



Biodiversity of Fish Fauna in River Niger at Agenebode, Edo State, Nigeria

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ABSTRACT

The River Niger is blessed with diverse fish species and aquatic life. The study of the fish fauna and biodiversity along the River Niger was conducted from October 2016 to December 2018. A total of 35 species belonging to 18 families were obtained from this study. New to this River as regards literature are the family Solidae and Catostomidae. The sole fish (*Solea solea*) (0.16%) with only 1 representation while the Catastomids were represented by 3 species; *Ictiobus niger* (1.73%), *Ictiobus cyprinellus* (2.20%), *Ictiobus bubalus* (2.52%). Other species obtained were the *Mormyrus rume* 3.93%, *Polyterus bichir* (2.99%) and *Protopterus annectens* (7.08%). The most abundant of species observed was *Gymnarchus niloticus* (8.49%) of the family Gymnarchidae while the least was *Solea solea* (0.16%). The biodiversity indices revealed that Station 2 had the most evenly distributed species and the most of diverse species though Station 1 had the most number of species. Station 3 however had the least of species obtained. It is concluded the River Niger is still productive and in good condition, capable of maintaining and managing fish species according to condition factor.

INTRODUCTION

Nigeria is a country blessed with vast expanse of land of in-land fresh water bodies, brackish waters and marine waters. These waters are blessed with diverse fish species and aquatic life. The largest diversity in vertebrates is found in fishes with approximately 250,000 species (Froese and Pauly, 2018). This great biodiversity is mainly a reason why it is a sustainable source of food supply to man and also a main source of stability to many tropical fishes providing a necessary reason for conservation. In recent past, it is observed that the global level of fish supply is becoming insufficient to meet the ever increasing demand of the human pressure due to population increase (FAO. 1999). The diversity, culture and management of fish species depends mainly on their abiotic and biotic factors and types of ecosystem available, the meristic and morphometric factors; age of fish, water level and turbidity also play a great role in the sustenance of fish life. (Agbugui and Oniye 2013).

In recent past, researchers have reported on the drastic decline in the quality, quantity, size and diversity of fish among the large species in the lower Niger River. Such fish species include the *Lates niloticus*, Gymnarchidae, *Protopterus annectens*, Cichlidae and *Heterobranchium bidorsalis*, *Clarias gariepinus* and the chichilds. (Obasohan and Orunsaye, 2006; Solomon *et al.*, 2012; Oguntade *et al.*, 2014). Studies

in biodiversity of fresh water fish in relation to habitat were also carried out by Watters (1992); Ita (1993); Allison and Okadi (2013) and Oguntade *et al.*, (2014) who reported relative abundance of fish fauna and species diversity. It was further revealed that fish diversity was influenced by variation in mesh sizes. Reports from these researches have revealed a gradual but alarming decline in the diversity of fish fauna. These reports provide and necessitate the periodic analysis and survey of the fish fauna and continuous collection of data to checklist the fish fauna for proper management.

The River Niger at Agenebode is located at 706'N 642'E. Agenebode is a waterside town located by the banks of the River Niger. Agenebode is located at the lower River Niger, typically with a humid climate and weather of approximately 32°C. The area is marked by 2 seasons, the wet season and the dry season. The wet season is from April to October and the dry season is from November to March. The lower Niger River at Agenebode is a boundary between Idah in Kogi State and Edo State. The River servers the people of Edo and its environs with a route for transportation to other neighboring communities; a fishing spot and fishery; market and a source of water for domestic purposes, farm, irrigation, industrial purposes and trading location for local traders and the riparian localities at the popular Bode Market.

The purpose of this study is to access the diversity and abundance of fish fauna at Agenebode in River Niger. The results obtained will contribute to existing knowledge on the state of the fish fauna in the River.

MATERIALS AND METHODS

Sampling Unit

Three sampling stations were used based of the major catch landing points along the River. Station 1; Idah Jetty, Station 2; Bode water front (Inueda) and Station 3; Solomon's camp by Weppa, all in Etsakor East Local Government Area of Edo State.

Sampling:

A total of three hundred and ten (310) fish species were sampled for 15 months from October 2016 to December 2018. Fishes were collected from catch landings by fisher folks at Agenebode by the use of canoes, outboard engines, gill nets, cast nets, drag nets, long nets, fish traps and calabashes. Samples of fishes were collected monthly throughout the sampling period.

Identification:

Fishes were identified to species level using guides, keys and pictures provided by Freose and Pauley 2018 and then preserved in 5% formalin.

Measurements and Data

The total length (cm) and weight (g) were taken by using a graduated meter rule and weighing balance. The total number of fish caught from the river was recorded also per species. The condition factor of fish was determined using the Fulton condition factor as described by Lecren (1951). The length weight relationship of all species was determined using the relationship $W = aL^b$, where "W" is weight of fish (g), "L" is the standard length (cm), "a" is the regression constant and "b" is the regression coefficient.

Statistical Analyses

The diversity Indices or Information Theory Indices was used to analyse the ecological statistics

A) The Shannon Index (H^i): was used to measure the diversity of species -----

$$(H^i) = - \sum_{i=1}^s pi \ln pi$$

B) Shannon Wieners Diversity Index (H)

C) Evenness Index (E): This is used to observe the spread of species in a habitat. This is expressed as the ratio of the observed diversity (H) to the maximum diversity (H_{max}). Evenness is expressed as -----

$$\frac{H}{H_{max}} = \frac{H}{\text{Log } S}$$

D) Species abundance: this analyses the richness of a species in a population and habitat. This is expressed using the Margalef’s species richness (d) and expressed as follows

$$\frac{S-1}{\ln N}$$

E) Simpsons’ Dominance Index: this evaluates the dominance of species in a habitat. They are weighted towards the commonest species. It is expressed as Simpsons Idex

$$(C) = \sum_{i=1}^s Pi^2$$

RESULTS AND DISCUSSION

A study of the fish species obtained in River Niger at Agenebode is presented in Table 1. The biodiversity of fish species obtained from the River Niger is represented on Figure 1, showing the various species of fish obtained.

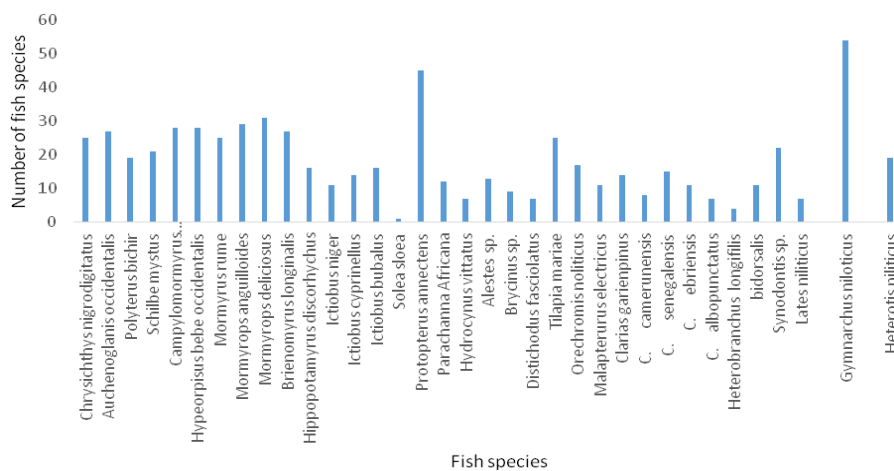


Fig. 1: Fish biodiversity of River Niger at Agenebode

Table 1: Diversity of Fish Fauna in River Niger at Agenebode

S/N	FAMILY	FISH SPECIES	COMMON NAME	NUMBER	% ABUNDANCE	LWR	Condition factor
1	Bagridae	<i>Chrysichthys nigrodigitatus</i>	Silver Catfish	25	3.93	0.40	0.3
	Sub-family Claroteidae	<i>Auchenoglanis occidentalis</i>	Giraffe Catfish	27	4.25	0.44	0.8
2	Polyteridae	<i>Polyterus bichir</i>	Bichirs	19	2.99	0.25	0.6
3	Schilbeidae	<i>Schilbe mystus</i>	African Butterfish	21	3.30	0.57	0.8
4	Mormyridae	<i>Campylomormyrus rhynchophorus</i>	Elephant fish	28	4.40	0.57	0.7
		<i>Hypeorpius bebe occidentalis</i>	Elephant Fish	28	4.40	0.46	0.6
		<i>Mormyrus rume</i>	Mormyrid or Trunk Fish	25	3.93	0.39	0.3
		<i>Mormyrops anguilloides</i>	Mormyrid	29	4.56	0.43	0.5
		<i>Mormyrops deliciosus</i>	Mormyrid	31	4.87	0.68	0.6
		<i>Brienomyrus longinalis</i>	Mormyrid	27	4.25	0.63	0.3
		<i>Hippopotamyrus discorhynchus</i>	Mormyrid		2.52	0.37	0.4
		<i>Ictiobus niger</i>	Black Buffalo	11	1.73	0.56	0.5
5	Catostomidae	<i>Ictiobus cyprinellus</i>	Big Mouth Buffalo	14	2.20	0.49	0.8
		<i>Ictiobus bubalus</i>	Small Mouth Buffalo	16	2.52	0.48	0.7
		<i>Solea sloea</i>	Sole Fish	1	0.16	0.48	0.8
6	Soleidae						
7	Protopteridae	<i>Protopterus annectens</i>	African Mud Fish or West African Lung Fish	45	7.08	0.16	0.4
8	Channidae	<i>Parachanna Africana</i>	Niger Snake Head	12	1.89	0.22	0.9
9	Alestidae	<i>Hydrocynus vittatus</i>	Tiger Fish	7	1.10	0.46	0.7
		<i>Alestes sp.</i>		13	2.04	0.29	0.6
		<i>Brycinus sp.</i>	-----	9	1.42	0.24	0.7
10	Distichodontidae	<i>Distichodus fasciolatus</i>		7	1.10	0.43	0.7
11	Cichlidae	<i>Tilapia mariae</i>	Tillapia	25	3.93	0.26	0.8
		<i>Oreochromis niloticus</i>	Tillapia	17	2.67	0.29	0.8
12	Malapteruridae	<i>Malapterurus electricus</i>	Electric Fish	11	1.73	0.46	0.2
13	Clariidae	<i>Clarias garienpinus</i>	African Catfish	14	2.20	0.27	0.7
		<i>C. camerunensis</i>		11	1.73	0.14	0.5
		<i>C. senegalensis</i>		7	1.10	0.19	0.6
		<i>Heterobranchus longifilis</i>		4	0.63	0.40	0.6
		<i>Heterobranchus bidorsalis</i>		11	1.73	0.16	0.6
		<i>Synodontis sp.</i>		22	3.46	0.16	0.7
14	Mochokidae						
15	Latidae	<i>Lates niloticus</i>	Nile perch	7	1.10	0.17	0.9
16	Gymnarchidae	<i>Gymnarchus niloticus</i>	Aba, aba trunk fish	54	8.49	0.22	0.9
17	Osteoglosidae	<i>Heterotis niloticus</i>	African bonny tongue or African arowana	19	2.99	0.11	0.5
18	Citharinidae	<i>Citharinus citharus</i>	Moon fish	51	6.01	0.18	0.5
		<i>Distichodus rostratus</i>		58	6.12	0.19	3.9
TOTAL				706	100.00	0.40	0.1

A total of 18 families, 35 species were identified throughout the study, from the three stations. The result from this study surpasses that obtained by Okomoda et al., (2012); Abiodun and John (2017) who 13 families, 28 species and 16 families, 44 species respectively. This denotes over time there is increase in fish species in the river. The number of catches was also more in this study than the records of Okomoda *et al.*, 2012; Abiodun and John 2017. This perhaps indicated that the fishes are faring well and that the river is a good breeding and nursery ground for various fish species. Another reason for this sudden increase might be loss of habitat at other communities along the River Niger due to increased farming activities and the recent flooding experiences around the region. Sikoki *et al.* (2008) established that fish assemblage of 11 families and 15 genera were obtained in Onu –Iyi –Ukwu stream, South Eastern Nigeria. Again, Abiodun and Odunze (2011) observed that 51 species belong to 12 families. These fluctuation in the number of families and number of species within the same river and from one river to another could be attributed to seasonal change, environmental changes and anthropogenic factors giving rise to migration and movement of fish species from one location to another.

This study reveals that *Gymnarchus niloticus* of the family Gymnarchidae was the most abundant with 8.49% than *P. annectens* of the family Protopteridae with 7.08% (Table 1). Both families were observed throughout the year and could be attributed that these fish species are dual spawners, spawning and breeding at different seasons, with high fecundity and proliferation rate.

In this study, two new species belonging to families of Solidae and Catastomidae were discovered. The family Catastomidae had three species that were obtained.

Their occurrence might be due to search for better breeding grounds, or again loss of habitat. Furthermore, the least abundant species in this study was the sole fish (0.16%) with only one species identified. This is the very first appearance of the Soleids and Catastomids in this river. The Sole fish is however an Atlantic species, its distribution is usually in the brackish and salt water region in Nigeria (Moreira *et al.*, 1992). Its sudden occurrence in this study in this River could possibly and strongly attributed to the search for food; mollusk and worms and small crustaceans (Abiodun and John 2017).

The Mormyrids were represented by seven families in this research, though same were obtained by Okomoda *et al.* (2012); Abiodun and John (2017) but the species differed. Form the work of fish biodiversity along this river it is evident that the river is still productive and the fishes obtained are in good condition according to condition factor from the results presented in Table 2.

Table 2: Biodiversity parameters for fish fauna in River Niger at Agenebode

	NUMBER	Station 1	Station 2	Station 3
Parameters	35	35	34	28
Individuals (N)	636	309	205	122
Dominance (D)	0.03922	0.04821	0.03557	0.05335
Simpson (1-D)	0.9608	0.9518	0.9644	0.9467
Shannon (H)	3.378	3.291	3.42	3.092
Margalef (d)	5.267	5.93	6.199	5.62
Evenness (E)	0.8374	0.7674	0.8993	0.7861

The results of the Length-Weight relationship (LWR) 0.11-0.68 of fish species obtained show that “*b*” >3 for all species. This is an indication of negative allometric growth implying that fish grows in length faster than in weight. The condition factors obtained in this study differ with the different species, *Distichodus rostratum* had the highest condition factor of 3.9 while *Malepterus electricus* had the least condition factor of 0.2. These differences could be due to fluctuation in food availability, changes in growth due to gonadal development and sex of fish. The values recorded in this study

for fish species is different from the report of Solomon *et al.* (2012). The condition factor (K) gives information on the physiological condition of fish in relation to its welfare. Perry *et al.* (1996) reported that fishes with a low condition index are presumably believed to have experienced adverse physical environment or insufficient nutrition while Maguire and Mace (1993), from a nutritional point of view stated that the increase in K values indicates the accumulation of fat and sometimes gonadal. In the study of the relationship and condition factor of *C. gariepinus* and *Oreochromis niloticus*, Getso *et al.* (2017) reported that the results obtained for condition factor were outside the range recommended for healthy fishes development. The biodiversity parameters revealed slight differences in abundance, spread and evenness of species within the three stations, (Table 2). In this study, it is revealed that station 2 was the station with evenly distributed species and most rich is species. Though station 1 had the most number of species, it could be as a result of being the largest fishing zone amongst the three stations. Station 3 (Solomon's camp by Weppa, Etsakor-East LGA) is more like a nursery. The environment was serene and not disturbed.

After much personal interaction with local fisher-folks along the River, the fishes with more economic value were *Gymnarchus niloticus* and *Lates niloticus*. These fishes have agreeable flavour in local food, medicinal properties, high local market demand, and commercial value and often used for marital engagements. Nugroho *et al.* (2006); Muchlisin (2013) reported that the snakehead (*C. striata*) is one of the high valued freshwater fish in Indonesia and it is very promising as a target species for aquaculture.

Apart from assessing fish diversity data and evaluating fish species that have potential to be cultured, this biodiversity study may also be used as basic data to monitor fish conservation in the River Niger since fishing activity is carried out throughout the year by the locals. The human and agricultural activities might cause harm to the fish fauna, the entire community and in turn the whole of the ecosystem, which causes loss of breeding ground, eutrophication, increased turbidity of the water, and creation of algal blooms that affect many species thus the continual study conservation and biodiversity study is encouraged.

CONCLUSION

A total of 35 species of fish belonging to 18 families were recorded during the study. For the first time the Sole fish (*Solea solea*) of the Family Solidae and the buffalo fish; *Ictiobus niger*, *Ictiobus cyprinellus* and *Ictiobus bubalus* of the Family Catastomidae were observed in the River Niger. This is an indication that the river is still a good environment for the growth and conservation of growth of fish species. From the biodiversity assessment, station 2 has the most diverse of fish species with an even distribution an indication of a good site for fish culture. Station 3 can best be used as a nursery site for growing fingerlings and juveniles in the case of possible breeding practice.

RECOMMENDATION

It is recommended that the continuous management of the river should be encouraged to enable the presence of diverse fish species. Station 3 can be a site suitable for cage culture and management of fish species.

Further research and attempts should be made to improve local people's ability to culture and conserve fish. There should also be a strong implementation of conservation laws to protect fish habitat.

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