



Understanding fisheries' Contribution for food and nutrition security in Ethiopia: A review study;

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Abstract

The objective of this review was to summarize the food and nutrition security functions of fisheries sector in Ethiopia. Published and unpublished sources were used to obtain appropriate data. Fishery sector is the most important livelihood activity in Ethiopia. The contribution of fishery sector however is not visible in food and nutritional security of the poor society. This is because almost all of the production is from small-scale artisanal fisheries. Poor quality of fish products due to poor handling, processing, and transportation, climate change, poor organizational structures in fishery governance, are affecting the sector. These problems led to misrepresentation and undermine the role of fisheries sector in the livelihood of poor societies of the country. Therefore, effective management and follow up is very important in order to improve the benefit from the sector, with more focus to encouraging the development of aquaculture.

Key words: - livelihood, food security, nutrition security, capture fishery, aquaculture, Ethiopia

1. Introduction

1.1. Background

In Ethiopia what we are revealing from different studies is that the decrease in the agriculture industry is contributing to the GDP growth of the country. But the sector is still given a priority in leading the country's development as well as the economy (NBE., 2019). To attest this, we can see the ten-year (2020 to 2030) perspective plan of the government. In this plan agriculture has been taken as an engine to the growth and development of the economy. This is because; much of the Ethiopian's relies on subsistence agriculture and the sector is still a host of an immense amount-73 percent of the population which generates 90 percent of the export earnings and supplying 70 percent of the required raw materials for the manufacturing industry with this perspective it is continuing to be the influence of the performance of other sectors (WFP., 2019, WFP., 2020).

Not only the ten-year perspective plan of the country but also the previously implemented strategies (the five-year growth and transformation plans (GTP-I and GTP-II) envisaged the agricultural sector as the major source of growth and thereby to lay the foundation for rapid industrialization and economic structural transformation by developing the industry sector more rapidly than the agricultural sector.

In the last two GTP periods progress has been made in alleviating food insecurity and poverty as well as unemployment rate and nutrition status of children. The prevalence of stunting in children has decreased considerably, from 44% in 2010/11 to 37% in 2019/20. Moreover, the prevalence of wasting decreased over the same time period, from 10% to 7%. The percentage of underweight children has also consistently decreased from 29% to 21% over this 10-year period. On the other hand, the proportion of the population who lived below the food poverty line has declined over time (EPHI and ICF., 2019). It is also known that the country has a plan to reduce the number of people who live in extreme poverty by 10% in 2030. But this progress still does not prevent 15 million people to live in this extreme poverty margin despite the progress (ISS., 2017).

Therefore, the country needs to boost the productivity and production of agriculture and also implementing some interventions that allow people to access and consume additional calories to reduce poverty significantly and drive economic progress. So, in addition to increasing food production from land agriculture, it is necessary to sustainably exploit the aquatic ecosystems to contribute towards the effort of food security by virtue of their high productivity. Ethiopia's fish

resources could undoubtedly offer one of the solutions to the problem of food shortage in the country (Breuil, Christophe. Grima, Damien., 2014).

Fish consumption leads to clear nutritional benefits. Fish provides high-quality protein, minerals and trace elements, fat-soluble vitamins and essential fatty acids, including long chain omega-3 polyunsaturated fatty acids (FAO., 2010). Food and agricultural organization (FAO) 2005 annual report stated that, fish is one of the important sources of employment and income generation along its value chain by hosting more women and young people in the sector.

Since Ethiopia is a land locked country, the growing fish demand has largely been met through inland capture fishery and extensive aquaculture-reservoirs (Janko., 2014). The Aquaculture sector is also another source of fish supply but is insignificant comparing with the capture fisheries sector. It contributes only 0.2% of the total fish production of the country in 2016 (FAOSTAT., 2020). Another means of fish supply comes from import of fish and fish products. According to annual research activities review report of agricultural research directorate of National Fishery and Aquatic Life Research Center in 2019; Ethiopia imported 437 thousand kg of fish products over 2014 to 2018, with a peak of 134 thousand kg in 2014.

Ethiopia's annual fish production from water bodies (this estimation was based on 14 major rivers, 25 major lakes and 14 major reservoirs of Ethiopia) is around 94,500 tons annually, while fish demand is projected to increase from 95,000 tons in 2015 to 118,000 tons in 2025 (Tesfaye et.al., 2014). There are not less than 200 fish species in Ethiopia. But only few are commercially important in the country. This is because of consumer preference, lack of awareness by fishers, lack of awareness by extension agents and policy makers on the diversity and potential use of some species.

Therefore, this review is to summarize the real potential contribution of fisheries to the food and nutrition security of the people of Ethiopia. Hence, researchers and policy makers and other stakeholders can understand about the contribution of fisheries sector to the food and nutrition security. Therefore, the concerned bodies give more attention as one of the sectors to alleviating food and nutrition security.

1.2. Objective of the study

The general objective of the study is to synthesize the contribution of the capture fisheries to food and nutrition security and explore drivers of those contributions.

The specific objectives are to: -

- Review what contributions do capture fisheries make to food and nutrition security
- Review the current policy dialogue regarding the links between capture fisheries and food and nutrition security
- Review the available data to inform research and policy development to support the contributions of capture fisheries to food and nutrition security

1.3. Methodology

The different literature sources were used for this review including journal articles, books and book chapters, workshop proceedings, FAO reports, bulletins, legal documents and unpublished reports including PhD dissertations as well as M.Sc. thesis. The documents were collected from National fishery research center, from the individual researchers and internet accesses.

2. Discussion

2.1. Fish production, distribution and consumption trends in Ethiopian

2.2. Total fish production in Ethiopia

Understanding fisheries' role in food and nutrition security requires information on how much fish is available and where it comes from. Following Eritrea's secession from Ethiopia in 1993 and the consequent loss of its coastline, Ethiopia has only inland freshwater capture fisheries. It has no significant aquaculture development. In Ethiopia there are about 200 fish species but only few species are known commercially. This is because of consumer preference, lack of awareness by fishers and lack of awareness by extension agents/policy makers on the diversity and potential use of some fish species ([Gordon Ann et al., 2004-2009](#), [Alebachew et al., 2016](#)).

The inland capture fishery comprises rift valley areas like Lake Hawassa, Lake Batu, Lake Langano, Lake Chamo and Lake Abaya, which accounts a potential production of 70%, while Lake Tana also contribute significant amount (around 17 percent) from the high land areas ([Breuil et al., 2014](#), [Tesfaye G. and wolf M., 2014](#)). Of course, catch composition is different according to the Lakes. For instance, referring to the survey results which was undergone from April to May of 2019 by the agricultural economics research department of National Fish and Aquatic Life research Center, in Lake Batu Tilapia species averaged about 28 percent, catfish 8 percent and carp species 64 percent of total fish production of the area. In Lake Hawassa Tilapia species averaged about 85 percent and catfish 15 percent of the total production at the landing site.

The study by G. Tesfaye and M. Wolff, 2014, revealed the fact that the potential fish production by the country was estimated to be 94,500 tons per year. All this production was expected to come from 14 different major rivers, 25 major lakes and 14 major reservoirs. But the actual produced fish in the country is not in line with its production potential. In 2016 the produced number of fish per year from capture fisheries was 45,500 mt (Kevin. O et al., 2019) which is only 48 percent of its potential. This is because of different reasons. According to the report by the Agricultural economics department of National Fishery and Aquatic Life Research Center in 2019 it was fish processing technology is in tradition way and everywhere around the landing site, fish activities takes place during the night and the fish are kept in the boat with traditional preservation method using leaves of a selected tree but no ice and this brings about the post-harvest loss before reaching to the market or landing site of the lakes, lack of enforcement by the government authorities led to a depletion of fish stocks, lack of security in and around the lakes leads to a competition on fishing grounds as unlicensed fishers compete to licensed fishers for the same areas. The post-harvest loss is not only at the landing site but also along the value chain. In 2012 it was estimated to be 30 to 40 percent of post-harvest loss in Ethiopia (Lemma B., 2012).

The market for frozen fish which is heavily concentrated in Addis Ababa and urban areas in the production zones (Hotels, restaurants and fish shops) is still in small amount but growing rapidly. Day-to-day and seasonal variations are extremely marked, reflecting uneven supply patterns and high demand on Christian fasting days and months. The main products are frozen fillets of tilapia, Nile perch, catfish and barbus. Under relatively conservative assumptions, aggregate demand for fish could be expected to grow to 118,000 in 2025. Historically, Addis Ababa has been supplied from the lakes in the south of the country. There is, however, a widely-held view that these lakes are now over-fished and market participants report growing difficulty in sourcing fish, suggesting that demand is now growing faster than supply. But in the landing sites and around the nearby cities of the major fish producer's lakes the whole fish and raw fish are consumed in different types.

Aquaculture is recently introduced to the Ethiopian fisheries sector which is contributing insignificant fish production into the country when compared with the production coming from its capture fisheries as shown in fig 1. Capture fisheries sector fish production reached to maximum during 2014 which is amounted about 50,119 metric tons which was 99.8 percent contribution to the total fish production of the fisheries sector.

Despite favorable condition, aquaculture in Ethiopia is at a very low level of development due to lack of extension support and training, shortage of expertise, lack of fingerlings, lack of funding, little research and institutional capacity and low purchasing power of the community.

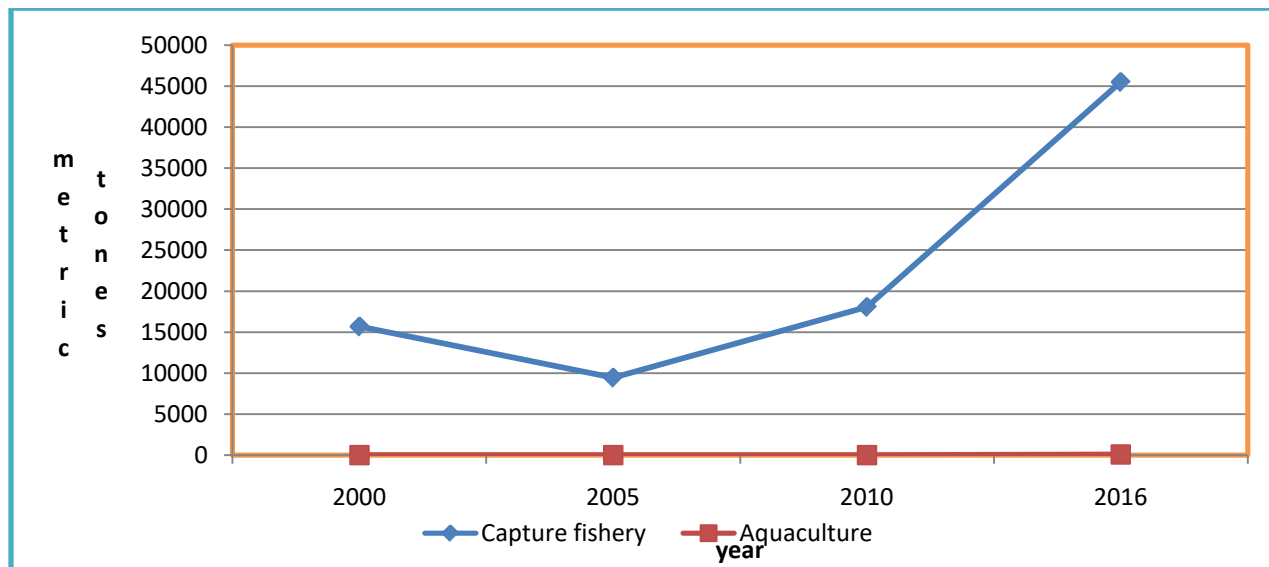


Fig1. Trends in fish productionSource: (FAOSTAT, 2020)

Candidate species for aquaculture development in Ethiopia include Nile tilapia, the African catfish and also carp although the country is rich in fish species. On the other hand, there are only 18 ponds at National Fishery and Aquatic Life Research Center for the aquaculture research purpose and a few other ponds which are owned by individuals and some fish farmer's associations throughout the country mainly for family use or demonstration purpose only. another source of fish is derived from imports from different countries but the countries cross boarder import data of fish is not properly documented so we cannot say anything here.

2.3.Fish distribution and trading'sin Ethiopia

Ethiopia has only inland fresh water capture fisheries. Studies reported that following Eritrea's resignation in 1993 from Ethiopia, this leads for Ethiopia to have only inland freshwater capture fishery. In Ethiopia the major inland capture fishery includes Lakes under rift valley area and Lake Tana, rivers and small water bodies. In the country of different districts, the production of fish for commercial purposes are mainly concentrated from Lake Chamo, Ziway and Lake Tana(Gordon et al., 2004-2009). Imbalance between demand and supply associated with population increments is the factor for increasing the price of fish. Some studies and observations suggested that, people with higher income may be the significant cause for the incensements in demands to wards fish and 2.1 percent increases in cumulative demand is due to population growth (Gordon et al., 2004-2009).

The fishery systems in Ethiopian Lakes are mostly by dominated by artisan fishery activities. 82.9 percent of fishing activity in Lake Tana is dominated by private fishers while 17 percent is by the members of different fishing cooperatives(Amare et al., 2018).In the case of Lake Ziway(Ignatius M. and Zelalem B., 2011)and Tana (Ali. H. and Khan E. (2017)reported that, fishermen working capacity are classified as full-time (24.8%, 58.5%), part-time (70.4%, 14.6%) and infrequent ones (4.8%, 26.8%). Fishing (60.8%) in Lake Ziway indicated that, the primary purposes of fishing is to feed their households while the other hand 36.8% of fishing is used as a source of income, but 2.4 percent as household assets.

Most of the time people who are participated in fishing practices are farmers during off season and students during breaks and summer season. Fisheries are very important commodity which provides diverse benefits to household and communities as food and income generations. Fisheries in the case of Lake Tana give 34.1 percent as income, 56.1 percent as food security and 2.4 percent is as source of employments (Amare et al., 2018).Generally, the fishers secure an average annual income of ETB 13492.86 (+1583.87) by providing whole, gutted and filleted fishes to different consumers(Amare et al., 2018).

Under Lakes of rift valley areas, most of the fishermen pursuit the tilapia fish, this is because of its high market demand and due to its historical preference by the local people(Ignatius M. and Zelalem B., 2011).The current challenges for fishing technologies is the requirements of much labor energy and at the same time distance to fishing sites associated with market in accessibility of the fishing areas. Therefore, young and older people are going to be stop using those manually energy demanding boats for fishing and it causes a series challenge to livelihood security of fishermen's in the area.

With considerable seasonal variations on average, traders sending 8 tonnes of frozen fish fillets (20 tonnes of whole wet fish) per week from Tana to Addis Ababa. Therefore, if volumes are maintained, traders would send 680 tonnes of whole fish annually (Gordon Ann et al., 2004-2009).Limited lakeside access at which fish can be landed at Lake Tana and the distance to Addis Ababa makes relatively expensive as compared to other lakes. On the other hand, the bad reputation for quality (off-smell) of fish from Lake Tana and long-distance having limitations of transport mechanism makes the fish susceptible for spoilages.In addition to this, there are observation that fishes from Tekeze reservoir are used for different hotels such as Haile resort at Hawassa. This indicated that fisheries under rift valley are not enough to serve fishes in terms of quality and size of the required amount.

2.4. Fish consumption patterns in Ethiopia

Fish is aquatic animals used as a source of human food in Ethiopia. Most of the time the people are consumed a large number of fish during fasting days and this is practically occurred around the production areas like Rift valley and other areas having a water resources such as Zeway, Arbaminch, Bahir Dar (Tana) including Addis Ababa. In addition to other water bodies which are found with different districts, fresh fishes are produced under Rift valley lakes where people consumed in the production areas and this indicated that fish consumption trends are limited to the area where fishes produced. Now adays the demand and supply of fish is not completely balanced especially in Ethiopian fasting season unless the supply becomes increase. This is because religions have effects on fish consumption trends, that the demand for fish is only noncompulsory and Christians are exempt from eating fish during lent season ([Assefa M. J., 2013](#)).

However, the consumption of animal flesh food in Ethiopia has associated with cultural practices. Meat plays key roles in special occasions and its cultural symbolic weight is evidently greater than that afforded to most other food. Ethiopians are dependent on certain types of animals as a source of food meat due to the taboo associated culturally. In Ethiopia, a cow or an ox meat is frequently used for the purpose of selling of their meat within the community. In special events, people have a cultural ceremony of slaughtering cow or ox and sharing among the groups used for their cultural celebrations and this is happened in the rural areas where meat obtained becomes challenging regularly ([Semeneh et al., 2014](#)). This indicated also Ethiopian cultural aspects associated with meat as food source are concentrated with cow or ox animal flesh. [G/Michael A. and Fantahun T. \(2019\)](#) reported that, in Bench Maji Zone, South Western part of Ethiopia, fisheries were not used as a major source of income rather the associations are mostly participated with agriculturally based productions. In addition to this, [Sintayehu B. and Seblewengel L. \(2017\)](#) study reported that, in Asella town, south enteral Ethiopia, the majority (60 %) of the households do not consume fish. And the study reported that, religion, family size, education and knowledge of the people around the area are the major factors having significant effects on fish consumption trends.

However, in Ethiopia, the fish consumption is very low and is 0.2 kg where the fish production potential was 51,481 tonnes ([FAO., 2003](#)), while the current fish production potential is estimated around 94,500 tonnes per year ([Tesfaye G. and wolf M., 2014](#)), indicated that high fish consumption expectations. But still in the country the dietary diversity is basically cereal crop

dependents. [Abdulhalik et al. \(2016\)](#) reported that, 96% consumed food was cereals followed by vegetable (81.6 %), 76.1 % (legumes) and 75.4% (oils), respectively. On the other hand, the animal source food including fish was the least consumed food group product in the household levels. However, only households in Gambella areas have a better fish consumption trend which is in significant proportions (44.8%) in the reference period ([Abdulhalik et al., 2016](#)).

Fish species diversity and composition varies within the Ethiopian geographical areas. However, this geographical disintegration in all Ethiopian water bodies have different fish species across different location. Different studies reported that, societies in different areas having water bodies have the tendency of consuming different fish species. [Asmareet al. \(2016\)](#), stated that, the main fish consumed by the community in Jemma and *Wonchit River, North Shewa Zone, Ethiopia*, are *Clarias gariepinus* [catfish] and *Labeobarbus intermedius* [Barbus] fish species in fresh and in dried forms, but *Oreochromis niloticus* (*Nile Tilapia*) is not known as it is edible. On the other hand, study [Birhanu K. \(2019\)](#) at North Shewa Zone, Amhara Regional State, Ethiopia, reported that, the fish demand and supply is unbalanced and the most common preferred fish species which are consumed by communities are *Lates niloticus*, *Oreochromis niloticus*, *Clarias* and *Bagrus dockmak*. While, under rift valley areas different studies and observations showed that, Catfish is the least preferred fish for human consumption in Ethiopia, but in terms of economically it is very essential and comparable with *Tilapia*, the most preferred species in the area used for human consumptions. Under rift valley areas as different observation indicated that, Cat fish is preferred by the societies use at home through the preparation of 'key watt', spice introduced sauce but not used as fresh one at the production areas. This may be happened because of consumer preference and lack of awareness of fisheries, lack of awareness on the societies and by extension mediators and lack of fisheries with the integrations of nutrition and processing of fishes with their nutritional profiling's and nutritional advantageous of the common Ethiopian commercial fishes. In addition to this the country have a limitation on the potential uses of fishes in Ethiopia.

2.2. Contribution of Fish to food and nutritional security in Ethiopia

2.3.1. Fish contribution to food security

Food security is a major concern in countries like Sub Saharan Africa (SSA) in general and Ethiopia in particular. Ethiopia which is the second most populated country in the SSA, is experiencing rapid population growth. The population is very young and is one of the least urbanized in the world. The country is heavily dependent on the agricultural sector which

accounts for almost half of the GDP. About three-quarters of the population are engaged in agriculture, mainly in subsistence and rain-fed farming and livestock production. Since 2000, the economy has been growing steadily. However, Ethiopia remains one of the poorest nations in the world, with almost a quarter of Ethiopians living with less than 1\$ a day. So, providing adequate food for a rapidly increasing human population is becoming one of the greatest challenges in the country, where natural and manmade climates aggravated the problem. So, in addition to increasing food production from land agriculture, it is necessary to sustainably exploit the aquatic ecosystems to contribute towards the effort of food security by virtue of their high productivity. Ethiopia's fish resources could undoubtedly offer one of the solutions to the problem of food shortage in the country ([Mathewos et al., 2019](#), [Ignatius M. and Zelalem B., 2011](#), and [Lemma A., 2016](#)).

Several studies reported their findings in that; fish has crucial contribution to food security at global, national and local levels([Misganaw K. and Getu A., 2016](#), [Fisher et al. Agric & Food Secur., 2017](#), [FAO., 2007](#), [Hasselberg A.E., et al., 2020](#), [HLPE., 2014](#)).According to FAO 2016 annual reports indicate that it is on average about 34-calorie per capita per day animal source protein comes from fish. In addition to direct consumption fisheries contribute to food security through income generation, increasing the household's ability to purchase food and providing a source of employment for women who participate in fishing and post-harvest activities. A considerable workforce is employed, both directly and indirectly, by Ethiopia's capture fisheries which also help in sustaining local communities. Whereas 4052 persons were employed directly by the sector in 2010, a total of 9 148 others benefited from indirect employment offered by the sector([FAO., 2015](#), [Amare et al., 2018](#)).On the landing site of the major fish producer lakes of the country fishers throw fish bi-products during filleting the fish. But this by product can be used as a fish meal which is a great protein source for animals like poultry. And if youths and women are engaged in processing these products it is another income opportunity and gives credential for the youths and women.

In 2009, FAO estimated that in Ethiopia fishery products account for 1 percent of animal protein intake, well below the African average (19.1 percent) even though fish as a food consumption has a long history in the country. Ethiopia is a country where animal protein from fish is the lowest in Africa. The per capita protein supply from fish has shown an erratic performance, reaching 0.1 grams in 2009. However, in areas like big cities where fish production is high like

Bahirdar, Arbaminch, Hawassa, Ziway and Addis Ababa this figure may get higher ([Janko A.M., 2014](#)).

2.2.2. Fish contribution to nutrition security

The Ethiopian diet is mainly composed of cereals (maize, sorghum, teff), tubers and root crops (enset, potatoes, sweet potatoes), pulses and oil seeds. Despite a large livestock population, the food supply of animal products is very limited, and consumption of these products is especially low in rural areas, except in nomadic areas where milk is a major component of the diet. Environmental and man-made factors cause widespread and severe food insecurity. The dietary energy supply is not sufficient to meet population energy requirements and almost half of the population is undernourished. Besides being quantitatively insufficient, food supplies also lack diversity.

Breastfeeding is widespread and early initiation is common. However, the duration of exclusive breastfeeding remains very short, bottle-feeding is frequent and complementary feeding practices are inadequate. These inappropriate practices, combined with poverty, food insecurity and limited access to health services, are major determinants of the high prevalence of malnutrition among young children. Almost half of under-five are stunted. Although the prevalence of stunting has declined slightly over the last five years, special attention still needs to be given to this silent emergency in order to obtain further reduction in prevalence. More than a quarter of women are affected by chronic energy deficiency.

Although recent data are lacking, it is likely that iodine deficiency disorders are still highly prevalent, especially in the mountainous parts of the country. There is currently no universal salt iodization programme in Ethiopia but a pilot project is envisaged. In the meantime, alternative approaches such as iodized oil capsules should be implemented urgently. Vitamin A deficiency is a severe public health problem, affecting young children and mothers and reaching alarming levels in Amhara and Tigray. Vitamin A supplementation coverage remains limited, especially in rural areas. Intensification of vitamin A supplementation and implementation of long-term food-based interventions are needed. Anemia is also a public health problem: more than half of under-five and more than a quarter of women are anemic. Iron deficiency due to low consumption of foods of animal origin is the main cause, compounded by high incidence of malaria and other parasitic diseases. Iron supplementation of pregnant women, which reaches only a limited number of women, and nutrition education are the only interventions that are currently

implemented to combat iron deficiency anemia. More efforts are needed to address this public health problem.

Severely affected by poverty, food insecurity and morbidity, rural populations are highly exposed to under nutrition and micronutrient deficiencies. Major efforts are needed to rapidly and sustainably improve the health and nutritional status of the population, which would have a positive impact on economic growth and development of the country.

Poor nutrition during the first 1000 days of a child's life—from conception through pregnancy and lactation to the child's second birthday—can result in permanent developmental problems. The report from WHO in 2013 revealed the fact that it is the first 1000 days that plays a great role in child brain and cognitive development, immune system and growth. So, how well the mother as well as the children are nourished and cared for during time have implication on the stated growth and development. Although progress is being made, the most recent Ethiopia Demographic and Health Survey (DHS) reported that the prevalence of stunting, wasting and underweight, among children under five, are all issues of great concern. i.e., 23% of women (15-49 years) have anemia, 37 % of children under the age of 5 are stunted, 7% wasted and 21% underweight (EPHI and ICF., 2019). According to Daniel A. et.al (2020), poor dietary diversity and low nutrient density of traditional foods are a key contributing factor to under nutrition in low-income countries diets. For instance, among the wealthiest families of children in Ethiopia, just 20% have diets with animal source foods; among the poorest families, only about 5% of children have such diets.

Though there is a strong consumer preference for beef, fish is regarded as an important component of a nutritionally rich diet. However, fish consumption patterns vary according to availability. More fish is consumed in areas where the product is more available, such as in the vicinity of the Great Rift Valley lakes. Fisheries are regarded as an important sector in the effort to increase animal protein consumption and achieve food security for the growing population. Two important national documents, the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP) and the Rural Development Policy, highlight the importance of the sector to food and nutrition security.

Fish are rich in vitamin B12, calcium, iron, zinc, fatty acids and animal protein, and some small fish are especially rich in vitamin A. When consumed as part of a meal, fish can increase the absorption of iron and zinc from other foods. Essential fatty acids, including DHA (Docosahexaenoic acid) and EPA (Eicosapentaenoic acid), which are only found in fish,

are critical for pregnant and lactating women as well as young children, as they are vital for cognitive development in the first 1000 days. Its flesh is a source of top-quality protein and for many, in the less developed parts of the world, it represents a significant proportion of the animal protein in their diet (Alemu L., 2016, Selamu A. and Lelisie M., 2018, Kefi A. S. et al., 2017).

2.5.Nutritional loss indicators associated with fish post-harvest

As general, food loss is unintentional loss in food quantity of a given food value chains. And food loss can be either the result of direct quantitative (weight or volume loss) or qualitative loss (nutrient and physical changes such as taste, color and texture etc.) (Buzby and Hyman., 2012). Fish-post harvest losses is a nutrient or economic loss in which the commodity becomes nutritionally deficient for the consumers.

Fish post-harvest losses occurred at different points from capturing, land site, transport, due to in proper storage materials and development of microbial growth and un organized marketing systems (Table 1). Therefore, post-harvest losses become the main causes for a huge amount of quality deteriorated fish discarded. Due to the perishable properties of fish as stable commodities, and the tropical climate's fish becomes unfit for human consumption. In addition to post-harvest losses, dissection of different parts of fish species are discarded at the landing site of the water bodies. Thus, it will have a negative effect on fish nutrition losses. Therefore, fish discarded associated with dissection and post-harvest losses at different stages have a negative effect on the nutrition and food security of the country. Fisheries are an important component of food security for the developing countries. In Ethiopia, there is no clearly stated the physical fish-post harvest and nutritional losses of fish species associated with fish dissection and their contributions for food and food security of the country as national wide. On the other hand, most of the studies dealing with fish post-harvest losses are concentrated in individually in different parts of Ethiopian water bodies. And, in addition to fish-post harvest losses, fish dissections (fish fin, heads, guts, skins, and muscles etc.) of individual Ethiopian common fish species are not clearly stated their contribution for nutrition and food security as an alternative food product and as well as industrial raw materials rather disintegrated studies are performed in different Ethiopian water bodies. Generally, post-harvest losses are happened in three different ways, physical losses, quality and market force losses. The former is occurred when the fish is not used after captured or landing. On the other hand, quality fish loss refers to the fish becomes unsafe for human use and this may occur due to spoilage or physical damage and quality deterioration. While, market force loss is caused by unpredicted market demand and supply.

Table 1: Fish species and total productions associated with post-harvest losses under different Ethiopian water bodies

Fish species	District of fish source	Total annual fish (kg)	PHL	Operational loss	Size discrimination %	Market access	Spoilage	Reference
Tilapia	Amerti and Fichawa Reservoirs	98, 784 kg	6.9%	1.34%	2.10%	6.56%	2.53%	Teklu. D. (2015)
Carp	Amerti and Fichawa Reservoirs	31,317 kg	11.3%	---	1.79%	NA	560 kg	Teklu. D. (2015)
Total fish productions	Hayq	46200	10.82%	NA	NA	NA	NA	Ayalew et al., 2018
Total fish productions	Tekeze	189.52 tonnes	2.48%	NA	NA	NA	NA	Ayalew et al., 2018

3. Conclusion

Ethiopia has the potential to produce and supply fish and fish products from capture fishery and aquaculture. The contribution of fishery in Ethiopia is however not significant in the national economy and at households' level. This is due to different reasons, such as the production from small-scale fishery, overexploitation, poor management, less acceptability on the market due to less quality, and others. In the future the fish demand will increase in relation to population growth. Thus, in order to sustain and enhance the benefits from capture fishery, threats to fisheries (including from water management, climate change, and overexploitation) need to be identified and addressed in each region. In addition, we need to encourage the indigenous investors to, expand scientifically supported and technology-based aquaculture. Further involvement of gender equality, dietary diversification and further research on the real livelihood function of fishery in each region are very essential.

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