



Fishery Production System Assessment in different Water Bodies: In the case of East and West Harerghe Zone, Oromia, Ethiopia

*Alemayehu, Abebe; Addisu, Hailu; Alema, Lema; Tilahun, Geneti

Oromia Agricultural Research Institute, Batu Fish and Other Aquatic Life Research Center, East Shewa, Batu, Ethiopia.

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***Corresponding Author**

Alemayehu Abebe

E-mail: addihailu@gmail.com

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ABSTRACT

This study was conducted to assess the existing fisheries production systems in different fishery potential area of East and West Hararghe Zone. Different reports, field assessment, structured and semi-structured questionnaires and observation were employed as a means of data collection techniques and analysed using Microsoft Excel sheet. For this study water bodies were purposively selected namely Chercher Lake from West Hararghe Zone and Adale Lake from East Hararghe in collaboration with experts of the respective Zone and districts. Nile Tilapia (*Oreochromis niloticus*), Common carp (*Cyprinus carpio*) and Catfish (*Clarias gariepinus*) were type of fish species found in Lake Charcher and Nile Tilapia (*Oreochromis niloticus*) and Catfish (*Clarias gariepinus*) were type of fish fishermen harvested from Adale Lake. In the studies area fishing activities was as secondary source of income. The most important fishing gear used to catch the fish were gillnets, beach seines, long-lines, hook-and-line, and cast nets. Fish processing method exercised by the fishermen were gutting and filleting. Fish processing was rarely practiced and in most cases, the fisher sold whole fish to fish trader, consumers or hotel owners. In West and east Hararghe the main fish production constraint were transportation problem, low yield and over exploitation of fish harvested. In all of the fishing areas fishermen were not able to increase their catch because of scarcity of modern fishing gears and poor road access to the potential markets. Fisheries management in the two zone were poor and fishery production is overexploited due to inappropriate fishing practice. This shows that the government and concerned bodies attention for fish management was very poor. Therefore, this study suggests giving attention in sustainable lake management system and also giving attention in aquaculture scale-up for the studies area.

INTRODUCTION

Ethiopia is a land-locked country which has approximately 7400 Km² surface area of major lakes and 7185 Km long river network (Dejen and Mintesnot, 2012). The aquatic ecosystem includes major rivers and lakes that are of great national and international importance. There are about 30 major lakes located in different ecological zones ranging from about 150 meters below sea level up to 4,000 meters above sea level (USAID 2008). The country has a number of international rivers, beautiful lakes and reservoirs which have political, ecological and economic importance. Providing adequate food for a rapidly increasing human population is one of the greatest challenges in the world. The problem is particularly acute in countries like Ethiopia where, besides population explosion, natural and man-made calamities have aggravated the problem. Ethiopia's fish resources could undoubtedly offer one of the solutions to the problem of food shortage in the country. The ecological diversity and climatic variation of the country is to a large extent explained by its highly variable topography, which implies that Ethiopia is a country of enormous habitat diversity.

The ecological diversity and climatic variation of the country is to a large extent explained by its highly variable topography, which implies that Ethiopia is a country of enormous habitat diversity. Ethiopia, with its different geological formations and climatic conditions, is endowed with considerable water resources and wetland ecosystems, including river basins, major lakes, many swamps, floodplains and man-made reservoirs hence, the water bodies support a diverse aquatic life including more than 200 fish species of which about 40 are endemic (Redeat, 2012). The total annual fish potential production of the country's major inland water bodies is estimated to be 51,481 metric tons per year on a maximum sustainable yield basis (Anteneh 2013). However, only 20-30% of this resource is utilized (Senbete, 2008). Almost all the fish consumed in Ethiopia are collected from the wild using artisanal methods. The current total fish production potential of the country is estimated to be around 51,481 tons annually for the main water bodies, of which only around 38,400 were exploited very recently (FAO, 2012).

According to (Brook, 2012), although there are some form of fisheries practiced in most freshwater bodies in Ethiopia, commercial fishery is concentrated at Lakes Tana, Chamo, Ziway, Abaya, Koka, Langano, Hawassa and Turkana. The major fish supply to the major cities and towns in Ethiopia are captured from the Rift Valley lakes (40%) and Lake Tana (50.2%) in the north (Tesfaye, 1998) and the remaining percentage going to riverine fisheries. Latest information on fish production potential in Oromia region was limited or not available. Therefore, an assessment of fish production potentials has paramount importance for planning and development activities in the fisheries sector, interventions for fishery management. So, this study was

instated with the objective of assessing the existing fisheries production systems in two rivers of Hararghe Zones of Oromia region.

2. MATERIALS AND METHODS

2.1 Description of the study area

Hararghe is situated in the eastern part of Ethiopia and the first geographic boundary of the zone is reached after driving some 200 km East of Addis Ababa. For administration purposes Hararghe is divided in two zones: East and West Hararghe zones of Oromia Regional State. East Hararghe is bordered on the Southwest by the Shebelle River which separates it from Bale, on the West by West Hararghe, on the North by Dire Dawa and on the Northeast by the Somali Region where chercher Lake is found (in Habro Wereda).

West Harerge Zone is bordered on the South by the Shebelle River which separates it from Bale, on the southwest by Arsi, on the northwest by the Afar Region, on the north by the Somali Region and on the east by East Hararghe which is Adele Lake is found (in Habro Wereda). This area is characterized by lowlands, midlands and highlands agro ecologically.

Unlike other areas in Ethiopia, the Hararghe mid- and highlands enjoy a terrain which, in addition to food crops, also favors the extensive cultivation of cash crops such as coffee and *chat*, a mildly narcotic leaf appreciated as a stimulant in many parts of the Horn of Africa as well as in Arab countries. While coffee is not perishable and can be traded at any time, *chat* is a highly perishable commodity requiring, once harvested, speedy delivery to the consumer in order to maintain quality and to achieve an optimal price. Therefore, only those *chat* farmers whose plantations are located at or near main roads or at least reliable rural road have adequate market access and can benefit from trading opportunities. Habro is one of the woredas in the Oromia Region of Ethiopia. It is part of the West Hararghe Zone, The woreda is bordered on the south by Darolebu, on the west and north by Guba Koricha, on the northeast by Kuni, and on the southeast by Boke. The average altitude of this Woreda is 1787.6 a.s.l were as the average temperature is 19^oc. The average latitude and longitude is 8.815/998 and 40.5/20188 respectively.

East Hararghe is one of the Zones of the Ethiopian Region of Oromia. It is bordered on the southwest by the Shebelle River which separates it from Bale, on the west by West Hararghe, on the north by Dire Dawa and on the north and east by the Somali Region. Towns and cities in East Harerge include Haramaya, Awaday, Babille and Fugnan Bira. Har amaya is a town in east-central Ethiopia. Located in the East Hararghe Zone of the Oromia Region, the town has a latitude and longitude of 9°24'N 42°01'E Coordinates: 9°24'N 42°01'E with an elevation of 2047 meters above sea level. The average

temperature and average annual rainfall were 19.5°C and 866mm respectively. The secondary data of livestock numbers obtained from districts of Habro and Haramayais summarized in the following table.

Table 1: Livestock holding in the Habro and Haramaya Districts

Districts	Livestock number in head						
	Oxen	Cow	Bulls	Sheep	Goat	Poultry	Camel
Habro districts	16,602	28,041	13,792	7716	42,068	92,500	14,041
Haramaya districts	16,178	48,850	13,509	79,950	125,145	125,950	480

Source: Own Survey results, 2016.

2.2. Study Design

The methodologies employed were review of different reports, field assessment, consultation and exchange of information, ideas and opinions with relevant organizations and individuals in some districts of West and East Hararghe zone. The Fishery activities, fish market and demand were studied with full participation of all stakeholders including the local people, districts and zonal livestock and fishery experts.

2.3. Sampling Techniques and data collection

Purposive sampling technique was employed to select the water bodies based on fishing activities. Accordingly, Chercher (West Hararghe Zone) and Adale (East Hararghe zone) were selected. From each zone representatives fishermen and households along and nearer to water bodies were selected and interviewed. Data were collected directly via observation, interview, and making focus group discussion with some selected fishermen and different experts at districts and the zonal level. Important socio-economic characteristics of the respondent, like sex, age, educational status, Family size, season of the exploitation, materials used for current production (quality and quantity), processing technique, transportation system, storage system, land and livestock ownership, income sources, fish handling, processing and preservation techniques, fish marketing, fish production trends, fishing efforts and fishery production constraints were collected.

2.4. Data analysis

Data collected through questionnaire, interview and field observations were analyzed quantitatively and qualitatively using STATA 13 software. Simple descriptive statistics (frequency count, percentage, mean and standard deviation) was used to describe and summarize the data.

3. RESULTS AND DISCUSSIONS

3.1. Socio-demographic characteristics of fishermen

The fishermen were organized by Habro district Fishery and livestock Agency on Charcher Lake. Currently due to the environmental problem Chercher Lake become decrease in water size as well in fishing activities. As we get information from the fishermen the fishing activities is already collapse since April 2008. Results for sex of the respondents show that 80% (3) are males and 20%(1) are females. Therefore, the overall sector of fishery cooperatives in charcher lake is dominated by male compared to female members. The average age of the respondents is 20.5 with a standard deviation of **7.51** and a minimum and maximum age of 20 and 22 respectively. The respondents have an average family size of 1.75 and a minimum and maximum size of 1 and 3 with a standard deviation of **1.98**. As far as educational level of the respondents is concerned, the results show that the average educational level of the respondents is 10.75 with a standard deviation of 2.11 and a minimum and maximum of 10 and 10⁺ 3 respectively. Major staple food in the localities was injera.

In adale lake east Hararge Zone all fishermen were male. There average age of the respondents is 28 with a standard deviation of **7.91** and a minimum and maximum age of 20 and 40 respectively. The average family size of 3 and a minimum and maximum size of 1 and 6 with a standard deviation of **3.34**. Major staple food in the localities were injera.

3.2. Income status of fishermen's

In Charcher Lake currently the fishing activities were collapse due to the reduction of water level of lake. Now the all fishermen totally get income from other sources other than fishing. Based on the interview made, the fishermen averagely own 2, 7, 1 and 1.5 of Cattle, Goats and Poultry, respectively, per Fishermen. Concerning of crop production the fishermen mainly produce teff (30 quintals) and maize (75 quintals) annually. Very small number of the fishermen supported their livelihood by produce chat, vegetable like cabbage and tomato.

East hararge at Adale Lake the fishery cooperative were organized. From Fishermen some of them engaging on rearing cattle and crop including cash crop farming activities for income generation. The average cattle, sheep and poultry were 0.75, 0.5 and 1.25 owned by the fishermen per head. In addition to this from cereal crop Maize 1.25quantal, sorghum 2,5quantal

produced at individual level. They also participated in practicing some vegetables (Potato and Cabbage) and khat.

3.3. Fishing gears and season of fish exploitation

Gears commonly operated in Ethiopian fisheries include gillnets, beach seines, long-lines, hook-and-line, and cast nets. Various forms of traps, scoop nets and baskets made of plant materials and wires are also used, particularly in the rivers of Ethiopia (Brook, 2012, 131). Gillnets are used almost on all Ethiopian lakes and account for most of the commercial production. Beach seines are used for commercial catches in the northern Rift Lakes such as Ziway and Langano and Koka Reservoir. In Lake Abaya both the bottom and surface longlines are used to catch *Bagrus* and Nile perch, respectively. The latter is also used in Lake Chamo to catch Nile perch. The use of hook-and-line is often restricted for subsistence fishing. Many other traditional gears are also employed on various lakes and rivers of the country's drainage basins. In Charcher Lake currently the fishermen use Gillnet were as at Adale lake the fishermen use for harvesting fish by beach cell, hook during the dry season. In both site the time of setting were from two o'clock to six o'clock at the morning and operating in group.

3.4 Fish Production, Marketing and price

Fisheries production is also under-exploited while current demand exceeds supply by about four-fold. One of the big and immediate challenges of our country is addressing the problems of food security and poverty. Currently, about 45% of the total population is living under poverty and the level of impoverishment is worse in rural areas, where 85% of the total inhabitants dwell (Sileshi, 2013). As the below table show that According to the respondents three types of fish species were found in Lake Charcher. These three fish species were Nile Tilapia (*Oreochromis niloticus*), Common carp (*Cyprinus carpio*) and Catfish (*Clarias gariepinus*).

Among this species the average number of fish harvested per day Tilapia was over 90%. From the given data Tilapia was the most commercially abundant fish species that found in Lake Charcher. This result simirale with Fitzsimmons, K., 2000 and Felegeselam, Y., 2003. Tilapia is one of the most important species for 21 century aquaculture and is produced in more than 100 countries (Fitzsimmons, K., 2000). Tilapia is the leading species caught and consumed in Ethiopia, although this does not seize for all groups and for all areas. This is reported by different researchers, Nile Tilapia (*Oreochromis niloticus*) is the dominant fish species of the landings (Felegeselam, Y., 2003).

Table 2: Average number fish species, price at landing site and at secondary place at Charcher

Fish species	Average number of fish harvested/day	Price at landing site(Br/kg)	Price at secondary place(Br/kg)
Nile Tilapia (<i>Oreochromis niloticus</i>)	18	30	30
Common carp (<i>Cyprinus carpio</i>)	1	30	30
Catfish(<i>Clarias gariepinus</i>)	1	35	35

Source: Own survey Results, 2016.

Fish processing (value addition) is rarely practiced and in most cases, the fisher sales whole fish which causes low price at landing sites as well as secondary markets. Fishermen sell their fish to the local consumers and hotel owners. The fishermen have stated that, the amount of fish produced from the river is decreasing from time to time. As the result indicate that filleted fish had high demand were as the whole fish was purchased by some consumers in the area. From the types of fish food in the area smoked fish and Tibs were selected by user. The price each prepared food is 20 Et. Br per dish.

In addition to this gutted, smoked and dried fish also preferred by user next to filleted.

In east Hararge zone, at Adale Lake Nile Tilapia (*Oreochromis niloticus*) and Catfish (*Clarias gariepinus*) were collected by the fishermen from the lake. From this Catfish were commercially important fish species, but Common carp (*Cyprinus carpio*) harvested in large amount than Cat Fish. According to the survey data filleted fish products well preferred by the consumer. Gutted and whole fish also ideal next to filleted one.

Table 3: Average number fish species, price secondary place at in East Hararge

Fish species	Average number of fish harvested/kg/day	Price at secondary place(Br/kg)
Common carp (<i>Cyprinus carpio</i>)	40	30
Catfish(<i>Clarias gariepinus</i>)	35	30

Source: Own survey results, 2016.

3.1.4 Fish handling, Storage and Preservation techniques

Fish is one of the most perishable foods, particularly in tropical climates of less developed nations [7]. If proper care is not taken immediately after capture, it can be spoiled in a few hours. Even using traditional methods fish can be still subjected to various forms of spoilages [14]. Fish handling in Ethiopia is at its lowest level and remains at its traditional stage. Starting from the collection of fishes from the net or hooks, fish are thrown on the floors of boats, canoes or rafts. Most of the fish catches from the lakes reach the market by traditional means of transportation without any preservation facilities. Some fishermen hook some of the fish together with a string and carry them by hand to the market for immediate cash income. Others put the fish in a basket, cover them with fresh leaves and carry them by hand. Still others collect their catch in sacks and carry it to the market by hand or on donkeys, taxis or Pickup trucks [33].

The most fish processing method exercised by the fishermen was gutting and filleting. After harvesting from the lake the fish put on wide bidet and transport by them self and donkey from the landing site. Then the fish is preserved in refrigerator until consumer come to buy it. Salting of gutted fish is practiced by fishermen. Only fishermen that established at Adale lake sale their products at secondary place. Due to the Lake near to the main asphalt road they used bajaj as transporting mechanizem. Then the fish is preserved in refrigerator until consumer come to buy it. Salting of gutted fish is practiced by fishermen

3.5 Fish production constraints

The contribution of the fishery sector to global economy and food security cannot be underestimated. Fish production serves as means of livelihoods to millions of people worldwide (Green Facts, 2004, But it perform underutilization due to over exploitation, low yield, transportation problem, poor postharvest processing practice, lake of market infrastructure, low price at landing site etc. In the area as the survey data in West and east Harargethe main fish production constraint that identify by the respondent were transportation problem, low yield and over exploitation of fish harvested.

4. CONCLUSIONS AND RECOMMENDATIONS

This study was conducted with the objective of assessment Fishery production system in the case of East and West Harerghe Zone. The Fishery activities, fish market and demand were studied with full participation of all stakeholders including the local people, districts and zonal livestock and fishery experts. Purposive sampling technique was employed to select the water bodies based on fishing activities. Accordingly,

Chercher (West Hararghe Zone) and Adale (East Hararghe zone) were selected. In Charcher Lake currently the fishing activities were collapse due to the reduction of water level of lake. East hararge at Adale Lake the fishery cooperative were organized. In Charcher Lake currently the fishermen use Gillnet were as at Adale lake the fishermen use for harvesting fish by beach cell, hook during the dry season. Nile Tilapia (*Oreochromisniloticus*), Common carp (*Cyprinus carpio*) and Catfish (*Clarias gariepinus* were type of fish species found in Lake Charcher and Nile Tilapia (*Oreochromisniloticus*) and Catfish (*Clarias gariepinus*) were type of fish fishermen harvested from Adale Lake. In West and east Harargethe main fish production constraint that identify by the respondent were transportation problem, low yield and over exploitation of fish harvested.

Fisheries management in Ethiopia would have great contribution to the economy. This is because fisheries provide employment, food & income and it makes possible evaluation of overexploitation of the fisheries. Since fishery production is overexploited due to inappropriate fishing practice the potential of fish was underdeveloped and the management rule and regulation at federal level and regional level to control the devastation was very poor. This shows that the government attention for fish management was very poor. In another ways the new upcoming lake management system co-management system which consists of end users, policy makers and all stake holders are promising for sustainable lake management.

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