

## Contributions of fisheries for Food and Nutrition Security: A review with Ethiopian contexts

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### Abstract

In Ethiopia, mainly fish productions are from Great Rift Valley lakes and in some other northern parts of the country. Despite the potential of fish production its fish consumption is insignificant and found to play little role in the households' livelihood. The demand for fish in the country is increasing; however, the supply side is not increasing with large opportunities to produce. For The consumption pattern and demand is increasing. The total fish production of the country accounts only 0.58% of total production in Sub-Saharan African countries. Therefore with a little contribution for food and nutrition security the fishery sector has challenges related to existing climate changes, mismanagement fishery resources, lack of timely policies and institution and other technical backups related to loose rules and regulations. There are numerous explanations ascribing to the low and poor production due to inappropriate and not advancing fishing methods, economic disabilities related to infrastructures like preservation technologies. The absence of appropriate managements has been affecting the utilization of fishery resources. Thus future works has to give due attentions to exploit the fish production potentials and enhance the contributions to food and nutrition security.

**Keywords:** fish productions, nutrition security

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### Introduction

Malnutrition is a problem of staggering size worldwide large enough to threaten the world's sustainable development ambitions for the post-2015 period. It affects all countries and almost one in three people on the planet. Almost 2 billion people experience micronutrient malnutrition (WHO, 2015m) and nearly half of all countries are dealing with more than one type of malnutrition at the same time (IFPRI, 2014a). The multiple burdens of malnutrition – undernourishment and under nutrition, micronutrient deficiencies, and overweight and obesity – impose high and, in some cases, rising economic and social costs in countries at all income levels. Different types of malnutrition may coexist within the same country, household or individual, and their prevalence is changing rapidly along with changes in food systems. The often confusing terminology used to describe malnutrition is it itself a reflection of the complex, multidimensional, dynamic nature of the problem and the policy challenges associated with it (FAO, 2013). Chronic food insecurity in Sub-sahara Africa is primarily caused by explosive population growth, high dependency on natural resources, deteriorating climate, low productivity, lack of appropriate storage facilities and a low level of income (UNDP, 2010). Today, under nutrition due to the mentioned challenges, still persists in the vast majority of the world's poorest countries, affecting in particular women and children. While the more obvious signs of under nutrition— mortality, morbidity, stunting and wasting—have received substantial attention in the past, the hidden consequences of inadequate nutritional intake have only started to be recognized. Under nutrition have very severe consequences

for human health and development (some of which have irreversible sequels). Ending hunger and reducing under nutrition has therefore become a key objective of the Sustainable Development Goals (SDGs). Agriculture is viewed as the central element of this goal, therewith endorsing an agricultural, food-based, rural-centered approach. However, to alleviate hunger and promote food security and nutrition, there can be other “means” that are even more important in many countries. While undernourishment can be improved by increasing energy intake, the problem of micronutrient deficiencies is of a different nature as it results from an inadequate quality of diet.

As foods from animal sources are important sources of micronutrients, their consumption has been promoted through food-based approaches as one of the ways to combat micronutrient deficiencies. It is not, however, always possible for poor households to increase consumption of foods from animal sources due, in particular, to the limited affordability, availability and cultural acceptability of these types of food (Pachón et al., 2007). In these respects, fish offer advantages as they may be more affordable, more available and consumed for preference in various regions of the developing world. Fish is staple food and as a source of animal protein. As a food for households, it is rising globally and the number of households participating in the sector is also among the growing food sectors in the world specifically in Asia (Speedy, 2003; Ahmed and Lorica, 2002). Interventions related to fish intake have therefore been implemented in Asia and Africa with the objective of promoting fish consumption to improve nutritional status (Kawarazuka, 2010). From the livelihood and rural development perspectives, livestock interventions at the homestead level have been implemented as a way to increase consumption of foods from animal sources. Also, in this context, small-scale fisheries and aquaculture have been recognized as important opportunities for enhancing household food security.

### **Overview of link between fishery and nutrition**

Global aquaculture production has grown at 10 to 11 percent a year over the past decade and is projected to continue increasing. Food and Agriculture Organization reported that out of the total tons of fish consumed in the world every year, almost half is produced in a controlled environment, whereas the remaining half is harvested from the wild. Aquaculture is developing, expanding and intensifying in almost all regions of the world, except in Sub-Saharan Africa, as the global population demand for aquatic food products is expected to increase (FAO 2012). People who are food and nutrition insecure largely reside in Asia and Sub-Saharan Africa and for many; fish represents a rich source of protein, micronutrients and essential fatty acids.

The contribution of fish to household food and nutrition security depends upon availability, access and cultural and personal preferences. Access is largely determined by location, seasonality and price but at the individual level it also depends upon a person’s physiological and health status and how fish is prepared, cooked and shared among household members. The sustained and rapid expansion of aquaculture over the past 30 years has resulted in >40% of all fish now consumed being derived from farming. While aquaculture produce increasingly features in the diets of many Asians, it is much less apparent among those living in Sub-Saharan Africa. The per capita fish consumption has grown little and despite the apparently strong markets and adequate biophysical conditions, aquaculture has yet to develop. The contribution of aquaculture to food and nutrition security is not only just an issue of where aquaculture occurs but also of what is being produced and how and whether the produce is as accessible as that from capture fisheries. The range of fish species produced by an increasingly globalized aquaculture industry differs from that derived from capture fisheries. Farmed fishes are also different in terms of their nutrient content, a result of the species being grown and of rearing methods. Farmed fish price affects access by poor consumers while the size at which fish is harvested influences both access and use (Beveridge *et al.*, 2013).

### **Overview of Fishery and Aquaculture as a means of addressing Food and Nutrition Security**

Fish is nutritionally important in many African countries as well as in Asia and Oceania. There are 30 countries who meet this criterion, including 22 countries which were officially referred to as low-income food-deficit countries (LIFDC) in 2009 (FAO, 2009 b). In other words, a large majority (73%) of the countries where fish is an important source of animal protein are poor and food deficient countries. In many low-income countries with water and fisheries resources, fish is important for livelihoods, income and as food for the rural poor who suffer disproportionately from under nutrition, including micronutrient deficiencies (Thompson and Subasinghe, 2011). For these population groups, fish is by far the most frequently consumed animal-source and thereby makes a valuable contribution to the diversity of everyday diets, dominated by carbohydrate-rich staples. Fish can therefore be considered an irreplaceable animal-source, providing essential nutrients of high bioavailability which are found in limiting amounts in the diet. These nutrients include animal

protein, essential fats, minerals and vitamins. Small fish, eaten whole or as fish products, e.g. dried fish are particularly rich in calcium and other micronutrients. In terms of protein, it is recognized that in low-income food-deficit (LIFD) countries the main sources of protein comes from plants such as rice, maize, or cassava (FAO, 2009). In addition, as pointed out by Kawarazuka (2010), in some conditions fish can be a far more efficient source of protein than any other food for the poor, due in particular to their accessibility, availability and digestibility. While the digestibility of foods derived from plants is very poor compared to those derived from animals, among the latter, fish is one of most affordable and accessible sources

The importance of fish as a source of animal protein and essential fatty acids is reasonably well documented. Recently studies suggest, however, that fish—and in particular small fish species—are rich in micronutrients (including calcium, iron and zinc and in vitamin A) (Kawarazuka, 2010). Plant foods, especially staples such as rice and maize, which contain low concentrations of lysine, have relatively limited levels of protein absorption as the amount absorbed is determined by the concentration of the least well represented essential amino acid (WHO, 2007). In contrast, proteins from animal sources, such as fish, have more balanced concentrations of all the essential amino acids and their concentration of lysine is particularly high (USDA, 2005).

### **Direct Contribution to Dietary Intake through Fish Consumption**

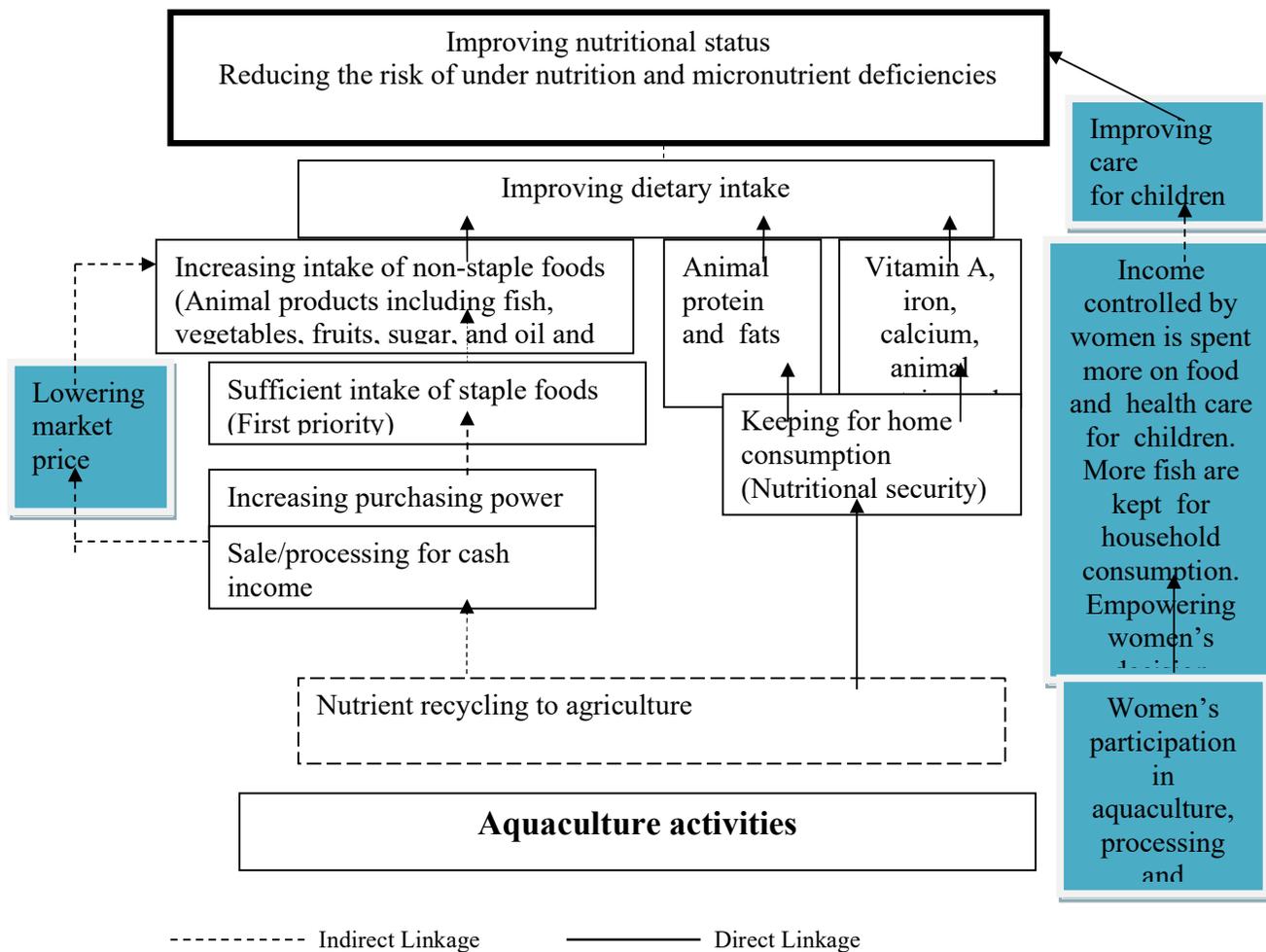
Poor people in developing countries tend to depend essentially on carbohydrate-based diets for their nutritional intake. These are, however, relatively low in protein and micronutrients. In this context, fish can play a particularly important role in combating micronutrient deficiencies, as they contain high quality protein, essential fatty acids and also key micronutrients such as vitamin A, iron, calcium, zinc and iodine (Kawarazuka, 2010). Fish is a preferred food item in the diets of many, especially poor, consumers. Fish provides energy and is a superior source of protein to other animal source foods in terms of total protein and essential amino acid content and digestibility (Kawarazuka & Béné, 2011). It is as a source of essential fatty acids and micronutrients, superior in both qualitative and quantitative terms to other animal-source foods, that may be of greatest importance in food and nutrition security terms.

Studies published in the literature report an increase in household consumption of fish for those who invest in pond-based aquaculture or in integrated agriculture-aquaculture. Consuming fish produced by their own ponds is a way for households to directly improve nutritional status through aquaculture (Kawarazuka, 2010). In India, Kumar and Dey (2006) observed that the energy intake of households that own fish ponds was 10.9% higher than that of households with wage earners but without ponds, and that the undernourished population amongst the fish pond owners was 10% lower than the control population. In the Dinajpur district of Bangladesh, it was shown that small fish species are important food items for low income households with fish ponds, especially in months when vegetables are not available or not affordable (Islam, 2007). In Malawi, Dey and his colleagues compared fish consumption between households with and without fish ponds. They observed that the frequency of fresh fish and dried fish consumption is higher in households with fish ponds (Dey *et al.* 2006).

### **Indirect Contribution through Household Income**

Fishing plays an important role in supporting livelihoods worldwide and also forms an important source of diet for over one billion people. In addition to direct contribution to dietary intake, fish is sold, contributing to household food security indirectly through increasing household income which can be utilised to purchase other food commodities, including lower cost staple foods (Béné *et al.*, 2007; Aiga *et al.*, 2009). It is one of livelihood strategies that have contributed much to people in developing countries. It is one of the vital strategies for the poor to achieve food, income and other social benefits. For instance, it serves as an important source of diet for over one billion people (Manasi *et al.*, 2009). The latest estimates from FAO indicate that small-scale fisheries contribute over half of the world's marine and inland fish catch of about 140 million metric tons, nearly all of which is used for direct human consumption (FAO, 2008). They play a vital role in contributing directly to food and livelihood security, poverty reduction, wealth creation, foreign exchange earnings and rural development especially in developing countries. The positive impact of fishery on household incomes was observed in several studies. In Ethiopia, a study done by Gebremedhin and his colleagues (2013) done in Lake Tana showed a significant income difference between fishers using modern and traditional boats. Fisheries contributed 48% to the total annual income of the fishers in Lake Tana. In Malawi, Dey and his colleagues found that the income of households owning fish ponds was 1.5 times higher than that of households without fish ponds (Dey *et al.*, 2006). In Bangladesh, Jahan and colleagues found that the average gross income of households recently engaged in pond aquaculture with technical support and management grew 8.1%/year generating a return on family labour of 15.6% year. For poor rural households engaged in aquaculture or capture

fisheries the surplus cash generated by selling fish is often used to buy food. Recent studies highlight the positive effects of household income from aquaculture in increasing consumption of staple foods (Jahan *et al.*, 2009).



Source: Kawarazuka N. (2010)

Figure 1: The pathways through which aquaculture can contribute to improving nutritional status of the women

Additionally, the ideas of the contributions of fishery may be depicted in the UNICEF (1990) conceptual framework of malnutrition which was adopted from the UNICEF's malnutrition conceptual framework. According to the conceptual framework the causes of malnutrition can be categorized into Immediate, Underlying and basic causes. Poor nutritional status results from underlying problems related to social institutions and mechanisms which give rise to poverty and inequality basic determinants) in a broader context. Household food security; maternal and child care; and health services and healthy environment, are three pillars of underlying determinants of nutritional status. Diversifying livelihoods to increase household income sources is a way of improving household food security. Although fish-related literature often does not include studies related to other pillars, child care, especially breast-feeding is an important factor to determine children's nutritional status. Access to health services and living environment is also an important factor as it determines the risk of diseases. Dietary intake is an immediate determinant of nutritional status. The typical diet of the poor is dominated by staple foods with small amounts of other plant-source foods such as vegetables and animal-source foods. Diversifying diet by adding animal-source foods, fruits and vegetables in their diets provides a variety of nutrients, contributing to improving nutritional status.

Disease is another determinant of nutritional status, and there is a direct correlation between these two factors. For example, an inadequate diet results in increasing the risk of diseases. Sick people require additional energy intake to fight disease, and at the same time, they have a poor appetite. Meanwhile in affected households, the labor productivity is reduced and extra money and time to care for the sick are needed. Consequently, diseases affect the nutritional status of not only individuals, but also other household members. In contrast, adequate dietary intake maintains the body's immunity and decreases the risk of diseases, contributing to minimizing extra costs and time for care and treatment, while optimizing labor productivity. Taking in mind this conceptual framework, it's possible to understand the impacts of small scale fisheries and aquaculture as shown in the following conceptual framework. In this regards, fishery and aquaculture could contribute to nutrition through dietary intake and food security of individual and households.

Many studies in fishing community do not prioritize about the nutritional status of the fishing community as it is difficult to analyze the nutritional outcome. A study in Laos (Meuschet *et al.*, 2003) showed that decreased fish catch resulted in low consumption of fish. As a result high prevalence of malnutrition occurred in the study area and optional capacity building of sustainable aquatic resource management strategies were drawn to improve the current nutritional status of the fisheries community. Another study in Kafue flats, Zambia, found that the relations between low fishing access in the community and household food insecurity and child growth. Fishing activities were a significant and regular practice for the local women to manage with food insecurity, especially during a food scarcity period. High fishing market and increased migrants made it difficult for the locals to engage in fishing, which resulting in increasing vulnerability to food insecurity (GFIES, 2014, Ma'alin *et al.*, 2016, Ayala and Meier, 2017). However, fisheries and under nutrition cannot be simply connected as causal relationship because the nutritional status is determined by many factors and fishing activities are only contribute a small part which can influence to key factors which directly and indirectly relate to nutritional status. Study in Kenya showed the body mass index of lactating mothers from fishing household were found to have a higher body mass index (BMI) compared to non-fish households from fishing households, 11.1% mothers were underweight, 72.2% had optimal weight and 13.0% were over-weight while 3.7% were obese. For those from non-fishing households, 68.5% were underweight, 24.1% had optimal weight and 5.5% were overweight while 1.9% were obese (Nguka G *et al.*, 2017).

### **The Contributions for Food and Nutrition security and existing challenges in Ethiopia**

Fish production and consumption could make the best possible use of underutilized resource presently available to the small farmers to raise their income and also to improve their nutritional status particularly through supply of animal protein and micronutrient requirements. The double burden of malnutrition in Ethiopia can be addressed through linkages of agriculture to nutrition emphasizing food production. In alleviation of these chronic problems for searching for alternative food and income sources and employment opportunities, like fishery sub-sector needs to be given special attention. There must be also an effort towards promotion of agricultural products and fishery for consumption. This effort will be on the ground with evidence based research. In Ethiopia there are many alternative means of achieving food and nutrition security in particular and poverty reduction. Despite the presence of lakes, rivers and reservoirs potential opportunity to produce fish, its

consumption is insignificant and found to play little role in the households' livelihood. Therefore it is very true to say fisheries and aquaculture in Ethiopia remains more potential than in actual practice, despite the fact that the country's environmental and socio-economic conditions support its development (FAO, 2005). The consumption and demand for fish as a cheap source of protein is on the increase in Ethiopia. But the fish supply in most cases comes from the major lakes and rivers in the country. Like other sub-saharan African countries, fisheries from natural water bodies have failed to meet the ever growing demand for fish. (Moehl *et al.*, 2005). Despite the country's huge aquaculture potential, the contribution of aquaculture towards food and nutrition security is insignificant (Ministry of Agriculture annual report, 2008). Therefore, the importance of aquaculture development for poverty mitigation and food self-sufficiency in the country could not be over emphasized (Kassahun, 2012).

Mainly fresh fish is produced in the Great Rift Valley lakes and in some other northern parts of the country. Price wise, fish is relatively expensive compared with the local prices of vegetables and grains on a unit weight basis, but it is frequently less costly than alternative animal protein sources. With increased marketing efforts and increase in supply, the demand for the fish product could be tremendously increased from the current level. The demand for fish is higher than supply especially in Ethiopian fasting season. This is because of religious influences on consumption patterns; the demand for fish is only seasonal. During lent, Christians who abstain from eating meat, milk, and eggs consume fish, since fish is the substitute of meat (Assefa, 2013). Additionally, fish consumption per year is very low (OECD-FAO, 2011). The national food consumption survey of Ethiopia (2013) indicated that the food group contributing to the highest proportion of women's diet was cereals or grains. Flesh foods including fish consumption was again very low for women in all regions. In the SNNP region, the consumption of this food group 0.4% in relation to the other food groups. On the other hand, it was reported that only 2.6% of pregnant women consumed fish in Wondo Genet districts of Sidama zone (Desalegn K., 2011). Even though the demand for fish in the country is increasing, the supply side is not increasing with large opportunities to produce. As mentioned, the potential productions in Ethiopia are major lakes, reservoirs, dams, small water bodies and rivers.

Ethiopia is endowed with many lakes and reservoirs for fish productions. The environmental conditions are very conducive fishery and aquaculture. Therefore, as a means of achieving food and nutrition security and poverty reduction it is important to invest on it. However, the fishery sector has challenges related to existing climate changes, mismanagement fishery resources, lack of timely policies and institution and other technical backups (Kebede et al, 2017). There are numerous explanations ascribing to the low and poor production due to inappropriate and not advancing fishing methods, economic disabilities related to infrastructures like preservation technologies. The existing rules and regulations are not tight as required. The absence of appropriate managements has been affecting the utilization of fishery resources (Lemma Abera Hirpo, 2017). Fish consumption pattern and demand is increasing in Ethiopia. However, in 2016-year Ethiopia produced a total of 45,610 tones (*i.e* only 0.58% of total production in Sub-Saharan African countries) (Alemayehu and Tamiru, 2019). Despite the existing challenges fishery has been providing multiple ranges of positive contributions for food and nutrition security. Individuals and households relying on fish production earn income which could directly linked with household assets (Dagninet Amare, 2018). Additionally, the study done in Hawassa, Ethiopia indicated that reproductive age women from fishing households had better fish consumption; household food security and minimum dietary diversity. This shows that fishing contributed to food and nutrition security (Samrawit et al, 2020).

## Conclusions and Recommendations

In many low-income countries with water and fisheries resources, fish is important for livelihoods, income and as food for the rural poor who suffer disproportionately from under nutrition, including micronutrient deficiencies. In alleviation of chronic nutrition problems for searching for alternative food and income sources and employment opportunities, like fishery sub-sector needs to be given special attention. The contribution of fish to household food and nutrition security depends upon availability and access. Ethiopia, the landlocked country, mainly gets fish Great Rift Valley lakes and in some other northern parts of the country. Fish production plays insignificant and little role in the households' livelihood. The supply side does not much with the existing demands. The total fish production of the country accounts only 0.58% of total production in Sub-Saharan African countries. Thus fishery is contributing a little due to existing challenges related to production. The challenges are related to existing climate changes, mismanagement fishery resources, lack of timely policies

and institution and other technical backups related to loose rules and regulations. Thus, to exploit the maximum contribution of fishery and aquaculture special attentions has to be given Ethiopia.

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