

Fisheries of Jemma and Wonchit Rivers: As a Means of Livelihood Diversification and its Challenges in North Shewa Zone, Ethiopia

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Abstract

Fishing plays a critical role as a 'bank in the water' for local populations that largely rely on this activity to access cash quickly. This study aimed: (1) to assess the importance of fisheries in improving farmer's livelihood in the study area. (2) to assess households and individual's involvement in inland fisheries in terms of utilization and management, and (3) to recommend means of interventions for sustainable use of the resource and enhance benefits from the river fishery. This activity was conducted by using a combination of monitoring of fish catch, focus group discussions, and key informant interviews. Fishing is seasonal and intensively carried out during the dry seasons starting from February up to April. The most popular fishing gears used for fishing are the seed of *Milletia ferruginea* (in Amharic called Birbira) and barks of *Balanites aegyptiaca* (locally called Bedeno). In the area the main fish type consumed by the community are *Clarias gariepinus* [catfish] and *Labeobarbus intermedius* [Barbus] 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. Fish catches from the rivers have declined significantly because of the destructive way of fishing, water pollution, and resource encroachment, thereby threatening the sustainability of Jemma and Wonchit river fisheries as well as the river's ecosystem.

Keywords: *Milletia ferruginia*; Destructive way of fishing; Livelihood diversification; River fisheries

Introduction

Ethiopia is uniquely rich in water resources. It has numerous water bodies including ponds, lakes, rivers, reservoirs and wetlands [1]. As a landlocked country following the secession of Eritrea in 1993, fisheries in Ethiopia come exclusively from inland sources [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 [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 [7]. Inland fisheries are particularly important for the food security of poor people, as most inland fish production goes for subsistence or local consumption [8]. It was estimated that more than 56 million people were directly involved in inland fisheries in the developing world in 2009 [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 [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 [14]. Fisheries play particularly an important

role among disadvantaged groups as a main or supplementary source of income, employment, and livelihood [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.

Materials and Methods

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 Merhabetie districts respectively. For these rivers, major beneficiaries of the fisheries resource are Midaworemo, Merhabetie, 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, Merhabetie and Muteranajiru districts.

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, key informant 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.

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 Merhabetie 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.

Result and Discussion

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 numerous other uses of water, as well as by irresponsible fishing practices. The open access nature of the rivers in which there is no restriction of entry into the fisheries has resulted in heavy fishing pressure on stocks and attempt at using chemicals [16]. These practices result in a loss of 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, and panga. The main function of locally made netlike sack and panga are to collect poisoned fish from the surface of the water and to kill the fish that are weakened due to use of poisoning plant materials respectively.

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 *Millettia ferruginea* seed, a tree that is endemic to Ethiopia (Figure 1) and the bark of *Balanites 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. However, 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. Using of extracts of certain poisonous plants for fish exploitation could damage some useful macro- and microorganisms which are essential for the stabilization of the ecosystem. These plant extracts pollute the aquatic ecosystem and reduce the fish stocks through uncontrollable mortality.

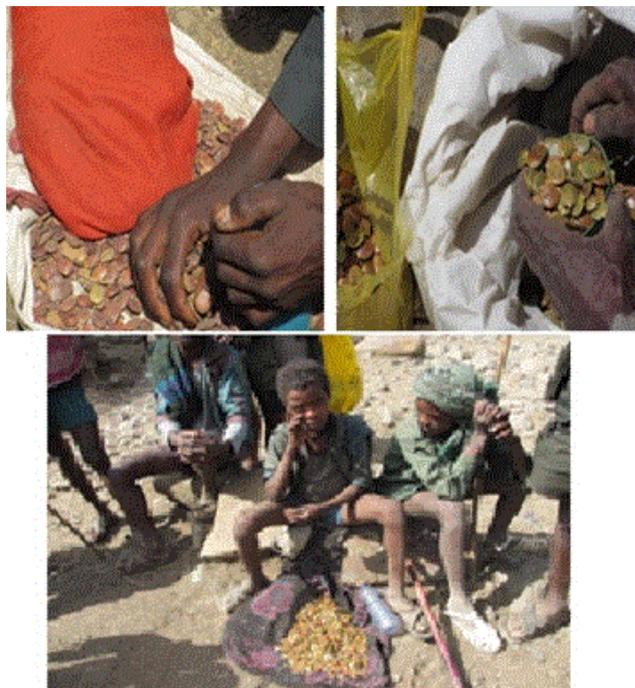


Figure 1: *M. ferruginea* seed sold at the local market by youth and adult men.

The matured seeds in the powder form are used for catching fish due to its toxicity is a common practice in the country. The powder is spread over the water surface for stunning fish. In agreement with this study Karunamoorthi [17] and Choudhury and Shiferaw reported that seed extracts of *M. ferruginea* are extremely toxic to the fishes as well as the environment [17,18]. The seeds are pulverized and are used to take care of the external parasitic and poison the fish by the [19-22]. It possibly affects other beneficial organisms in the aquatic ecosystem and ultimately disrupts the food chain due to their toxic nature. The effect of the two poisoning plant materials used for fishing are quite different. 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 fishes poisoned with the seed of *M. ferruginea* are unable to see the environment it lives and make them float to the water surface for allowing easy catches. A study by Ameha also revealed that solutions of *M. ferruginea* seed powder affect oxygen uptake by the fish and the fertilized eggs [23]. In addition, solutions resulted in abnormal activities such as restlessness, sudden quick movements, rolling movements, swimming on the back, and settling at the bottom. The experiment of Ameha confirmed that when using *M. ferruginea* concentrations of 0.02 to 0.4 g/l, all of the fish died in about 30 to 60 minutes [23]. When we see the fish killed with *Balanites 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.

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. Nevertheless, fishing was ranked as very important for income generation, the most important activities for household food supply is agriculture (cropping) especially sorghum production. Jemma and Wonchit river fisheries are exploited largely by local communities which are open access fisheries for all. 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 also for a large number of rural households that partly and seasonally engaging fishers.

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.

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 [24]. 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 *Clarias gariepinus* [catfish], *Heterobranchus longifilis* [catfish] and *Labeobarbus intermedius* [barbus] fish species in fresh and sun dried forms. Surprisingly, *Oreochromis 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 might 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.

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 Merhabetie are the 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 gutted fish and sun-dried form.

During fish market survey 1.2 m *Heterobranchus longifilis* gutted fresh whole fish was registered (Figure 2).



Figure 2: Gutted *Clarias gariepinus* fish at the marketing place.

Many other medium sized with the range of 70 and 80 cm whole fresh gutted and washed *Clarias gariepinus* and *Heterobranchus longifilis* were also recorded. Large *Labeobarbus 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. This simply shows the livelihood and income contribution of Jemma and Wonchit river fisheries for the smallholder farmers. A study by Okeowo also showed that the business of artisanal fishing is profitable in both locations [25].

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 or seasonal fishers.

According to Moni & Khan, 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 [15]. It also alters households' protein consumption level and income, expenditure and savings pattern of the households. Andersson and Ngazi also reported that fisheries can provide an important contribution to household cash income [26]. This cash income gives access to other benefits such as education, health services, clothing, and other foodstuffs etc. It also allows investment in other assets or enterprises such as land, livestock and fishing gear.

Likewise, fisheries of Jemma and Wonchit have a profound role for food and income generation including for women who mainly 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 dwellers. 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. This shows fisheries of Jemma and Wonchit 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 (Figure 3).



Figure 3: Local fresh and dried fish market at Meragna town from Midaworemo district.

In agreement with our finding, a report by Welcomme RL confirmed that small-scale fisheries 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 [10]. Similarly, Bene, 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 [27].

Different studies showed that the foods we eat can influence our health seriously. On the other hand, fish is the major source of omega-3 fatty acids in the diet and has long been known to lower cholesterol. Therefore, fish can 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. Due to absence of market linkage and transportation problems, fisher sale their catches around the vicinity alone. This increases fish consumption habit around the rural area and it might have high contribution for improve nutrition status of smallholder farmers.

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 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 rather both youths, middle classes, and older age groups are involved in the marketing and fishing. In fisheries, men and women often have

distinct roles. Similar to a study by Erkie Asmare around Lake Tana, in Jemma and Wonchit fisheries only men go to fishing, but women are often involved in marketing and post-harvest processing [11]. In general, women's participation in the fishery sector is restricted especially, fishing is unthinkable. Pre-fishing activities like logistical functions, picking up equipment, crashing seeds of *M. fergusonia*, purchasing seeds of *M. fergusonia* and barks of *B. aegyptiaca*, and post-harvest processing 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.

Opportunities from Wonchit and Jemma river 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. Because of fishers let small fishes out to the water body while they are collecting their catches, Gotera/kefo a locally made fishing gear which has a hive like structure is the best practice. 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 or gutted when there is demand for fish or sun-dried form during fasting season and surplus of production.

Challenges for Jemma and Wonchit river fisheries

- Inaccessibility for transportation and marketing which only delimited to local areas
- Lower awareness of the community about the wise way of utilization and sustainability of the resource
- Non-existence of aquaculture production to supplement the river fisheries and habitat degradation
- Fishers don't get much help from the government in terms of training and other forms of capacity building. That is why fishers use traditional and devastating method of fishing only and the don't care about the resources' sustainability.
- Due to climate change and 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 is by violating regional fisheries proclamation No. 315/2003 article 5(7) which states "fishing by using illegal fishing materials, such as poisons, and fish narcotizing plant is forbidden except for the purpose of research" [28]. Therefore, poor implementation regional fisheries regulation was clearly observed.

Destructive way of fishing by the inhabitant is 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.

Conclusions 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. ferruginia* 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 *Labeobarbus 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. ferrugunia* and *B. aegyptiaca* by implementing regional fisheries proclamation No. 315/2003 article 5(7). Support the fishermen in terms of fishing and processing equipment which are eco-friendly techniques; 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 *Heterobranchus 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 [7]. 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. ferrugunia*. Finally, the effect of poisoning plant materials on the biology of fish must be studied.

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