an uncertain environment (Bene et al., 2007). Fishing in such areas also creates a synergy between the inputs and outputs of these activities, thereby enhancing capital accumulation

and income opportunities. Fishing as a secondary or complementary activity is therefore essential for rural households both in terms of income and food security (Bene et al., 2007).

## 10. Small-scale fisheries as a safety net activity for the poor

Small-scale fisheries can provide a critical safety net for vulnerable households (even those who were not previously poor) when they face a sudden decline in their income (Bene et al., 2007). This can occur, for example, when the head of household loses his or her job, farm crops fail, or on a larger scale, when the local or even national economy deteriorates. Recurrent civil wars or military conflicts, population displacements and natural disasters, all frequent in sub-Saharan Africa, also create circumstances where those affected turn to fisheries as additional or alternative sources of income, food and employment, especially given the open access nature and management of many fish resources (Bene et al., 2007).

In Southern Africa, for instance, the Lake Kariba fishery has been shown to have fulfilled this role at least twice over a number of years (Jul-Larson, 2003). First, in the mid-1970s several thousand miners working in the Copperbelt in Zambia lost their jobs and migrated to the Lake region, where they undertook fishing as an alternative support for their livelihoods. Second, a few years later during the Zimbabwean Independence War, several hundreds of families moved to the Lake region for security reasons and engaged in fishing to ensure survival revenue until the political situation in their area of origin had improved (Bene et al., 2007).

## 11. Challenges and Constraints Facing Small-Scale Fisheries and Aquaculture

Small-scale fisheries in sub-Saharan Africa are threatened by overfishing, pollution and competition for water (HLPE, 2014). The significant development of aquaculture raises many questions about its environmental impacts on land, water and biodiversity, and has itself to face competition from other users of land and water (HLPE, 2014).
Fishing communities face many health hazards (Arthur et al., 2013). Fishing is among the most dangerous occupations in the world. For various social, cultural and economic reasons, fishing communities are particularly exposed to risks related to diseases such as malaria, water-borne diseases, STDs and HIV/AIDS (Arthur et al., 2013). Aquaculture provides suitable conditions for the breeding of mosquitoes which thrive in open standing water, as well as for the spread of Schistosomiasis, a water-related parasitic infection that affects more than thirty million people in East, West and Southern Africa (WHO, 1995). Therefore, the risks should be assessed and appropriate measures taken to control the breeding of snails and mosquitoes in ponds, and to keep the ponds clean from human waste. Prevalence of these diseases is often higher among fishing communities than the rest of the population.

In parts of Southern Africa such as the North-Western Province of Zambia, seasonal competition for labour and inputs is particularly noted as a constraint to increased production. (FAO, nd). In addition, there is often a lack of stable access to land and/ or water, and poor access to markets or access on terms which are advantageous to fish producers (Townsley, 2013). Small-scale aquaculture producers constitute a sizeable number of poor rural farmers, and as such they are unable to exert any meaningful influence over decision making. Their lack of political capital often makes them vulnerable in conflict situations as they are more likely to be unable to influence how these conflicts are resolved (Townsley, 2013). Lack of working capital to invest in initial inputs is a common feature of rural poverty. This is particularly acute because aquaculture activities may depend on expensive seed and feed inputs (Townsley, 2013).

The technical skills involved in aquaculture may be relatively complex. Yet because the poor are mostly engaged in ensuring their day-to-day survival, they have little time to invest in education and often lack the skills required for more complex activities (Townsley, 2013). Similarly, access to information, including technical information on how to conduct aquaculture, may present a significant challenge for the poor. Additionally, the poor tend to be of necessity, risk-averse as any increase in risk can have disastrous implications for those already living on the borderline of destitution, such as small-scale aquaculture producers (Townsley, 2013). Furthermore, aquaculture farmers are constrained by the availability of animal manure to use as fish feed because of the free range nature of animal husbandry, and the high cost of inorganic fertilizers, thus the need to focus on appropriate farm-made feeds (FAO, 2007).

In all sub-Saharan African countries access to credit is very limited, and banks consider aquaculture in the region a high risk investment (SARNISSA, 2010). Even if credit is available, the high cost of credit inhibits fish farmers' access.

Finally, climate change and extreme weather events such as floods, droughts and storms have unpredictable consequences for aquatic production (FAO, 2008). The smallholder group of farmers normally does not have the safeguards to depend on, guard against or ameliorate such natural calamities (WorldFish Centre, 2009). In sub-Saharan Africa, climate change phenomena like droughts and floods are now major concerns as they affect aquaculture in terms of destroying ponds, with fish escaping into the wild, or causing the drying out of previously permanent water sources (Mwanja & Nyandat, 2013).

## 12. Fish Processing and Marketing

Fish is a highly perishable commodity that is susceptible to high post-harvest losses. There is consistent evidence that these losses occur throughout the food value chain and can be both quantitative and qualitative (i.e. economic and nutritional) (Arthur et al., 2013). However, in developing countries such as those in sub-Saharan Africa, processed fish (dried, salted, smoked, or fermented) typically outweighs fresh fish by volume and number of traders (Arthur et al.,

2013). Furthermore, these types of processing typically produce little waste when compared with fillet processing. Proper smoking improves the keeping quality of dried fish and can also increase its acceptability (FAO, nd). In addition, fish from small-scale local producers that is processed and preserved using these methods can be supplied to both local and distant markets, and there is often a diverse range of actors involved before the processed fish reaches the final consumer (in the case where fish is not directly consumed by producers), such that fish feature in a wide range of livelihoods (Arthur et al., 2013). The ability to store and transport preserved fish products makes them accessible to consumers in arid or mountainous areas where little or no fish is available, as well as smoothing seasonal peaks and troughs in supply in fish producing areas (Belton & Thilsted, 2014).

Processing of fish in sub-Saharan Africa is often managed by women (FAO, nd). Traders, particularly women, as well as their clients, should be educated about the strict hygienic practices required in handling fish. If fish purchasers, who also tend to be women, are unaware of the health advantages from improved food quality and safety (for example of fish sold in ice) they may be unwilling to pay more for the more hygienic fish (FAO, nd).

Efficient marketing of fish in sub-Saharan Africa is often hampered by remoteness and large distances to the market, as well as poor infrastructure conditions and high transport costs, constraining especially small and medium scale, but sometimes even large-scale aquaculture systems (SARNISSA, 2010). The security situation in certain countries or that affect the whole region can be an important fish marketing constraint. For example, in 2008 catfish fingerling production in Uganda dropped by 50%, largely due to insecurity in Kenya that affected the flow of imported goods and services from the Kenyan port of Mombasa to Uganda (SARNISSA, 2010). Another marketing constraint for fish in sub-Saharan Africa is low local demand. Due to transport difficulties fish often has to be marketed mainly locally, where demand may be more limited and prices may be lower (SARNISSA, 2010). These problems are compounded by fluctuating prices and farmers' lack of information on prices, buyers and consumer preferences. There are also difficulties of reaching high end-user consumers such as high class hotels, the tourism industry and larger supermarket chains for smaller and individual producers (SARNISSA, 2010). Fish is a perishable commodity and the absence of storage facilities such as ice can hamper any fish marketing efforts by aquaculture producers in the region. Fish from sub-Saharan Africa faces stiff competition from international markets such as Asia, and low international market prices for imported Asian frozen fish are a major limitation to the profitability of fish marketing operations in the region (Desprez, 2009). Fish exports from sub-Saharan Africa may be affected by trade policies of export destination countries. An example is the limitation caused by EU regulations regarding fish and fish products from African countries (Desprez, 2009).

## 13. Gender in Fish Farming and Small-Scale Capture Fisheries

Within the population groups directly linked to fish production and supply chains, gender has a central role to play in the different mechanisms and processes that determine food security and nutrition, namely availability, access, stability, utilization, and nutrition adequacy (HLPE, 2014). Gender, along with intersectoral factors such as economic class, ethnic group, age or religion, influences food security and nutrition (HLPE, 2014). Most work in fisheries and aquaculture is differentiated by gender. Women work in almost every type of fish sector activity but their typical roles are much less visible than those of men, often leading to the perception that fisheries and aquaculture are men's domains, especially in sub-Saharan Africa (Davis & Nadel-Klein, 1992; Bennett, 2005; Williams et al., 2005). Weeratunge et al. (2011) even suggest that if gleaning and post-harvest activities were enumerated, the fisheries and aquaculture sector 'might well turn out to be a female sphere'.

Men are dominant in the fisheries and aquaculture direct production work. Much of women's work, such as gleaning and post-harvest processing and vending, is not recognized or is poorly recorded, despite its significant economic and other contributions (Weeratunge et al., 2010). Women's participation in small-scale fisheries varies greatly from country to country (e.g. over 70% in Nigeria, 40% in Ghana, 32% in Senegal, and 4% in Mozambique) (HLPE, 2014). In aquaculture, women are more active in small-scale operations, hatcheries and post-harvest processing (Williams et al., 2012).

As in most economies subject to increasing globalization, women's incomes in small-scale fisheries and aquaculture in sub-Saharan Africa are usually lower than those of men (HLPE, 2014). Even where women are the majority, such as in processing factories, few women rise to the supervisor and management levels. Those that rise are either better educated than their male counterparts, or are the wives of top managers (HLPE, 2014).

There is almost a consensus in the literature that women's roles in fisheries are not fully recognized, are often unrecorded and undervalued, and are largely invisible in national statistics (Arthur et al., 2013). Almost 50% of the people employed in the primary and secondary sectors associated with small-scale fisheries are women (Mills et al., 2011). Besides being fishers themselves, women are heavily involved in the processing and marketing of fish and fish products from small-scale fisheries (Bene et al., 2007). Fish marketing is in most cases the responsibility of women (FAO, nd). Williams et al. (2002) note that women in the small-scale fisheries sector are more disadvantaged and vulnerable than men, and certain types of social marginalization may be gender-specific.

Gender-disaggregated data in small-scale fisheries are not routinely or systematically collected, and as a result little policy attention is given to the gender dimension in the small-scale fisheries sector in sub-Saharan Africa (HLPE, 2014). Small-scale fisheries, women's livelihoods, and food

and nutrition security tend to be strongly linked, yet women's sectoral needs tend to be ignored. Female-headed small-scale fisheries tend to be significantly poorer and hence more likely to suffer food insecurity than fisheries headed by their male-headed counterparts (HLPE, 2014).

## 14. Conclusions and Recommendations

The development of small-scale fisheries should be supported by national efforts covering the following areas: community-based fisheries management (CBFM); involvement of small-scale fisheries in policy, legislation and management processes; formulation and enactment of local by-laws that can support particular local circumstances; movement of migratory fishers and access to fish resources (although care needs to be taken concerning migratory rights coming into conflict with indigenous fishing rights); and addressing social security and labour rights issues in small-scale fisheries.

From the preceding discussion of the role of fish in socio-economic development in sub-Saharan Africa, it is clear that fish deserves a central position in national food security and nutrition strategies. Governments in the region should therefore make fish an integral component of inter-sectoral national food security and nutrition policies and programmes, with special regard to promoting small-scale production and local arrangements (such as procurement through local markets, e.g. for school meals) and other policy tools, including nutrition education. National governments should also include fish in their nutritional programmes and interventions aimed at tackling micronutrient deficiencies especially among children and women. They should also conduct regular intra-household studies to better understand the pathways between fish, gender and the nutritional status of individuals and households, based on gender-disaggregated data.

Governments and other stakeholders in the public and private sectors should recognize the contribution of small-scale fisheries to food security and nutrition, and take into account their characteristics in the design and implementation of all national and international policies and programs related to fisheries. These stakeholders should support self-organized local professional organizations and cooperatives, as these arrangements strongly contribute and foster the integration of small-scale operations into markets. Furthermore, they should promote the contribution of small-scale fisheries to food security and nutrition and, in particular, develop national policy regulations that protect small-scale fisheries.

With regard to social protection and labour rights, governments, in particular state labour agencies, in collaboration with fisheries agencies, should improve national regulations for fishworkers, including women workers in fish processing factories and markets. Stakeholders in the small-scale domestic fishing industries should put in place social protection systems in the form of minimum wages and social security schemes for both fishers and fishworkers, including self-employed workers, women and migrant workers.

With regard to gender equity, states should ensure that their aquaculture and fisheries policies and interventions do not create negative impacts on women, and encourage gender equality. They should also ensure gender equity in all fisheries rights systems, including licensing and access rights. Good governance measures should, among other things, promote women's participation in aquaculture and small scale fisheries. It has been observed that women's participation ensures more equitable resource sharing within the family, while improving their position in society.

There is also need for adequate funding of small-scale fisheries and aquaculture, given their demonstrated contributions to poverty alleviation, food and nutrition security. Funding is a key requirement in implementing policy, legislation and management in general, as well as implementing specific strategies aimed at supporting small-scale fisheries and the poor and food-insecure. Clearly, donor agencies can play an important role here; but it is also important for fisheries ministries and departments, as well as ministries of finance or national treasuries to ensure that adequate and specific budget allocations are made to allow support for the development of small-scale fisheries and aquaculture projects.

Finally, direct involvement of farmers and other stakeholders in the process of priority setting and choice of technology is likely to make aquaculture adoption rates to improve.

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