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Erkie Asmare

Bahir-Dar Fisheries and Other Aquatic Life Research Center, P. O. Box 794, Bahir-Dar, Ethiopia

Sewmehon Demissie

Amhara Regional Agricultural Research Institute, P. O. Box 527, Bahir Dar, Ethiopia

Dereje Tewabe

Bahir-Dar Fisheries and Other Aquatic Life Research Center, P. O. Box 794, Bahir-Dar, Ethiopia

Socio economic study on the fisheries of Jemma and Wonchit River, Ethiopia

Erkie Asmare, Sewmehon Demissie and Dereje Tewabe

Abstract

Fishing plays a critical role as a 'bank in the water' for local populations. This study aimed to: (1) assess the importance of fisheries in improving farmer's livelihood in the study area. (2) assess household's involvement in fisheries, and (3) recommend means of interventions for sustainable utilization of the river fisheries. The most popular fishing gears used for fishing are the seed of *Milletia ferruginea* and barks of *Balanites aegyptiaca*. The main fish type consumed by the community are *Clarias gariepinus* and *Labeobarbus intermedius* fish species in fresh and sun dried forms but *Oreochromis niloticus* is not known as it is edible. The farmers have a good fish consumption habit which is by far greater than the town's inhabitants. Hence, Farming and fishing are overwhelmingly the most important activities for household food supply and means of income generation. However, fish catches from the rivers have declined significantly because of the destructive way of fishing, water pollution, and resource encroachment.

Keywords: *Milletia ferruginea*, *Balanites aegyptiaca*, farmer's livelihood, river fisheries

1. Introduction

Ethiopia is uniquely rich in water resources. It has numerous waterbodies including ponds, lakes, rivers, reservoirs and wetlands (Tessema A., *et al.*, 2014) ^[1]. As a landlocked country following the secession of Eritrea in 1993, fisheries in Ethiopia come exclusively from inland sources (Amare, *et al.*, 2014) ^[2]. The inland water body of Ethiopia is estimated to encompass about 7,400 km² of lake area and a total river length of about 7,000 km (Janko AM., 2014; Wood, R., and Talling, J. 1988; Tewabe D., 2015; Goshu G., *et al.*, 2010) ^[3-6].

Fish is an important food item that has significant socioeconomic contribution as a source of income, employment and cheap protein for marginal people in developing countries including Ethiopia (Asmare, E., *et al.*, 2015) ^[7]. Inland fisheries are particularly important for the food security of poor people, as most inland fish production goes for subsistence or local consumption (FAO, 2004) ^[8]. It was estimated that more than 56 million people were directly involved in inland fisheries in the developing world in 2009 (BNP, 2009; R. L. Welcomme *et al.*, 2010) ^[9, 10]. Fisheries are one of livelihood strategies that have contributed much to people in developing countries. It is one of the vital strategies for the poor to achieve food, income and other social benefits. For instance, it serves as an important source of diet for over one billion people (Erkie Asmare, *et al.*, 2016; Manasi *et al.*, 2009; Gebremedhin, S., 2013) ^[11-13].

Migrant fishers may employ agricultural workers as crew, providing seasonal employment and contributing to village economies. Fisheries contribute to livelihoods in a range of ways: Directly as food, as a source of income and through other social benefits, such as source of supplementary income (Hortle and Suntornratana, 2008) ^[14]. Fisheries plays particularly an important role among disadvantaged groups as a main or supplementary source of employment, livelihood and income (Moni & Khan, 2014) ^[15].

Fisheries of Wonchit and Jemma rivers are highly impacted by irresponsible fishing practices, which result in reduced potential benefits and loss of aquatic biodiversity. Resource potential, uses and socioeconomic benefits from Wonchit and Jemma rivers have not been studied yet and there are no reports on their fisheries. This study aimed to assess the importance of fisheries in improving farmer's livelihood in the study area; assess household and individual involvement in fisheries in terms of utilization and management; to recommend means of interventions for sustainable use of the resource and enhance benefits from the river fishery.

Correspondence

Erkie Asmare

Bahir-Dar Fisheries and Other Aquatic Life Research Center, P. O. Box 794, Bahir-Dar, Ethiopia

2. Materials and Methods

2.1 Description of the study area

Wonchit and Jemma rivers, which are one of the most flowing rivers to the lower course of Blue Nile are mainly found in North Shewa zone of Midaworemo and Merhabete districts respectively. For these rivers, major beneficiaries of the fisheries resource are Midaworemo, Merhabete, Muteranajiru, Ensaro and neighboring districts of south Wello of the same region and districts from Oromia region. But in most cases fishing is practiced on Midaworemo, Merhabete and Muteranajiru districts.

2.2 Methods of data collection

Both primary and secondary data has been collected to make this paper successful. The qualitative data were collected between November 2012 and December 2014. The qualitative approach employing different data collection tools including transect walk, interview, focus group discussion, stakeholder consultation, and document analysis were used to collect most of the qualitative data. The main data collected included information on fishing related activities, the market situation for fish, and major fishing gears used by fishers. Secondary data was collected from literature and district agricultural and rural development experts.

2.3 Sampling procedures

Based on the existence of fishing activities, two districts were purposely chosen. A purposive sampling technique was followed for the selection of districts and fishers. At the first stage Midaworemo and Merhabete districts were selected purposively to represent Wonchit and Jemma rivers respectively. At the second stage fishers were purposively selected from non-fishers. Finally, simple random selection of fishers was done for key informant interview, focus group discussion and stakeholder consultation. The collected data was analyzed by qualitative approaches. In addition, SWOT (strength, weakness, opportunities and threats) analysis was used to assess the situation of Jemma and Wonchit fisheries.

3. Results and discussion

3.1 Fishing and fishing gear used

Fisheries provide trade, employment, nutrition and recreation for people throughout the world, and particularly in the developing world. However, the sector is impacted by irresponsible way of fishing and practices. These practices result in a loss in the fishery production, reduced food security and loss of aquatic biodiversity. Many fishers flee from all sides of the river gathered somewhere and move to downstream where fishes are found in mass at low altitudinal

sites by carrying plant poisoning materials, locally made netlike sack material to collect poisoned fish from the surface of the water and panga to kill the weakened and poisoned fish. Fishers' knowledge towards the negative impact of poisoning plants is very minimal, and they believed that fishes have come into existence along the incidence of clouds during the rainy season.

In the study area, modern fishing gears such as cast nets, gill nets and hooks are not known. The most popular fishing material that are extensively used for fishing are *M. ferruginea* seed, a tree that is endemic to Ethiopia (Figure1) and the bark of *B. aegyptiaca* (locally called Bedeno). These plant materials are used by crashing and diluting with water, squeeze and then spread over the surface of the pooled water bodies starting from the post rainy seasons up to just pre-rainy seasons of a year. The effect of the two poisoning plant materials used for fishing are quite different.

The powder from the matured seeds of *M. ferruginea* is commonly practiced to spread over the water surface for stunning fish in the area. In agreement with the report of (Karunamoorthi, et al., 2009; Choudhury & Shiferaw, 2015) [16, 17], seed extracts of *M. ferruginea* are extremely toxic to fishes as well environment. The seeds are pulverized and are used to take care of the external parasitic and poison the fish by the natives (Banerjee S., et al., 2013; Azene Bekele, 2007; Banouzi, J.T., et al., 2008; Legesse Negash, 1995) [18-21]. It possibly affects other beneficial organisms in the aquatic ecosystem and ultimately disrupts the food chain due to their toxic nature. The crushed *M. ferruginea* seed has strong toxicity against aquatic macroinvertebrates in general and damages the nervous system and eye of the fish in particular.

The poisoned fish is unable to see the environment it lives and make them float to the water surface for allowing easy catches. A study by Ameha A. (2004) [22] also revealed that solutions of *M. ferruginea* seed powder affect oxygen uptake by the fish and the fertilized eggs. In addition, solutions resulted in abnormal activities such as restlessness, sudden quick movements, rolling movements, swimming on the back, and settling at the bottom. When using *M. ferruginea* concentrations of 0.02 to 0.4 g/l, all of the fish died in about 30 to 60 minutes. When we see the fish killed with *B. aegyptiaca* poisoning plant, the fish exhibited stressful behaviours such as unusual swimming and loss of balance which is due to the bark damage the nervous system and general metabolism of the fish. As a result, the body cavity of the fish becomes bad smell and changed its normal color to black color.



Fig 1: A, B, and C- *M. ferruginea* seed sold at the local market by youth and older men.

3.2 Seasonality of fishing

Fisheries represent a supplementary livelihood in the study area, as local people generally consider themselves farmers, with fishing as a part-time and seasonal activity. Even though, fishing was ranked as very important for income generation, the most important activities for household food supply is agriculture (cropping) especially sorghum production. River fisheries are exploited largely by local communities which are open access fisheries. River basin communities and their traditional livelihoods are intimately linked to the seasonal cycle and the mixture of fishing and agricultural cropping. Hence, one of the most important contributions of Jemma and Wonchit river fisheries as a source of cash for households, not only for families of full-time fishers but for a large number of rural households that live close to water bodies and engage in fishing activities.

There are three main periods in the fishery: dry season (February to April), early-wet and wet season (May to August) and late-wet/recession season (September to January). During the early-wet season, the farmers prepare their land for crop production and therefore; fishers concentrate less on fishing and fisheries related activities. During the early wet and wet season water level become at peak and flow rapidly. At these times, farmers become more concentrated on agricultural activities and fishing in the down courses of Jemma and Wonchit rivers is impossible. Fishing is most intense from December to April during the dry season since agricultural activities are reduced. These seasons are very conducive for fishing because the water volume becomes decreased and make important for plant poisoning materials to be concentrated and not washed out by running water.

3.3 Household fish consumption and preference for fish species

Fisheries provide a crucial source of animal protein and essential micronutrients for local communities. The contribution of fish to household food and nutrition security depends on availability, access and cultural and personal

preferences. Access is largely determined by location, seasonality and price (Beveridge *et al.*, 2013) [23]. In Jemma and Wonchit river fisheries, the farmers have a good fish consumption habit which is by far greater than the town's inhabitants. The household uses their catches for both home consumption and generating income by selling at the nearby local market only.

In the area the main fish type consumed by the community are *C. gariepinus* [catfish], *Heterobranchus longifilis* [catfish] and *L. intermedius* [barbus] fish species in fresh and sun dried forms. Surprisingly *O. niloticus* is not known as it is edible by the surrounding community. Although *O. niloticus* is a healthy source of protein as well as Omega-3 fatty acids, it needs excessive care while consuming. This is because of the narrow and thin bones that line the meat may get stuck in and piercing the consumer's throat. Moreover, the bone is quite thin, it will not pass along the throat easily and making it more difficult to remove. This situation refrains fishers and local consumers from eating this delicious food.

3.4 Fish market in Wonchit and Jemma Rivers

The catches of fishers used for both home consumption and generating income by selling at the nearby local market. Hence, the Meragna town from Midaworemo and Alemketema from Merhabetic are towns where the fish market operates. Most of the catches are sold in fresh, gutted whole fish and sun-dried form. Catches are brought to the market in fresh, whole fish gutted and sun-dried form. During fish market survey 1.2 m *H. longifilis* gutted fresh whole fish was registered. Many other medium sized with the range of 70 and 80 cm whole fresh gutted and washed *C. gariepinus* and *H. longifilis* were recorded. Large *L. intermedius* fish species appear at the market in sun dried forms filled with sacks. Big sized gutted fresh whole fish sold from 40 to 50 Ethiopian birr. During market transaction period most of the time customers are women from peasant associations (Figure 2).



Fig 2: gutted *Clarias gariepinus* fish; local fresh and dried fish market; and dried *Labeo barbus intermedius* fish at Meragana town from Midaworemo district.

3.5 Socio economic role of fisheries in the Jemma and Wonchit rivers

Farming and fishing are overwhelmingly the most important activities for household food supply and means of income generation in the study area. In particular, the poorest rely in a larger proportion on fishing activities while the better off mainly rely on farming. The study shows clearly that fishing is of considerable importance for people living in the study area including crop producer and part-time/ seasonal fishers. According to (Moni & Khan, 2014) [15], fisheries has an important implication for ensuring emergency cash flow in terms of urgent medical expenses, financing children's

education and supporting household economy in times of maintaining social and family occasions. It also alters households' protein consumption level and income, expenditure and savings pattern of the households. Andersson and Ngazi (1998) [24] also reported that fisheries can provide an important contribution to household cash income. This cash income gives access to other benefits such as education, health services, clothing, other foodstuffs etc. It also allows investment in other assets or enterprises such as land, livestock or fishing gear.

Likewise, fisheries of Jemma and Wonchit have a profound role for food and income generation including for women

who participate in post-harvest processing. Rural farmers in the study area employ casual workers for agricultural activities when they go to fishing; this provides seasonal employment for the poor and landless. People often turn to fishing when other livelihood options are limited, thereby, fisheries reduce vulnerability to hunger by providing a complementary food source as part of diversified livelihood strategies and fisheries can act as a 'safety net' for the poor. For example, people who have not agricultural lands could participate in fishing to meet their basic needs. In agreement with our finding a report by R. L. Welcomme *et al.*, (2010) [10] confirms that small-scale fisheries also play a role as a 'safety-net' in that fishing can provide alternative or additional sources of income, employment and food for the poor and near-poor households whose livelihoods have been temporarily reduced or affected by unexpected shocks or in periods of individual or collective economic crisis. Similarly, Be'ne' *et al.*, (2009) [25], reported that fishing plays a critical role as a 'bank in the water' for local populations that largely rely on this activity to access cash quickly.

The foods we eat influence our health seriously. Fish is the major source of omega-3 fatty acids in the diet and has long been known to lower cholesterol, protect against heart disease, newborn development, combatting depression, reduces the risk of Alzheimer's disease, reduced risk of prostate cancer, longevity, and decrease the risk of sudden cardiac death. Fisheries of Jemma and Wonchit in this regard have a substantial nutritional role for the local community and the fishers themselves, who sell their catches around the vicinity alone.

In addition to financial and nutritional benefits, fisheries of Jemma and Wonchit have a meaningful social and cultural role. In the study area, many fishers flee from all sides of the river gathered somewhere and move to downstream where fishes are found in mass. In the dry season, the farmer goes far from their home to fishing by holding their food for many days until they get enough amounts. Because of speedy water flow to the down course of the river and group fishing by using *M. ferruginea* seed and bark of *B. aegyptiaca*, fishing is rarely carried out alone and is often a very social activity in nature. During their stay, fishers share a fishing and other household experiences each other. This has a paramount role in strengthening bonds between people and community cohesion. Increased production from fisheries provides greater community income, this enables them to invest in community projects such as school, road, and support poorer community members.

During market transaction period catches brought to market by both men and women. Age structures are not clearly observed, youths, middle classes, and older age groups are involved in the marketing and fishing. In fisheries, men and women often have distinct roles. In Jemma and Wonchit fishery only men go out to fish, but women are often involved in marketing and post-harvest processing. In general, women's participation in the fishery sector is restricted especially, fishing is unthinkable. Pre-fishing activities like logistical functions, picking up equipment, and crashing seeds of *M. fergunia*, purchasing seeds of *M. fergunia* and barks of *B. aegyptiaca*, post-harvest processing etc are executed by both men and women. However, caring child, preparing food, fetching water and fuel wood, cleaning house, shopping, washing close and utensils, grinding are the main tasks of women in the study area.

3.6 Opportunities from Wonchit and Jemma rivers in fisheries

Attractive fish prices at local market for better profit; the presence of diversified fish species; and inhabitants' traditional knowledge for fisheries and good consumption habit are considered as an opportunity. In addition, gotera/kefo a locally made fishing gear which has a hive like structure is the best practice. Because fishers let small fishes out to the water body while they are collecting their catches. This system enables fishers to be either selective or non-selective which depends on the size and preference of the fishers. Fishers in the study area have a good practice in the post-harvest processing, which is either fresh and gutted when there is demand for fish or sun-dried form during surplus of production.

3.7 Identified problems of Jemma and Wonchit rivers

Inaccessibility for transportation and marketing which only delimited to local areas. Lower awareness of the community about wise way of utilization and sustainability of the resource; and non- existence of aquaculture production to supplement the river fisheries are the challenges of Jemma and Wonchit river fisheries. Moreover, habitat degradation is a serious problem in the study area. Due to climate change and anthropogenic activities, the water volume of the rivers declines each year dramatically. Poisoning plant material added to the upper part of the river flow with the water to the down course of the rivers by poisoning or damaging all the aquatic organisms non-selectively. This destructive way of fishing by the inhabitant are the major threats to the sustainability of aquatic organisms including fingerlings. In addition, some fish species, such as *O. niloticus* considered as inedible in the study area.

4. Conclusion and recommendations

From the study it was found that fisheries are ranked as a very important activity for income generation; it is the most important activities for household food supply. Fishing is seasonal in the study area and the most popular fishing gear used is *M. ferruginea* seed and barks of *B. aegyptiaca* which poses a great threat to fish and other non-target organisms. Fishers' knowledge towards the negative impact of poisoning plants is very minimal, and they believed that fishes have come into existence along the incidence of clouds during the rainy season. In the area, the main fish type consumed by the community are *C. gariepinus* (catfish) and *L. intermedius* fish species in fresh and sun dried forms. Surprisingly, *O. niloticus* is not known as it is edible. In Jemma and Wonchit rivers fishery activities are sex oriented. Transportation and market problem, nonexistence of aquaculture production, destructive way of fishing, and high algal population are the main threats to Jemma and Wonchit river fisheries.

Taking into account the above issues we recommend the followings: awareness creation on promoting aquaculture to supplement river fisheries; awareness creation for the inhabitants for sustainable use of fisheries resource and its management; provision of appropriate fishing gears; and train ways and means of using the fishing materials. Prohibiting use of poisoning plant materials like *M. ferruginea* and *B. aegyptiaca* by providing alternative eco-friendly techniques for fishing; aware the residents on how *O. niloticus* is important for human food so that can be one of commercially important fish species in the area; train and demonstrate how *O. niloticus* and *H. longifilis* (locally called *Gilgel*) fish species are important for fish farming; and integrate fish

farming with the existing irrigation scheme of the area. Methods for fish preservation and transportation should be designed to allow fishers to sell their catch in areas where the price of fish is attractive. Fish dried by direct sun often results in low quality as a result of slow drying, insect infestation and contamination from airborne dust etc. However, drying fish by solar tent fish dryer enables to produce hygienic, high quality, organoleptically good dried fish with low cost (Asmare, E., *et al.*, 2015). Therefore, Introducing and disseminating solar tent fish drier technology to keep the hygiene of catch will have a vital role. Further study is also recommended on the health implication of fish caught by using *B. aegyptiaca* and *M. ferruginea*. Finally, the effect of poisoning plant materials on the biology of fish must be studied.

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