

# ASSESSING FISHING ACTIVITY, FISH PRODUCTION AND DEMAND IN ILU ABBA BORA ZONE, SOUTHWEST ETHIOPIA

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<https://doi.org/10.59411/frveae78>

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#### How to Cite:

Tujuba Ayele\*, Simagegnew Melaku and Tsegaye Dobamo (2023) *Aquaponics*, 3(1). <https://doi.org/10.59411/frveae78>



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## ABSTRACT

*The study was aimed to assess fishing activity, fish production and demand outlook in Ilu Abba Bora Zone, Oromia Region, southwest Ethiopia, to generate baseline data that would help in the proper and sustainable utilization of fish resources. Previous reports, field assessment, structured and semi-structured questionnaires and direct observation were employed for data collection. Five districts (Mettu, Yayo, BiloNopa, Bure and Sale Nono) were selected using purposive sampling technique. From each district, fishermen and households along and near riverine water bodies were selected purposively. The fishing activities of the area are aimed for subsistence by part-time fishermen and for local market during the dry season. The fishing gear commonly used are hooks of different sizes, traps (fish basket) and rarely gillnet. Birbira (*Milletia ferruginea*) is also used by fishermen in Sale Nono district. Though the severity of the constraints varies from one district to the other, the main fish production constraints in the area are low demand for fish, lack of awareness, lack of facilities, low profit, and long distance to market place. The fish demand and supply in the study area is unbalanced. Fresh whole fish, gutted and dried fish are mostly preferred fish products. *Labeobarbus intermedius*, *Labeobarbus nedgia*, *Bagrus docmak* and *Oreochromis niloticus* are the species preferred by consumers in the study area. Awareness creation and promotion of local fish farming is important to integrate fish in the community's diet and to scale up fish demand and supply in the area.*

Keywords: Fishing activity, Fish production, Ilu Aba Bora, Preferred fish species.

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### **1. Introduction**

#### **1.1. The state of global fish production and consumption**

The world's fisheries are under more pressure than ever before. From 1950 to 1990, there was a fivefold increase in the world annual fish catch. The average yearly per person fish consumption in the industrialized world (59 pounds) is three times that of people in the developing world (20 pounds). Fish demand remains high. An additional 15.5 million tons of fish will be required just to maintain current rates of fish consumption. Today, 70 percent of the planet's marine stocks are fully exploited or overexploited (FAO, 2002).

The number of people fishing and practicing aquaculture worldwide has doubled since 1970. More than 21 million people are full-time fishers, and 200 million depend on fishing for their livelihood. Asia contains the vast majority of the world's fishers. In the early 1950s, developed countries took 80 percent of the world's fish catch. Today, they take only 36 percent of the catch, while developing countries take 64 percent (FAO, 2002).

Globally, fish provides more than 1.5 billion people with almost 20 percent of their average per capita intake of animal protein, and 3.0 billion people with at least 15 percent of such protein. In 2007, the average annual per capita apparent fish supply in developing countries was 15.1 kg, and 14.4 kg in low-income food-deficit countries (LIFDCs). In LIFDCs, which have a relatively low consumption of animal protein, the contribution of fish to total animal protein intake was significant at 20.1 percent – and is probably higher than that indicated by official statistics in view of the under recorded contribution of small-scale and subsistence fisheries. China remains by far the largest fish-producing country, with production of 47.5 million tons in 2008 (FAO, 2010).

In sub-Saharan Africa, fish is an important food for over 400 million people, contributing essential proteins, minerals and micronutrients to their diets. Paradoxically, despite the high dependence on fish as a source of animal protein, fish consumption in sub-Saharan Africa is lowest in the world. The continent is projected to need an additional 1.6 million tons of fish a year by 2015 just to maintain current consumption. This demand will increase by a further 2.6 million tons a year by 2030. Most wild capture fisheries, however, have reached their production limit or are over-fished. The rapid increases in fish supply required over the next decades will only be possible, therefore, if these fisheries are sustained and improved, while simultaneously developing fish farming (World Fish Center, 2009).

#### **Fish production in Ethiopia**

Ethiopia is endowed with inland waters for fish production as a cheap source of animal protein. It has a number of lakes and rivers with substantial quantity of fish stocks. The total area of the lakes and reservoirs stands at about 7,000 to 8,000 km<sup>2</sup> and the important rivers stretch over 7,000 km in the country (Mebrat Alem, 1993). In addition, minor water bodies such as crater lakes and reservoirs make up about 400 km<sup>2</sup> (Tesfaye Wudneh, 1998). Most of the lakes are located in the Ethiopian Rift Valley depression, which is part of the Great East African Rift Valley system. However, Lake Tana, the largest lake in the country and the source of the Blue Nile River, is located in the northwest plateau outside the Rift Valley. These lakes and rivers are stocked with various species of fish. The potential yield of fish is estimated to be between 30,000 tons and 40,000 tons/year for the main water bodies, and about 25,000 tons/year from Baro River alone and a large potential from other rivers (FAO, 1995).

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According to Tesfaye Wudneh (1998), the exploitation of the different water bodies of the country is very uneven. For example, those located near the capital, Addis Ababa, and having good road connection, such as Lake Ziway and Lake Hawassa, have been heavily exploited to the extent of overfishing. Lake Tana, which is located 500 km from Addis Ababa, is amongst the least exploited lakes, in spite of its size of 3200 km<sup>2</sup> and fish resource. Hence, for most water bodies, the production estimate is far below the estimated potential yield.

In 1998, the total production, mainly from the Rift Valley lakes, was estimated to be about 14,000 tons (LFDP, 1998) less than 50% of the estimated potential. There are several reasons attributed to the low production among which the lack of fishing tradition and low fish consumption habit of most people is frequently quoted. Ethiopia has only inland freshwater capture fisheries. It has no significant aquaculture development. The inland capture fishery comprises: Rift Valley lakes (for example, lakes Chamo, Abaya and Ziway and the northern part of Lake Turkana) and Lake Tana, which although shallow, is the largest lake in Ethiopia; rivers; and small water bodies (reservoirs, natural ponds). There is fishing on all these water bodies, but commercial production (i.e., serving markets other than the local communities) is concentrated on the five lakes, with Chamo, Ziway and Tana particularly dominant

### **1.2. Challenges for fish production and marketing in Ethiopia**

Fish production and marketing is challenging in Ethiopia due to inaccessibility of some water bodies such as rivers and lack of infrastructure and facilities. In fish production areas, fish consumption patterns reflect the local availability of fish (with some notable exceptions, such as catfish in some areas). Fish Production and Marketing Enterprise (FPME) retail indicated that the range of fish available has increased over the last twenty years, exclusively of Nile perch and tilapia (Gordon *et al.*, 2007). Outside of the production areas, where much of the local trade is in fresh whole fish, there is a relatively strong preference for fillets, and most frozen fish is traded as fillets. *Labeobarbus* is the exception and is sold whole, gutted and skinned.

There is negligible use of ice - as indicated by traders and observed with only some trucks using ice to limit thawing of frozen fish being transported overnight from production areas to Addis Ababa. Ice is used neither on fishing boats, nor on collector vessels. At landings, fish is traded fresh for rapid consumption or resale. However, at traders' collection points, freezers are used and frozen fish is sent to Addis Ababa and local urban markets (even those situated on lakes). Thus, the fish products on sale in Addis Ababa (and in urban centers near the production areas) are frozen, and very often filleted (or more accurately, the fish is semi-frozen on arrival in Addis Ababa, following transport in normal non-insulated trucks). There is also a tradition of dried fish consumption (particularly catfish) in some parts of Ethiopia, notably Tigray and Gambella (Hussein Abegaz *et al.*, 2010).

### **1.3. Fish demand and supply pattern in Ethiopia**

Fish consumption presents a complex pattern, ranging greatly between countries and within different areas in the same country or region. Fish consumption varies greatly depending on the quantities of fish supply available for consumption produced from capture and/or cultured or imported. Ethiopians do not consume large quantities of fish, although there is no religious prohibition for the Christian and Muslim populations. Rather, this is a country with a strong tradition of livestock rearing and meat consumption. The Ethiopian Orthodox Church observes several fasting periods as well as fasting days every week, when meat is not consumed. Most Christians consider fish acceptable during those periods, though some strict followers will not eat any animal products (Brook Lemma, 2008).

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These factors give rise to some particular characteristics of fish consumption in Ethiopia. Overall, per capita fish consumption is very low. However, consumption is heavily biased towards quite limited geographical areas (production areas and Addis Ababa) and also heavily weighted towards fasting days (Wednesdays and Fridays) and fasting periods (55 days in March/April, 15 days in August, as well as other periods which may be less widely observed). Increasing scarcity (apparently reflecting both rising demand and supply constraints) has resulted in rising real prices for fish, so there is an increasing tendency for fish to be a luxury product consumed by higher income groups. Moreover, according to the study of Gordon *et al.* (2007), anecdotal evidence that higher income groups may represent a significant source of the increase in demand (reflecting wider exposure to different types of food and echoing the global shift in demand towards fish as a healthier source of animal protein), though population increase (particularly in growing Addis Ababa) and a modest general increase in incomes are also factors.

In the Baro-Akobo basin and its floodplains, the largest flood plains in the country, fishing is mainly artisanal. The major river systems of the basin include: Alwero, Gilo, Baro, Akobo, Baro Kela, Sore, Gabba, Birbir, Ganji, Bonga and Jejebe rivers. The most important commercial fish species of the river systems are *Oreochromis niloticus*, *Clarias* sp., *Polypterus bichir*, *Heterotis niloticus*, *Gymnarchus niloticus*, *Malapterurus* spp., *Lates niloticus*, *Alestes* spp., *Hydrocynus* spp., *Mormyrops* spp., *Bagrus* spp., *Barbus* spp. and *Labeo horei* (Abebe Getahun 2003). Major riverine fishing activities are mainly carried out on Baro River around Gambela and Gilo River near Pugnido town in Gambella. The catch estimates from rivers around Gambella is 5,000 tons per year whereas the actual fish production is about 12,000 tons per year (Ministry of Water Resources, 1996). In comparison to the lower catchments, there is little fishing in the upper catchments of Baro River. Fishing occurs on the Baro, Sore, Waber, Yabi, Didu, and Uka rivers, but this is purely on a subsistence basis using traditional gears. Generally, fishing in the region is mainly on a subsistence basis and used for family consumption while a small amount is sold at a local market to get extra cash income. Most of the population that lives near water bodies meets more of their animal protein requirements through fish consumption. Fishery is practiced in a traditional technique and tools as past time activity.

Ilu Abba Bora Zone is gifted with inland water bodies which are rich in faunal diversity such as fishes and others. Recent study by Simagegne Melaku (2013) identified nine economically important fish species from rivers Sor and Gabba. Riverine fishery, fishing activity and marketing systems of the Baro- Akobo Basin especially in the Gambella Regional State was roughly assessed by Hussein Abegaz *et al.* (2010) and other investigators. However, the fishing activity, fish production and demand outlook in the riverine systems of Ilu Abba Bora Zone such as Saki, Sese, Dogi, Ganji, Sor, Gabba, Dabana and Dedesa is not yet studied. Therefore, the present study tries to provide preliminary information on the fishing activities, fish production system and demand aspects in Ilu Abba Bora Zone. Additionally, the study can also contribute in the proper and sustainable exploitation of the fish resources of the area.

## **2. Objectives**

### **2.1. General objective**

The study was aimed to generate baseline data on fishing activity, fish marketing systems and demand in Ilu Abba Bora Zone.

### **2.2. Specific objectives**

- To assess fishing activities at some rivers in Ilu Abba Bora Zone.

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- To explore the challenges of fish production and demand in Ilu Abba Bora Zone.
- To determine the fish consumption patterns and preferred species of fish.
- To generate baseline data for further referencing.

## 3. Materials and Methods

### 3.1. Description of the study area

The study was conducted in Ilu Abba Bora Zone focusing on some districts with riverine water bodies. Ilu Abba Bora Zone is one of the zones of Oromia Regional State located in southwest Ethiopia (Fig. 1). It lies between latitudes 7°05' and 8°45' North, and longitudes 33°47' and 36°52' East (CSA, 2007). The altitude of the area ranges between 1,500- 2,500 m above sea level (Dixon, 2003). It is bordered to the north by East and West Wollega zones, to the south by Kefa Zone, to the east by Jimma Zone and to the west by Gambella region.

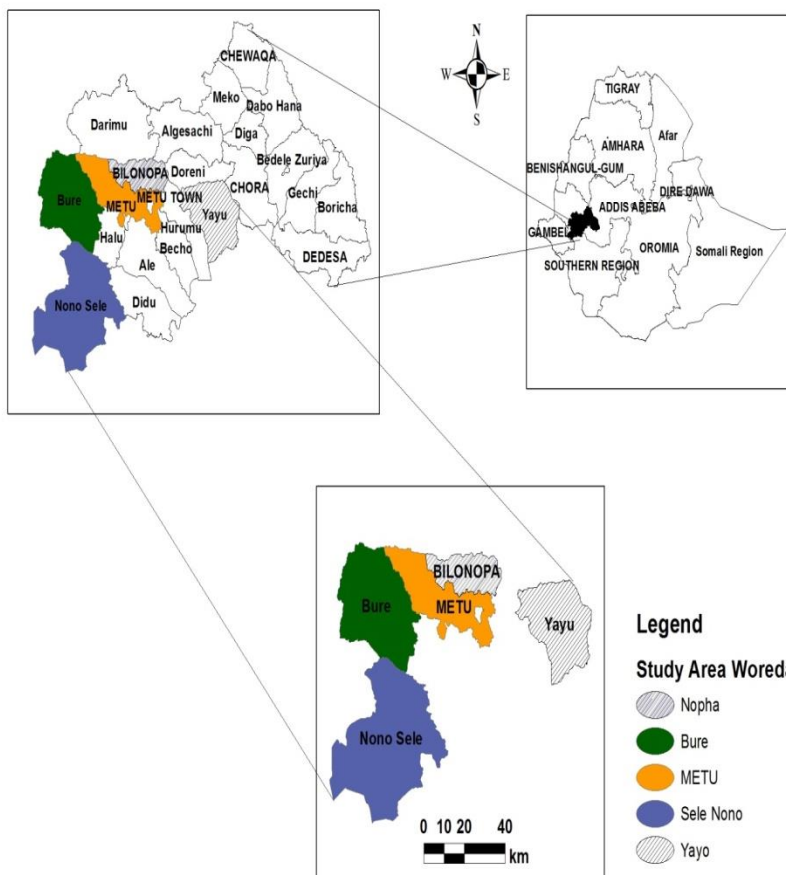


Fig. 1. Map of Ethiopia, Ilu Abba Bora Zone and the study area (woredas).

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### **3.1.1. Land cover**

Ilu Abba Bora zone has a total area of 16,331.56 km<sup>2</sup> and the land form is characterized by undulating and dissected plateaus. There are narrow strips of lowland less than 1,500 m altitude in the northeast along Dhedhesa river valley and southwest of Baro river valley (Solomon Abebe, 1994).

The zone has relatively good vegetation cover of tropical montane evergreen rainforest on the highlands. The vegetation cover gradually changes to bush shrubs, open deciduous and savanna when one descended to the eastern and western lowlands. The vegetation in the valley bottom wetlands are dominantly sedge (*Cyperus latifolius*) (Dixon and Wood, 2003). Nearly 30% of the surface area of Ilu Abba Bora Zone is under forest cover (mainly natural forest). The forest cover significantly varies between districts. Sale Nono (68%), Yayo Hurumu (55.8%), Ale Didu (43.9%), Metu (37%) and Alge Sachi (33%) are the five districts with large areas of forest cover whereas Bedele Dabo (3.7%), Darimu (10.7%) and Dhedhesa (14%) are districts with lower forest cover (Legesse Taffa, 2007).

### **3.1.2. Agro-ecology**

Ilu Abba Bora Zone shows varied topographic features which influence the vegetation cover, the soil type and the climatic conditions.

Due to the altitude and windward location to the moist monsoon winds, Ilu Abba Bora highlands are among the places which receive the highest amount of annual rainfall in Ethiopia (Asmamaw Legesse, 1998). The total annual rainfall of the zone is between 1,200-2,000 mm and the mean temperature is 20.5°C. The rainfall has uni-modal pattern where about 85% occurs between May and October. June, July, August and September are the peak rainy months while December, January and February are the driest months. The warmest months are February, March and April. Temperature declines during the peak rainy months due to the effect of cloud cover (Asmamaw Legesse, 2007).

### **3.1.3. Agriculture and economy**

The dominant economic activity in Ilu Abba Bora is farming which includes both crop production and livestock keeping. Maize (*Zea mays*), sorghum (*Sorghum bicolor*) and teff (*Eragrostis tef*) are the staple food crops while coffee is the major cash crop. Generally, Ilu Abba Bora had no experience of serious food deficit during the past ten years (Asmamaw Legesse, 2007).

Livestock, primarily cattle, are important in the rural economy, although the ratio of cattle to people is less than in most parts of the highlands due to the lack of grazing. Ox-drawn plough cultivation is practiced although only half of the rural households own oxen. Grazing tends not to be restricted to certain areas of farmland except during the growing season. In many areas the practice of pen rotation is used to ensure an even application of animal manure into the soil enhancing its productivity. Domestic animals such as sheep and goats are also reared primarily for their meat which fetches a high market price during religious festivals (Afework and Dixon, 2000).

### **3.1.4. Demographic characteristics**

According to CSA (2007), the population of Ilu Abba Bora for the year 2007 is 1,271,609 (90.21% rural and 9.79% urban). This population is with an average crude density of 69 persons/km<sup>2</sup> and agricultural density (the ratio of total rural population to cultivated land) of 230

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persons/km<sup>2</sup>. The crude density ranges from 127 persons/ km<sup>2</sup> in Chora district to 13 persons/km<sup>2</sup> in Sale Nono district. Agricultural density is the highest for Sale Nono district because of the largest portion (68%) of the total area occupied by forest (DFED, 2001).

The area has several pull factors (fertile lands, mild climate, suitable environment for coffee production, forest and water resources, etc.) that attract inward migrations (Solomon Abebe, 1994). Significant number of people migrated into this area over the past centuries and affected the demography of the area (Alemneh, 1990 as cited in Asmamaw Legesse, 2007).

### **3.2. Study design**

The methodologies employed were review of different reports, field assessment, consultation and exchange of information, ideas and opinion with relevant organizations and individuals in some districts of Ilu Abba Bora Zone. The fishery activity, fish market and demand were studied with full participation of stakeholders including the local people, district and zonal livestock and fishery experts. The fishermen, consumers, and households were also interviewed using structured and semi-structured questionnaires. Direct field observation was made at different fishing sites along the rivers of Sor, Gabba and others.

### **3.3. Sampling techniques and data collection**

Purposive sampling technique was employed to select the districts based on fishing activities along the rivers. Accordingly, five districts (Mettu, Yayo, Bilo Nopa, Bure and Sale Nono) were selected. From each district, fishermen and households along and near riverine water bodies were selected purposively. Data were collected directly via observation, interview, and making focus group discussion with some selected fishermen and different experts at district and zonal level.

### **3.4. Data analysis**

Data collected through questionnaire, interview and field observations were analyzed quantitatively and qualitatively using Microsoft excel. Fishing activity, fish species preference among different districts and demand and supply relationship were analyzed.

## **4. Results and Discussion**

### **4.1. Fish resources of Ilu Abba Bora**

#### **4.1.1. Fish species diversity**

The water resource of the Ilu Abba Bora Zone is part of the White Nile system. The White Nile system within the territory of Ethiopia accommodates the most diverse fish fauna (Golubtsov *et al.*, 1995). The zone has less fish diversity but with high fish potential. Golubstov and Darkov (2008) reported only six fish species from Gabba River at the bridge along the road from Mettu to Gimbi and their tributaries while Simagegnew Melaku (2013) reported nine fish species represented in four families and seven genera from Gabba and Sor rivers.

#### **4.2. Commercially important fish species**

Regarding the commercially important fish species, Abebe Getahun *et al.* (2008) reported that the major commercially important fish species of Ethiopia include *Oreochromis niloticus*, *Labeobarbus* spp., *Lates niloticus*, *Clarias gariepinus*, *Bagrus docmak* and *Cyprinus carpio* (introduced). In the riverine water bodies of Baro Akobo basin, Hussein Abegaz *et al.* (2010)

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identified 20 commercially important fish species. Thus, majority of commercially important fish species of Ilu Abba Bora Zone are more than four genera and 9 species (Table 1 and Figure 2).

Table 1. Commercially important fish species from some Ilu Abba Bora rivers (Sor and Gabba).

Genera	Scientific name	Local Name
<i>Mormyrus</i>	<i>Mormyrus hasselquistii</i>	Gillo Aredamale
<i>Garra</i>	<i>Garra</i> spp.	-
<i>Labeo</i>	<i>Labeo cylindricus</i>	-
<i>Labeo</i>	<i>Labeo forskalii</i>	Genbareteftafa
<i>Raiamas</i>	<i>Raiamas senegalensis</i>	-
<i>Labeobarbus</i>	<i>Labeobarbus intermedius</i>	Daltuadi/Faranji
<i>Labeobarbus</i>	<i>Labeobarbus nedgia</i>	Daltuadi
<i>Bagrus</i>	<i>Bagrus docmak</i>	Farkus/Gilo Abareda
<i>Oreochromis</i>	<i>Oreochromis niloticus</i>	Orome/Batte
<i>Heterobranchus</i>	<i>Heterobranchus bidorsalis</i>	Anbaza

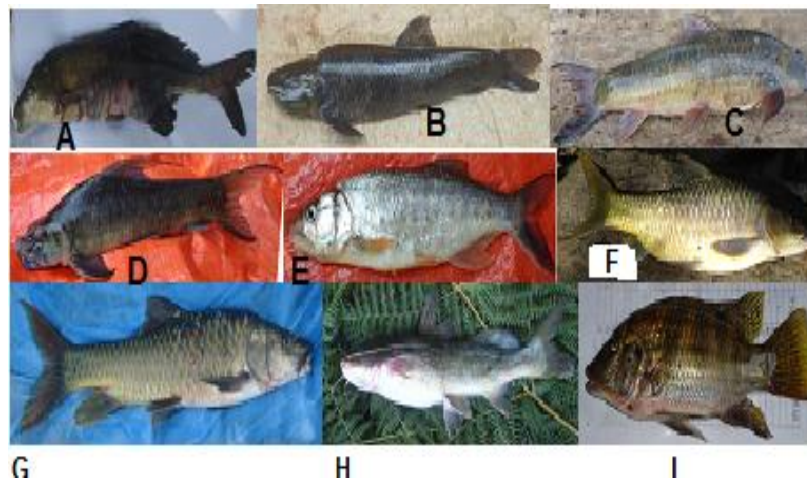


Fig. 2. Commercially important fish species from some Ilu Abba Bora rivers (Sor and Gabba): *Mormyrus hasselquistii* (A), *Garra* sp. (B), *Labeo cylindricus* (C), *Labeo forskalii* (D), *Raiamasene galensis* (E), *Labeobarbus intermedius* (F), *Labeobarbus nedgia* (G), *Bagrus docmak* (H), *Oreochromis niloticus* (I).

### 4.3. Fishing activity and fishing gear

Fishing activity is common in most water bodies of Ethiopia with different fishing gears. For instance, in the rift valley lakes of Ethiopia such as Lake Hawassa, Langano, Chamo, and Abaya, fishing activity is carried out with gear ranging from hand hooks to motorized fisheries association. In Baro-Akobo basin, especially in the rivers, lakes and floodplains of Gambella



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region, fishery supports the livelihood of many people. The fishermen use more than 15 types of fishing gear which are diversified based on season, method of fishing and materials these are made from (Hussein Abegaz *et al.*, 2010). Fishing is conducted in different rivers of Ilu Abba Bora Zone, such as Sor, Gabba, Dabana, Didhessa, Ganji, Baro Kela, Kabar, Gumero and other rivers. The fishing activities on these rivers are on subsistence basis by part-time fishermen for family consumption and for sale on small scale during the dry season. Fishing is commonly carried out mostly at the end of rainy season (starting from October) and continues to the beginning of rainy season (April). The fishing gear commonly used are hooks of different size, traps (fish basket) locally made and rarely gillnet (Figs. 3-5). Birbira (*Milletia ferruginea*) is also used by fishermen in Sale Nono district on Ganji river. The rivers of Ilu Abba Bora Zone such as Gabba, Dogi, Ganji, Gumaro and others are not easily accessible due to the dense forest covering the river banks.



Fig. 3. Fish trap or fish basket locally called Gubo) with edible crop as bait.



Fig. 4. Fishing hooks of different size used in the different rivers of Ilu Abba Bora Zone.

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Fig. 5. Gill net (10 cm mesh size) used by few fishermen in Gabba River in Yayo area.

### **4.4. Awareness and willingness to engage in fishing activity**

The local people living near the different rivers of Ilu Abba Bora and few individuals in the town of Mettu, Yayo, Nopha and Sale Nono are involved in fishing activity. Fishes caught by the people are mainly used for household consumption and for sale on individual basis during the dry season, commonly during fasting periods. In other parts of Ethiopia, there are organized fishery cooperatives on lakes and rivers. For instance, around Lake Tana and Rift Valley lakes, there are fishery cooperatives working on fish production and marketing system (Gordon *et al.*, 2007). There are also fishing cooperatives in the Baro-Akobo basins in Gambella region at Baro, Gillo, Alwero and other lakes and rivers (Hussein Abegaz *et al.*, 2010). In the different rivers of Ilu Abba Bora there are no organized fishery activities. However, there are initiatives of fishery cooperatives organized for pond fish farming in Yayo, Darimu and Didu districts by livestock experts (personal communication with zonal expert). As one part of agricultural activity, people living near the different rivers of the zone do not have enough awareness to be engaged in the capture fishery and fish farming despite the presence of abundant seasonal and permanent water bodies including wetlands in the zone.

### **4.5. Fish marketing and distribution**

#### **4.5.1. Fish demand and supply**

Demand for fish in Mettu town is far higher than the supply in the town. This is probably due to awareness of the people around Mettu town about the nutritional value of fish. The increment of urban people and urbanization are also increasing the demand for fish (BoFED, 2007). In contrast, in towns such as Yayo and Nopha, the demand for fish consumption is low. This is because the people living around these towns do not have awareness about the nutritional value of the fish. Assefa Mitike Janko (2014) also reported that domestic fish market is low outside Addis Ababa, Bahir Dar and towns in the Rift Valley due to the absence of integration of fish in the diet of most of the population, limited supply and religious influence.

#### **4.5.2. Tradition of fish consumption and fish species preference**

Fish is an important source of food and income to many people in the developed world. In Africa, some 5 percent of the population, about 35 million people, depend wholly or partly on the

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fisheries sector for their livelihood. Various traditional methods are employed to preserve and process fish for consumption and storage. These include smoking, salting, drying, boiling, marinating and different combination of these. In Ethiopia, since early days fish has been consumed fresh, and it is still the preference of many people to eat fish fresh as soon as possible after catching (Abera Degebas, 2010).

The variety of fish products for consumption is different from district to district in Ilu Abba Bora Zone (Fig. 6). Accordingly, 73% of respondents in Mettu town responded as whole fresh fish was preferred fish products while about 26.5% respondent responded as gutted fish but fillet and dried fish were not accustomed around Mettu. In the case of Yayo, all of respondents (100%) responded that gutted fish were marketed by fishermen in the district (Fig. 6) and similarly in Sale Nono district. Fillet and dried fish products were not common in Mettu, Yayo and Sale Nono districts. Most of the respondents do not have storage facilities but they have tried to improve the shelf life of the fish by processing. Some of the producers gut the fish by removing the stomach content and other internal organs immediately after catching. The result of this study agrees with the study done by Hussien Abegaz *et al.* (2010) in which they use gutted fish as tradition of fish consumption in Gambella region but not agree with the findings of Gordon *et al.* (2007) in which outside of the production areas much of the local trade prefer fresh whole fish, there is also a relatively strong preference for fillets and most frozen fish is traded as fillets. Fish species preference was dependent on the availability of species at different water bodies, but as a whole tilapia, cat fish, carp and *Barbus* were the most preferred fish species successively in the study area.

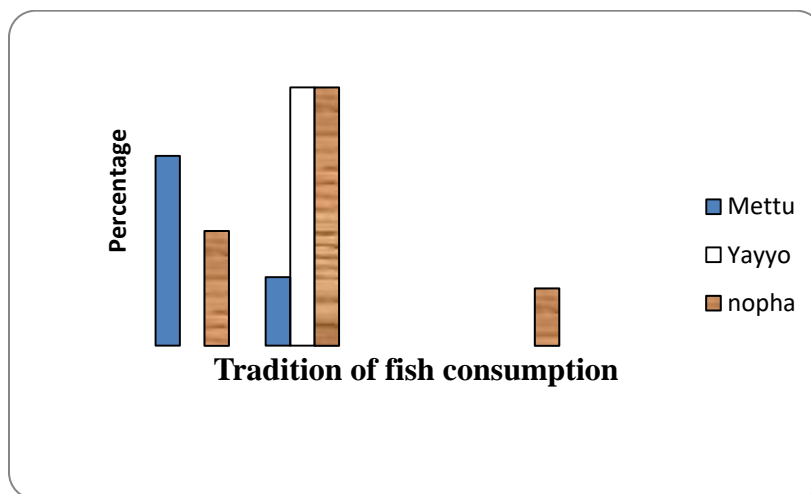


Fig. 6. The tradition of fish consumption in some districts of Ilu Aba Bora Zone.

### 4.6. Challenges in fish production

The fishermen were interviewed about the existing production constraints and they generally responded and ranked them according to their importance. Accordingly, lack of demand for fish was ranked as the first most important constraint while lack of awareness was ranked as the least observed constraint in Mettu town (Fig. 7). But the rank of constraints in Yayo and Nopha districts were different from that of Mettu town, that is, in both districts the respondents ranked lack of facility as the first most important constraint and demand for fish as the least observed constraint (Fig. 8).

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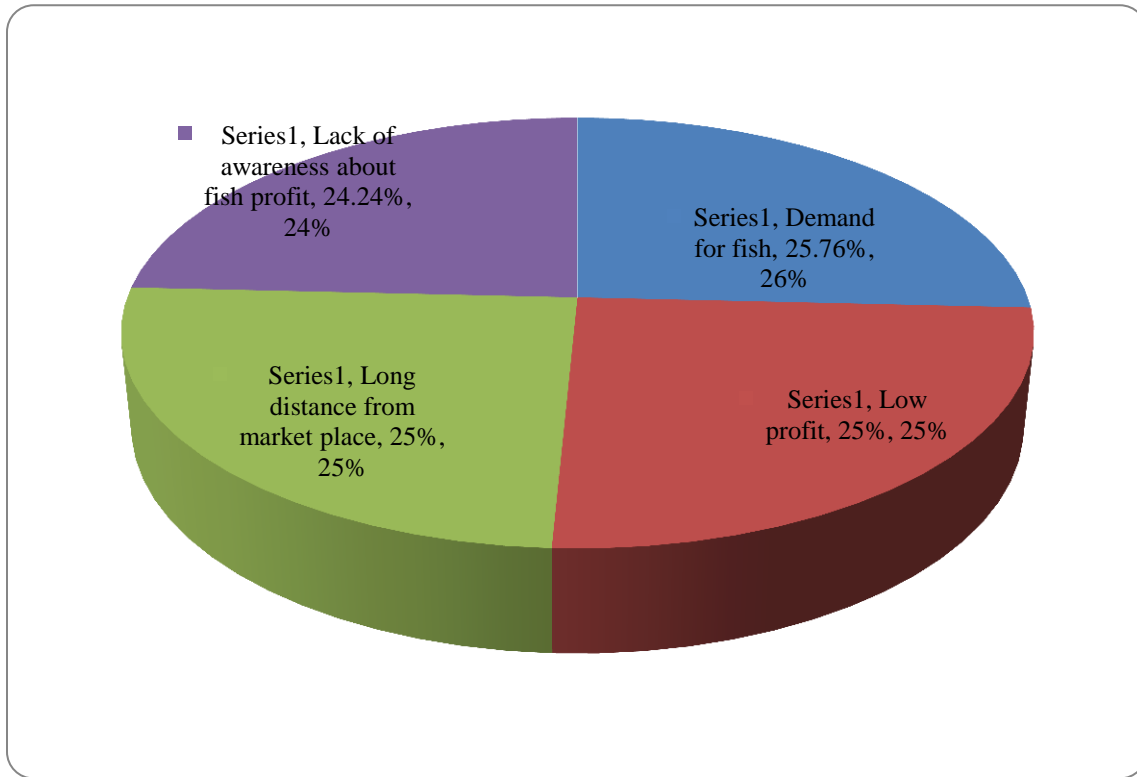


Fig. 7. The rank of fish production constraint in Mettu town.

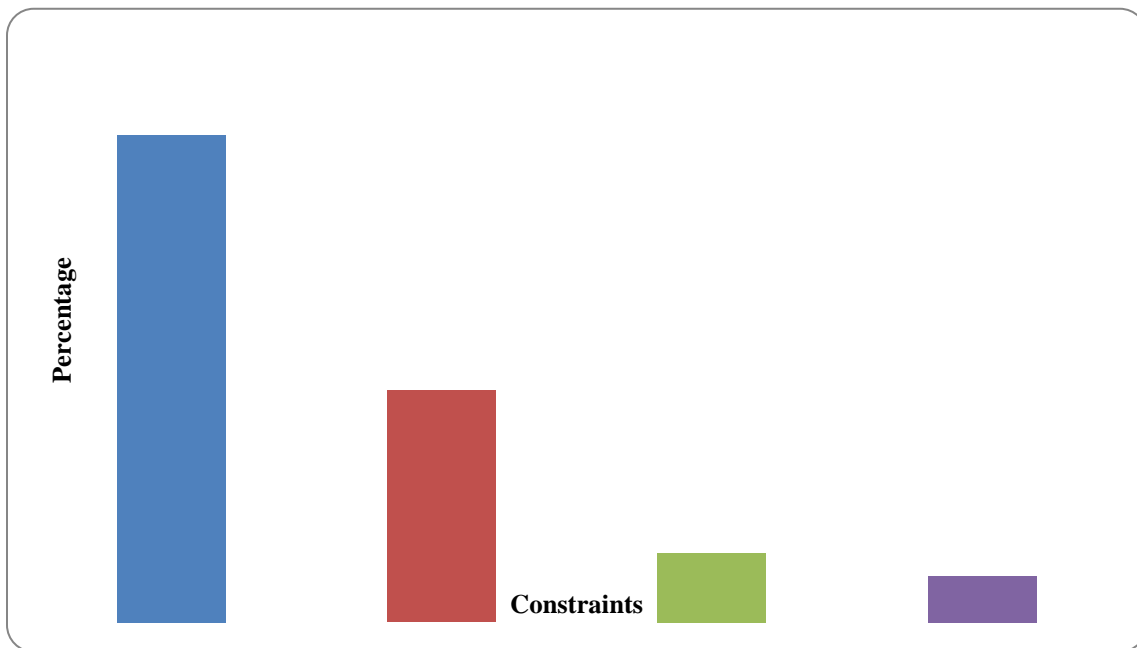


Fig. 8. The rank of fish production constraint in Yayo and Nopha districts.

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This research is in line with the finding of Hussien Abegaz *et al.* (2010) for Afar region, where lack of transportation facilities, proper fishing gear, wide use hook for fishing, poor post-harvest handling, low price of fish as a result of low bargaining power of producers, lack of proper fish processing and storage facilities, poor extension service, lack of awareness, poor culture of eating fish, lack of permanent fish market places (shops) are the main fish production constraints. The current finding is also in agreement with that of Gordon *et al.* (2007) in which physical access to landing points, collector boat collection points, and road-side traders, loss of quality because of limited options for conservation and time/distance from trading points are major marketing constraints faced by the fishermen.

## **5. Conclusion and Recommendations**

### **5.1. Conclusion**

Fishing occurs in different rivers of Ilu Abba Bora Zone such as Sor, Gabba, Dabana, Didhessa, Ganji, Barokela, Kabar, Gumero and other rivers. The fishing activities of these rivers are on subsistence basis by part-time fishermen for family consumption and sale on small scale during dry season. Fishing is commonly carried out mostly at the end of rainy season (starting from October) and continues to the beginning of rainy season (April). Hooks of different size, traps (fish basket) locally made and rarely, gillnet are the fishing gears commonly used in the area. Birbira (*Milletia ferruginea*) is also used by fishermen in Sale Nono district.

Demand for fish, lack of awareness, lack of facility, low profit, and distance from market place are the main fish production constraints in the area though the severity of the constraints vary from one district to the other. The fish demand and supply vary from one district to the other within Ilu Abba Bora Zone.

Fresh whole fish, gutted and dried fish are mostly preferred fish products. *Labeobarbus intermedius*, *Labeobarbus nedgia*, *Bagrus docmak* and *Oreochromis niloticus* are the fish species preferred by consumers in the study area.

### **5.2. Recommendations**

Based on the findings, the following recommendations were made:

- Establishment of fish farming site is important to promote fish consumption tradition and create awareness on the nutritional value of fish in the zone.
- Promotion works and training to the local communities, the development agents, the experts at district and zonal level is highly required.
- Formation and strengthening of fishermen cooperatives through training and provision of appropriate fishing gears is highly important.
- Fishing methods like poisoning with birbira (*Milletia ferruginea*) which causes mass destruction of fish and other aquatic fauna also needs special attention.
- Methods for fish preservation and transportation should be designed to allow fishers to sell their catch in areas where price of fish is attractive.

## Aquaponics

- Fish diversity, fishery potential, and the feeding habit of fishes of riverine water bodies of Ilu Aba Bora Zone await further investigation.

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