Assessment of Fin Fish Composition, Diversity and Abundance in the Upper Course of Otamiri River, Imo State

Abstract
The fish composition in the upper course of Otamiri River was investigated for six months between July and September 2019, to determine the related abundance and diversity of fish species in the river. Fish species were collected weekly using fishing gears from three sampling stations which were purposefully selected. Sixteen species of fish belonging to nine (9) fish families were recorded. Among the families, *Cichlidae* recorded the most abundant at 83.3%, followed by Notopteridae (6.7%), Alestidae (4.2%) and *Clarotidae* (3.8%). Others include: Hepsidae (0.4%), and Cyprinidae (0.2%), while *Channidae* and *Gymnarchidae* were recorded as the least abundance with values of 0.1% each. The study showed that *Sarotherodon melanotheron* has the highest diversity with the value recorded 3.18, followed by *Coptodon* zilli having the value 3.09 respectively. It also shows that *Barbus occidentalis* with the value 0.69, followed by *Coptodon dageti* with value 1.01 has the least diversity. The study also showed that *Pelmatopia mariae* with value 0.99 was highly distributed. From the study, the fish species harvested from this water body have low population. This has great implication on the stock in the fishery and can also act as an indicator of over-exploitation of this species. Regular and detailed study on species composition of this water body should be encouraged for the sustainable utilization of its resources, also a proper restocking of Otamiri water body should be embarked on by Imo State government to enhance fresh water fish availability in the State and its environs.

Key Words: Fish, species, abundance, diversity, physicochemical, Otamiri River

Introduction

Fishery resources should play important role in the development of nations endowed with lots of natural maritime and freshwater ecosystems like Nigeria since fishes are obligate aquatic organisms. Apart from being a cheap source of animal protein, fishery resources contain other essential nutrients required by the body for healthy living (Sikoki *et al*, 2008). The importance of fish as a source of protein is an indisputable fact. Fish is mainly eaten for its protein contents; the human body utilizes protein from fish better than protein from beef, pork, chicken and milk (Olanusi, 2001). All the protein from fish is adequate, important and digestible. Fish is also valued as a source of Omega-3 (n-3) fatty acids, very long chain poly unsaturated fatty acids which is critical for the development of the brain and retina which may protect one from some chronic disease (Olanusi, 2001). Fish is an excellent source of vitamin B (niacin) which assists in the functioning of the digestive system, skin and nerves (Olanusi, 2001). Fish can also contribute appreciable amount of dietary calcium, iron, zinc and nutrients that tend to be low in people diets. Fish is among the best source of dietary selenium (Schoener, 1998).

It is a widely accepted view that the fish yield of most Nigerian inland water are especially on the decline (Nwaturuogu, 2018). The decline of these fisheries has been attributed to a wide range of causes ranging from environmental degradation of the water bodies to inadequate management of the fisheries resources. According to Orji, (1989), Otamiri has a wide variety of fishery resources many of which might offer possibilities of utilization by modern methods of resource management. Okukwu (2012) identified 20 fish species from 10 families from the Otamiri River in Imo state. For sustainability of these resources, an adequate knowledge of species composition, diversity and relative abundance of the fisheries resources of the water bodies must be understood. Increased fishing pressure exerted by artisanal fishermen that are operating in this water body coupled with the downstream migration of fish in search for food, shelter and spawning, industrialization, urbanization and farming activities around the river are factors that contribute to variation in fish composition and diversity.

After more than 21 years of study by Okereke (1990) on this river, it was needful to once again study the fish species composition of this river in order to have a picture of the occurrences in the ecosystem as a precursor to advising on the most efficient use of the river for socio-economic development. Owing to the continuous decline in the water quality, the effect of dredging, and variations in the fish composition from the earlier researchers, there is need for update in the fish composition information on the river.

Materials and Method

The study was carried out at the upper course of Otamiri River, Owerri in Imo State. The Otamiri River catchment is located in southeast Nigeria, bordered geographically by latitude 4^0 45' 14''N and longitude 7^0 08' 30''E. The Otamiri River is joined by the Nworie River at Nekede in Owerri, a river about 9.2km in length (Okereke, 1990).

The River passes through Ihiagwa and Nekede autonomous community in the Owerri West Local Government Area in Imo State, Nigeria. The River runs south from Egbu to Owerri and through Nekede, Ihiagwa, Eziobodo, Olokwu Umuisi, Mgbirichi and Umuagwo to Ozuzu in Etche, in Rivers State. The length of the river from its source to confluence at Emeabiam with the Oramiri-ukwa River is 30km (Fig. 1). The Otamiri watershed covers about 10,000km^2 with annual rainfall 2250 – 2500mm. The area around the water shed is dominated by rainforest vegetation, with mean temperature of 27^0C throughput the year (Okereke, 1990).

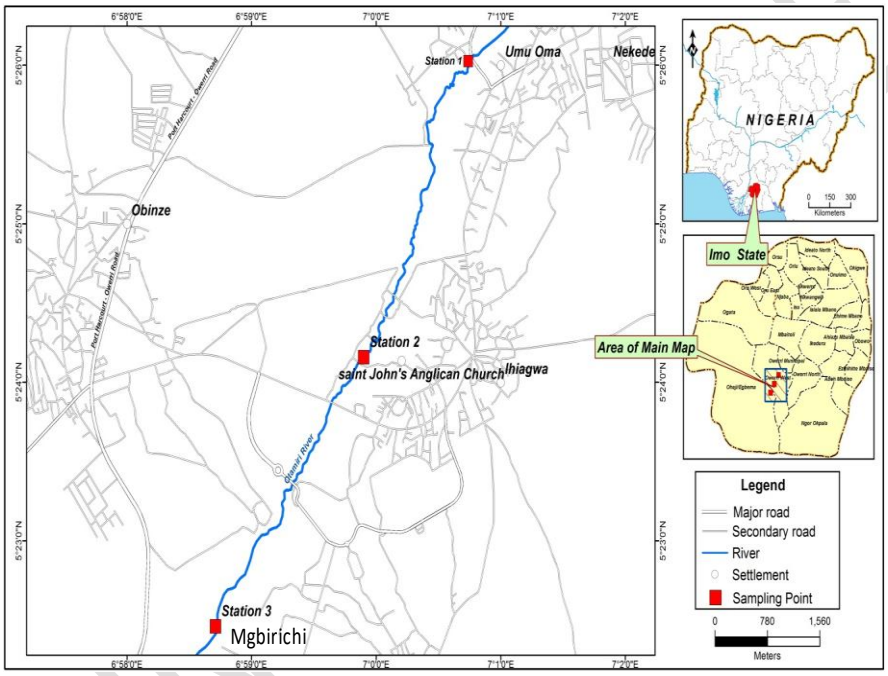

Figure 1: Map of Otamiri River showing the Sampling Stations (Sources: Cartographic Unit,, University of Ibadan, 2019)

Three (3) sampling stations were selected for study in Otamiri River with specific locations based on a reasonable distance apart and the activities around the river.

Station 1 was located at Nekede, Owerri, Imo State. It is located at latitude $5^0$26'N and longitude 7^o08'E and elevation of 3.5m. The mean annual rainfall, temperature and relative humidity are 250mm, 26.5 – 27.5^{o}C and 70 – 80% respectively (Atlas, 1984). The water is mostly covered by depleted rainforest vegetation. The activities carried out within the sampling station are sand drenching and car washing.

Station 2 was located at Ihiagwa, Imo State. It is located at latitude $5^0$39'N and longitude 6^o99'E and elevation of 3m. The mean annual rainfall, temperature and relative humidity are 250mm, 26.5 – 27.5^{o}C

and 70 – 80% respectively (Atlas, 1984). The catchment area is made up of rain forest vegetation, with mean temperature of 27°C. The activities carried out within the sampling station are sand dredging and car washing.

Station 3 was located at Mgbirichi, Ohaji/Egbema Local Government Area of Imo State. The town lies on the Otamiri River downstream from Nekede/Ihiagwa and 26km from Owerri on the Port Harcourt Road. They cut across the Arab Company in Mgbirichi. Activities carried out around the area include Fishing, mechanic repairs and block molding.

Samples were collected from the river weekly for six months between the months of April to September, 2019. Data on fish species were collected weekly using gill-net, trammel-net, single hook and line, long-hook and line, Mali trap, wire basket trap for a period of six months. The number of fish caught in each sampling station were counted and recorded accordingly. The number of fish species caught by each of the fishing gear were also counted and recorded. The weights of each fish were obtained using digital weighing balance (model Tescoma Acura QC passed No. 05) to the nearest 0.01g. The standard length, fork length and total length were also measured. Fish samples were sort out, counted and identified using Nigeria fresh-water identification scheme of Babatune and Aminu (2013).

Single hook and line and baited long lines were used for fish capture. The single hook and line was used for fishing from 8am to 4pm. For the long lines, it was baited and set overnight from 7pm to 6am. The hooks were baited mostly with earthworm. A total of 30 sets of gill-net with stretch mesh sizes ranging from 6.675cm, 5.715cm, 8.89 cm, 8.255cm, 7.62cm, 52.07cm, and 6.35cm were used. The net was set overnight between 6pm – 7am, and checked thereafter for catches.
A trammel net consists of two/three layers of netting with slack small mesh inner netting between two layers of large mesh netting within which fish will entangle. These nets are strings of single, double or triple netting walls kept more or less vertical by floats on the head rope and mostly by weights on the ground rope. These are occasionally set in strings. Small Solid/Coats, usually made of plastic and either cylindrical or egg-shaped, are attached to the head rope and lead weights are evenly distributed along the ground rope. A total of 2 sets of gill-net with stretch mesh sizes ranging from 52.07cm, 7.62cm and 5.715 were used. This had a mesh sizes of is 5.715cm, it is built with bush rope that is folded in cylindrical form, some attractant sources such as kwilikwili was introduced inside, this attractant has attractive aroma, which can attract fish to enter inside.
A basket wire trap is a trap used for fishing. The mesh wraps around the fame and then tapers into the inside of the trap. When a fish swims inside through this opening, it cannot get out, as the chicken wire opening bends back into its original narrowness.

Statistical Analysis
Shannon Weiner's Index (H), Margarlef Index (J), Evenness (E) and Equitability (Q) were used to analyze the diversity and evenness of the caught fish species.
The Shannon Weiner diversity index (H) was used with the formulae given as:

$$H = \sum[(ni/_N)]$$

Where, ni is the number of individuals of each species (the ith species), N is the total number of individual or amount for the site and In is the natural logarithm (Shannon Weiner, 1963)

Species Richness using Margalef's Index

$$d = \frac{(S-1)}{Log\ N}$$

Where S= Number of species presented

N = Number of individuals

Results and Discussion

Fish Composition and Diversity

The check list of the encountered fish species during the study period is presented in Table 1.Cichlidae was observed to record the highest percentage abundance during the study with abundance count of 780 (83.3%), the other fish families showed the following abundance: Notopteridea 63(6.7%), Clarotidae 36(3.8%), Alestidae 39 (4.2%), Hepsidae 4(0.4), Mormyridae 10(1.1%), Gymnarchidae 1 (0.1%), Channidae 1 (0.1%), Cyrinidae 2 (0.2%). The dominance of cichlid fishes agrees with what is obtained in many other lakes and reservoirs in Nigeria (Adaka, *et al.,* 2016). The dominance of this family in terms of species diversity, number and weight could be attributed to the presence of high food resource such as plankton (Nwadiaro, 1989) and their prolific breeding capabilities.

The total of 936 fishes was caught during this study, the three station used for the research recorded some number of fish caught. Station 1 recorded a total of 417 fishes with the mean weigh 26084 and average weight of 73.3, Station 2 recorded a total of 377 fishes with mean weight 2478.5 and average weight of 71.6 while station 3 recorded a total of 142 with mean weight of 7673 and average weight 73.1. In all of the station *Sarontherodon melanotheron* recorded the highest percentage in each station.

Table 1: The check list of the fish sample from Otamiri River from April to September 2019

FAMILY	**Species**	**Total Abundance**	**Sub Total abundance for the families**	**Percentage Abundance**
CICHLIDAE	*Sarotherodon Melanotheron*	536	780	83.3
	Hemichromis elongatus	14		
	Coptodon zilli	112		
	Pelmatochromis guntheri	3		
	Coptodon guineensis	3		
	Coptodon zilli	95		
	Pelmatopia mariae	4		
	Coptodon dageti	13		
NOTOPTERIDAE	*Papyrocranus afer*	63	63	6.7
CLAROTIDAE	*Chrysicthy nigrodigitatus*	36	36	3.8
ALESTIDAE	*Alestes macrolepidotus*	39	39	4.2
HEPSETIDAE	*Hepsetus akawo*	4	4	0.4
MORMYRIDAE	*Mormyrops deliciosus*	9	10	1.2
	Petrocephalus bane	1		
GYMNARCHIDAE	*Gymnarchus niloticus*	1	1	0.1
CHANNIDAE	*Parahiocephalus obscura*	1	1	0.1
CYPRINIDAE	*Barbusoccidentalis*	2	2	0.2
TOTAL 9	**17**	**936**	**936**	**100%**

Table 2: Diversity indices of total fish species caught in Otamiri River during the study period

Taxa	**H**	**J**	**E**	**Q**
Sarotherodon Melanotheron	3.18	5.57	0.67	0.89

Hemichromis elongatus	2.11	3.03	0.91	0.96
Coptodon zilli	3.09	5.51	0.82	0.94
Pelmatochromis guntheri	1.09	1.82	0.00	0.00
Papyrocranus afer	2.98	5.26	0.82	0.94
Chrysicthys nigrodigitatus	2.83	4.70	0.89	0.96
Alestes macrolepidotus	2.70	4.91	0.79	0.92
Hepsetus akawo	1.95	3.08	0.00	0.00
Mormyrops deliciosus	2.09	2.72	0.89	0.95
Petrocephalus bane	0.00	0.00	0.00	0.00
Coptodon guineensis	0.00	0.00	0.00	0.00
Tilapia dageti	1.01	0.78	0.92	0.92
Pelmatolapia mariae	1.09	0.76	0.99	0.99
Gymnarchus niloticus	0.00	0.00	0.00	0.00
Channa obscura	0.00	0.00	0.00	0.00
Barbus occidentalis	0.69	1.44	0.00	0.00

(Species identification adopted from Olaosebika and Raji, (2013)
H = Shannon Weiner's
J = Margarlef index
E =Evenness
Q = Equitability

Table 2 revealed the fish species with the highest diversity was *Sarotherodon melanotheron* with the value 3.18, followed by *Coptodon zilli* having the value 3.09 respectively. The table also shows the fish species with the least diversity as *Barbus occidentalis* with the value of 0.69, followed by *Pelmatolopia dageti* with value 1.01 respectively. In terms of the equitability or evenness some fish species was evenly distributed in the upper course of Otamiri River, the fish species that were evenly distributed were *Pelmatolapia mariae* with the value 0.99, followed by *Hemichromis elongatus* with value 0.96 and *Chrysichthys nigrodigitatus* with the value 0.96 respectively. Otamiri River contains different kinds of fish species. A total of 936 fish were caught from the study area. These were identified and classified into 16 species of fish representing 9 families. The species composition is lower than the results of other studies in other water bodies. Adaka, *et al.*, (2016) with 32 species and 18 families from Oguta lake; Lowe McConnell, (1964) encountered 44 species on the Rapennine River. Okereke (1990) in her study of Otamiri River, Imo State recorded 46 species in 20 families. Other comparable study results include; Nwadiaro (1989) 98 species from Oguta lake. Abowei, (2000) 36 species from 22 families in Nun River; Adaka, (2016) with 23 species and 10 families from Njaba river; Sydenham, 1979 of Ogum River (85 species), Victor and Tetteh (1988) 58 species from Ikpoba River, Imeobore and Okpo (1975) 70 species from Niger, Nwadiaro and Okereke (1993) 46 fish species from 20 families from Otamiri River and (Okukwu, 2012) 20 fish species from 10 families from Otamiri River. Some factors that could affect the populations of freshwater species include; simple habitat loss resulting from withdrawal of water for human use such as irrigation, domestic and industrial use; impact of anthropogenic factors; impoundment, wetland drainage and flood control which cause the load of inorganic and organic pollutants. The 16 fish species encountered in the study is however, higher than the number recorded by Alfred-Ockiya (1998) in Kolo Creek (11 species). Sydenham (1975) in Odo-ona Stream (13 species). The conspicuously absent from the present study of some species notably cichlid species like *Oreochromis niloticus*, mochokid, and large species like *Lates niloticus.* This could be related to high fishing effort and human population explosion as earlier observed by Ita and Balogun (1983). It is worthy of note the present of *Hepsetus akaro* mostly found in the Cross River which was not found in other earlier literature of the water body. This could be as a result of high flood that has occur in the recent times within the Cross River basin. The result shows that Otamiri River consists of various fish species that can be compared favorably with other fresh water bodies. This study recorded low species abundance probably owing to over exploitation and other factors earlier mentioned. A management plan should be initiated, enforced and properly funded to

prevent the collapse of the fisheries and the social and economic disruption which will inevitably follow. More especially since the fisheries operate under conditions of free and open-access. This information can be used for management decisions and formulations of resource development in the area in addition to the provision of a checklist for fisheries study.

Conclusion

From the study, the fish species harvested from this water body are low in population. This has great implication on the stock and can also act as an indicator of over-exploitation of these species and also level of management of their habitats. Human activities of the communities living along the river reach such as uncontrolled sand dredging, application of fertilizers and other chemicals by farmers etc may be attributed to the low composition.

There is need to curb or monitor indiscriminate sand dredging in the river as this activity could contribute to the low number of fish species as a result of disrupt natural fish habitat and migratory routes as well as the physicochemical composition of the river.

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