Fish Market Chain Analysis In Ethiopia: The Case Of Lake Tana And Three Rift Valley Lakes

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Abstract
This study examined the fish market chain in Ethiopia from four purposely selected fishery centers, namely, Lakes Tana, Ziway, Hawassa and Chamo with special focus on commercially important fish species from October 2018 to July 2020. A total of 450 fishers and 89 fish traders were interviewed. A descriptive analytical method was used to analyze the data. The study analyzed fish markets in terms of their structure, conduct and performance (SCP). All fishers and assemblers engaged in the study did not have fishing license as well as 65.2% of market actors were not licensed in fish trading. Transportation of fish from the collection points to registered storage sites has shown a clear association with licensed fish traders ($P<0.005$); while considerable amount of catch entered the market using illegal and unregistered routes by passing standard storage facilities. Fishers shared financial benefits rating 46.82%, 3.18% and 50% from assemblers, cooperatives and retailers, respectively. Fish retailers and assemblers obtained the highest gross profits of 1620 and 1572 Ethiopian Birr/quintal (ETB/Qt), respectively; whereas fishers and cooperatives obtained lower gross profits of 1514 and 1050 ETB/Qt, respectively. Fishers, assemblers, retailers, cooperatives, wholesalers, hotels and consumers were important fish market intermediaries. Fish market channel members clearly indicated that the chain is predominantly traditionally split and there are too many market networks. We concluded that efficient government administrative setup, re-organized cooperatives and institutionalized market outlets are urgently needed to address short and efficient chains by the intensive efforts of stakeholders for the benefits of all actors to establish improved fish production and marketing system in the country.

Key words: Ethiopian fishery, Fish markets, Market actors and Profits

1. Introduction

Fish is one of the most traded food commodities worldwide with more than half of fish exports by value originating in developing countries (FAO, 2020). In Ethiopia, agriculture is the main backbone of the economy and it is the source of livelihood for a large section of economically disadvantaged population of the country. The fishery subsector, one of the potential intervention areas to achieve the objective of enhancing poverty alleviation, can also provide employment opportunities and alternative sources of income to improve the livelihoods of poor rural people in a sustainable manner (Global Fish Alliance, 2010; Tesfaye and Wolff, 2014; FAO, 2020; Hendriks, 2022). Farmers living along shorelines have livelihoods directly linked to the wetlands where they practice fishery. It is becoming apparent that the demand for fish is increasing in Ethiopia and the market is not supplying sufficient quantity fishery products with the required quality (Lemma, 2012). The major consumable fishery resources are captured from the rift valley lakes (40%) and Lake Tana (50.2%) in the north (Abera *et al*., 2018) and the remaining percentage come from riverine fisheries. The annual fish production from the capture fishery alone has increased from less than 10,100 tons/year in the 1990s to over 50,000 tons/year in 2015 (MOA, 2019). Conversely, the total annual fish production potential of the country's major inland water bodies (lakes, reservoirs, small water bodies and rivers) is estimated to be 94,541 metric tons per year (Tesfaye and Wolff, 2014). Regarding the riverine fishery potentials of the country, it is expected to produce about 21,405 tons/year (Tesfaye and Wolff, 2014). Of these, only less than 38% is being utilized annually (Chekol, 2013). In Ethiopia, fisheries still use traditional, involving aging gears that require high manual labor and time inputs and comprise of illegal fishing practices (Garoma *et al*., 2013). It is also threatened with problems of overexploitation, environmental degradation (Dejen *et al*., 2017). Despite its potentials, the fishery sub-sector is still underdeveloped and its contribution to the agrarian-based national economy remains negligible. The share of fisheries to the national economy is only 0.3% (NBE, 2018/19), despite the presence of 206 species of fish in Ethiopian freshwater systems (Habteselassiie, 2012).

Ethiopian water bodies support a diverse aquatic life including 206 fish species of 70 genera and 29 families. 206 valued species of which 41 species are endemic to Ethiopia (Getahun, 2007). Lake Tana alone contains natural stocks of 28 fish species, of which 21 are endemic (Dejen, 2008; Vijverberg *et al*., 2009). It is also the home of diverse species of the

genus *Labeobarbus* (Getahun, 2007; deGraaf, 2003). However, only three taxa are regularly represented in the market. These are the Nile tilapia (*Oreochromis niloticus*), the African catfish (*Clarias gariepinus*) and a *Labeobarbus* species. Another species, Beso (*Varicorhinus beso*) is represented in a very low proportion, which is found mainly in rivers (Demessie 2003). Moreover, there are between 20 and 30 fish species overall in the Rift Valley lake basins (Golubtsov & Mina, 2003), with the most common species of commercial value are *O. niloticus*, *C. gariepinus*, and *Lates niloticus*, *Bagrus docmac*, *Labeobarbus* (Golubtsov & Mina, 2003; Vijverberg *et al*., 2012). There is some level of traditional fishing in all these lakes with Lakes Chamo, Ziway and Tana dominating the fish market (Gordon *et al*., 2007).

Fish are collected from the wild from Ethiopian lakes in what is known as open access to anyone who wishes to capture fishes, although many argue that cooperatives organized by the government are legally entitled entities. Currently, "illegal fishers" are rampant in Lakes Ziway and Langano, and legal enforcements to prevent their action are loose (Garoma *et al*., 2013). Aquaculture in Ethiopia can be considered as non-existent in the sense that it has no significant contributions in becoming means of livelihood to the poor and the generation of revenues to the nation (Wakjira *et al*., 2013). Further, fishes captured with artisanal methods from the wild are not handled as per the FAO standards and the market chains are not organized in formal value adding manners (Lemma, 2012). Complemented with the cheap prices at the lake landing sites, the decreases in fish outputs due to overexploitation significantly affects the gross margin earned by fisher households (Garoma *et al*., 2013). According to Lemma (2012) and Janko (2014), value addition at each market chain and free access to fresh waters, as in Ethiopia, should be regulated for the sake of sustainability in fishery production, food security and conservation of biodiversity. For instance, value addition in fisheries and aquaculture promotes improved profits, by way of establishing more stable market conditions, conversion of postharvest wastes into usable materials, creating job opportunities and product diversification (Russell and Haanoomanjae, 2012). Despite these facts, the socioeconomic aspects and improving the fish value chains in the study areas has not been given the due attention. It does not have a well-developed standard form of marketing network. In Ethiopia, the fishery research is mainly focused on biological aspects (see also deGraaf, 2003; Getahun, 2007; Dejen, 2008; Anteneh et al., 2012; Dejen *et al*., 2017; Abera *et al*., 2018). Consequently, unavailability of previous study on fish market chain hinders the potential gains that could have been attained from the existing opportunities and hence the problems in this sub-sector need to be investigated. As a result, this study attempted to fill these gaps with the objective of analyzing the fish market value chains of Lakes Tana, Ziway, Hawassa and Chamo to develop evidence-based and efficient alternative fish market chains for decision-making and sustainable fish stocks management.

2. Materials and Methods

2.1. Study area

The study was conducted at the north-western highland lake (Tana) and the Rift Valley Lakes such as central Rift Valley Lakes (Ziway and Hawassa), the southern Rift Valley lake (Chamo) (Getahun, 2007; Gordon et al., 2007; Tesfaye and Wolff, 2014) (Figure 1 and Table 1). Among these Lakes, Tana, Ziway and Chamo are contributing more than 65% of the total annual fish catches in Ethiopia (Janko, 2014; Tesfaye and Wolff, 2014). In addition, Lakes Hawassa contributed 7% of the total production (Tesfaye and Wolff, 2014). In contrast, Lake Tana is the largest lake, which constitutes half of the area of the lakes of the country (Vijverberg et al., 2012); while Lake Hawassa is the smallest both in surface area and fish production and potentials when compared to the other study lakes (Figure 1 and Table 1). The details below give baseline information of the study lakes.

Table 1. Baseline information on the study areas (deGraaf, 2003; Golubtsov & Mina, 2003; Abebe Getahun, 2007; Gordon et al., 2007; Redeat Habteselassiie, 2012; Vijverberg et al., 2012; Wassie Anteneh et al., 2012; Assefa Mitike, 2014; Gashaw Tesfaye and Wolff, 2014)

No.	Parameters	Lakes			
		Tana	**Ziway**	**Hawassa**	**Chamo**
1.	Location	12°N, 37°15'E	$7^0$54'N, $38^0$45'E	$7^0$03'N, $38^0$27'E	5°42′N, 37°39′E
2.	Elevation (m.a.s.l)	1830	1636	1680	1233
3	Watershed area (km^2)	16500	7025	1250	2210
4.	Surface area (km^2)	3200	440	91	551
5.	Max. depth (m)	14	7	22	13
6.	Mean depth (m)	8	2.5	11	6
7.	Secchi depth (cm)	27-52.9	17.85- 22.12	70-80	29-39
8.	Salinity (mgL^{-1})	<110	350	455.6	1000
9.	Conductivity (μScm^{-1})	142-184	361.50-484.51	846	1100-1910
10	Potential yield t/year	15000	3010	611	4500
11	Per unit area (t/km^2)	4.3	5.1	5.8	5
12.	Major inflows	Gilgel Abbay, Megech, Rib, Gumara, Dirma, Arno-Garno and Gelda Rivers	Meki and Katar Rivers	Swampy area, Tikur-Wuha	Sile, Argoba, Wezeka, Sego and Kulfo Rivers
13.	Major outflows	Blue Nile River	Bulbula River	no	Sagan River

No.	Parameters	Lakes			
		Tana	Ziway	Hawassa	Chamo
14.	Offshore towns	Bahir Dar, Goregoa, Delgie	Batu	Hawassa	Arbaminch
15.	No. of fish species	28	7	7	19
16.	Commercial fishes				
16.1	*Oreochromis niloticus*	✓	✓	✓	✓
16.2	*Clarias gariepinus*	✓	✓	✓	✓
16.3	*Labeobarbus* spp.	✓			
16.4	*Cyprinus carpio*		✓		
16.5	*Ttilapia Zilli*		✓		
16.6	*Lates niloticus*				✓
16.7	*Barbus* spp.	✓		✓	✓
16.8	*Bagrus docmac*				✓

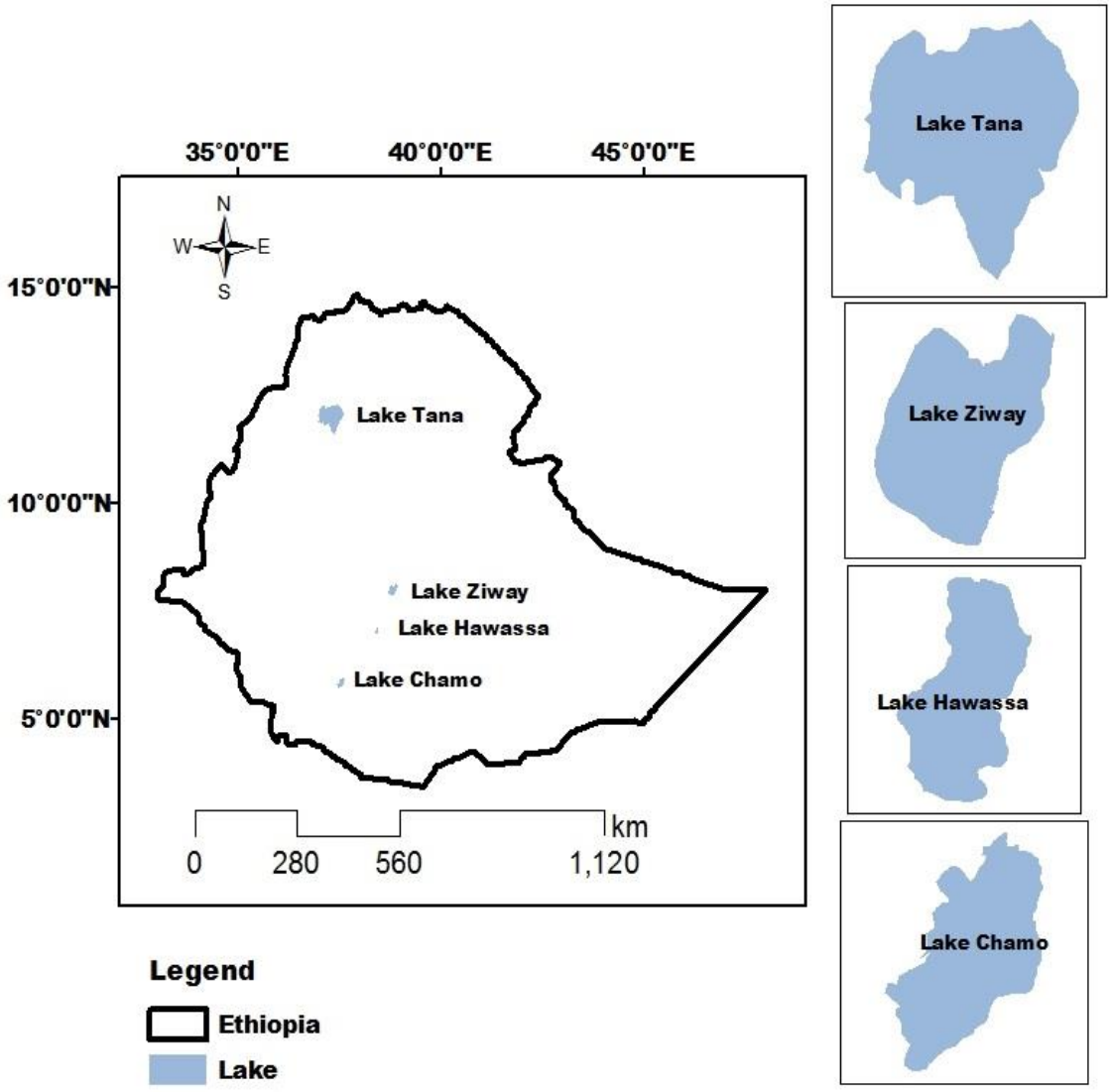

Figure 1. Geographical locations of study Lakes: Tana, Ziway, Hawassa and Chamo

The above four lakes were selected purposively based on the basis of their accessibility to market outlets from their respective landing sites, number of fishers operating in the area, availability of marketable fish, the volume of trade generated, opportunity of market and number of forward and backward linkages in the market chain and providing considerable catches and fishery that supply resources for the local and urban communities of the major cities including the capital, Addis Ababa.

1.1. Data sources, sampling procedure and data collection methods

This study was conducted from October 2018 to July 2020. Observations, primary and secondary data sources were used in Lake Tana and the Rift Valley lakes Ziway, Hawassa and Chamo. Both qualitative and quantitative data were collected from primary and secondary sources.

1.1.1. Observations

Throughout the study first hand observations were made on the existing, postharvest handling, gutting, filleting, packaging, transporting and marketing processes of fish.

1.1.2. Primary data collection tools

Primary data collection was conducted using questionnaires to find out the responses of the involved persons in the market chain from the producers or fishers all the way up to the consumers. Accordingly, a questionnaire was developed and validated at a small scale level to ensure consistency and all possible areas of investigation were covered. Before starting the actual data collection, the objectives of the research were clearly explained to each respondent, group and office-holding experts. Cascading from the main questionnaire, an itemized checklist was prepared to ensure that all comments for fishers, fish traders, government and non-government institutions at different levels were captured. The main data collection was focused on socioeconomic characteristics, fishing and trading experiences, buying and selling, pricing by species type, mode of transportation, types of preservation, postharvest handling techniques, characterization of fish marketing actors and problem associated with fish marketing and the sanitary conditions at all levels of the market chain.

1.1.2.1. Sampling fishers and traders

Sampling selecting the personnel to be interviewed was done based on proportional, random and purposive sampling method. The sample size for each lake was determined based on number of the fishers, which were 4539 at Lake Tana, 1766 at Lake Ziway, 1495 at Lake Hawassa and 1104 at Lake Chamo. Accordingly, random selection of 150, 125, 90 and 85 were made, respectively; making a total sample size of 450 fishers.

Sampling of with respect to fish traders, purposive sampling technique was used depending on the volume of fish they were handling and their proximity to the market place at Lakes Tana, Ziway, Hawassa and Chamo (Table 2).

1.1.2.2. Sampling for focus group discussions, key informants and leaders of cooperatives

This survey was also supplemented by additional general and specific information collecting mechanisms whereby selection of responsible persons of both sexes with diverse age groups were formed for focus group discussions (FGD), key informants (regional fisheries experts), knowledgeable fishers on the issue of the conditions of the lakes in each fishing grounds, cooperative leaders, fisheries experts from the Ministry of Agriculture and members of the private Fish Production and Marketing Enterprise management group (Table 2).

Finally, fish market channels were drawn based on the data collected to help the authors produce a complete picture of the fishery market chain from the Lakes Tana, Ziway, Hawassa and Chamo. After this whole exercise, the overall sample size came to 597 individuals or subjects which were involved in the primary data collection (see the breakdown in Table 2, below).

Table 2. Summary of data sources

Categories of subjects involved in the study	Study areas (lakes)										Total
	Tana		Ziway		Hawassa		Chamo		Total		
	M	F	M	F	M	F	M	F	M	F	
Fishers	150	0	122	3	89	1	84	1	445	5	**450**
Fish traders	25	5	22	1	19	0	17	0	83	6	**89**
Focus groups	8	2	7	0	6	1	6	0	27	3	**30**
Regional Bureau of Agriculture and Zonal experts	5	1	2	0	2	1	3	1	12	3	**15**
Leaders of fishery cooperatives	2	0	2	0	2	0	2	0	8	0	**8**
Experts from the Federal Ministry of Agriculture									2	2	**4**
Technical persons from a private Fish Production and Marketing Enterprise									1	0	**1**
Total	**190**	**8**	**155**	**4**	**118**	**3**	**112**	**2**	**578**	**19**	**597**

1.1.3. Secondary data collection tools

Collection of catch statistics of the Ethiopian fishery was made by reviewing published and unpublished reports from the Bureaus of Agriculture (BoA) of the regional and federal ministries, *Woreda* (district) Agricultural and Rural Development Offices (WARDO) and fish production cooperatives. Moreover, various relevant policy papers catch records from cooperatives and the Fish Production and Market Enterprise (FPME) were examined. Additional secondary data collection was conducted by examining catch statistics of fish stock assessment studies done by academic and research institutes and changes in fish prices from user hotels and traders.

1.2. Data Analysis

In this study, the collected data were tabulated and organized in graphs, charts and tables and analyzed using descriptive statistics such as frequency, average, percentage and other appropriate statistical methods with SPSS version 20.0 Statistical Software. The data collected from the focus group discussions and the interviews made with key informants were analyzed using qualitative methods and included in the discussion accordingly.

Estimation of market margin was considered as most appropriate for this study analyze performance of the market (Mendoza, 1995). This was found very effective when there are several participants in the market chain, and hence the margin is calculated by finding the price variations at different segments of the chain and then, comparing them with the final price at the consumer end. Hence, the consumer price was taken as the base or common denominator for all marketing margins (Mendoza, 1995). The relative size of various market gross margins of the participants can indicate where in the marketing chain value is added and/or profits are made (Mendoza, 1995; Cramer and Jensen, 1982). Mathematically, this can be expressed as:

$$P_S = \frac{P_x}{P_r} = 1 - \frac{MM}{P_r}$$

Where, P_S = Producer's share

P_X = Producer's price of fish

P_r = Retail price of fish

MM = Marketing Margin

The Total Marketing Margin (TGMM) was calculated using the following formula (Mendoza and Mark Rosegant, 1995; Cheffo, 2016):

$$\text{TGMM} = \frac{\text{Consumer Price} - \text{Fishermen Price}}{\text{Consumer Price}} \times 100$$

The margins at each stage of the different channels were then compared against each other.

2. Results and Discussion

2.1. Demographic characteristics of fishers

Fishers are diversified in their demographic aspects such as their sexes, ages, marital status and education levels. In this study 98.9% of the sampled fishers were males; while only 1.1 % were females and 79.1% were married, 20.4% were single and the rest 0.4% were divorced (Table 3). It was found out that the ages of the fishers ranged from 18 to 70 years (Table 4) and the active working age group was between 25-50 years old. The mean age of heads of fishers' families was about 38.2 years for all lakes and the average ages by study site were 39.5 years for Tana, 38.9 years for Ziway, 38.5 years for Hawassa and 34.6 years for Chamo. Besides that 19.3% of fishers were illiterate and while the rest ranged from simple writing and reading skills up to preparatory school levels, which is equivalent to Grade 8 in the Ethiopian standard. Concurrent to the reports of (Hoppe, 2002; Demessie 2003; Mfinanga, 2014), fishing activity is male dominated due to its distress and the need for a high level of physical work, requirement of experience with age, source of initial capital and quick decision-making abilities.

Table 3. Demographic characteristics of sampled fishers

Variables		Sampled fishers in Lakes								Total	%
		Tana	%	Ziway	%	Hawassa	%	Chamo	%		
Sex	Male	150	100	122	97.6	89	98.9	84	98.8	**445**	**98.9**
	Female	0	0	3	2.4	1	1.1	1	1.2	**5**	**1.1**
Education level	Illiterate	25	16.7	17	13.6	24	26.7	21	24.7	**87**	**19.3**
	Read and write	35	23.3	10	8.0	12	13.3	22	25.9	**79**	**17.6**
	First cycle	32	21.3	39	31.2	17	18.9	5	5.9	**93**	**20.7**
	Second cycle	46	30.7	41	32.8	29	32.2	31	36.5	**147**	**32.7**
	High school	8	5.3	17	13.6	8	8.9	5	5.9	**38**	**8.4**
	Preparatory	1	0.7	0	0	0	0	1	1.2	**2**	**0.4**
	Above preparatory	3	2	0	0	0	0	0	0	**3**	**0.7**
	Religious school	0	0	1	0.8	0	0	0	0	**1**	**0.2**
Marital status	Single	28	18.7	27	21.6	16	17.8	20	23.5	**91**	**20.2**
	Married	122	81.3	98	78.4	74	82.2	63	74.1	**357**	**79.3**
	Divorced	0	0	0	0	0	0	2	2.4	**2**	**0.4**
Total		**150**	**100**	**125**	**100**	**90**	**100**	**85**	**100**	**450**	**100**

Table 4. Age ranges of fishers in years

Age range of fishers in years	Sampled fishers in Lakes								Total	%
	Tana	%	Ziway	%	Hawassa	%	Cham	%		
18-25	26	17	21	16.8	7	7.8	10	11.8	64	14.1
26-50	101	67	82	65.6	69	76.7	71	83.3	323	71.7
>50	24	16	22	17.6.	14	14.4	4	3.5	64	14.2
Total	**150**	**100**	**125**	**100**	**90**	**100**	**85**	**100**	**450**	**100**

The fishers working experience ranged from 2 to 41 years, with a mean of 17.8 years for all lakes which was 18.8 years for Tana, 19.1 years for Ziway, 16.9 years for Hawassa and 14.8 years for Chamo (Tables 4 and 5). Hence, most respondents have been involved in fisheries activities since the last fifteen years (Table 5). This also indicates that the fishery in the study lakes is still inviting new fishers as the profession is a quick source of supplementary. As argued by Endebu et al. (2015) most of the fishers have long experiences of fishing activity at Lake Ziway. Tuluka et al. (2021) also stated that the majority of the experienced fishers feel the sense of ownership on the fishery resources than the less experienced, young and newcomer fishers. As a consequence, fishers with long fishing experiences are familiar to the lake system and they are knowledgeable on issues of areas of fish abundance, fishing practices, fishing hours and seasons (Table 5).

Table 5. Fishing working experience in years

Fishing working experience in years	Sampled fishers in Lakes								Total	%
	Tana	%	Ziway	%	Hawassa	%	Chamo	%		
2-15	64	42.6	66	52.8	49	54.4	57	67.1	236	52.4 Fishing working experience in years
16-30	62	41.3	30	24.0	26	28.8	25	29.4	143	31.8
31-41	24	16.0	29	23. 2	15	16.7	3	3.5	71	15.8
Total	**150**	**100**	**125**	**100**	**90**	**100**	**85**	**100**	**450**	**100**

2.2. Structure, conduct and performance of fish markets

2.2.1. Fish market structure

The fish market structures of the study areas were found to involve marketing agents like fishers, cooperatives, retailers, assemblers, hotels/restaurants and consumers.

Business experience: The survey of the traders showed that most of them have been in the fish trading business for a very long period of time. In terms of age, fish traders ranged from 18 to 63 years of age and a total of (93.3%) fish traders were males; while (6.7%) were females. As seen from Table 6, the wholesalers and cooperatives had 7 to 42 years of fish trading experience, and the assemblers and retailers had 8.5 to 12 years of experience, respectively. Overall, the results indicated that 80% of the sampled fish traders had more than five years in fish trading experience while 20% fish traders had less than five years. According to Mebrate and Worku (2019) 75 % of the fish traders had more than one year experience in fish trading. Most traders seemed to have sufficient experiences and awareness in the understanding the changes in buying and selling prices. They seemed to be proactive in detecting the trends of price fluctuations and deciding when to buy or sell fish.

2.1.1. Working capital

As shown in Table 6, below, on average the wholesalers and cooperatives had the purchasing capacity of 12.8 and 15 quintals (Qt) of fish /day and the assemblers and retailers had the capacity of purchasing 0.06 and 8.9 Qt/day, respectively. The chi-squared test (χ^2) indicated that the percentage of source of working capital of fish traders' through almost comparable distribution Lakes Tana (70%), Ziway (82.7%), Hawassa (84.2%) and Chamo (76.5%). On average, the survey result indicated that about 77.5% of fish traders had their own sources of working capital, while the rest of the traders (22.5 %) don't have any source from which they can solicit working capital. However, working capital ranging from 100,000 to 885,000 ETB was suggested by respondents to enter the business and to become a competent member of a cooperative.

Table 6. Commercial profile of fish traders in Lakes Tana, Ziway, Hawassa and Chamo

Characteristics of traders	Wholesalers	Cooperatives	Assemblers	Retailers	Range
Number (N)	4	8	47	30	
Average employees	-	69	1.20	9	0- 150
Average purchase (Qt/day)	15	12.8	0.06	4	0.01-21.9
Average initial capital in Birr	-	550,000	100,000	104,000	100,000-885,000

2.2.2. Legal and policy constraints

Licensing is a major barrier in many business activities, including the fishery business in Ethiopia. There are no concessionaires in Ethiopia. It was observed that most of the traders and fishers operating in the study area had no fishing licenses. Table 7 shows that 94.0% of the fishers taken as subjects of this study do not have fishing licenses that hence technically they can be considered as illegal fishers. The study lakes and especially Lake Ziway are increasingly under extensive fishing pressure due to increasing numbers of unlicensed fishers and hence many fish stocks are now depleting both in catch and individual sizes of the fishes (MOA, 2019).

Table 7. Status of licensing of fishers in the study lakes

Responses	Tana	%	Ziway	%	Hawassa	%	Chamo	%	Total	%
Yes	135	90.0	121	96.8	87	96.7	80	94.1	423	94.0
No	15	10.0	4	3.2	3	3.3	5	5.9	27	6.0
Total	**150**	**100**	**120**	**100**	**90**	**100**	**85**	**100**	**450**	**100**

Based on the survey results, on average at all of the study areas, 65.2% of the respondents are not licensed in fish trading (Table 8). Lack of fish trading licenses is the highest at Lake Ziway (73.9%) followed by L. Chamo (64.7%), then L. Tana (63.3%), and L. Hawassa (57.9%). Mebrate and Worku (2019) recorded in their report that 61% of fish traders had no fishing licenses in Ethiopian fishing areas. This assessment implied that absence of fishing and trading licenses has not restricted fishers and traders from entering and practicing the fishing business. The poor law enforcement of the government institutions and cooperatives has resulted in the increase of illegal fish trading and hence the decline of fish stocks. It is necessary to implement and enforce the rules and regulations to support fisheries and increase the economic value of fish products to empower those who conduct legal practices.

Table 8. Status of licensing of fish traders in the study lakes

Responses	Tana	%	Ziway	%	Hawassa	%	Chamo	%	Total	%
Yes	19	63.3	17	73.9	11	57.9	11	64.7	58	65.2
No	11	36.7	6	26.1	8	42.1	6	35.3	31	34.8
Total	**30**	**100**	**23**	**100**	**19**	**100**	**17**	**100**	**89**	**100**

Regarding the technical support fish traders obtain from the extension workers of the government, they were asked their perceptions, constraints and attitudes of the services. Overall, 44.9% of the respondents had access to extension services (Table 9a). This implies that the fishery sector had less attention in the planning and development projects of the government. It is characterized by less budget and poor extension activities in fish production, processing and fisheries management. Moreover, there is no sufficient number of fishery experts in each *Woreda*, let alone providing guidance and training through extension programs.

When asked if the water level of the respective lakes has decreased over the years, (Table 9b), fishers responded that 95.7% have perceived decrease in the water level of Lake Ziway, while only 4.3% indicated that there are no observed changes. In contrast, at Lake Tana (86.7%), L. Hawassa 94.7% and L. Chamo (88.2%) perceived decreased water levels (Table 9b).

Table 9. Constraints and attitudes of fish traders in the study sites

Variable	Fish landing sites (Lakes)				Total
	Tana No. (%)	Ziway No. (%)	Hawassa No. (%)	Chamo No. (%)	
(a) Extension services					
Yes	22 (73.3%)	8(34.8%)	10(52.6%)	9(52.9%)	49(55.1%)
No	8(26.7%)	15(65.2%)	9(47.4%)	8(47.1%)	40(44.9%)
(b) Water level fluctuation					
Yes	26(86.7%)	22(95.7%)	18(94.7%)	15(88.2%)	81(91.0%)
No	4(13.3%)	1(4.3%)	1(5.3%)	2(11.8%)	8(9.0%)

2.2.3. Fish market conduct

2.2.3.1. Producers (fishers) behavior

In this survey, it was observed that whatever small catch fishers have, they mostly sell them right at the landing sites to hotel owners or to middlemen to collect immediate cash for home use. Besides this, considerable number of fishers suggested that they take no fish or negligible quantity for family consumption. In due course, it is usually observed that some small fraction of the catch is wasted due to mishandling and poor sanitation practices. Survey results also showed that fishers spent 13 to 27 days (22.58 days, on average) per month or on average 8.92 working months per year in fishery operations at Lakes Tana, Ziway, Hawassa and Chamo (Figure 2). The fishers at Lake Ziway spent 25.25 days per month or 10.1 working months per year in fishery operations more than any other studied lakes (Figure 2). According to Demessie (2003), fishing was practiced for about 257 and 300 days per year at Lake Tana. This study showed that on average L. Tana fishery was conducted for about 150.8 and 334.6 days per year. Despite this, it was observed that fishing is an important income sources in Ethiopian conditions with an average 2039 ETB/month (equivalent to 39 USD at current exchange rates of 53 ETB for the dollar) and job opportunities for many in Lakes Tana, Ziway, Hawassa and Chamo fishing areas. The responses of the fishers indicated that the periods from February to April of each year was the highest fish supply time for tilapia, June to September for catfish and June to October for *Labeobarbus* species. These periods are likely to be associated with the feeding and migration patterns of the various fishes species (Lemma, 2007; Anteneh et al., 2012; Gebremedhin, 2018).

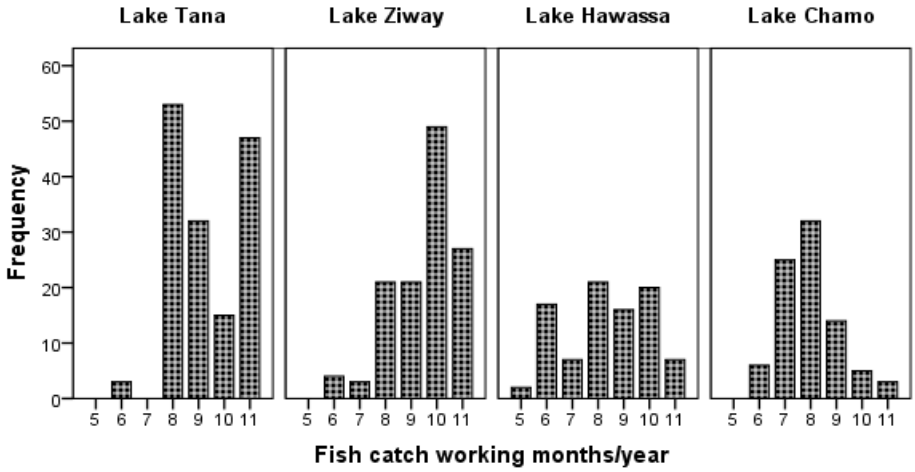

Figure 2. Frequency of working months/year of fishers in the study lakes

2.2.3.2. Trader's behavior

The informal marketing system for fish was in most cases characterized by no licensing requirements to start the operation, low cost and no regulations of operation and sanitation. Fish traders are more aware of price information of the supply and demand conditions at Lakes Tana (62.7%), Ziway (69.6%), Hawassa (52.6%) and Chamo (49.4%) fish marketing system when compared to fishers. According to Mebrate and Worku (2019), there were no operational brokers in the Ethiopian fish market. The fish retailers were found to purchase fish, preserve fish and transport the same either directly from fishers at fish landing sites and/or assemblers in their surroundings and sell it at local markets in Addis Ababa, at hotels/restaurants and to individual consumers (Figure 5).

Table 10 shows the percentage of preserved fish in kept in freezers until sold in the areas of Lake Tana reaches upto 50%. This is higher than in the areas of the remaining lakes, e.g., at Lake Ziway (30.4%), Hawassa (47.4%) and Chamo (29.4%). Nearly 69.6% fish traders did not use any types of preservation in Lake Ziway, while 64.7%, 52.6% and 46.7% indicated they did not preserve fish until sold to market in Lakes Chamo, Hawassa and Chamo, respectively. Due to the inaccessibility of working places in the market and the lack of an appropriate transportation system, these traditional methods often cause economic and considerable amount of postharvest losses.

Table 10. Preserved fish until fish are sold out

Variable	Fish landing sites (Lakes)				Total
	Tana No. (%)	Ziway No. (%)	Hawassa No. (%)	Chamo No. (%)	
Freezer	15(50%)	7(30.4%)	9(47.4%)	5(29.4%)	36 (40.4%)
Cold room	1(3.3%)	0(0.0%)	0(0.0%)	1(5.9%)	2(2.2%)
None	14 (46.7%)	16(69.6%)	10(52.6%)	11(64.7%)	51(57.3%)
Total	**30(100%)**	**23(100%)**	**19(100%)**	**17(100%)**	**89 (100%)**

Using Chi-square test (χ^2) the responses of fish traders regarding the mode of transportation of fish from the landing sites to store or user hotels and restaurants indicated that there is an association only between the fish traders (Table 11). About 42.1% of the fish traders at Lake Hawassa replied that '2-wheelers' are efficient transporters of fishery products, while relatively small fish is transported by 2-wheelers, namely, 34.8 % at Lake Ziway, 17.6 % at Lake Chamo and 13.3% at Lake Tana.

Table 11. Mode of transportation used from collection point to storage site

	Tana	**%**	**Ziway**	**%**	**Hawassa**	**%**	**Chamo**	**%**	**Total**	**%**
Manual	12	40.0	1	4.3	1	5.3	3	17.6	17	19.1
3-wheelers	4	13.3	6	26.1	4	21.1	2	11.8	16	18.0
Refrigerated cars	2	6.7	1	4.3	1	5.3	6	35.3	10	11.2
Carts	3	10.0	5	21.7	2	10.5	0	0.0	10	11.2
Not used	5	16.7	2	8.7	3	15.8	3	17.6	13	14.6
Bicycles	4	13.3	8	34.8	8	42.1	3	17.6	23	25.8
Total	**30**	**100**	**23**	**100**	**19**	**100**	**17**	**100**	**89**	**100**

Chi-Square (χ^2 =33.854); Fifteen degrees of freedom; P<0.005

2.2.3.3. Traders pricing behavior:

The survey results revealed that major factors, namely, seasonal rainy periods and dry seasons, social festivals days, non-fasting and fasting periods were found to exert considerable impact on fish pricing behaviors. It was observed that the price of fish reached its peak during the big social festivals, meetings and fasting periods when guests come to Bahir Dar (city on the shores of L. Tana), Ziway, Hawassa, and Arba Minch City found in close proximity to L. Chamo and to large cities like Addis Ababa (Table 12). In the fasting periods, followers of Orthodox Christianity do not consume animal products, but tradition has it that they revert to fish and fish products to supplement their animal protein needs. At such moments, fish price stagger a bit higher than usual. At such moments, some retailers and assemblers were making inappropriate and fake price increases to obtain unfairly raised incomes. This behavior of alteration of prices in their favor is expressed in the form of, compromised the quality. Selling undersized (3-5 cm) fishes, stashing catches in cold rooms or freezers and adulteration of fishery products.

Table 12 indicates that unhygienic fish handling and processing of fish, ignorance of standard sanitary procedures increase at such fasting periods as observed at fish processing centers of Lake Hawassa (by 94.7%) higher than the remaining Tana (by 70%), Ziway (by 82.6%), and Chamo (by 76.5%). Almost all lakes have poor quality of fish processing due to inadequate fish postharvest handling, sanitation techniques and lack of clean water for fish processing (Table 12). The chi-squared test (χ^2) indicated the percentage of lack of standard grade and quality of fish (e.g. under sized fish of 3-5 cm length and poorly washed fishes), where Lake Ziway reached 91.3%. In Lakes Tana area it reached 76.3%, at L. Hawassa 78.9% and at L. Chamo 70.6% (Table 13). It was very common to see and collect feedbacks at cross examinations during interview sessions that small scale retailers and assemblers were found to adulterate fish after filleting, particularly at Lake Tana.

Table 12. Assess fish supply and fish handling in the Lakes

Variable	**Fish landing sites (Lakes)**				**Total**
	Tana No. (%)	**Ziway No. (%)**	**Hawassa No. (%)**	**Chamo No. (%)**	
Unhygienic fish handling and processing					
Yes	21(70%)	19(82.6%)	18(94.7%)	13(76.5%)	71(79.8%)
No	9(30%)	4(17.4%)	1(5.3%)	4(23.5%)	18(20.2%)

Table 13. Lack of standard grade and quality of fish

Responses	**Tana**	**%**	**Ziway**	**%**	**Hawassa**	**%**	**Chamo**	**%**	**Total**	**%**
Yes	23	76.7	21	91.3	15	78.9	12	70.6	71	79.8
No	7	23.3	2	8.7	4	21.1	5	29.4	18	20.2
Total	**30**	**100**	**23**	**100**	**19**	**100**	**17**	**100**	**89**	**100**

2.2.3.4. Strategies of setting purchasing and selling price by traders

The survey result showed that negotiation was found to be the most frequently used fish purchasing strategy. At each level of product exchange particularly at landing sites, each buyer finds himself or herself negotiating the price based on the volume of fish on sale, sizes, species type and freshness of the landed fish. However, during the visits of landing sites and later in the discussions made during the interview of key informants it was found out that the price of fish per kilogram differed from landing site to landing site and lakes to lakes which was based on the volume of catch and the demand at each occasion, accessibility of infrastructure, storage, transport, access to fish market centers and fishing

grounds (Table 15). As stated above, the purchasing as well as selling price of fish usually differed based on fish species types, *Lates niloticus* (Nile perch) fetching the highest price followed by *Oreochromis niloticus* and the rest in their appearance order here (*Clarias gariepinus*, *labeo barbus*, *Cyprinus carpio*, *Cyprinus carassius*, and *Bagrus docmac*) (Table 15), transportation [36] and based on consumer's preference. It was observed that the consumers had to pay highest average price of 200 ETB/kg for Nile perch at Lake Chamo, which obviously fetches three or four times more when it reaches the big hotels in Addis Ababa 500 km from Chamo. at Nile-tilapia was sold at 180 ETB/kg at the landing site Lake Chamo, and the African catfish fetched 60 ETB/kg at Lake Hawassa. In contrast, the lowest market price for common carp was 11.5 ETB/kg at Lake Ziway (Table 15). Nile Tilapia was the most dominant species by volume of catch, followed by the African catfish. Consumers preferred mainly Nile Tilapia species since it is commonly available at all the study sites its year-round availability and its reasonably good taste.

Using chi-square test (χ^2) cross-tabulating characteristics it was observed that fish price setting at the respective lakes is associated with fish traders (Table 14). For instance, like anywhere else in the fishery business, the selling prices of fish at Hawassa landing site is set each day by the relations of supply and demand of fish markets. On the other hand, in Lakes Tana area fish traders responded that market price is set by negotiation, where at Lake Tana (30.0%), L. Ziway (34.8%) and L. Chamo (52.9%) (Table 14).

Table 14. Assessment of fish price setting

Responses	Tana	%	Ziway	%	Hawassa	%	Chamo	%	Total	%
Yes	9	30.0	8	34.8	12	63.2	9	52.9	38	42.7
No	21	70.0	15	65.2	7	36.8	8	47.1	51	57.3
Total	**30**	**100**	**23**	**100**	**19**	**100**	**17**	**100**	**89**	**100**

Chi-Square (χ^2 =6.546); three degrees of freedom; P<0.005

Table 15. Current fish price at LakesTana, Ziway, Hawassa and Chamo

No.	Fish species	Tana		Ziway		Hawassa		Chamo	
		Whole (ETB/Kg)	Filleted (ETB/Kg)	Whole (ETB/Kg)	Filleted (ETB/Kg)	Whole (ETB/Kg)	Filleted (ETB/Kg)	Whole (ETB/Kg)	Filleted (ETB/Kg)
1	Nile Tilapia (*O.nilotics*)	40-60	95-160	15-31	50-80	21-35	60-100	40-60	100- 180
2	African Catfish (*C. gariepinus*)	15-30	35-50	16.5-20.5	28.7-50	15-30	25-60		30-40
3	*Lebeobarbus*	13-20	25-35						
4	Common Carp (*C. carpio)*			11.5-15	19-40				
5	Crucian Carp (*C. carassius)*			11.5-15	19-22.5				
6	Nile perch (*L. niloticus*)							50-100	150-200
7	Kerkero (*Bagrus docmac*)							40-80	120- 180

Market performance: Marketing costs, gross margin and profit margin of traders

Table 16. Marketing margins analysis considering the central market

Cost components	Cost (Ethiopian Birr/Quintal)	% cost share
Producers/fishers (N = 450)		
Estimated labor cost of fish production (50 ETB/day)	500	85.3
Boat and gillnet cost	60	10.3
Fuel cost	26	4.4
Total cost	586	
Producers' gross profit	1514	
Average selling price	2100	
Assemblers (N = 47)		
Assemblers' purchase price from fishers	**2000.5**	
Loading/Unloading costs (50ETBr/Qt)	50	13.2
Transportation cost (From fish landing site to market)	28	7.4
Cost of plastic	25	6.6
Cost of filleting (2 ETB/kg)	200	53.0
Personal travel cost	50	13.2
Communication	25	6.6
Total cost	2378.5	
Average selling price	3950.6	

Cost components	Cost (Ethiopian Birr/Quintal)	% cost share
Margin	1949.5	
Assemblers gross profit	1571.5	
Fishers share from assemblers	**46.82%**	
Cooperatives (N = 8)		
Cooperatives' purchase price from fishers	2150	
Loading/Unloading costs (50 ETB/Qt)	50	11.2
Cost of plastic	50	11.2
Cost of filleting (2 ETB/kg)	200	45.0
Transportation cost (From fish landing site to market)	59.33	13.3
Communication (400 ETB/month)	19	4.2
Fuel cost	42	9.4
Employers salary (100 ETB/day)	25	5.7
Total cost	2595.3	
Average selling price	3200.3	
Margin	1145.6	
Cooperatives gross profit	1050.3	
Fishers share from cooperative	**3.18%**	
Retailers (N=30)		
Retailers' purchase price from fishers	2130	
Storage (20-66 ETB/day)	43	9.5
Cost of plastic	100.8	22.4
Cost of filleting	200.0	44.4
Personal travel cost (725 ETB/month)	81.6	18.1
Communication(412 ETB/month)	25.0	5.6
Total cost	2580.4	
Retail price	4200.5	
Margin	2080.0	
Retailers' gross profit	1619.6	
Fishers share from retail price	**50%**	

Table 17 shows an overview of the distribution of marketing margins among different actors in the chain. Retailers get the highest gross marketing margin (value added), which is 2,080 ETB/Qt. According to Mebrate and Worku (2019), the share of margins of retailers reached the highest margin than with all other fish marketing agents. Cooperatives and assemblers got gross margins of around 1,146 and 1950 ETB/Qt, respectively. But cooperatives got the lowest margin (1146 ETB/Qt). Producer's (fishers) share from assemblers, cooperative and retailers was 46.8%, 3.2% and 50% respectively (Table 16). Fish retailers and assemblers obtained the highest gross profit of 1620 and 1572 ETB/Qt, respectively; whereas fishers and cooperatives got the lowest gross profit of 1514 and 1050 ETB/Qt, respectively (Table 16 and 17).

Table 17. Summary of marketing cost, margins and profit of fishers and traders

Cost Items		Cost and Prices (ETB/Qt)	Gross Marketing margin (1)	Total marketing cost (2)	Profit margins (ETB/Qt) (3)=(1)-(2)
I.	Fishers (N=450)		1600	86	1514
1.	Production cost /Qt	500			
2.	Total marketing cost	86			
3.	Cost price (3=1+2)	586			
4.	Average selling price	2100			
II.	Assemblers (N=47)		1949.5	378	1571.5
1.	Production cost /Qt	2000.5			
2.	Total marketing cost	378			
3.	Cost price (3=1+2)	2378.5			
4.	Average selling price	3950.6			
III.	Cooperatives (N=8)		1495.6	445.33	1050.3
1.	Production cost /Qt	2150			

2.	Total marketing cost	445.33			
3.	Cost price (3=1+2	2595.99			
4.	Average selling price	3200.33			
IV.	Retailers (N=30)		2070.4	450.4	1619.6
1.	Production cost /Qt	2130.0			
2.	Total marketing cost	450.			
3.	Cost price (3=1+2)	2580.4			
4.	Average selling price	4200.5			

Notes: (1) Gross marketing margin (value added) =Average selling price–Average buying price.
(2) Average selling/buying price at different level was based on the survey made in this study in 2019.
(3) The time dimension for profit margin is one year (2019)

Although fish retailers got the highest marketing margin, they incurred the marketing cost of 450 ETB/Qt. Assemblers got the lowest marketing cost (among traders excluding fishers) and cooperatives the lowest profit margin.

2.3. Characterization of fish marketing actors

There were several actors in the market chains who engaged themselves in various activities at Lakes Tana, Ziway, Hawassa and Chamo (Figure 4), although, most traders, assemblers, retailers and brokers are not licensed (65.2%), as compared to the licensed ones with 34.8%. Based on their roles and responsibilities, the market participants (actors) present in the chains are classified as follows:

Fishers: These groups contained the largest number of actors and are considered as the primary link in the marketing chain. The members were exclusively men (98.9%). According to the Ministry of Agriculture (MOA) report of 2020, they can be classified as full time, part-time and contractual occasional fishers. The later ones are likely to use motorized wooden boats and rafts and reed boats (*Bofofe* or *Yabala*: local names for rafts) at all the study sites.

a) **Fishers using motorized boats** commonly put up their catches for sale to the Tana Haik No. ONE Fishers' Cooperative and the Fisheries Production and Marketing Enterprise (FPME), where their daily supplies are recorded and they collect their pays monthly. They also sell some remaining catches, possibly of lesser quality, e.g. sizes of individual fishes, to local customers, hotels, traders coming to their landing sites, mainly coming from towns or villages in close proximity such as Bahir Dar town, Woreta, Infranz and Dera Hamusit. These sales give the fishers immediate daily supplementary income.
b) **Fishers working with reed boats** (*Tankua*: local name) sell fish to different customers including Tana Haik No. ONE Fishers' Cooperative, Georgis Fishers' Group, local village markets like (Zegie, Bata Mariam, Delgie, Goregora and Infranz) or other local collectors. They also sell their products to retailers, hotels, restaurants and individual consumers, traders coming to the lakeshore or the landing sites. Most of the income of these fishers is gained on a daily basis.
c) **Fishers with wooden boats**: Lakes Ziway, Hawassa and Chamo fishers are using wooden fishing boats and rafts to sell fish to cooperatives, wholesalers, retailers, hotels or restaurants and consumers.
d) **Fishers with steel motorized boats** are mainly used to collect or purchase fish from fishers at landing sites or in open water to sell fresh fishes further to the nearest towns as in L. Ziway area at Batu Town, L. Hawassa area at Hawassa Town and L. Chamo area at Arba Minch Town. These fishers are are a sort of disjointed sets from the rest and the majority of poor and low level fishers. The capacity of their boats, speed to bring fresh fish to the market and so on gave them the advantage of reaching out to the lucrative markets of the bigger towns, hotels and restaurants. Such fishers are also paid better than the ordinary fishers in many cases the made small contracts with their buyers in the towns (Mfinanga, 2014). Through all these processes of exchange of fish catches, it was observed that large amounts of fish were passing through the market chains in the months of the fasting period of each year, especially in the months from February to April. Supplies of fish decreased in the months of June through October of each year, reaching its lowest level, mainly due to the heavy rains and coldness of these periods.
e) **Fishers' cooperatives** of the respective study sites do both catching by employing their own fishers and selling of fish and fish products to different actors and/or customers such as wholesalers, retailers, hotels or restaurants and consumers, other traders coming to landing sites and their storage facilities (Figure 4).

Generally, the fish resources of the study lakes are officially expected to be used by cooperatives organized and recognized by Ministry of Agriculture, Regional Fishery Offices and their branch offices. Technical and extension workers also visit them and provide them with trainings and fishing materials at subsidized costs. But private fishers, individually or as a group operate in the same ways as the fishers captured in the cooperatives and they are referred to by the cooperatives as "illegal fishers", although Ethiopian waters are free to be accessed by anyone who wishes to do fishing, a tradition that cascaded from the socialist government of 50 or so years ago.

In the case of Lake Tana, the cooperatives after collecting fish from their own fishers, private assemblers (rural and urban) and fishers and assemble them from different fishing grounds store fish in cold-rooms and refrigerators. These cooperatives have extension fish stores and shops in towns. In contrast, the fish captured from Lakes Ziway, Hawassa

and Chamo seem less organized where the cooperatives may not be stored their products in cold-rooms or refrigerators, as these facilities are non-existent. According to Cheffo et al. (2016) at these sites fishes are mostly sold out or go completely go into the market chains each day and fishers are paid their dues in most cases daily.

f) Wholesalers don't move from one market to another like that of petty fish traders. They rather, permanently reside in cities such as Addis Ababa with their permanent fish stores and collect fish from Lakes Tana, Ziway, Hawassa and Chamo Cooperatives through their representatives. These are fewer in numbers and most of the time they sell out fish to individual consumers and hotels (Figure 4).

g) Processors participated in the gutting, filleting, salting, drying and other similar activities of fish processing, using the labor of their family members such as women and children. However, the larger volumes of fish processing at cooperatives, enterprises, wholesalers, retailers and exporters are done by specialized processors at Lakes Tana and Chamo. In these institutions, mainly women were doing the gutting and filleting of fish at the respective processing plants and landing sites of Lakes Tana and Chamo. These women were paid based on the weight of fish they processed, i.e., 1 kg of fish with 2 ETB for cooperatives and 2.50 ETB for individual customers (Kidanie Misganaw personal observations, 2019). At the production chains of Lakes Tana, Ziway, Hawassa and Chamo one rarely sees the value addition practices. Particularly, at Lakes Tana and Chamo, some level of quality preservation and the fish handling process appeared to be in the form of washing the fish with clean tap water (which is prone to frequent interruptions) and then chilling the catch in cold rooms from two months up to a year, although this study did not make how the fish quality would change over a long period of preservation given the frequent power interruptions at the freezing facilities (Kidanie Misganaw personal observation), 2019. Other fish processing activities are continuing as business-as-usual.

In the current fish value chains, particularly at Lakes Ziway and Hawassa, there were no proper preservation facilities and the fish handling process appears to be improper since tap water was not regularly available and the preservation in cold rooms and deep freezers was impacted by frequent power blackouts. In the southern gulf of Lake Tana, the middlemen and cooperative members washed and packed fishes in clean plastic bags at specific masses to transport and sell them to consumers in Bahir Dar City or even further in Addis Ababa, over 600 km away. This is to preserve the quality of the fish and to avoid unnecessary foul smells that would affect the value of the products.

h) Retailers are usually those that sell whole fish at landing sites or nearby destinations sites accessible by road (e.g., the cities of Bahir Dar, Gondar, Ziway, Hawassa, Arba Minch and Addis Ababa) or to other retailers, hotels, household users by collecting it from fishers and local assemblers. Dried fish fetches relatively better prices when sold to exporters to distant places such as Addis Ababa or the Sudan particularly from the northern Lake Tana (Figure 4). Such dried fish retailing activities were done with gutted, filleted or wet fish in all areas the study areas.

i) The Fish Production and Marketing Enterprise (FPME) has a licensed legal firm retailing fish since 1970 G.C. and actively operates at all four study sites. It is specialized to sell fish, which handles about 30% of the fish that enters the national fish market chain, mostly coming from Lake Tana (Abebe Getahun et al., 2008). The southern part of Lake Tana, where the regional city of Bahir Dar is located, fishers have good access to potentially diverse traders and market chains because of the existence of FPME, cooperatives and others. At the same time they have the alternative of selling fish to household consumers, hotels and export, whenever they feel they get better prices for their products.

Recently, the price of filleted fish increased dramatically and currently filleted Nile-tilapia, catfish and *labeobarbus* spp. costs 160, 50 and 35 Ethiopia ETB/kg, respectively (Kidanie Misganaw personal communication, FPME sellers, 2019 G.C). Since a few years before the start of this study, the services of the FPME are not anymore available at Lakes Ziway, Hawassa and Chamo market outlets. Over time, It has been replaced by other retailers that supplied fishes at lesser prices outcompeting FPME and that started to add considerable value to their products by using clean tap water for washing and filleting, preservation of whole and filleted fishes in cold rooms until such time as transportation facilities are organized to sell products at competitive prices in larger markets of big cities such as Addis Ababa (Figure 4). With gradual increase in production and demand fish catches from these lakes are decreasing in individual sizes and volume from time to time (Figure 3). According to FPME head office, 2019 stated that there are no integration government offices (*woreda*, zonal, regional and federal governments).

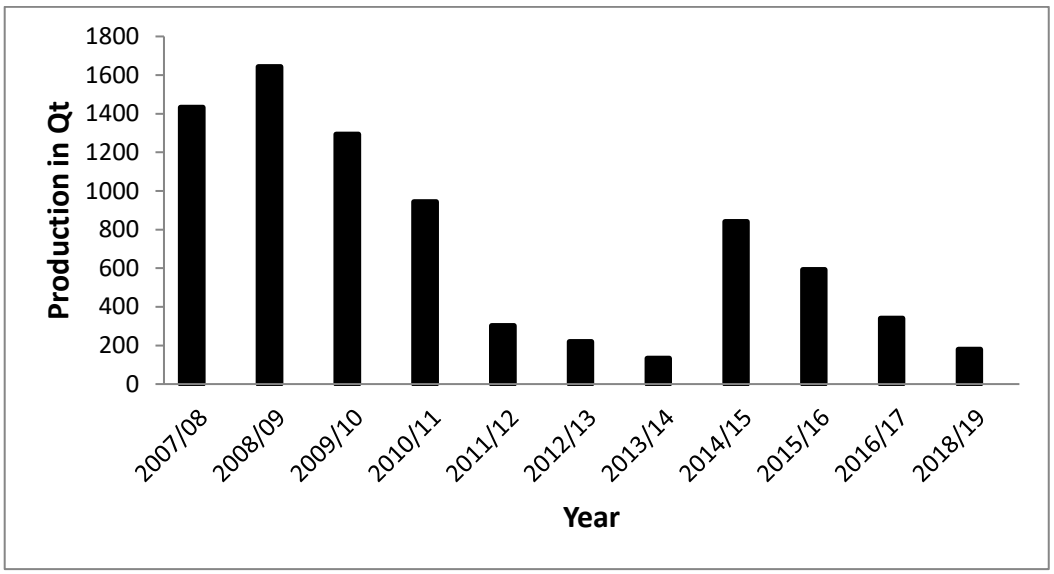

Figure 3. Marketed fish statistics from the FPME Head office in Addis Ababa, 2019

j) Dried fish exporters are the last link in the market chain in the domestic trade. The survey result indicates that most traders in dried fish market business were not licensed, they purchase poor quality fish (such as those dried in traditional ways and poorly handled fish), dried it and export it to the Sudan. In recent years, marketing of dried fish is attracting a good number of fishers and traders in the north-western side of Lake Tana, where it is very close to the Sudan (Figure 4). The business has increased in recent years with road access and slowly it is gaining popularity among fishers and retailers of the region and at the same time it has become a source of earning some foreign currency on a regular basis (Tefera et al., 2009).

k) Assemblers (Rural/urban) were high in number who collected fish from fishers at local markets and fish landing sites. There are unlicensed and comprise of high numbers of informal traders in Lakes Tana, Ziway, Hawassa and Chamo. Assemblers are the primary market chain actors that assemble fish from fishers at the landing site and transport either the whole or filleted fish to sell it at the nearby urban centers. The landing sites are open to all actors, usually once daily and usually early in the mornings when fresh fish land after overnight fishing operations. From here, retailers, assemblers of various levels distribute fresh fish ti local/village and obtain the best bargain those that reach the market early enough out-competing their colleagues. Depending on the volume they transport, some transported fish personally in sacs some use motorcycles and carts and three wheelers to get to the nearest market to fetch better better bargains at the village markets of Bahir Dar, Ziway, Hawassa and Chamo, as the case may be**.** Open markets are very common types of the markets in Lakes Tana, Hawassa, Ziway and Chamo. It was observed in this study that the most dominant forces in the retail trade are the small traders with regular spots in the open markets, who generally buy fish from freelance or non-cooperative fishers and who flexibly sell their fishery products at landing sites, by road sides, by moving from village to village (door-to-door selling), and at public places (Figure 4).

2.4. Fish market channels

The analysis of market chains of fish in Ethiopia is a very difficult task. This is mainly due to the difficulties mentioned above, among which are:

2.4.1. Catches are very limited and seasonal to warrant permanent means of livelihood to those involved in the market chain.

2.4.2. Catches are seasonal, adding to the difficult of maintaining permanent job.

2.4.3. Catches are strictly come from the wild. There is no fish farming practice in Ethiopia to warrant permanent flow of products into the market chain.

2.4.4. The handling, processing and transportation of fish and fishery products are very poor by any standards which again, added to the above points; do not attract consumers and investors to improve quality.

2.4.5. The fishery industry in Ethiopia is also impacted by the policy that allows anyone with some kind of facilities to access the natural stocks and harvest at his/her will.

Despite these backdrops, this study has attempted to highlight the different channels through which fish and fishery products harvested from the wild may eventually reach the consumers, directly or indirectly, formally or informally (Figure 4).

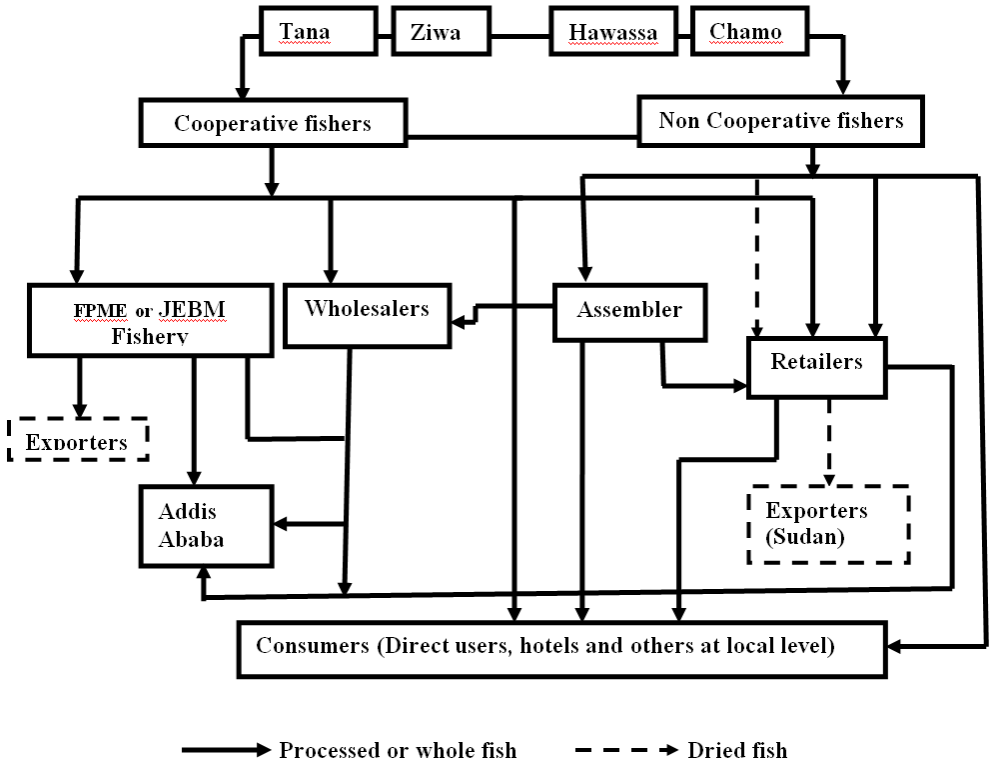

Figure 4. Market supply chain of fish from the four study Lakes: Tana, Ziway, Hawassa and Chamo.

3. Conclusion and Recommendations

Fish markets, however small, they are common in Lakes Tana, Ziway, Hawassa and Chamo. The fish market in the country has been dominated by a large number of intermediaries (illegal fishers, retailers, assemblers, traders, cooperatives, etc.). Based on the data and analysis of the fish market channels, it is clear shown that they tended to be predominantly traditional, divided and had far too many small channels handling very small quantities to consider in the market chain modeling exercise. The task became even very difficult since most actors are not licensed and hence they do not want to be accountable what they do and they try to evade any form of investigation that attempts to construct a meaning full picture to policy makers and scientists. In addition, the fish marketing system in all the study areas are characterized by disorganized and poorly recorded catch data. In other words, fishers and consumers in most cases deal with each other without approaching any central recording system, although the responsible government offices technically require all fishers to report their catches. Relatively better data is obtained from the cooperatives, some enterprises that report to the government offices.

Most fish markets have inadequate facilities for fish processing, transporting or preserving. The hygienic conditions of the operator personnel and the processing lines leave much to be desired, as they are poor by any standards. Little or no apparent value addition activities have not been applied in all the study areas, as fish are mostly sold out daily because of low amount of catches. At the same time, the personnel engaged in the business (owners to operators) do not seem to have the awareness and appreciation of value addition. All activities continue as business as usual. Fish market prices in the landing sites have not been integrated with the prices of out of the lake areas and nearby towns, showing the relative poor organization of the market. This implies that the fishery sector is not receiving the due attention by the government responsible offices. Even those positive sections of the Fisheries Development and Utilization Proclamation (No. 315/2003) that stipulated licensing as a requirement for all fishers and traders is not implemented. The reluctance of the government offices to implement the above mentioned legislation is probably because the fishery industry practically makes no significant contribution to the national revenue generation or the GDP growth (see also Brook Lemma (2012) report to the FAO). The dried fish export to the Sudan mentioned above is largely sold out illegally and even that passes through the legal means is insignificant by any statistical standards.

Based on the above conclusions, the following recommendations are suggested to improve the trends of value chains and fishery resources of Ethiopia.

- Re-organize or reform the fish cooperatives to effectively serve the fishers and local communities. This recommendation goes as far as allowing concessionaires to take over the business and make it very competitive.
- Market chains should be supported by revised future intervention strategies and policies that guide the development of fish value chains and sustainability of fish stocks.
- Fishers should be able to establish networks so that they support each other and share experiences and improve production of good quality fish as required by the market.

- Fish marketing systems and fishers' census should be documented in order to make better future projections for proper policy interventions.
- Improve cold chain (storage and transportation), packaging materials, logistics and better communication systems throughout the value chains.
- Facilitate a shift to more collaborative and competitive horizontal and bottom-up governance also instead of relying always top-down governance structures.

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