

INVESTIGATIONS OF THE COMPOSITION, ABUNDANCE AND DISTRIBUTION OF FISH SPECIES IN EBENEBE RIVER, AWKA, ANAMBRA STATE, NIGERIA

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Abstract

Fish stock assessment is an integral part of the conservation strategies of aquatic biodiversity and a major key for planning, formulation and execution of fisheries policies and programmes especially in the artisanal sector of fisheries. The rapidly declining catch from fish landing is a veritable indication that the fish yields of most Nigerian inland waters are generally low for causes that may range from inadequate management of fisheries to degradation of water bodies. Fish fauna of Ebenebe River in Awka, Anambra State was investigated in the present study. A total of 1086 fishes were obtained from fishermen within three months, covering 6 families and 12 species with the cichlidae having the highest dominance of 41.06%, followed by the Alestidae (16.06%) and Notopteridae 16.06%). However the dominant fish species observed during the study was *Chromidotilapia guntheri* (23.7%); *Papyrocranus afer* (14.3%) and *Thysimichromia ansorgii*(11.8%).The least abundance fish species were *Synodontis filamentous* (4.7%), *Synodontis ngirita* (2.6%) and *Brycinus macrolepidotus* (2.1%). Conservation policies are urgently needed to protect some species from going into extinction.

Keywords: Fish Stock Assessment, Fish Fauna, Abundance, Physicochemical parameters, Distribution.

INTRODUCTION

Freshwater diversity includes the species that depend upon freshwater ecosystems for one or more components of their life cycles, including plants, insects, amphibians, reptiles, fishes, crustaceans, mammals, and birds [1]. Likewise, CBD [2] explained that freshwater biodiversity is simply biodiversity associated with inland waters. But since all terrestrial animals and plants depend on fresh water, the boundaries between aquatic and terrestrial are blurred. At the species level, inland water biodiversity generally includes all life forms that depend upon inland water habitat for things other than simply drinking (or transpiration in plants). Besides the obvious life living within water itself (e.g., fish), this also includes many “terrestrial” species of animals (e.g. water birds), semi-aquatic animals (e.g. hippopotamus, crocodiles, beaver) and plants (e.g. flooded forest, mangroves, vegetation associated with the margins of water bodies). The majority of amphibians, for example, breed in fresh water [3].

The fish yields of most Nigeria inland freshwater bodies (rivers, lakes, and reservoirs) waters are generally on the decline [4]. The decline of these fisheries has been attributed to a wide range of causes ranging from inadequate management of the fisheries resources to environmental degradation of the water bodies [5]. For sustainable exploitation of these resources, a crucial management tool is to have a comprehensive understanding of the ichthyofaunal composition of the water bodies. The freshwater food fishes found in Nigeria are about 268 different fish species [6]. Fish stocks in rivers are generally replenished from their adjacent flood plains after each flood season during which fish breed. Therefore, any natural phenomenon such as drought or artificial activities such as dam construction, which eventually affect the natural cycle of flooding, will certainly undermine fish species diversity both in lakes and wetlands. Considering this fact, therefore, that lakes, wetlands and reservoirs are supplied with fish by their inflowing rivers, the rivers would be characterized by higher species diversity [6]. The interest in aquatic flora and fauna generally began in the tropics in the beginning of second half of the 20th century. This interest arose from possible advantages and threat the macrophytes may pose to man and water body utilization [7]. Conversely, Naseer *et al.*, [8] and Dienye [9] noted that aquatic flora and fauna constitute a significant component of the aquatic ecosystem and they are of considerable ecological and economic importance.

The composition, abundance and density of aquatic organisms are influenced not only by geographical locations but also by the water quality of their habitats which can, in turn, be adversely affected by human activities [10, 11]. In Nigeria, aquatic weed infestation in inland waters is increasing geometrically [12]. The spread is augmented by anthropogenic activities like the use of fertilizers and organic manures in farming and dumping of wastes in water bodies and channels. Aquatic weeds respond to the high level of nutrient in urban, industrial and municipal wastewater [13]. To ensure that control is effective, sustainable and leads to economic development of the riparian communities, cognized must be made of the approach that sustainable development must include management and conservation of natural and resource base (such as Ebenebe River and its floodplains) in such a manner that ensures the attainment of continued satisfaction of human needs. Such sustainable satisfaction and development in the agricultural and fisheries sector should conserve land, water, plant and animal resources in environmentally non-degrading and technically appropriate economically viable and socially acceptable manner. There is paucity of information on the composition, abundance and distribution of fish species of Ebenebe River. This study, therefore, seeks to provide a bench mark data on the composition, abundance and distribution of fish species of Ebenebe River, Anambra state of Nigeria.

MATERIALS AND METHODS

Study Area

This study was carried out in a fishing community Ebenebe. Ebenebe (English: Places and Places) is a town in the Awka North Local Government Area of Anambra State, Nigeria (Egbokhare *et al.*, 2002). The town has an estimated population of 45,897 according to the 2006 Nigerian Census. Ebenebe is made up of eight villages, each of which contain hamlets, it lies 6°20'02"N latitude and 7°07'45"E longitude of the equator. Ebenebe is 25 km from Awka, the capital city of Anambra State. With climate and soil conditions that are favorable to farming, Ebenebe is bordered by Amansea to the south, Odoli River and Mgbakwu to the west, Ugbenu to the north, and (Agbaja) Ezi-agu Local Government Area of Enugu State to the east. Like every other agrarian community. The temperature in Ebenebe is generally between 28 and 32 degrees Celsius from June through December. It rises to 32–34 degrees between January and April, with the last few months of the dry season marked by intense heat.



Figure 3.1 Map showing the study Area

3.2 Sample collection and Identification

Data for this study was based on records of fish catches by local fishermen taken through the month of November, 2021 to January, 2022. Bi-weekly fish species were sampled from three stations namely station 1, Station 2 and station 3 of Ebenebe river. The fishing gears used in the study area were made of four different types, hook and line, cast nets, different types of traps and gill nets. The sampling sites were generally accessible throughout the year and shallow in depth with surface to bottom transparency along sandy areas.

The fishes were bought from fisher men in the landing sites and taken to the department of Fisheries and Aquaculture laboratory Nnamdi Azikiwe University, Awka for identification with the aid of Fishbase database and field guide to Fresh water fish a Publication of the National institute for Freshwater Fisheries Research, New Bussa, Niger State of Nigeria [14.15]. The local fishermen also helped in providing the local name of different fish species. The total number of fish caught from the river were counted and recorded; this enabled the determination of the relative abundance of the various species in the river.

Statistical data analyses

The Statistical Package for Social Sciences (SPSS, version 21) and Microsoft Office Excel software were employed in this study. Analysis of variance (ANOVA) was used to test for month, and station differences at 5 % probability level.

Results

Table 1 shows the water quality parameters investigated during the study. The values of pH, dissolved oxygen and temperature were within the same range with no significant difference ($P > 0.05$). Table 2 shows the percentage composition of various fish families in Ebenebe River. The family Cichlidae had the highest value of 41.60%, while the families Bagridae, Characidae and Mochokidae recorded the lowest value of 8.3%. Table 3 shows the numerical abundance of fish species and indicated station 1 record the highest number of species of fish while station 2 had the least species occurrence. Table 4 shows the relative percentage abundance of fish species identified in Ebenebe river within the period under study. The percentage are decreasing in the following order with (*Chromidotilapia guntheri* 23.7% > *Papyrocranus affer guntter* 14.3% > *Thysimichromis ansorgii* 11.8% > *Oreochromis niloticus* 8.5% > *Micralestes humilia* 7.4% > *Tilapia maria* 6.9% > *Chrysichthys nigrodigitatus* 6.6% > *Labio cubie* 5.6% > *Oreochromis aureus* 5.1% > *Synodontis filamentous* 4.7% > *Synodontis ngirita* 2.6% > *Brycinus macrolepidotus* 2.1%).

Table 5 shows the numerical abundance and relative occurrence of fish species from different stations of Ebenebe River. The result revealed that station 1 the highest relative abundance of fish species (420) followed by station III (off market) (357) while station 2 had the least (311) relative abundance of fish species during the period of this study.

Table 1: Physico-Chemical Parameters of Ebenebe River

Sampling Stations	Physico-Chemical Parameters		
	pH	Dissolved Oxygen(mg/L)	Temperature ($^{\circ}$ C)
Station I	6.33 \pm 0.28 ^a	13.26 \pm 1.16 ^a	28.23 \pm 0.25 ^a
Station II	6.23 \pm 0.05 ^a	14.00 \pm 2.57 ^a	28.60 \pm 2.22 ^a
Station III	6.80 \pm 0.45 ^a	13.23 \pm 4.39 ^a	27.50 \pm 2.19 ^a

Mean within the column with different superscripts are significantly different ($P < 0.05$)

Table 2: Percentage Composition of Various Fish Families in Ebenebe River

S/N	Family	Number of Species	Percentage (%)
1.	<i>Alestidae</i>	2	16.60
2.	<i>Bagridae</i>	1	8.30
3.	<i>Characidae</i>	1	8.30
4.	<i>Cichlidae</i>	5	41.60
5.	<i>Mochokidae</i>	1	8.30
6.	<i>Notopteridae</i>	2	16.60
	Total	12	100

Table 3: Numerical Abundance of Fish Species from Ebenebe River

S/N	Fish Species	Station I	Station II	Station III	TOTAL
1.	<i>Papyrocranus affer guntter</i>	58	52	46	156
2.	<i>Synodontis ngirita</i>	12	9	8	29
3.	<i>Brycinus macrolepidotus</i>	15	6	2	23
4.	<i>Chrysichthys nigrodigitatus</i>	37	16	21	72
5.	<i>Synodontis filamentous</i>	20	13	19	52
6.	<i>Chromidotilapia guntheri</i>	95	87	76	258
7.	<i>Tilapia maria</i>	23	15	38	76
8.	<i>Oreochromis niloticus</i>	42	18	33	93
9.	<i>Oreochromis aureus</i>	18	9	29	56
10.	<i>Thysimichromis ansorgii</i>	28	65	35	129

11.	<i>Micralestes humilia</i>	43	10	28	81
12.	<i>Labio cubie</i>	28	11	22	61
	Total	420	311	357	1086

Table 4: Relative Abundance of Fish Species Identified In Ebenebe River

S/N	Fish Species	Total	Percentage (%)
1.	<i>Papyrocranus affer guntter</i>	156	14.3
2.	<i>Synodontis nigrita</i>	29	2.6
3.	<i>Brycinus macrolepidotus</i>	23	2.1
4.	<i>Chrysichthys nigrodigitatus</i>	72	6.6
5.	<i>Synodontis filamentous</i>	52	4.7
6.	<i>Chromidotilapia guntheri</i>	258	23.8
7.	<i>Tilapia mariae</i>	76	6.9
8.	<i>Oreochromis niloticus</i>	93	8.5
9.	<i>Oreochromis aureus</i>	56	5.1
10.	<i>Thysimichromis ansorgii</i>	129	11.8
11.	<i>Micralestes humilia</i>	81	7.4
12.	<i>Labio cubie</i>	61	5.6
	Total	1086	100

Table 5: Abundance and Relative Occurrence of Fish Species from Different Stations of Ebenebe River

S/N	Fish Species	Station I	Station II	Station III	TOTAL
1.	<i>Papyrocranus affer guntter</i>	58	52	46	156
2.	<i>Synodontis ngirita</i>	12	9	8	29
3.	<i>Brycinus macrolepidotus</i>	15	6	2	23
4.	<i>Chrysichthys nigrodigitatus</i>	37	16	21	72
5.	<i>Synodontis filamentous</i>	20	13	19	52
6.	<i>Chromidotilapia guntheri</i>	95	87	76	258
7.	<i>Tilapia mariae</i>	23	15	38	76
8.	<i>Oreochromis niloticus</i>	42	18	33	93
9.	<i>Oreochromis aureus</i>	18	9	29	56
10.	<i>Thysimichromis ansorgii</i>	28	65	35	129
11.	<i>Micralestes humilia</i>	43	10	28	81
12.	<i>Labio cubie</i>	28	11	22	61
	Total	420	311	357	1086

Discussion

The water parameters showed variation throughout the study period. The pH ranged from 6.23-6.89 with station III having the highest 6.80 while station II showed lowest in pH 6.23. The temperature was highest temperature 37.50°C in station III, while station I had the least temperature 28.23°C. The dissolved oxygen of the river was between 13.23-14.00. This finding compare well with that of Ezekiel *et al.* [16] who observed the same trend in Odhioku-Ekpeye flood plains in Niger Delta, Nigeria. The six (6) families consisting of twelve (12) species observed during this study within the period of three months showed that the Ebenebe river is rich in ichthyofauna when compared to the 4 fish families consisting of five (5) species identified by Lamai and Kolo [17] in the Dan-Zaria dam, in Kaduna State of Nigeria. This result compares well with the finding of Ataguba *et al.*, [18] who reported six families comprising of twelve species in Gubi Dam, Bauchi state. Moreover, Onuoha *et al.*, [19] recorded 26 fish species belonging to 7 families during the study of Ntak-Inyang stream, Ikpa river, Akwa- Ibom. Also, Sikoki *et al.* [20] investigated the fish assemblages of Onu-Iyi-Ukwu stream in South Eastern Nigeria recorded 17 species belonging to 15 genera and 11 families.

From the results obtained in this study, the family *Cichlidae* had the highest species followed by *Alestidae* and *Notopteridae* respectively. In terms of relative abundance of the 12 species identified, *Chromidotilapia guntheri* was the dominant species. This result conform to that of Udoidiong and King [21] who reported *Cichlidae* as the most dominant species in Iba-Oku Stream but differs from the report of Onuoha *et al.* [19] reported *Characidae* as the most abundant in terms of taxa. This finding affirms the finding that cichlids are the most dominant in West African waters bodies. Three species were recorded for the family *mochokidae* alone in Onah Lake, Nigeria by Olele *et al.* [22] whereas only one species, *S. filamentous* was recorded in this report for Ebenebe River. *Tilapia (Cichlidae)* was the highest family (5) compared to other like *Bagridae*, *Characidae* and *Alestidae* which had (1,1 and 2) species respectively. This contradicts the finding of Ataguba *et al.* [18] who found tilapia to be little in size compared to other families like *Clariidae* and *Mormyridae* constituted 61.51% of total fish caught in Gubi dam. The dominance of *Chromidotilapia guntheri* in this study and the absence population of species like *H. longifilis*, *C. garipepinus* and *M. rume* may be due to the fact that in fisheries, aggressive and competitively dominant fish are often the first to be over fished and are often in the habit of preventing subordinate fishes from taking baits as observed by Mcclanahan *et al.*, [23]. The dominance of *Tilapia* may also be connected to its prolific reproductive nature which allows it to populate water bodies especially where the population of aggressive and carnivorous species that could control its population has declined [24].

The study showed that abundance of fish species varied with station I, having the highest species this might be as a result of abundant distribution of zooplankton and also non disturbance of the water body. The second highest was station III which could be due to the increased number of fisher men in this station. The low number of fish species reported in station II may be due to industrial and commercial activities such as sand dredging that form the main activity in this station. Discharge of waste-water from treatment plants, individual pollution and anthropogenic activities are known to affect the distribution of aquatic organisms. Other factors that might have affected species diversity and abundance are destruction of breeding grounds, eutrophication, obnoxious fishing method practiced by fish farmers in this water body, pollution, competition by species and alteration in food web and habitat destruction. The reason why the *Chromidotilapia guntheri* was dominant during the study period might be attributed to the excessive breeding among Cichlids while the absence of many piscivorous fish species such as *Hydrocynus* species that might have helped check the population of Cichlid in the water body[25].

This study recorded low species probably of the factors earlier mentioned such as sand dredging activities which is one of the a activity going on in the river as this affect fish species diversity also heavy metals from petroleum products used in the operation of the machineries produce noise pollution, dredging which can also destroy breeding grounds and other pollutants which effect fish diversity in many ways. The low value of species richness recorded in this work might be due to a combined effect of flooding and pollution of the aquatic ecosystem which have been known to have negative effect on the distribution of the resident organisms. The study also observed that the gears predominantly used gears in the water bodies were gill nets, cast nets, hooks and line and traps hence, netting, lining and trapping were the mainly employed methods of fishing in the water body. The predominant use of these gears is because they are the cheapest and less sophisticated types of gears requiring little financial inputs in obtaining them and little effort in and skills in using them. Canoes (planked and half dug-out) were the main crafts used in the water body. The fishermen of the water bodies were found to be making use of undersized nets which is as a result of the reluctance of the government in enforcing the policies required to maintain the water body. The use of these undersized fishing nets leads to exploitation of smaller fishes that might make up the fish stock of the river in the future.

Conclusion and Recommendations

Conclusively, anthropogenic activities such as sand dredging, logging and waste disposal into the water was observed in all the sites studied. These have negative impacts on the quality of the water as well as fish faunal diversity. Poor management of the fishery resources in Ebenebe River ought to be addressed in order to make the river produce fish sustainably and to ensure that fish species continue to exist in the river. Environmental awareness should be carried out to educate the fisher folks on the danger of extinction of fish species and the need to conserve them. Also, Government should enforce the policies required to regulate the use of obnoxious fishing methods and further study should be carried out in this area as biodiversity is important in knowing the health of water bodies.

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