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Research Article

Composition, Distribution, Fishing Activities, and Physico-Chemical Characteristics: The Case of Jemma and Wonchit Rivers, Amhara Region, Ethiopia

Abstract

The distribution of fish species in Jemma and Wonchit Rivers was studied from November 2012 to May 2014 based on samples collected during wet and dry seasons using gillnets of 60, 80, 100, 120 and 140 mm stretched mesh sizes. *Labeobarbus intermedius, Labeobarbus nedgia, Heterobranchus longifilis, Bagrus docmak, Varicorhinus beso* and *Oreochromis niloticus* are commercially important fish species found in both rivers of the pooled experimental fish catch. But, *Synodontis schall, Ramias loti, Labeo forskhalii, Tilapia rendelii, Mormyrus kannume* and *Bagrus bajad* are found in river Jemma only. The high level of pH in Wonchit (9.14) may be lethal for some of the fishes that found in the river. The pH in Jema (8.79) might indicate higher productivity of water, but it is very approximate to the higher limit. The most likely explanations for the fishing activity of fish species are the increase of the illegal commercial plant poisoning material used for fishing activities that seriously affects the riverine fishery of the surroundings. Fishery targeting their aggregations in the pooled, and the increasing trend of the degradation of spawning and nursery habitats by poisoning plant in the water pooled area should be protected. This means, there should be a need for urgent development of a management plan focusing on ensuring sustainable utilization of a resource. Control the production grounds of *Millettia ferruginea* poisoning plant from its source and its market is important.

Introduction

Shibru Tedla [1], has listed and described about 94 species of fishes in Ethiopia. Although extensive review work is in progress, it appears that there are about 183 valid indigenous species included in 25 families so far known from Ethiopian fresh waters [2]. At the moment, we have no clear and complete list and description of the diversity of the fish fauna of Ethiopia.

Many of the drainage basins, especially the rivers, are not exhaustively explored [2]. According to Abebe Getahun [3], there are about 38 species and two sub-species endemic to Ethiopia. Lake Tana from Abay drainage basin exclusively has larger number of endemic species (twenty one species) in the country [3]. According to Golubtsov and Mina [4], the total numbers of valid fish species known from Ethiopian inland water bodies is about 168 to 183 including 37-57 countrywide endemics. There are also about 10 exotic fish species introduced from abroad into Ethiopian freshwaters [5]. The Rift valley is the region with highest number of introduced fish species. Eventhough there are about 25 fish families reported in Ethiopia [3,4]. Currently, results of a study indicate that the number of species could increase to 200 and above [6].

The freshwater fish fauna of Ethiopia contains a mixture of Nilo-Sudanic, East African and endemic forms (Boulenger, 1975; Banaerscu, 1975; Nichols and Griscom, 1975 and Roberts, 1975 as cited in Abebe Getahun and Stiassny, 1998). The Nilo-Sudanic forms are related to West African fishes and this is believed to be past connections of the Nile to central and West African river systems [2,7,8,]. The Nilo-Sudanic forms are the dominant forms in terms of diversity and represented by a large number of species found in the Baro-Akobo, Omo-Gibe, Tekeze and Abay drainage basin (e.g., the genera *Alestes*, *Bagrus, Citharinus, Hydrocynus, Hyperopisus, Labeo, Mormyrus*, etc…) [2]. These forms dominate the Nile basin fishes [2]. de Graff [9], has described some of the elements of the Nilo-Sudanic species from southern Rift valley lakes. These include the families Mormyridae, Cyprinidae, Bagridae, Clariidae and Mockokidae.

Wonchit and Jemma Rivers are some of the rivers flowing to lower course of Abay, in which adequate attention has not been given in the study of the diversity, abundance, fishing activity and socio-economic conditions of fish fauna due to inaccessibility for transportation, security and harsh geographical features. The purpose of this study was, therefore, to answer the following leading research questions:

Do Wonchit and Jemma Rivers fishes vary in species composition?

What do fishing activities look like and what type of fishing gears used?

What is the current water quality status of the two rivers look like?

General objective

The major objective of the study was to generate baseline scientific information/ data about economically important and commonly found fish species for management and sustainable utilization of the resources

Specific objectives

- To generate baseline information for fishing and marketing activities of the study areas.
- To identify species composition of fishes in the rivers.
- To characterize physico-chemical parameters of the rivers.

Materials and Methods

Study area

Data was collected from November, 2012 to June, 2014 considering wet and dry seasons of a year that means four time sampling have been done during the study period. Wonchit and Jema Rivers are mainly found in North Shewa zone of Midaworemo and Merhabetie Woredas, respectively and they are in drainage basin of Abay River. Major beneficiaries of the fisheries resource are Midaworemo, Merhabetie, Muteranajiru, Ensaro and neighboring Woredas of south Wollo of the same region and Woredas from Oromia region are main ones.

Stratified sampling sites were selected based on its topography, encroachment and fishing activities. Samples were collected using gillnets of various mesh sizes (6 cm, 8 cm, 10 cm, 12 cm and 14 cm stretched mesh) and monofilament nets with various stretched mesh sizes (5 mm-55 mm stretched mesh). Specimens were brought to the lab for species identification purpose. Purposive sampling techniques were used to address fishers. Personal observation was also made during the market day.

Results and Discussion

Fishing and marketing of fish in wonchit and jema rivers

The catches of fishers used for both home consumption and generate income by selling at the nearby local markets. Hence, Meragna town from Midaworemo and Alemketema from Merhabetie are towns where fish market was commonly practiced during the market day. The most popular fishing gear used for fishing were *Millettia ferruginea* and *Balanites aegyptiaca* in Amharic called Bedeno, Jemo or Kudkuda (locally available plant poisoning material). The plant materials used for fishing are seeds of *Millettia ferruginea* and barks of Bedeno by crashing and diluting with water, squeeze and then, spread over the surface of the pooled water bodies starting from post rainy seasons up to just pre-rainy seasons of a year. The effects of two different plant poisoning materials used for fishing are quite different; *Maletia fergunia* damages the eye of the fish (ref.). As a result the poisoned fish is unable to see the environment it lives, so it becomes too susceptible for fishers trap (ref.). But when we see the fish killed with Bedeno its body cavity had bad smell and changed its normal color to black color.

Catches of the fishers brought to the market into two different forms:

Whole fish gutted and sun dried 2) whole fresh fish gutted and washed.

During fish market survey 1.2 m *Heterobranchus longifilis* gutted fresh whole fish was registered which was caught by plant poisoning materials. Many other medium sized with the range of 70 cm and 80 cm whole fresh gutted washed *Clarias gariepinus* and *Heterobranchus longifilis* were recorded. Large *Labeobarbus* fish species appeal at the market in sun dried forms filled in sacks. During market transaction period, most of the time customers were rural women. Catches of fishers brought to market by both men and women. Age structures were not clearly observed, youths, middle classes and old aged groups were equally involved in the market to sell their product. *Millettia ferruginea* seed was sold to the fishers in the local market from where it grows at relatively higher altitude areas of the vicinity. Fishing activities with plant poisoning materials had been mainly carried out by youth and middle class male society groups. These fishing activities were intensively carried out during the dry seasons starting from February up to the end of fasting seasons where no farming activity is taking place. These seasons are very conducive for fishing, because the volume is low and make intermittent pools which would be important for plant poisoning materials to be concentrated and not washed out by running waters. Mass flee of fishers about 30 individuals in one

Figure 1: Mass flee of fishers to downstream of Jemma River by carrying plant poisoning materials, locally made netlike sack material and Gejera to kill the weakened poisoned fish.

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group to downstream by carrying plant poisoning materials, locally made netlike sack material to collect poisoned fish from the surface of the water and Gejera to kill the weakened poisoned fish and sacks to hold their catches was common (Figure 1).

Distribution and composition of fish in wonchit and jemma rivers

In the catches of fishes of Wonchit River, seven different species were identified and registered (Table 1). Of which the three species namely: *O. niloticus*, *C. gariepinus* and *H. longifilis* are nominated for aquaculture activities as a farmed fish (ref.). *O. niloticus* is considered as non-edible species in the vicinity of communities (Table 1). Hence, strong extension service is required to use natural resources in a sustainable manner. During this century this type of thinking has a negative impact on food security strategies of the region.

In the catches of fishes of Jema River, twelve different species were identified and registered (Table 2). Of which the three species namely: *O. niloticus*, *Tilapia rendelii* and *H. longifilis* are nominated for aquaculture activities used as a farmed fish (ref.). *O. niloticus* is also considered as non-edible species in the vicinity of communities in the river catchment of this river (Table 2). At this river, the primitive type of fish species (ref.) was registered which is named as *Mormyrus kannume*.

Table 1: Composition of fish in Wonchit River.

No.	Scientific name	Local name
1	*Labeobarbus intermedius*	Azat
2	*Labeobarbus nedgia*	Azat
3	*Varicorhinus beso*	
4	*Heterobranchus longifilis*	Zemetu Gilgel
5	*Clarias gariepinus*	Michilig (Chilug)
6	*Oreochromis niloticus*	Qurquishit

Table 2: Composition of fish in Jema River.

No.	Scientific name	Local name
1	*Bagrus docmak*	Foroks
2	*Synodontis schall*	Zuza
3	*Oreochromis niloticus*	Qurquishit
4	*Ramias loti*	-
5	*Labeo forskhalii*	Tseyimat
6	*Labeobarbus nedgia*	Azat
7	*Labeobarbus intermedius*	Azat
8	*Heterobranchus longifilis*	Gilgel
9	*Varicorhinus beso*	
10	*Tilapia rendelii*	Qurquishit
11	*Mormyrus kannume*	Yeayit Assa
12	*Bagrus bajad*	Foroks

Table 3: Physical properties of Wonchit and Jemma Rivers.

Parameters	Jemma River	Wonchit River
pH	8.79	9.14
Oxygen in mg/l	6.43	6.08
Temperature unit	23.79	24.74
TDS in g/l	261	242.5
Salinity unit	0.195	0.175
conductivity unit	393	371

Table 4: Chemical properties of Wonchit and Jemma Rivers.

Parameters	Jemma Mean value	Wonchit Mean value
Phosphate (mg/)?	1.13	0.655
Ammonia (mg/l)	0.26	0.03
Nitrate (mg/l)	0.594	0.694
TH??? mg/L	135	126
Sulphate???	7	33
Alkalinity (mg/L)	181.5	180.5
Turbidity (NTU)		

Table 5: Different taxa in Wonchit River.

Taxa	abundance	Ind. /m3
Baciliarophyceae (Diatom)		
Meloseria	3	300
Navicular	3	300
Synedra	60	6000
Cladocera		
Bosmina	3	300
daphnia	6	600
ceriodaphnia	3	300
Chrysophyceae (Golden-brown algae algae)		
Denobryan	3	300
Diatom		
brachionus	1	100
insect (Plecoptera)		
stone fly	1	100

Physico-chemical properties of the two rivers

The high level of phosphate value of Jema shows the river was in a condition to be not suiTable for aquatic organisms (ref.). High pH value which indicates excessive alkalinity might be harmful to aquatic organisms. A pH value of 9 may be lethal to fish [10]. The high level of pH in Wonchit (9.14) mightbe lethal for some of the fishes that found in the river (ref.). The pH in Jema (8.79) might indicate higher productivity of water [11], but it was very approximate to the higher limit?? [12]. The two rivers were very turbid, which may indicate the high rate of siltation which, in turn, decreases the depth of the rivers (Tables 3-5).

Challenges and opportunities of the two rivers regarding to fishes and fisheries Challenges

Fishing activities carried out at both rivers are??? In most cases are??? The same activities they followed. Fishers used fishing gears locally made from plant materials like fikenet locally called Kefo. This material has traditional hive like structure which has parts inside the hive that allows the entrance of the fish, because fishers put bait material mainly cereal crops like sorghum at the end code side of the

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Figure 2: *Millettia ferruginea* sold at the market of Midaworemo which is main Woreda town.

Figure 3: Fish market brought from Wonchit River by fishers of both men and women.

Figure 4: Algal production types and biomass in Wonchit River from November to March.

fykenet. This part would not allow the trapped fish to come out of the fykenet once get into the fyke to eat the placed bait. Fishers did not need to come every day to check and take the trapped fish, but they can come any time and take the fish by selecting the big ones or else all of them. This system can be belonged to either selective or non-selective, it depends on the size preference of the fishers.

Plant poisoning material (*Millettia ferruginea*) is commonly used fishing gear and its seed widely produced at high altitudes of the surrounding and brought to market for sale during the market day (Figure 2).

Fish catch brought to market during every market day by both men and women individuals mostly middle aged groups with no gender discrimination. But fishing activity is totally carried out by men. Catches could be gutted fresh whole fish or it could be sun dried fish products. Big sized gutted fresh whole fish sold from 40 to 50 Ethiopian Birr (Figure 3).

Extended period of algal production in both rivers are creating a problem to fish using gillnets in the surrounding (Figure 4). During both sampling periods, wet and dry seasons was in full production potential conditions, as a result gillnets were unable to gilled the fish. Because the eyes/holes of the gillnet clogged with the filamentous algae so that the chance of trapping fish was almost none. High algal biomass production was observed from November to March of the present study period (Figure 4).

Fishers made trap from locally available rope materials, and operated by themselves manually while poisoned fishes came to the surface and try to pass through purposely built narrow spillways supported by the water current drained to down streams (Figure 5).

Conclusion

Even though there are diversified fish species in the two rivers, inhabitants fishing activity was very traditional (used non-selective plant poisoning materials these are *Malletia ferginua* and Bedeno). The results of phosphate and pH was above recommended level, showing that the two rivers received very high amount of pollutants from the

Figure 5: Local made trap net used to sieve poisoned fishes.

surroundings most likely contaminated by fertilizers and pesticides from agricultural runoff. Fish marketing was carried outduring the market day in un-hygienic manner. Among the available fish species there are fish species which can be used for aquaculture purposes (*O. niloticus* and *H. longifillis*).

Existence of' traditional knowledge both for home consumption and marketing of fish of the community create good opportunity to expand fisheries in the surrounding. Presence of diversified fish species in both rivers could help the community to satisfy their nutritional requirement and generate income. There is a room for good accessibility for fish catch transportation and marketing (Road and Electric).

Recommendation

- Awareness creation for the inhabitants for wise use of fishery resources (avoid plant poisoning material marketing and protect from where it grows) by developing local bylaws and/or implementing fishery proclamation and legislation of the region.
- Provision of appropriate fishing gears (multifilament gillnets) and train ways and means of using the materials
- Establish good and hygienic marketing systems
- Introduce and disseminate knowledge how to dry their catch and brought to market, for instance Solar tent fish drier technology
- Physical and biological soil and water conservation strategies to minimize siltation or nutrient load of rivers
- Train the inhabitants how *O. niloticus* (locally called Qurqushit) 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.
- Further investigation on fish diversity and algal type and usage is important
- Algal production system along the rivers should be investigated and try to use this biomass for food, medicine or for any other valuable biological products.

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