

Full Length Research Paper

Assessing fish production, demand and supply in the selected districts of North Shewa Zone, Ethiopia

Birhanu Kapital

Department of Biology, College of Natural and Computational Sciences, Debre Birhan University, Ethiopia.

Received 3 April, 2019; Accepted 11 June, 2019

This study was aimed to assess fish production, supply and demand in selected districts of North Shewa Zone, Amhara Regional State, Ethiopia to generate base-line data that would help in the proper and sustainable utilization of fishery and water resources. Structured and semi structured questionnaires were employed as a means of data collection tools. Respondents from five districts that is, Merhabete, Menz Mama, Menz Gera, Shewa Robit and Ataye were selected using purposive sampling techniques. From each district, consumers, producers, fish traders, stakeholders and fish experts were selected purposively. The fishing and aquaculture activities of the area were performed by part-time fishermen (producers) mainly for family consumption and sale on small scale during dry season. The fishing gears commonly used are hooks of different sizes, traps (fish basket) locally made and rarely gillnet. Though the severity of the constraints varies from one district to the other, the main fish production constraints in the areas were low fish supply, lack of awareness, lack of support, lack of facilities, low profit, and distance from market place. The fish demand and supply in the study area is unbalanced. *Lates niloticus*, *Oreochromis niloticus*, *Clarias* and *Bagrus dockmak* are the fish species preferred by consumers in the study area. Continuous support, awareness creation and promotion of local fish farming are important to integrate fish in their diet to scale up fish demand and supply in North Shewa Zone, Ethiopia.

Key words: Aquaculture, fish demand and supply, fish production, food security.

INTRODUCTION

Food security and poverty reduction have been central to the world development agenda but the principal themes have evolved with the growing population, and changes in the world economy, technology, and state of the environment (Hazell et al., 2007). Therefore, aquaculture development can make a direct contribution to food security and poverty alleviation through the provision of high quality food, self-employment and income. Because

of this, fish farming has been practiced in different parts of the world like Europe, Canada, East Asia, China, Africa and developing countries like Nigeria (FAO, 2009) and China remains by far the largest fish-producing country, with production of 47.5 million tons in 2008 (FAO, 2010). Fish are known as efficient feed converters compared to other livestock such as cattle, pork and poultry (Brown, 2003). Recent food security discourse

E-mail: capitalization263@gmail.com.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

stresses the need for multiple policies, economic and social actions addressing consumer demand, access, supply and nutrition (Grafton et al., 2015). Within the global food production and distribution system, poverty reduction strategies have renewed the focus on the role of smallholders in agriculture, and identified the importance of upstream and downstream linkages, as well as non-farm activities (Hazell et al., 2007). Agriculture being the main back bone of the country of Ethiopia, fishery has also considerable potential that could contribute to the country, and again. Fishery has significant role that contributes to the economy of the country (Mitike, 2015). In 2005, the total capture production in Africa was approximately 4.99 million tons, of these 15,681 tones were from Ethiopia (FAO, 2006). Ethiopia endowed with 7400 km² of lake that herbivorous fish species which are economically and ecologically important to the country (Tedela, 2003). In addition, artisanal freshwater fishery is one of the most important economic activities in Ethiopia (FAO, 2012).

The integration of fish and livestock production is probably closer today, and more important than ever before (FAO, 2000). Thus, implementing a successful aquaculture and integrated fish farming in Ethiopia can be a measure to support the livelihoods of the poor. The problem is particularly acute in countries like Ethiopia where, besides population explosion, natural and man-made calamities have aggravated the problem. In addition to increasing food production from land agriculture, it is necessary to sustainably exploit the aquatic ecosystems to contribute towards the effort of food security by virtue of their high productivity. So, Ethiopia's fish resources could undoubtedly offer one of the solutions to the problem of food shortage in the country. The ecological diversity and climatic variation of the country is to a large extent explained by its highly variable topography, which implies that Ethiopia is a country of enormous habitat diversity (Redeat, 2012). According to Redeat (2012) there are more than 200 fish species of which about 40 are endemic, in other study, there are 180 different species of fish in Ethiopia and 30 of those are native to the country (Assefa, 2013). In addition to this, fish provides the main source of animal protein for some 200 million people on the African continent (Heck et al., 2007). Also today, because of the need to meet a significant portion of proteins, such as omega-3 fatty acids and essential amino acids, as a protein rich source of high-quality, fish meat is the most important alternative food source. Thus, according to the studies of FAO (2014), 150 g of fish, meet the needs of 50 to 60% of an adult's daily protein. Therefore, it is recommended for consumption at least twice a week (300 g). In other way, fisheries also provide a direct source of livelihoods to over 10 million Africans, while five to ten times that number engage in fisheries as a secondary activity for food security in rural areas. Fish depend on available open surface water and inland

fisheries are normally associated with wetlands. Water, and in particular surface water, is the primary element of scarcity in dry lands (Kapatué et al., 2013) and dry land fisheries and aquaculture may therefore sound like a paradox.

It is estimated that the inland fisheries of Africa produce 2.1 million tons of fish, which represents 24% of the total global production (FAO, 2004). According to FAO (2009), developing countries accounted for 49% of world exports by value and 59% by volume in 2006. In related evidence, in Africa, over 60% of the fish supply to domestic and regional markets, as well as export-oriented processing units, is of artisanal origin (NEPAD, 2005). With growing trade in fish products, there is growing concern about the possible effects on developing country consumption and nutrition (Gordon et al., 2013). So, the present study aimed to assess the availability of suitable natural conditions, policy environments, the necessary fish farming and fish production inputs and the overall current status of the sector's development and its potential for food security and poverty alleviation in selected districts of North Shewa Zone, Ethiopia.

MATERIALS AND METHODS

Description of the study area

This study was conducted in 5 districts of North Shewa Zone, namely: Merhabete, Shewa robit, Efratana Gidim, Menz Gera and Menz Mama. Debre Birhan a capital city of North Shewa Zone is located at 130 km North of Addis Ababa, the capital of Ethiopia. The average annual rainfalls of these districts are from 943 to 1149 mm and are located in the latitude and longitude of 10°10'0"N and 39.91E, respectively. Further, the average temperature of these districts ranges from 12.2 to 23.0°C.

Sampling size and sampling techniques

A total of 275 informants were selected randomly from fish consumers, producers, traders, stakeholder and experts. From each district, 20 informants from consumers, 10 from producers, stakeholders and traders and 5 from experts were selected using simple random sampling techniques. This implies 100 respondents from consumers, 50 from traders, producers and stakeholders and 25 from experts were selected randomly.

Data collection

The data was collected between March and August 2010, using a semi structured checklist consisting of questions on issues prepared in advance. Five separate questionnaires were prepared, one for fish consumers, the rest four were for fish experts, stakeholders, traders and fish producers. The questionnaires were both close ended and open-ended questions. All questions were held in Amharic and then later translated into English.

Data analysis

The data was analyzed using quantitative methods of data analysis.

Mean comparison between the treatments were compared using Sigmaplot version 13. Sigmaplot version 13 was also used for graphs.

RESULTS AND DISCUSSION

Demographic data of the respondents

Most of the respondents' age was above 41 and most of them were male. Most of the respondents were traders followed by other job category and farmers. About 75% of the respondents were married and ca. 60% of the respondents were self-employed (Figure 1).

Consumers response on fish health benefit, price, demand and supply in the study districts

In Ataye, most of the respondents (60%) have a very good knowledge of the health benefit of fish. Whereas, in the rest of the districts, that is, Merhabete, Menz Gera, Ataye and Shewa Robit respondents (45-65%) partially know the health benefit of fish (Figure 2A). Most of the respondents (50-60%) in all districts, that is, Merhabete, Menz Gera, Ataye, Shewa Robit and Menz Mama responded that fish was very costly compared to other foods (Figure 2B). Almost all (80-90%) of the respondents thought that there was/were no quality fish providers in the study area (Figure 2C). Almost all (60-90%) of the respondents in all districts, that is, Merhabete, Menz Gera, Ataye, Shewa Robit and Menz Mama responded that there was low fish supply in the study area (Figure 2D). The demand for fish is higher than supply especially, in Ethiopian fasting season and higher in off-fasting season. This is because of religious influences on consumption patterns; the demand for fish is only seasonal. During lent, Christians who abstain from eating meat, milk, and eggs consume fish, since fish is the substitute of meat (Assefa, 2013). Therefore, the present study is in line with Assefa's. In other way, fish is nutritious and good to eat, so currently, the beneficial health effects of fish are particularly attributed to marine n3-FA. As observed in other regions, the trend of increasing demand for fish in Africa is driven by population and income growth, and increasing appreciation of health benefits of fish consumption (Thurstan and Roberts, 2014). In several epidemiological studies, where a correlation between an abundant fish consumption and a reduced risk for cardiovascular diseases was observed, this effect was explained with the contained polyunsaturated fatty acids (PUFA) EPA and DHA.

Price is determined by the interaction of demand and supply at both producing centers and consumer markets. Therefore, the consumers lack awareness about health benefits of fish. And also the market structure for fish products in Ethiopia is not well understood. The effects of

price changes and other socio-economic variables on market demand have not been studied (Ahmed, 2007).

Most of the respondents from three districts, namely Menzgera, Ataye and Shewa robit said that the fish demand in the study area is more than 85% (Figure 3A). Following this the fish demand in Menze mama is around 65% and in Merabete 59%. More than 65% of respondents in four districts namely Menz gera, Menz mama, Ataye and Shewa robit responded that highly interested to produce fish if they will get appropriate support in the study area (Figure 3B). But in one district (Merhabete) the interest of people to produce fish is low. 80% of informants at Merhabete and Shewa robit, around 60% of respondents at Menze gera and Menz mama and at Ataye 40% of respondents said consuming fish is considered as consuming omega 3-fatty acid (Figure 3C). Lastly, at Merabete, Shewa robite and Menz mama more than 60% of informants and around 40% informants in the remaining districts were aware of fish health benefits (Figure 3D). Consumption of fish and our primary source of long-chain omega-3 polyunsaturated fatty acids EPA and DHA, is associated with numerous health benefits including improved infant cognitive and visual development, reduced risk of cardiovascular disease, reduced risk of non-alcoholic fatty liver, and reduced inflammation and positive clinical outcomes in inflammatory disease (Watters et al., 2012). In addition, in the study districts where the informants responded on reasons to eat fish, they just like it and some responded as an alternative food. The consumption of fish has grown faster than that of any other animal product. Disparities in the fish consumption pattern exist widely across the income groups, location of the households (rural, urban, costal, etc.), and regions (Kumar and Dey, 2004). Generally, this study showed that demand is higher than supply especially, in Ethiopian fasting season and during off-fasting season, supply is higher. The price of fish per kg was higher in fasting season and lower when not fasting.

Almost in all the study districts, quantity of fish consumed is higher during none fasting season, at Menz mama nearly 80% of informants, at Merhabete and Menze gera around 60%, at Ataye and Shewa robit more than 40% confirmed this. Between 20 and 40% of informants responded to have consumed fish during fasting season. In addition, less than 20% of the respondents consumed fish in all seasons (Figure 4A). Over 70% of respondents agreed to the possibility that increasing fish production in the study area can ensure food security. Whereas, between 20 and 40% of informants responded that no possibility of ensuring food security by increasing fish production (Figure 4B). More than 80% informants at Menze gera, Menze mama and Shewa robit and around 60% at Merhabete and Ataye had high interest in fish production. Whereas less than 40% of informants had no interest on fish production in all study districts (Figure 4C). Respondents also reported

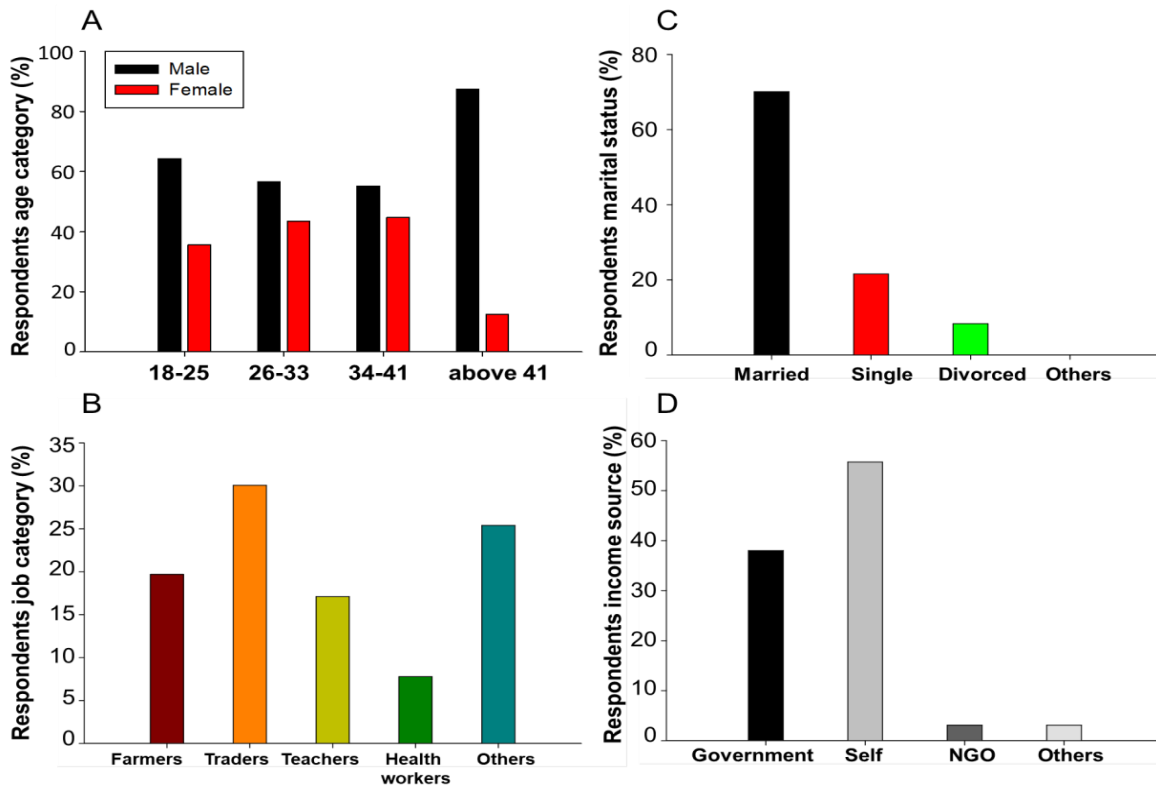


Figure 1. Respondents' demographic data.

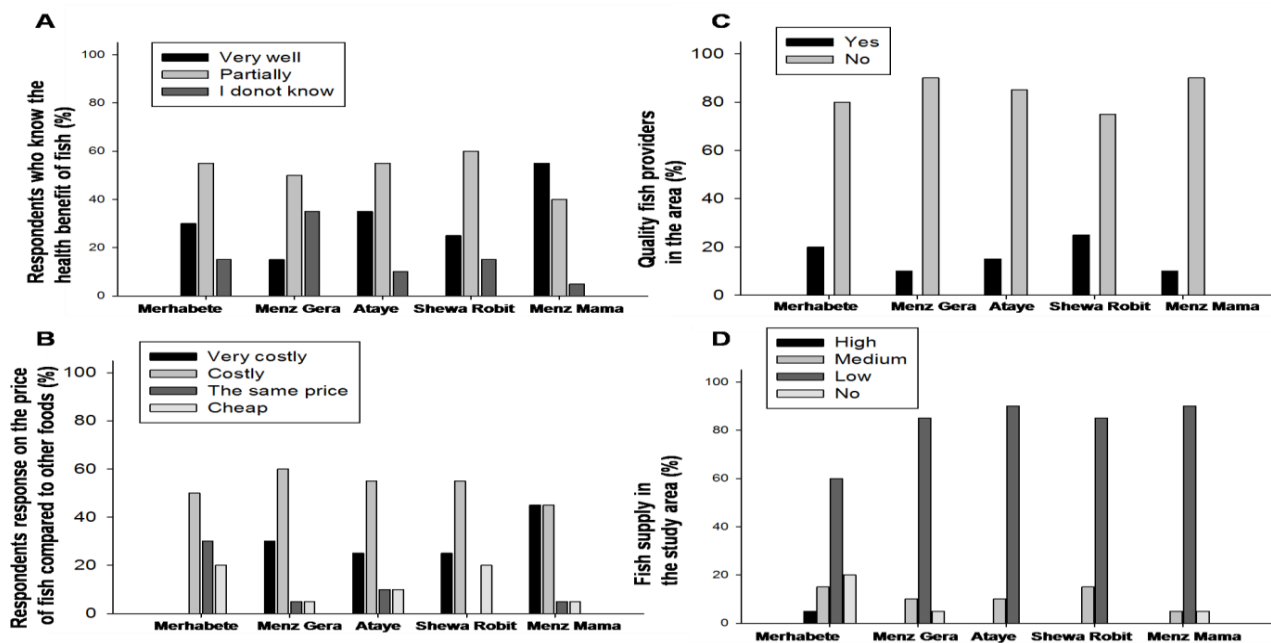


Figure 2. Respondents who know the health benefit of fish, price of fish, quality of fish and fish supply in the study districts.

some challenges related to fish production, such as lack of place, lack of money, lack of awareness, lack of

market and others (Figure 4D). There is an increase in the demand for fish products in Ethiopia during fasting

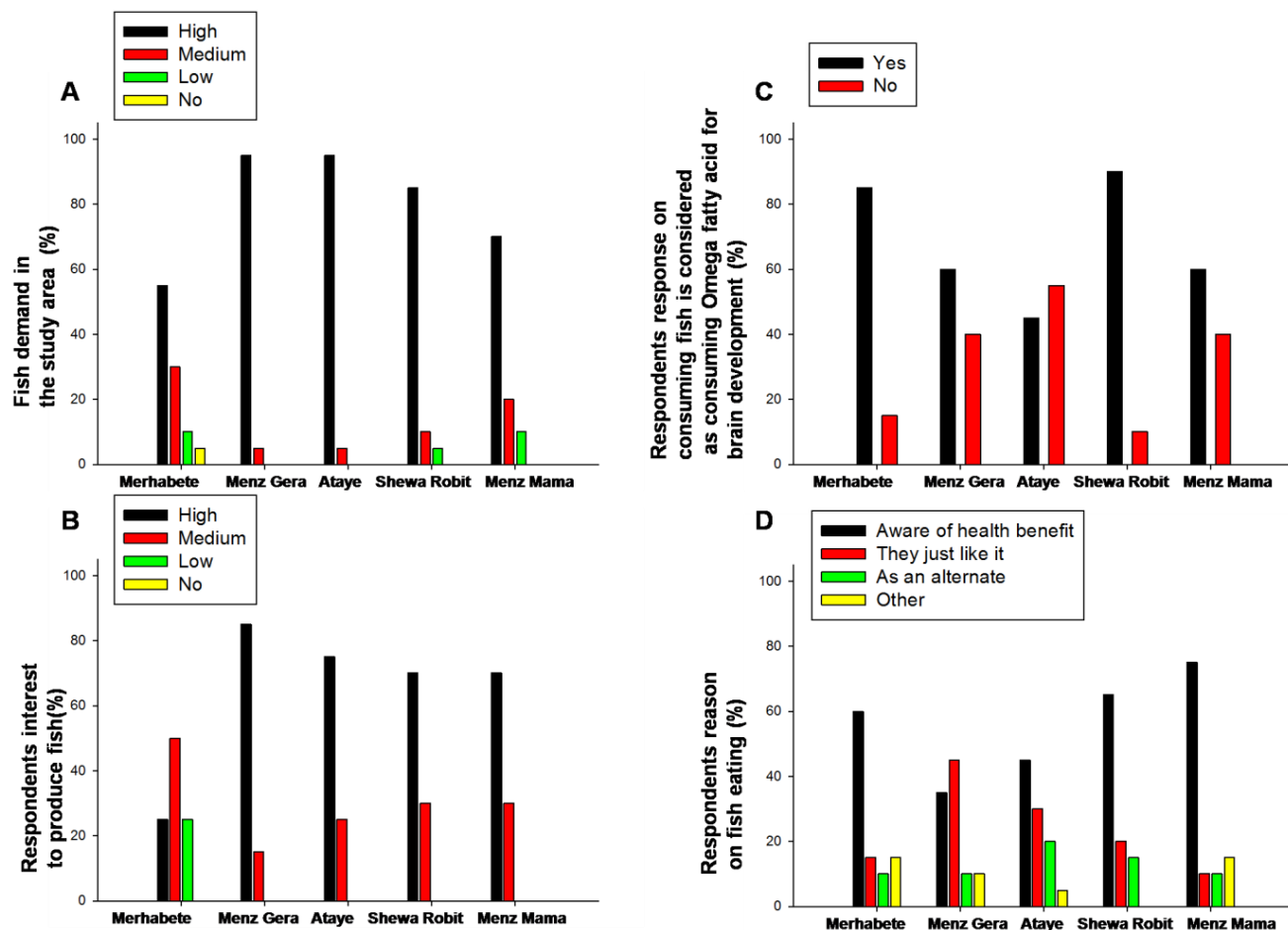


Figure 3. Respondents who know fish demand, consuming fish considered as consuming omega 3-fatty acid, interest to produce fish and reason on fish eating in the study districts.

season (March-April full month and Wednesday and Friday in year round) for Orthodox Christians. Current annual per capita fish production is less than 240 g (FAO, 2003). Despite this, based on only a single factor - population - current annual demand for fish in the country is estimated at 65,344 tones, equivalent to 1 kg/person.

Fish producers response on fish health benefit, price, demand and supply in the study districts

At Merhabete and Menz mama, 55 to 60% informants responded that they produced fish because of its health benefit, at Ataye and Shewa robit nearly 80% respondents responded that they produced fish for profit, some also said as a habit and for source of income (Figure 5A). Almost in all study districts, the source of water for fish production is river according to majority of respondents. In addition, water from rain and pipe were also sources of water for fish production in the study area (Figure 5B). In all districts nearly 60% informants said

they had no professional advice before fish production, in contrast to this, 40% of the respondents said they had advice (Figure 5C). Majority of respondents in all study area responded that they like fish production work (Figure 5D). Fish is the least expensive form of animal protein, and is the main protein source for many underprivileged communities (Finegold, 2012). Additionally, many people around the world depend on fishing as a source of income, and it is a large part of many economies. So in the study districts the community engaged in fish production.

Respondents (60%) responded Nile perch and cat fish interested fish type, next to this Nile tilapia interested and finally African cat fish was the list favorite fish type (Figure 6A), almost in all districts except Menze mama participants responded that they did not get follow up and advisory from the government and non-NGOS, but in Menz mama there were equal opportunities to get follow up and advisory (Figure 6B). Agricultural and fish experts were the dominant advisory in the study area, in addition to individuals who were given advises for fish production

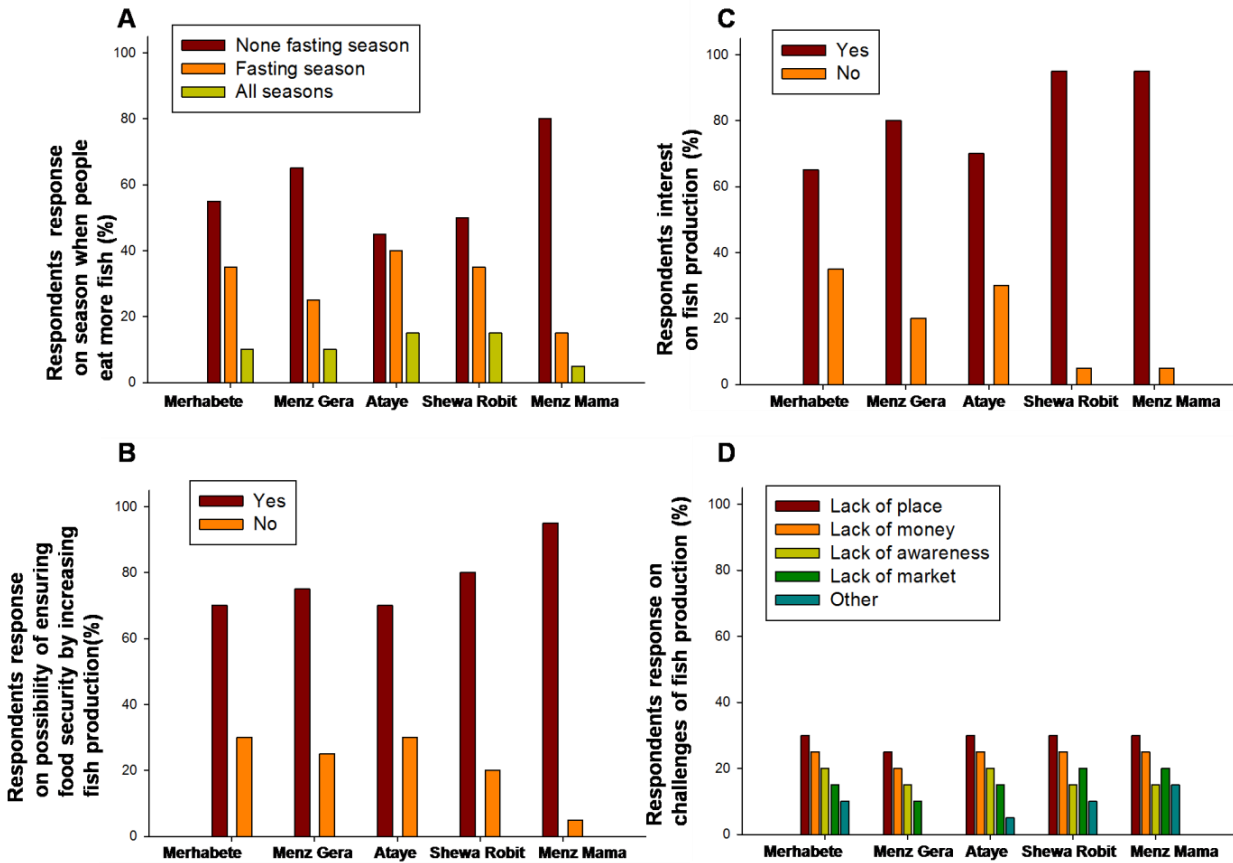


Figure 4. Respondents who know, when people eat more fish, possibility of ensuring food security by increasing fish production, interest on fish production and challenges of fish production in the study districts.

(Figure 6C). The fish producing frequency in all districts varied and is very little. Majority of informants said that they produced fish from 3 to 4 times per year, but the amount of fish they produced is very little (Figure 6D). The vast range of activities in the fisheries sector means that there are many different institutions and agencies involved. All of these have a role to play and their activity should be encouraged, however these activities should be coordinated so as to ensure that their specific role is known and overlap of responsibilities is avoided (Bhaban and Dhaka, 2006). Therefore, the continuous and committed support from the government and concerned bodies will increase product and productivity of fish in the study area.

According to informants at Merhabete, Ataye and Shewa robit, majority of the producers produced fish at private places, at Menz gera both government and private places were equally used for fish production but at Menz mama mainly government place was used. And also natural rivers and natural ponds were used for production (Figure 7A). Based on respondents from 40 to 50%, the accessibility of fish market in the study districts was rated not good, good and very good (Figure 7B).

Nearly 40% of informants identified the good fish marketing season at the three districts namely (Menz gera, Ataye and Shewa robit) to be during both fasting and none fasting season (Figure 7C). At Merhabete, 60% of informants said the fish market is good during fasting time, but at Menze mama, 60% of respondents said that it was rather during none fasting time. Few informants also responded at both season the market is good. At four districts except Menz mama all respondents said there was no quality food for consumer, but at Menz mama 80% of respondents said there was quality fish food for consumers (Figure 7D).

Fish traders response on fish health benefit price demand and supply in the study districts

In all districts more than 60% respondents said that the amount of fish production in the study area were low (Figure 8A), in contrast to this the fish demand in four districts except Merhabete was high but in Merhabete the demand was medium (Figure 8B). 50 to 95% of informants in the study districts said that the integrated

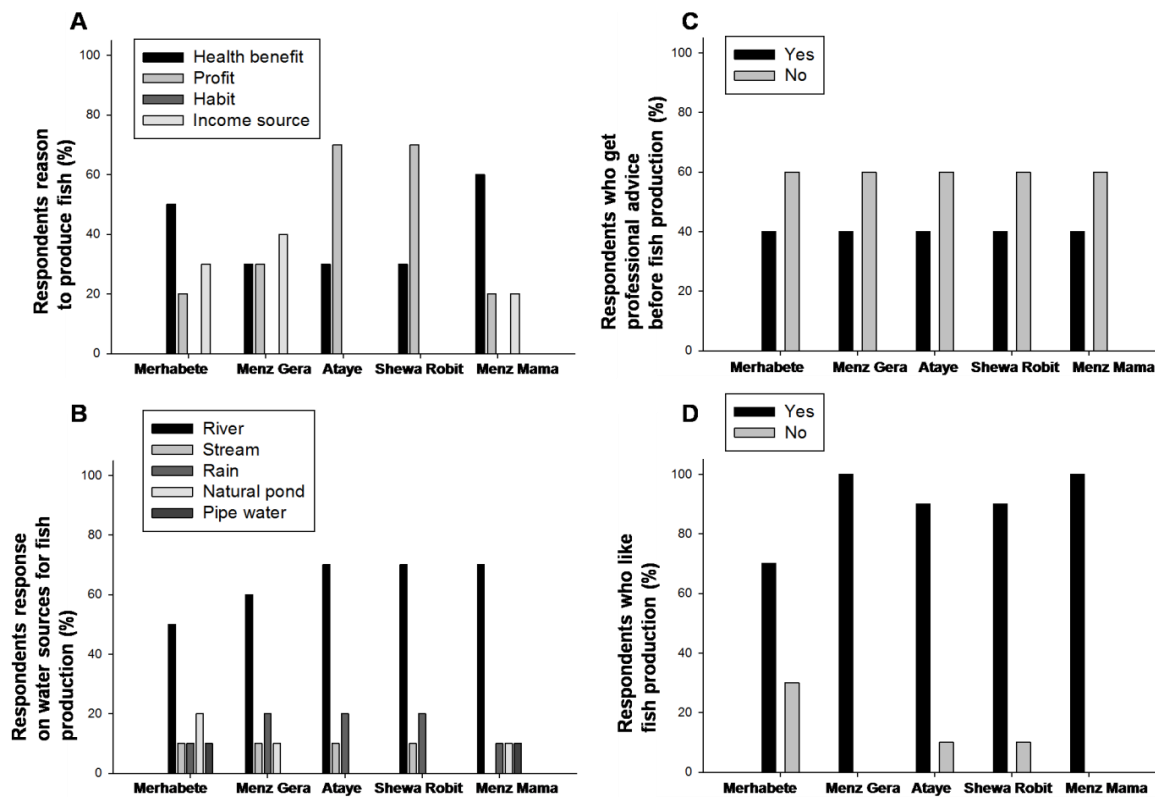


Figure 5. Respondents who know, reason to produce fish, water sources for fish production, respondents who get professional advice before fish production and respondents who like fish production in the study area.

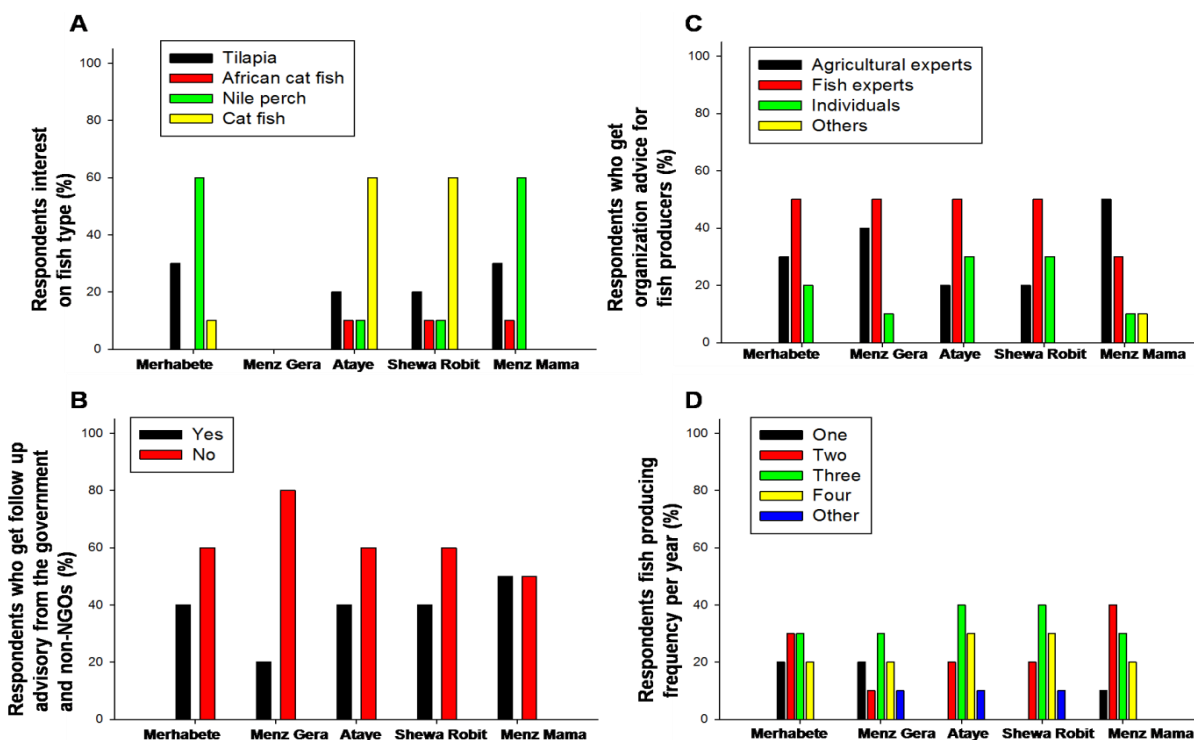


Figure 6. Respondents who know, interest on fish type, who get follow up advisory from the government and non-NGOs, respondents who get organization advice for fish production and respondents fish producing frequency per year in the study area.

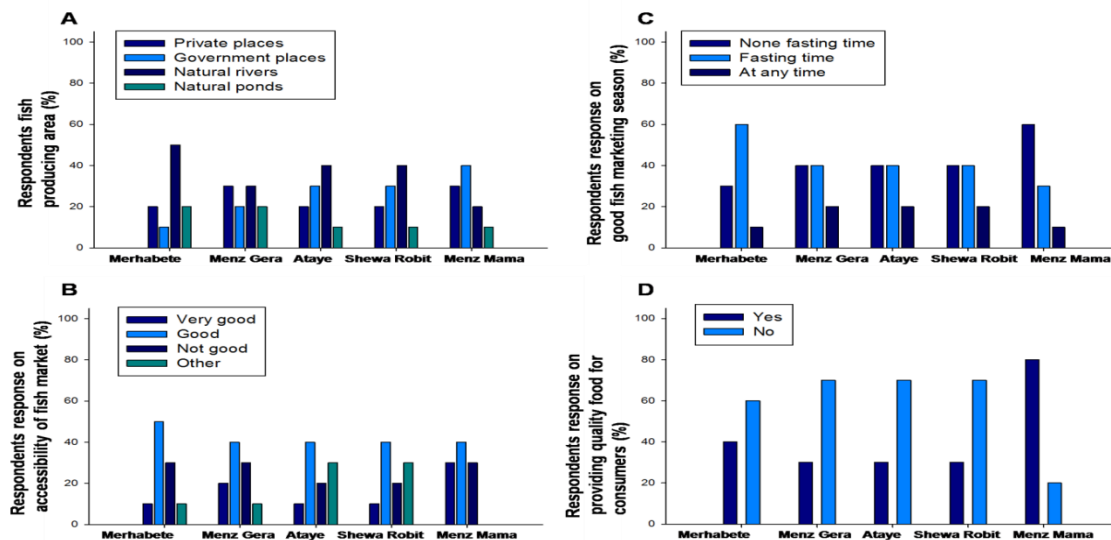


Figure 7. Respondents who know, fish producing area, accessibility of fish market, good fish marketing season and providing quality fish food for consumers in the study area.

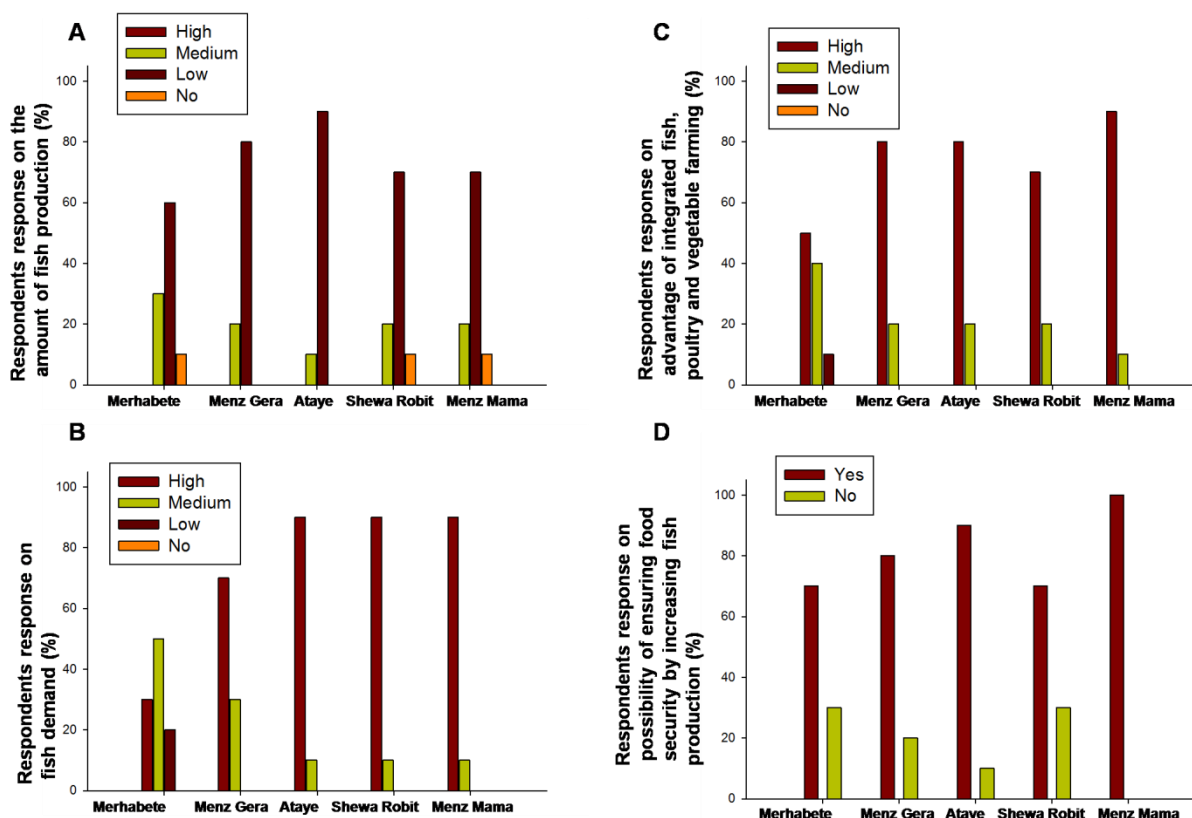


Figure 8. Respondents who know, the amount of fish production, fish demand, advantage of integrated fish, poultry and vegetable farming and possibility of ensuring food security by increasing fish production in the study area.

fish farming system is highly advantageous (Figure 8C). And finally majority of informants more than (70%) responded to the possibility of ensuring food security by

increasing fish production (Figure 8D). Based on the following study, inland fishes are important food and nutritional resources, especially rural economies in

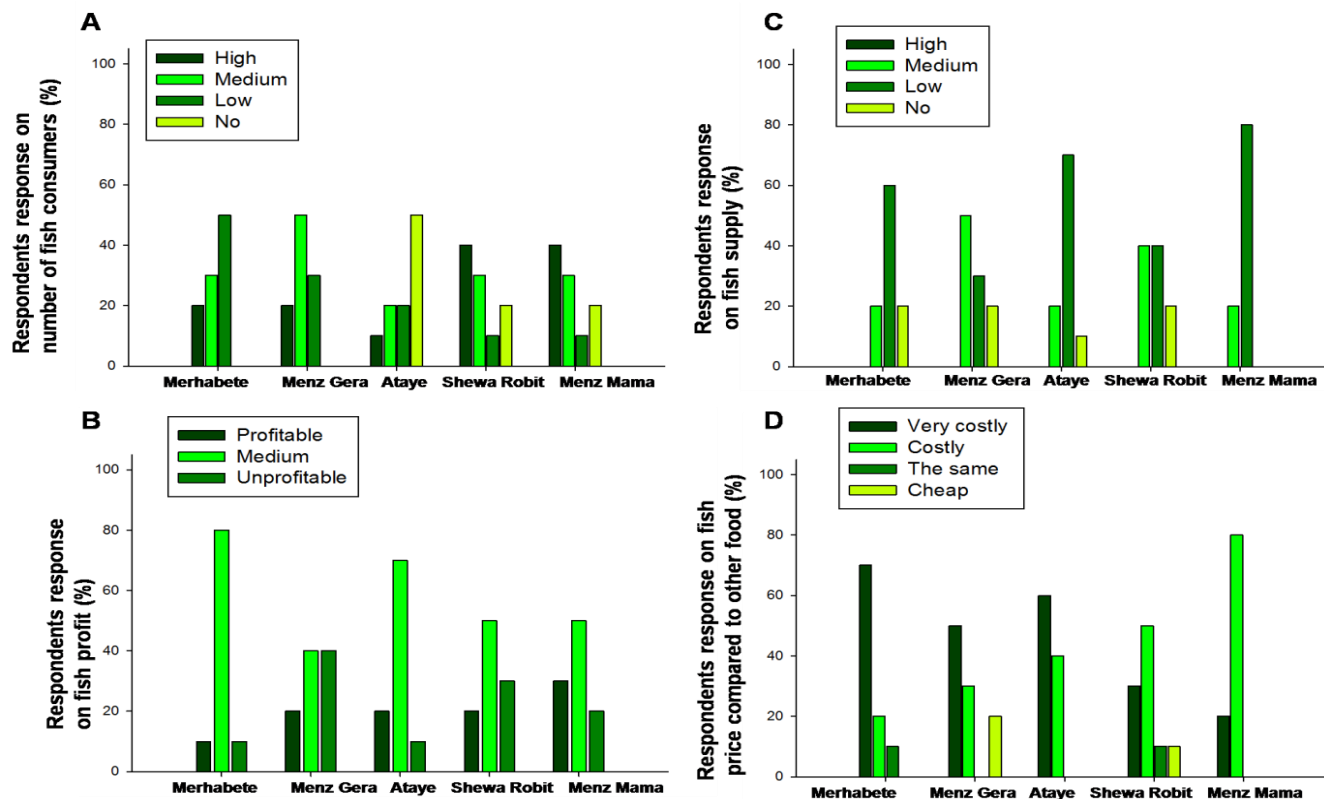


Figure 9. Respondents who know, number of fish consumers, fish profit, fish supply and fish price compared to other food in the study area.

developing countries (Welcomme et al., 2010). Low-income food-deficit countries account for 80% of the total reported harvest from inland capture fisheries (Kapetsky, 2003). Therefore, this study agreed that using inland waters for fish production will work towards food security in the study districts.

Forty percent of respondents said that the number of fish consumer in Shewa robit and Menz mama was high, 50% of them said low at Merhabete and medium in Menz gera; in Ataye there was no consumer at all (Figure 9A). The fish profit in the study area was medium in all districts (Figure 9B). The fish supply in Merhabete, Ataye and Menz mama was low, in Menz gera it was medium and finally in Shewa robit 40% said medium and the other 40% said low fish supply (Figure 9C). In terms of fish price compared to other foods, 50 to 70% of informants responded that it was very costly in Merhabete, Menz gera and Ataye, but in Shewa robit 50% of informants said costly, in Menz mama more than 80% informants said costly (Figure 9D).

Fish experts response on fish health benefit price demand and supply in the study districts

Majority of informants at three districts namely Ataye,

Shewa robit and Menz mama, the wise use of fish products in the area was low, in Merhabete 60% said medium and in Menz gera 40% said medium and low (Figure 10A). There were quality fish production in Shewa robit and Merhabete and also in the remaining three districts there were no providing quality fish (Figure 10B). More than 80% of informants responded that there was high fish supply in all districts (Figure 10C).

More than 80% of respondents said the demand of fish was high in all districts, 20% of the respondents from Merhabete and Menz gera also said medium. Again more than 80% of informants ensured that integrated farming system was highly advantageous. Only 20% of the informants from Merhabete said medium. 80% of informants from Ataye and Shewa robit said that they had experience in applying farming system, but in the remaining districts majority of the informants responded they did not have any experience. In addition, 100% of informants in all districts responded that they can ensure food security by increasing fish production (Figure 11).

Stakeholders response on fish health benefit price demand and supply in the study districts

Above 70% of informants in all districts said there was

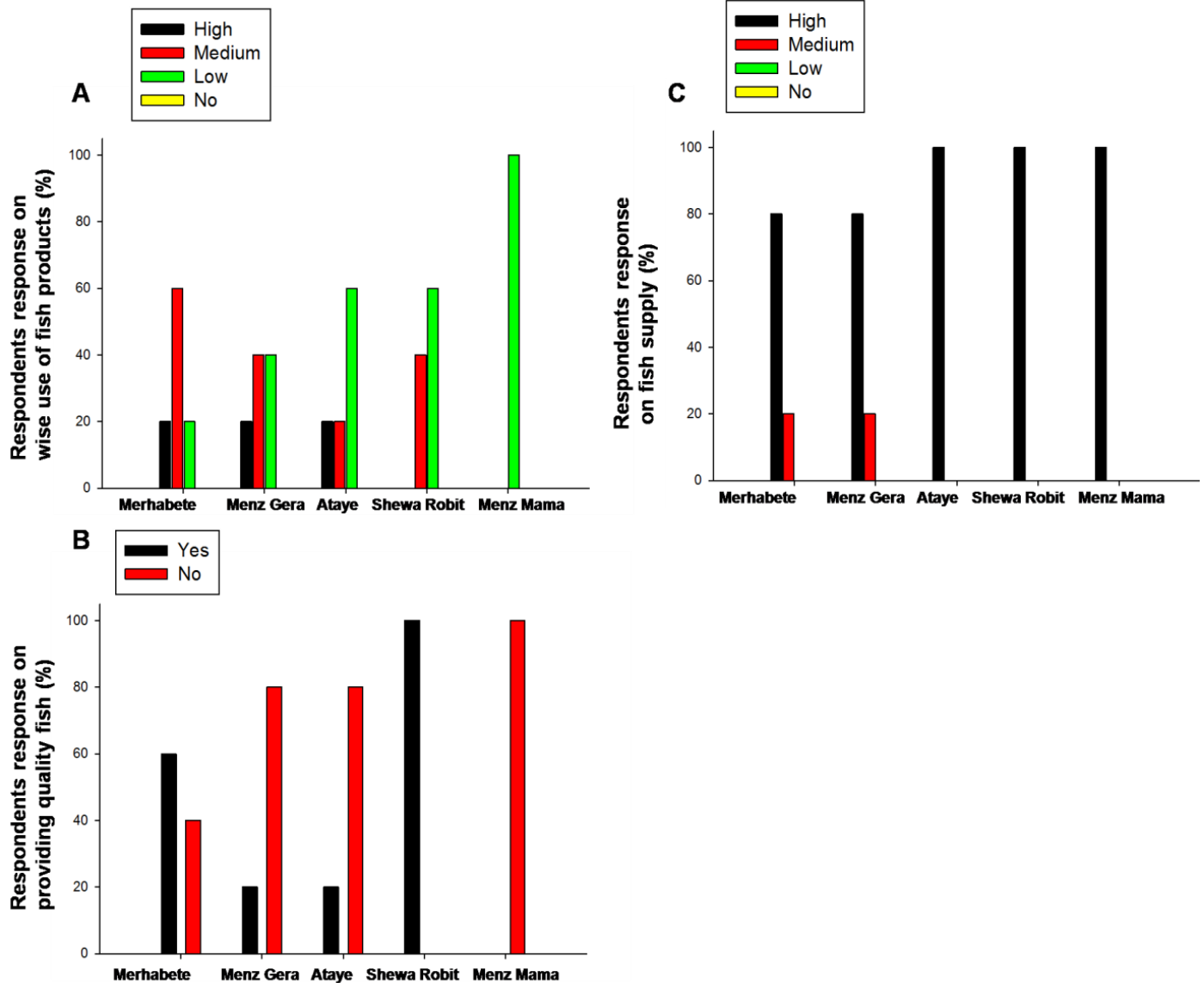


Figure 10. Respondents who know, wise use of fish product, providing quality fish, fish supply in the study area.

low fish supply (Figure 12A) and more than 80% of informants responded that there was high fish demand (Figure 12B). Again, in all study districts more than 70% of the respondents said there was not enough supply of fish for consumer (Figure 12C), majority of informants in four districts said there is no awareness about fish production potential, but in Ataye informants equally said yes and no (Figure 12D). Global demand for fish is growing due to a combination of population growth, urbanization and increasing wealth. With only very modest increases in yields from capture fisheries forecast, rising demand must be met by aquaculture. The World Bank recently concluded that per capita fish supplies will increase fastest in rich countries and in those parts of the world, such as China, where

aquaculture thrives, leading to growing regional disparities between supply and demand (World Bank, 2013). Demand and consumption are likely to increase throughout Asia, but while the World Bank predicts increases in fish supply in Latin America, declines in consumption are likely (that is. exports will increase). Most worrying, however, are the projected declines in consumption in sub-Saharan Africa, where, levels of food and nutrition insecurity and poverty are the highest in the world and per capita consumption of animal source protein is the smallest of any region (Fishing for a Future, 2013b). However, according to this study the fish supply and demand opposite in the study area because the supply is very low and the demand is very high. And also there is not enough supply of fish production for

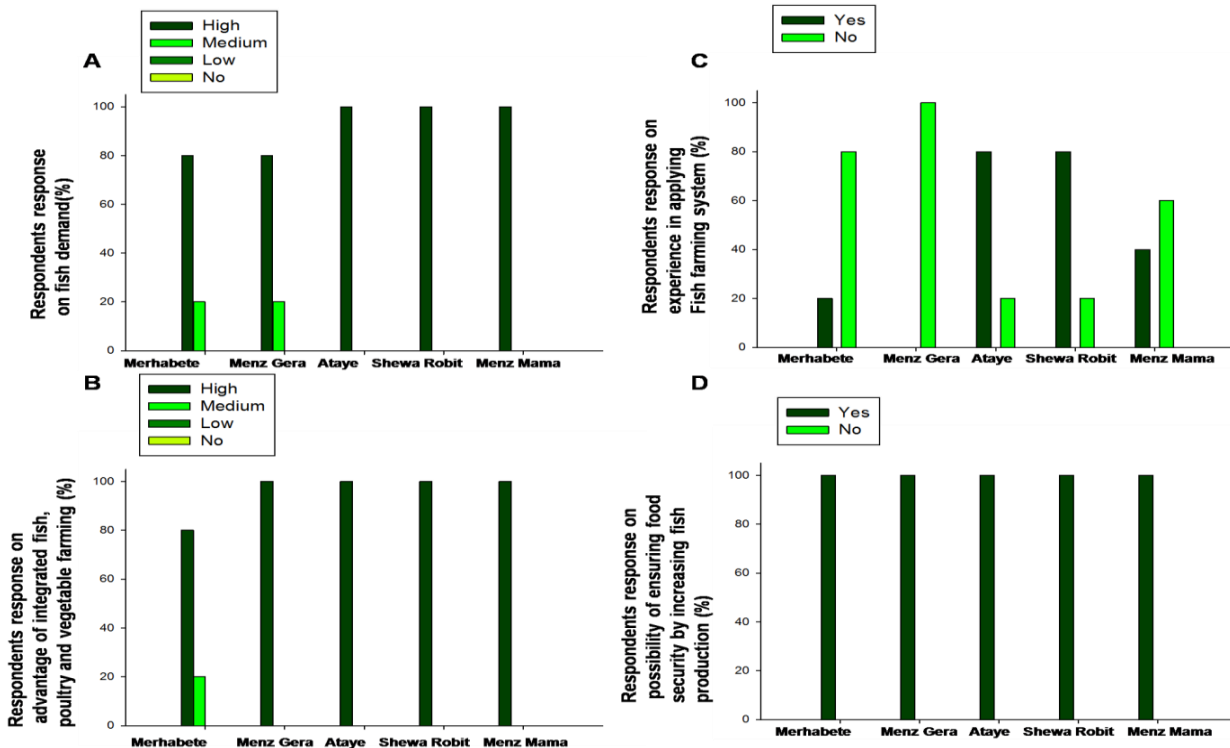


Figure 11. Respondents who know, fish demand, advantage of integrated fish poultry and vegetable farming, experience applying fish farming system and possibility of ensuring food security by increasing fish production in the study area.

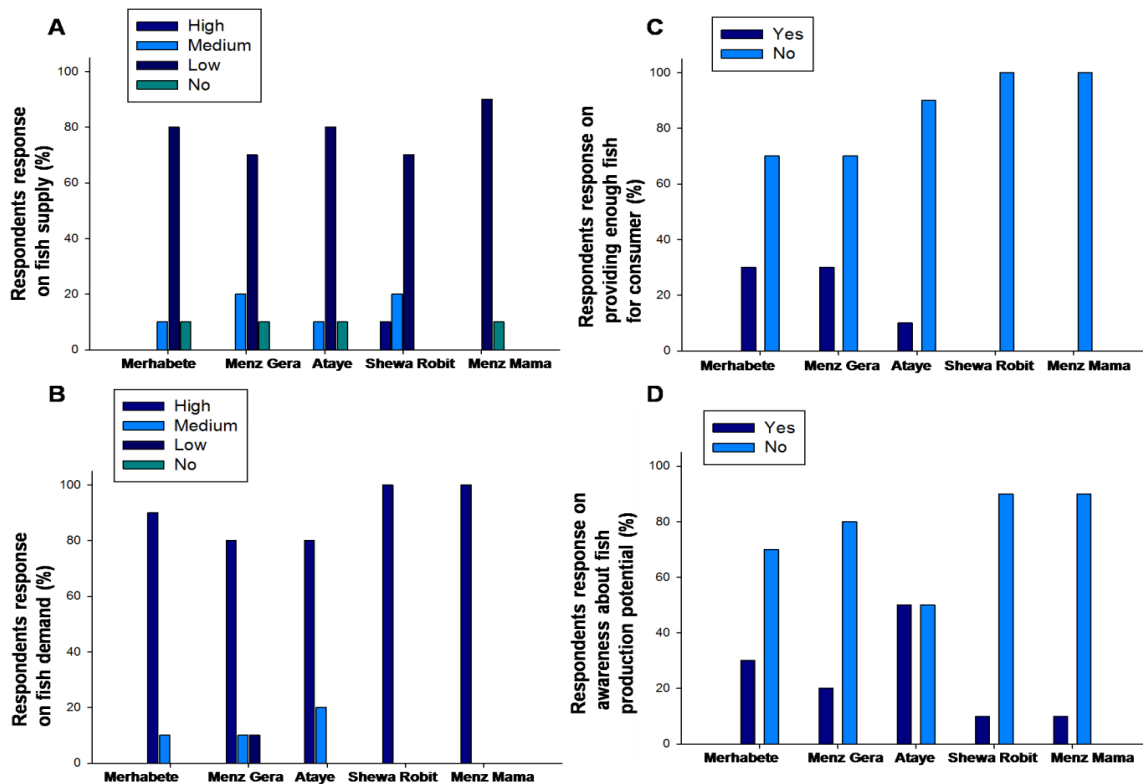


Figure 12. Respondents who know, fish supply, fish demand, providing enough fish for consumer and awareness about fish production potential in the study area.

consumers; in addition, the producers did not have enough awareness about fish production potential.

Conclusion

Aquaculture and fishing occur in different rivers, artificial ponds, natural ponds and inland waters of North Shewa zone. The fishing activities of all these water bodies are held by part-time fishermen for family consumption and sale on small scale during dry season. Fishing is commonly carried out mostly at the end of the rainy season (starting from October) and continues to the beginning of rainy season (April) and also the remaining season. Hooks of different sizes, traps (fish basket) locally made and rarely gillnet are the fishing gears commonly used in the area. Lack of support, lack of place, lack of awareness, lack of facility, low profit, and distance from market place are the main fish production constraints in the area, though the severity of the constraints varies from one district to the other. The fish demand and supply vary from one district to the other within North Shewa zone. Nile perch, Nile tilapia and African catfish are the fish species preferred by consumers in the study area.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

- Ahmed M (2007). Fish production system in mid-rift valley of Ethiopia: Proceedings of the 15th annual conference of the Ethiopian Society of Animal Production (ESAP), Ethiopia.
- Gordon A, Finegold C, Crissman CC, Pulis A (2013). Fish Production, Consumption and Trade in Sub-Saharan Africa: A Review analysis
- Assefa MJ (2013). Assessment of fish products demand in some waterbodies of Oromia, Ethiopia. *International Journal of Agricultural Science* 3(8):628-632.
- Bhaban M, Dhaka R (2006). Aquaculture extension sub-strategy: The future of fisheries. *Science* 302:1359-1361.
- Brown LR (2003). Plan B: rescuing a planet under stress and a civilization in trouble. Earth Policy Institute, Washington, DC, USA. P 285.
- FAO (2012). Fishery and Aquaculture Country Profiles – Ethiopia. Fisheries and Aquaculture Department. Available in <http://www.fao.org/fishery/en>
- FAO (2014). Fishery and Aquaculture Country Profiles. Ethiopia. Country Profile Fact Sheets. In: FAO Fisheries and Aquaculture Department 2014. [online]. Rome. <http://www.fao.org/fishery/facp/ETH/en>.
- Food and Agriculture Organization (FAO) (2000). Small ponds make a big difference. Integrating fish with crop and livestock farming. Rome. 30 p. Available also in Arabic, Chinese, French and Spanish. Accessible at <http://www.fao.org/docrep/003/x7156e/x7156e00.htm>
- Food and Agriculture Organization (2004). The State of World Fisheries and Aquaculture Report.
- FAO (2006). The state world fisheries and aquaculture 2000. FAO Department, Rome.
- Food and agricultural organization (2009). Farm Pond for Water, Fish and Livelihood, FAO, Rome.
- Food and Agricultural Organization (2009). Farm Pond for Water, Fish and Livelihood, FAO, Rome.
- Food and Agricultural Organization (2010). The State of World Fisheries and Aquaculture 2010. Rome 197p.
- Finegold C (2012). The importance of fisheries and aquaculture to development. America, http://pubs.iclarm.net/resource_centre/WF_2546.pdf
- Fishing for a Future (2013b). Meeting Needs. FFAF briefing Paper 6. Penang, Malaysia. World Fish. P 12. <http://www.fishingfuture.org/resources/06-meeting-needs/>.
- Grafton RQ, Daugbjerg C, Qureshi ME (2015). Towards food security by 2050. *Food Security* 7:179-183.
- Hazell P, Poulton C, Wiggins S, Dorward A (2007). The future of small farms for poverty reduction and growth. 2020 Vision Discussion Paper 42, Washington, DC: International Food and Policy Research Institute 48p.
- Heck S, Béné C, Reyes-Gaskin R (2007). Investing in African fisheries: building links to the Millennium Development Goals. *Fish Fish* 8:211-226.
- Kapatué AT, Hanan NP, Prihodko L (2013). Characterization of the spatial and temporal variability of surface water in the Soudan-Sahel region of Africa. *Journal of Geophysical Research: Biogeosciences* 118:1472-1483.
- Kapetsky JM (2003). Review of the State of World Fishery Resources: Inland Fisheries. FAO Fisheries Circular 942.
- Kumar P, Dey MM (2004). A study on modelling of household demand for fish in India. *Indian Journal of Agricultural Economics* 59:465-475.
- Mitike A (2015). Fishermen's willingness to pay for fisheries management: the case of lake Ziway, Ethiopia. MSc. thesis Submitted to the School of Agricultural Economics and Agribusiness. Haramaya University, Ethiopia.
- NEPAD (2005). NEPAD Fish for All Summit. 22–25 August 2005, Abuja, Nigeria. Poulter, G.R., Ames, G.R. and Evans, N.J. 1988. Post-harvest losses in traditionally processed fish products in less developed countries. In Postharvest Fishery Losses. Proceedings of an International Workshop held at the University of Rhode Island. Kingston, Rhode Island.
- Redeat H (2012). Fishes of Ethiopia, annotated checklist with pictorial identification guide, 250. Sathiadhas, R. and R. Narayanakumar, R. eds 1994: Price Policy and Fish Marketing System in India.
- Tedela A (2003). Fresh water fish of Ethiopia, Haile Selassie University, World Bank.
- Thurstan RH, Roberts CM (2014). The past and future of fish consumption: can supplies meet healthy eating recommendations? *Marine Pollution Bulletin* 89:5-11.
- Watters, C.A., Edmonds, C.M., Rosner, L.S., Sloss, K.P., leung, P. (2012). A Cost Analysis of EPA and DHA in Fish, Supplements, and Foods. *Journal of Nutrition and Food Sciences* 2:1-5.
- Welcomme RL, Cowx IG, Coates D, Béné C, Funge-Smith S, Halls A, Lorenzen K (2010). Inland capture fisheries. *Philosophical Transactions of the Royal Society B: Biological Sciences* 365:2881-2896.
- World Bank (2013). Fish to 2030: Prospects for Fisheries and Aquaculture. Washington, World Bank, P 102.