

Full Length Research Paper

Analysis of fish market chain for Lake Zeway, Central Ethiopia

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Although fish is economically and socially important, its marketing chain and their characteristics have not yet been studied and analyzed for Lake Zeway, Central Ethiopia, where great potential of fish production exists. The study was initiated to investigate the fish marketing chain in this area. This was done by identifying the marketing channels of fish and the major factors influencing its market supply. Data were collected from 90 households and 24 traders using a simple random sampling method. Results indicate that fishers, fishery cooperatives, retailers, wholesalers and consumers were the main actors of the fish marketing channel. Among the explanatory variables included in the econometric model, five variables (income from non-fish marketing, access to extension service, access to credit, price of fishes and access to market) were found to significantly influence the marketable supply of fish. The study identified the need for policy interventions by the Ethiopian government to improve storage and transportation systems as well as render other services like training, which would encourage fishers to be legal in order to improve harvesting and marketing of fish in the study area.

Key words: Fish, fish marketing, Lake Zeway, market chain, multiple linear regression analysis.

INTRODUCTION

Ethiopia can produce over 51,500 tons of fish per annum (Sileshi, 2013); however, their exploitation and consequently their contributions to food security and growth in the country are minimal despite the technologies capable of resolving the problems of fisheries production.

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 utilized (Abera, 2017). This leaves considerable potential for its expansion. Hence, under-exploitation of existing

fisheries potential contained in the natural water bodies of the country is of great concern. Even if the available stocks of these fishery waters will be fully exploited in the near future, both current and future demand for fish by the population cannot be met (Sileshi, 2013).

Fish is a highly perishable commodity and its quality deteriorates very rapidly, which negatively influences its marketability. Although the production and consumption areas are also widely separated, production of fish can be increased by making best utilization of existing inland resources through modern and scientific methods of fish

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culture and fishing techniques, the consumers still depend on an effective marketing system to be able to purchase fish at a reasonable price, and at a time closes to its harvesting. Thus, a successful and sustainable fishing culture also depends on an effective distribution system (Alam et al., 2010).

The concept of fish market chain analysis has been studied several times from different perspectives around the world. For example, Nwabunike (2015) analyzed the constraints that militate fish marketing in the Abakaliki metropolis of Nigeria. Findings of the study showed that the most notable constraints to fish marketing in the Abakaliki metropolis include problems associated with processing and inadequate spacing in fish marketers' stalls or shops. Based on these findings, Nwabunike (2015) recommended that, fish marketers should form a co-operative society in order to enable them obtain loans from financial institutions in order to expand their marketing activities. It further recommended that government and private organizations should encourage fish marketing by building an organized market and effecting free trade within the Abakaliki metropolis.

Some researchers also studied issues that are related to market chain analysis of fish in Ethiopian context. For example, Bikila and Amanuel (2016) studied the fish market supply of Fincha Amarti Nashe Reservoir in Horo Woreda of Oromia region, Ethiopia. Their study results showed that fisher men are confronted numerous problems such as a market access, modern fishing materials, a lack of policy framework to control the illegal fishing as well as an over exploitation of fish resources.

Fish production in Lake Zeway, Central Ethiopia is rather for commercial reasons to surrounding urban centers than for subsistence purposes (Birhanu, 2015). However, the fish marketing chain and their characteristics have not yet been studied for Lake Zeway, where significant potential of fish production exists. Therefore, this study aimed at investigating fish market chains, the margin share of the fish marketing agents, and factors affecting fish supply to the market, as well as the challenges of fish harvesting and marketing. This study will narrow the information gap on the subject and contribute to a better understanding of marketing system which would benefit fishers, traders and ultimately consumers of fish.

METHODOLOGY

Sample population

The target population of this study consists of fish producers in the cooperatives of Lake Zeway, Central Ethiopia (Figure 1). The nine fishery cooperatives have a total of 473 members, from which 90 fishers were randomly selected by taking 10 fishers from each of the cooperatives.

For selecting fish traders, in addition to Zeway town, five markets (Addis Ababa, Butajira, Adama, Mojo and Shashemene) were selected based on the flow of large volume of fish output. The

number of cooperatives selected from Zeway town was 6. The number of wholesalers selected from Zeway and Addis Ababa were 4 and 1, respectively. The number of retailers selected from Zeway, Addis Ababa, Butajira, Adama, Mojo and Shashemene were 5, 2, 2, 2, 1 and 1, respectively. This totaled the cooperatives, wholesalers, and retailers to 24.

Sampling method

The aforementioned population samples were interviewed from December 2018 to May, 2019 by employing a semi-structured questionnaire which was prepared in three languages: English, Amharic and Oromigna (the local native language) and both qualitative and quantitative data were collected. Enumerators were used to collect the data from the samples. Statistical Package for Social Sciences Software (SPSS) version 20 was used to carry out analyses of value addition across each actor and constraints of different actors.

The potential factors (explanatory variables) that can affect the market supply of fish (dependent variable) considered in this study were: (1) Sex of fishermen, (2) Age of fishermen, (3) Education level of fishermen, (4) Experience of fishermen, (5) Market access, (6) Access to extension service, (7) Access to credit, (8) Access to information, (9) Price and (10) Non-farm income.

The explanatory variables expected to influence the dependent variable were determined and reported based on their measurement nature like: age of the fisherman is a continuous variable and measured in years based on different categories (below 20, 20-25, 25-30, above 30). The sex of fisherman is dummy variable that takes a value of one if the household head is male and zero for female. Moreover, access to market information is a dummy variable taking value of 1 if the producer had access to market information and 0 otherwise. Access to extension service has the objective of the extension service introducing fishers to improved agricultural inputs and to better methods of production, and it was measured as a dummy variable. Access to credit is a dummy variable, which assumes a value of one if the fisher has credit access and zero otherwise. On the other hand, price of fish as a continuous variable was measured considering annual average price of fish in the reference market in 2017/2018, that is, the one year lagged price of fish. Experience in fishery refers to the number of years the fisherman engaged in fishing activity and was expected to influence supply of fish to the market positively. Education level of fisher as a continuous variable was measured and reported by categorizing as Illiterate, read and write, primary school (1-6), secondary school (7-12), certificate and above.

Data analysis

Descriptive analysis of the collected data was conducted on market channels of fish with actors and their respective linkages, the margins that the producers and other traders share and the challenges and opportunities of fish harvesting and marketing.

Marketing margin, which is the difference between price received by producers and that paid by consumers, is represented by the total gross marketing margin (TGMM) calculated as per the method of Muhamed (2011).

$$TGMM = \frac{\text{End buyer price} - \text{first seller price}}{\text{End buyer price}} \times 100 \quad (1)$$

where TGMM is the total gross marketing margin. It is useful to introduce the idea of 'producer's participation', 'farmer's share', or 'producer's gross marketing margin (GMMp) which is the share of the price paid by the final consumer that goes to the producer.

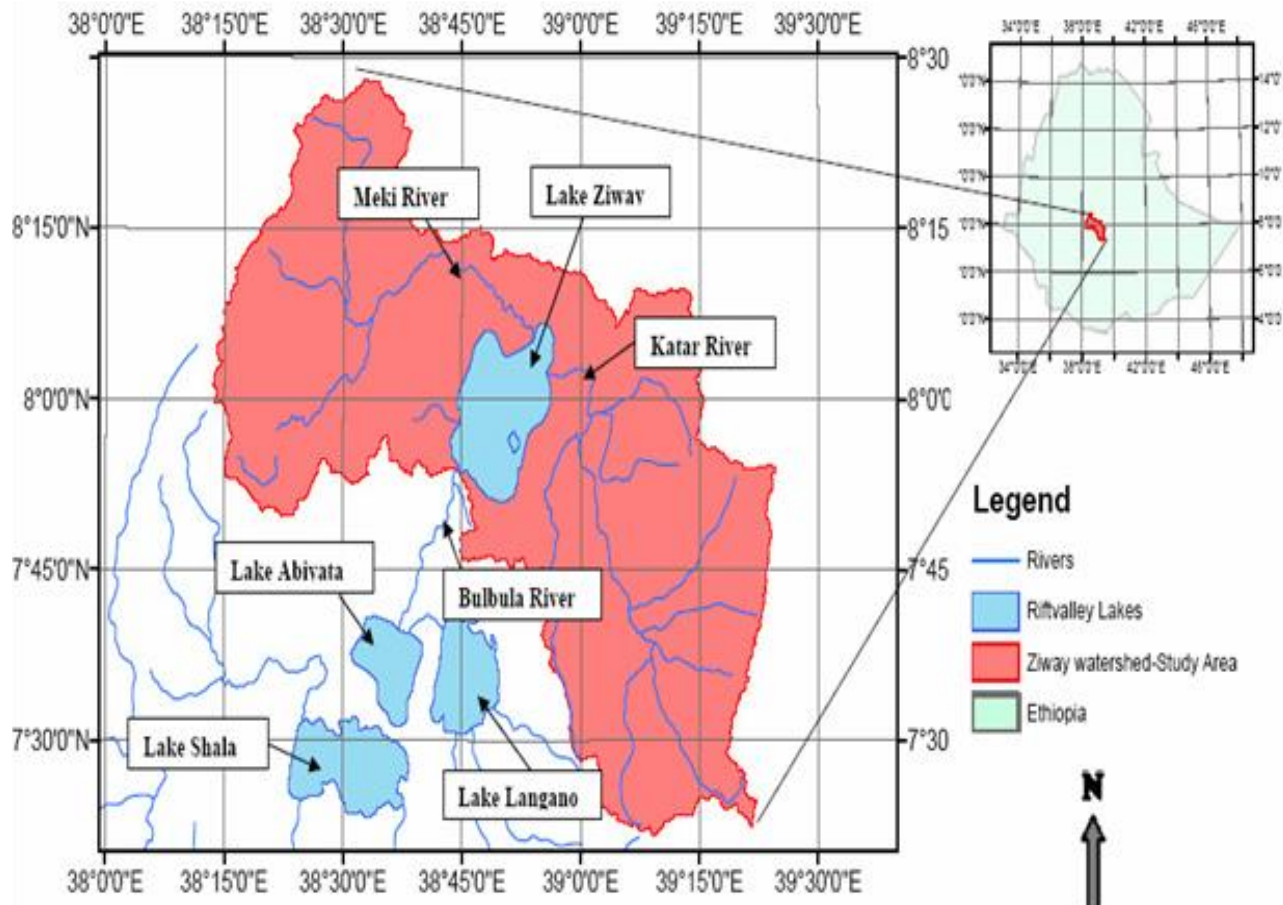


Figure 1. Map showing Lake Zeway, Ethiopia. Source: Mazengia (2008).

The producer’s marketing margin is calculated as:

$$GMMp = \frac{\text{End buyer price} - \text{marketing gross margin}}{\text{End buyer price}} \times 100 \quad (2)$$

where GMMp is the producer’s share/portion of the final consumer price.

The net marketing margin (NMM) is the percentage over the final retail price earned by the intermediary as is net income after the marketing costs the incurred are deducted. The equation shows that a higher marketing margin decreases the producer’s margin share and vice-versa. It also provides an indication of benefit distribution among production and marketing agents.

$$NMM = \frac{\text{Gross margin} - \text{Marketing costs}}{\text{End buyer price}} \times 100 \quad (3)$$

where NMM is net marketing margin.

From this measure, higher NMM or profit of the marketing intermediaries reflects unfair income distribution between the intermediaries and producers, which depresses market participation of fishers. An efficient marketing system is the one which shows the net margin near to normal or reasonable profit.

All margins are calculated in each channel for the principal market chain actors.

Model specification

The economic model specification of the variables is as follows based on a previous model employed by Zekarias (2014):

$$y = \alpha + \beta_1x_1 + \beta_2x_2 + \dots + \beta_{10}x_{10} + e$$

where Y = quantity of fish supplied to market, X1 = Fisherman’s age, X2 = Sex of fisherman, X3 = Access to market information, X4 = Access to extension service, X5 = Access to credit, X6 = Price of fish, X7 = Access to market, X8 = Experience in fishery, X9 = Education level of fishermen, and X10 = Non -farm activity.

Econometric model specification of supply function in matrix notation is shown as:

$$Y_i = \beta X_i + U_i$$

Where Y_i = fish supplied to the market, β = a vector of estimated coefficient of the explanatory variables, X_i = a vector of explanatory variables, and U_i = disturbance term.

Ethical considerations

As this study required the participation of human respondents, certain ethical issues were addressed. The consideration of these

ethical issues was necessary for the purpose of ensuring the privacy as well as the safety of the participants. In order to secure the consent of the selected participants, the researchers relayed all important details of the study, including its aim and purpose. By explaining these important details, the respondents were able to understand the importance of their role in the completion of the study. The confidentiality of the participants was also ensured by not disclosing their names or personal information in the research. Only relevant details that helped in answering the research questions were included.

RESULTS AND DISCUSSION

Demographic characteristics of sampled fishers

There were no female fisherwomen from the 90 sampled fishers. The result contradicts with that of Baba et al. (2015) who found that 20.9% of fishers in Kebbi State of Nigeria were females. The interview result indicated that no involvement of women in fishing in Zeway area was due to their exposure to lack of finance since they are economically dependent on their spouses. This may be an obstacle in moving the fish market forward since there are many females who have the local knowledge about fishing and value addition. The Oromia regional state and other financial institutions in and around the study area must facilitate the way the females can get access to finance and engage in fishing activity. The age of fishers sampled in the study area ranged from 19 to 47 years. The mean age of the sampled fishers lies in the third category which accounts for 48.9% where biggest shares of the fishermen age lie within a productive age, that is, between 25 and 30. Concerning education level, 2.2 and 12.2% of the sample fish producers were illiterate and have certificate and above, respectively. However, 36.7% of the sample respondent fish producers can read and write whereas 27.8% have accomplished formal secondary school education. Hence, this educational entitlement has supported their production and marketing of fish in the study area and also improved their ability to acquire new idea regarding market information and enhanced production of the fishermen, due to the fact that educational background sample fishermen has is believed to be of crucial feature that determines the readiness of fishermen to accept new ideas and innovations as stated by Holloway et al. (2002) that argued that education had positive significant effect on quantity of milk marketed in Ethiopian highlands (Table 1).

Experience in fishing

According to Leonard and Blow (2007) it is costly entering the aquaculture industry as the business necessitates high level of experience and is recognized to be risky. The respondents in the study area have a fishing production experience of between 1 and 15 years. As the number of years increase, it implied that fish

farming and harvesting experience is acquired and the capacity to produce more and yield to the market will be greater. Most (62.2%) fishermen in Zeway Lake have spent above 5 years in fishing. Fishermen (37.8%) with least years of experience were those that spent up to five years in fishing. On the average, the years of experience of fishermen in the study area was estimated at three which is believed to be good to achieve some economies of scale mostly through lower costs of input access (Kelling et al., 2010) like equipments, advise and marketing.

Access to markets

It is a distance measured in kilometers to reach the nearest fish market. Since fish is a perishable product, near access to market is of great significance. The survey result revealed that about more than 60% of sampled fish producers in the lake did not have easy access to fish market centers. Except three cooperatives (Zeway Batu, Edo Gojola and Abosa) all others are far from the nearby fish markets. The result is consistent with a report by ERA (2015) that states on the average, households are 10 km far from the closest dry-weather road and 18 km far from public transport services in Ethiopia. Due to the remoteness of these fishery cooperatives from fish market areas 76.7% of the respondents got problems in getting buyers when they want to sell fish products at better price. As a result they suffered due to market inaccessibility, lack of market information, and charging of low prices at 35.6, 11.1 and 32.2%, respectively.

Access to market information

Timmer (1989) stated that having access to accurate and timely market information enhances market performance by improving the supply and demand knowledge of buyers and sellers. Closer look at access to market information showed as there is no system in the study area that steadily collect, analyze and distribute information appropriate to the needs of different market agents. The sampled respondents exposed that their primary source of market information were co-fisherman, traders (wholesalers, retailers) cooperatives, and personal effort. But the overall assessment indicated fishers get incomplete market information than traders.

This research discovered that 62.2% of fishermen operating in the study area actively seek for market information and had market information access, even if the quality of the information is questionable. About 37.8% of the fishermen are engaged in the marketing of their daily catch without seeking or having for information on supply, demand and prices. The result shows fishers in Lake Zeway has a relatively better access to market information than fish farmers in Kamuli, Iganga, Jinja, and Mukono areas of Uganda who had no knowledge about

Table 1. Socio-demographic characteristics of fisherman.

Age of respondents	Frequency	Percent
Below 20	6	6.7
20-25	23	25.6
25-30	44	48.9
Above 30	17	18.9
Total	90	100.0
Education level		
Illiterate	2	2.2
Read and write	33	36.7
Primary school	19	21.1
Secondary school	25	27.8
Certificate and above	11	12.2
Total	90	100.0

better markets, depending on intermediaries for information (Ssebisubi, 2010).

Characterization of fish production in Lake Zeway

Fishing in Lake Zeway fisheries is almost commercial. Though there were artisanal fishers during the study time, this fishing method was being replaced by commercial fisheries using motorized boats. Every day a trip is made to catch fish and a single trip is made by 3 fishers in a boat (motorized) with 20 gillnets. Fishing is mainly made in some part of the water body of the lake. Fish production in Lake Zeway varies by species, time and space. Temporal variations are visible between months/seasons and years. According to the report of WOARD (2017/2018), total fish production in fisheries decreased from 6217 Quintals in 2012 to 4889 Quintals in 2018.

Fish price was determined by different mechanism in Lake Zeway. Sometimes the interaction of demand and supply condition of fish in the lake determine price of fish. Fish trapped in surplus amount during top fishing seasons, like from July to September and March to May, is permanently likely to be exposed to post harvest losses due to perishable nature of the produce. Cheke and Ward (1998) explained a more pragmatic classification of post harvest fish loss into four common categories: physical loss, quality loss, nutritional loss and market force loss. In Lake Zeway, it was seen that due to lack of appropriate storage and packing quality loss happens on the fish catch and this leads to market force loss expressed in market agents being unwilling to buy the catch and/or offer very lower prices (Table 2).

Major fish varieties in Lake Zeway and their means of transportation

According to the data obtained from livestock and fishery

department of Zeway Woreda Rural and Agricultural Development (WOARD) office, there are about 17 species of fish in the lake. A study by Vijverberg et al. (2012) also listed the species of fish found in the lake as *Barbus paludinosus*, *Clarias gariepinus*, *Cyprinus carpio*, *Garra dembecha*, *Labeobarbus intermedius*, *Oreochromis niloticus*, and *Tilapia zillii*.

From these species the three that has been harvested most so far are Tilapia ('koroso'), Catfish ('Ambazza') and Barbus ('Bilica') types. However, Tilapia fish is the most dominant fish species in the lake and takes the lead in commercialization. Fish which is produced on the lake was presented either as gutted, filleted and whole fish. Fish filleted was then washed and packed by plastic for filleted and frozen to get ready for sale. The part of the fish removed during filleting is thrown to the lake as unusable part or the lake banks. Fish produced in Zeway Lake fisheries is mainly distributed for local market. The produced fish is kept in a deep freeze as gutted whole or filleted fish and sold mainly 41% to Addis Ababa and the rest 59% to near urban markets from Zeway. Distribution of this product was mainly using refrigerated vehicle facilities especially to Addis Ababa every time. But for other markets they use temporal freezers like plastic, iced boxes and cartoons and packing.

Marketing participants, their roles and linkages

Marketing of fresh fish passes through several market participants and exchange points before reaching the final consumers. The marketing system and structure is one of the main circumstances of socio economic condition of the local people and production system of any area (Alam et al., 2010). Fish marketing participants in the study area included fishermen/producers, cooperative associations, wholesalers, retailers, and final consumers of the fish product. The intermediaries discovered in the area are similar with a previous study

Table 2. Production and price trends.

Year	Production (Quintals)	Price (kg)
2012	6217	28
2013	5978	35
2014	5486	37
2015	5342	44
2016	5215	48
2017	5337	55
2018	4889	55

conducted by Abebe et al. (2016) in Koka reservoir fish in Ethiopia.

Fishermen: These are the first market agents in the channel who catch and supply fish, to the market. Fishers in the study area do not depend on one buyer since inability to store their fish makes them create relationships with several buyers. Hence, fishers in Lake Zeway can be called freelancers (Crona and Bodin, 2010; Kininmonth et al., 2017) because they do not depend on a single buyer.

Associations: In Zeway Lake, there were 9 (nine) associations which collect fish from their respective members and then dispatch to fish traders after adding small value on the fresh filleted fish. Main purpose of building this association was to assemble individual produces and serve to find markets and to give market information to members and to increase scale of production and bulk supply to traders. These alternative trading structures such as market-oriented fisher's organizations (that is cooperatives, associations), auctions, or fishery certification schemes, are often promoted to bypass fish buyers and, in that way, increase fishers' income and strengthen sustainable resource use (Bailey et al., 2016; Purcell et al., 2017).

Wholesalers: These are market agents responsible to buy bulky produces that has good financial as well as information advantages. They buy fish at the fishers gate, from a major source (cooperatives) with a bulk amount than the other marketing intermediaries does. They supply to retailers for onward marketing. The level of investment of wholesalers in fish marketing is higher than that of retailers.

Retailers: These are known for their restricted ability of buying and transacting produces and little monetary and information capacity. However, retailers are the final market agents in the chain that purchase and deliver fish to consumers.

Marketing channels

According to Mendoza (1995), marketing channel is the

sequence through which the whole of fish passes from fishers to consumers. The analysis of marketing channel is intended to provide a systematic knowledge of the flow of the goods and services from their origin (produce) to the final destination (consumer). Hence during the survey, the following major fish marketing channels were identified. The channels discovered in the study area were in contradiction with studies of Baba (2015) and Madugu and Edward (2011) who found that the major channels of fish were those directed from the fisherman to the consumer directly in Kebbi and Adamawa States of Nigeria, respectively.

Channel I (Fishermen vs Consumer): This channel accounted for 5% (244.45 quintals) of the total fish marketed (4850 quintals) during the study period. It was the shortest but the fourth important channel in terms of volume. More direct market chains involving little or no middlemen's that are more adaptable to challenges and have greater connectivity can mitigate vulnerability of fishers to poverty (Plagányi et al., 2014).

Channel II (Fishermen vs Retailer vs Consumer): This channel representing 15% (733.35 quintal) of the total fish marketed was the third important channel in terms of volume.

Channel III (Fishermen vs Fishery Cooperative vs Consumer): This channel representing only 4.2% (205.34 quintals) of the total fish marketed by the sampled respondents in the study area was the least important channel in terms of volume.

Channel IV (Fishermen vs Fishery Cooperative vs Wholesaler vs Retailer vs Consumer): This was the longest channel involving three market agents between the fisherman and the final consumer, but the most important one by which 46% (2248.94 quintal) of fish was transacted. In this channel, the retailers reported that they prefer buying fish from wholesalers because of their easy access to credit for their fish selling activities like reported by a previous study of Drury and Crona (2017) some trade relationships encompass credit arrangements, where one fish buyer can lend fish to another.

Channel V (Fishermen vs Fishery Cooperative vs Retailer vs Consumer): This channel represented 29% (1417.81 quintal) of the total fish marketed in the survey period and was the second most important channel in terms of amount of fish transacted.

These market channel relationships amongst the fish buyers affect their economic performance and benefit distribution amongst actors in the trade network (Vignes and Etienne, 2011; Drury and Crona, 2017) and affect the margin they share as profit.

Marketing margin

Olukosi and Isitor (1990) stated that marketing margin is an important indicator of market performance. Usually, the middlemen performing the role of marketing are being accused of earning higher profits in the marketing system (Bryceson, 1993). At various stages in the marketing chain, fish has to be packed and un-packed, loaded and un-loaded to meet consumer demand. Each handling cost will not amount so much but the sum total of all loading can be significant, depending on the length of chain (Ali et al., 2008). Based on these, the costs and margins of each market agent was calculated and marketing margins were analyzed based on the average selling price of different intermediaries in the marketing channels of producers, cooperatives, wholesalers and retailers.

Leaving channel I (the direct channel with no intermediaries), the total gross marketing margin (TGMM) was the highest in channels II, IV and V, which was about 58.82% each and the lowest 36.36% in channel III. Retailers in channel II got the highest gross marketing margin (58.82%) of consumers price and next (36.36%) by cooperatives. Producer's share (GMMp) was the highest (63.64%) from the total consumers' price in channel III and lowest in channels II, IV and V (41.17 each).

Finally, among fish market actors, retailers in channel II had relatively the highest net fish marketing margin 40.62% followed by fishery cooperatives in channel III which accounted 26% of the final price paid by consumers. The result of the study is consistent with a study by Ferhan and Mustafa (2018) that stated that share of retailer's margin in selling price is the highest accounting for about 60.05% of the final price in Istanbul, province of Turkey. Here, the higher the NMM of the marketing intermediaries reflects unfair income distribution. According to Ali et al. (2008) a greater difference in price paid between urban consumers at the end of the chain and river bank price at the beginning of the chain can lead to a wider market margin between the producer and the final consumer. However, when the market margin is high, it may be evidence as producers or consumers are being exploited.

Nonetheless, high margin cannot be completely justified (Table 3).

Econometric analysis

In the econometric analysis, out of 10 hypothesized explanatory variables, five variables (non-farm income, access to extension service, access to credit, access to market and price of fish) were found to be significantly affecting the marketable supply of fish. From these statistically significant variable access to extension service, access to credit service, and price of fish affect fish market supply positively and non-farm income and access to market affect fish market supply negatively. The rest variables (sex, age, education level, experience in fishery and access to market information) were found to have no significant effect on fish market supply which could be because they do not have strong linear relationship and/or their values have very high variability leading to large standard error. Even though the adjusted R^2 value of the fitted model was only 55.4% suggesting that the model explains 55.4% of the total variability in fish supplied to the market, the model passed a rigorous model validity checks.

Income obtained from non-fish marketing: This variable had negative and significant influence on amount of fish supply. Its coefficient sign is negative and this implies that the more other income earned by fisherman, they supply less number of fish to the market by 28.2%. The result is consistent with a study reported by Birhanu (2015) who found a significant and negative impact of non fishing income on fish harvest in Lake Zeway.

Access to extension service: The econometric result of the study revealed that access to extension service had positive and significant impact on the amount of fish supplied to the market. On average, if a fisherman gets extension service, the amount of fish supplied to the market increased by 21.8% holding other independent variables constant. This suggests that access to extension service provides information about technology that improves production and affects the marketable supply of fish.

Access to credit: Credit access had positive and significant influence on amount of fish supplied to the market. Access to credit of the fisher increased the probability of quantity supplied by 15.7%.

Access to market: Access to the market significantly and negatively affected market supply of fish in Lake Zeway. Due to the perishability nature of fish the time taken to access the market was expected to negatively influence the amount of total fish sales. An increase in 1 km resulted in a decrease in the quantity of fish supply by

Table 3. Marketing Margin of Intermediaries in the major fish marketing channels.

Marketing margin	Fish marketing channels				
	Channel I	Channel II	Channel III	Channel IV	Channel V
TGMM	0	58.82	36.36	58.82	58.82
TGMMF	100	41.17	63.64	41.17	41.17
TGMMr	-	58.82	-	11.76	35.29
TGMMw	-	-	-	23.52	-
TGMMcoop	-	-	36.36	23.52	23.52
NMMr	-	40.62	-	5.45	17.1
NMMw	-	-	-	9.26	-
NMMcoop	-	-	26	16.84	16.84

Table 4. Determinants of fish supplied to the market.

Variable	Coefficient	Standardized coefficient	P-value
Intercept	3.706	-	0.000
Age	0.020	0.059	0.175
Education	0.141	0.068	0.203
Experience	0.038	0.060	0.216
Means of income	-1.359	-0.282	0.006
Extension	1.099	0.218	0.000
Credit	0.747	0.157	0.002
Information	0.298	0.063	0.502
Access to market	-0.207	-0.284	0.000
Price	0.092	0.129	0.017

28.4%.

Price of fish: This variable shows a positive influence to the quantity of fish supplied to market. A one birr price increase in the fish market leads to the fishermen to increase yearly fish supply by 12.9% holding other independent variables constant (Table 4).

Marketing constraints and opportunities

The results from key informant interview identified the following challenges in marketing fish in Lake Zeway.

Extension Problem: Fishermen lack knowledge regarding fish handling and preservation techniques that supposed to be given by the extension workers leading to post harvest loss.

Credit problem: Access to credit for the traders was limited in the study area which accounts only about 25%. The lack of credit access for the fisher men in their area is a constraint which leads them to fail to access improved fishing equipment for their fishing activities due to the lack of money.

Lack of market information: Inaccessibility of market information is among the constraints of fish supply. The survey result revealed 37.8% of the fisher men lack market information regarding price of the fish market. This challenges the fisher men on choosing the suitable market channels and finally the fishermen are obligated to sell at lower price.

Overfishing: In Lake Zeway, though the fish population was not open access, illegal fishers are extensive across the lake and legal implementations to prevent their action were loose.

Post-Harvest loss: Fishermen in the study area have adopted measures to reduce fish post-harvest loss, which include the frequent removal of spoiled fish from the unspoiled, protecting catch from direct sun heat and rain by means of direct sale or delivering to cooling areas. Despite this, control of post-harvest loss remained a serious problem due to environmental factors associated with acceleration of fish loss in the study area, which include high environmental temperature. Post-harvest losses occur at different points from capture to marketing, and in some fisheries the level of losses could be

considerable; for example, downgrading of fish because of spoilage is perhaps as high as 10% and more (UNEP, 2009). According to Teklu (2015), Ethiopia loses one-third of its annual production and this was about 10,000 tons of fish per annum among 28,000 tons of production.

Conclusion

Most of the fish produced passes through the longest channel which involves fishery cooperatives, wholesalers and retailers between the fishers and the final consumers. Regarding distribution of the margins, the study identified that retailers get the highest net marketing margin than all actors taking more than 40% of the final consumer price as their Net Marketing Margin. The result of multiple linear regression analysis model pointed out that income other than fish marketing, access to extension service, access to credit, access to market and price of fish were found to exert significant impact on quantity supplied of fish in the fish market in 2017/2018. The study was limited to only the Lake Zeway area for fishermen data and considers only five markets for trader's data, therefore, future studies are recommended to be conducted in more geographical scope.

In view of the findings of the study, we make the following recommendations about fish marketing in Central Ethiopia: (1) Fishers in the study area need a strong government support (extension service, market information, refrigerator facilities, infrastructure, regulation, etc.) to enable them to get their deserved margin and grow to become financially capable and improve their livelihoods. (2) The WOARD and other aquaculture development partners should give fishery training which focused on pre and post-harvest management of fish production and marketing which in turn helps them to decrease the waste and increase their supply. (3) Proper handling of fish between capture and delivery to consumer is crucial element in assuring fish product quality, therefore, a quality assurance legislative inspector should be assigned in the study area to take corrective measures in misbehaves. (4) Emphasis should be given to improve storage and transportation systems and other services access such as training, encouraging fishers to be legal is very important for better harvesting and marketing of fish.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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