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Species Composition, Distribution and Abundance of Fishes and Physico-Chemical Parameters of River Ibi, Nigeria

[1]Mairiga, Aji Gani., [2]Umar, Nuvalga Jacob & [3]Wachap, Iyaussa Regina

[1]Department of Biological Sciences, Federal University Wukari
[2]Department of Biological Sciences, Kwararafa University Wukari
[3]Department of Fisheries, Joseph Sarwuan Tarka University Makurdi
[1]mairiga@fuwukari.edu.ng., [2]umarnuvalgajacob@yahoo.com &[3]iyawachap28@gmail.com

Corresponding Email: mairiga@fuwukari.edu.ng

Abstract

A study on the species composition, distribution and abundance of fishes and Water Quality Index of River Ibi, Nigeria was carried out from September-November 2023 which aimed at evaluating the distribution and abundances of fish species in River Ibi, Nigeria. Sampling was done fortnightly for a period of three months. Water samples were taken within 0.5-1.0m depth from each of the sampling stations and analyzed for Physico-chemical parameters. Fish capturing was done by the fisher men via different fish capturing tools such as gills net and identification of fishes caught was done. Microsoft Excel 2010 and SPSS 23.0 were used for statistical analyses, respectively. Result showed that, water quality parameters of river Ibi with mean Temperature of 28.03 ±0.28, Dissolved Oxygen of 5.6±0.13, pH of 6.63±0.19 and Conductivity of 159.8±0.32 revealed all water quality parameters were within water quality parameters standard. A total of 834 individual fishes were identified from the study during the different months of evaluation, these comprises of 16 species namely *Coptodon mariae, C. zillii, Sarotherodon galileaus, Oreochromis niloticus, Chrysichthys nigrodigitatus, Lates niloticus, Schilbe mystus, Alestes macrolepidotus, Hydrocynus forskahlii, A. dentex, Hepsetus akawo, Hemisynodontis membranaceous, Synodontis budgetti, Labeo senegalensis, Mormyrus rume*, and *Parachanna obscura* from 10 families; *Cichlidae, Claroteidae, Latidae, Schilbeidae, Alestidae, Hepsetidae, Mochokidae, Cyprinidae, Mormyridae* and *Channidae*. *Cichlidae* was the most abundant across the sections studied with 35.61% abundance with four species and *C. marie* is the most abundant specie (11.63%) amongst the four species. Generally, the fish abundance across the months were observed to fluctuate with highest monthly abundance in November (45.44%) and the least in Jan. (21.94%). *Schilbe mystus* recorded the most abundant fish species during the study (15.23%) and the least was *Synodontis budgetti* (0.48%). Findings from the present study showed that river Ibi is less polluted and hence it supports wide variety of fishes in the river.

Keywords: Species composition, Distribution, Abundance, Physico-chemical Parameter, Ibi River

Introduction

Fishes are exclusively aquatic and cold blooded vertebrates with streamlined body and lateral line sense organs (Verma and Prakash, 2020). They occur both in marine and fresh water. Fishes are good sourcing of both macro (such as proteins, lipids, ash) and micro nutrients (such as vitamins and minerals). The nutrients are essential for good health (Srivastava and Srivastava, 2008) and better life as they provide energy and involved in repair and regulation processes (Kumar *et al*., 2020). Fish provides essential nutrients especially proteins of high biological values and fats, so it is often referred to as rich food for poor people (Sujatha *et al*., 2013). Protein and fats are the major nutrients of fish which determine the nutritional value of fish.

Fishes has excellent nutritive value, which provides high quality protein, fats, vitamins and minerals like magnesium and phosphorus (Ali *et al*., 2020). Because of the presence of both macro and micro nutrients in fish, it is better than other animal foods. Apart from being food source, fish also functions to prevent human being from variety of diseases in the world. The fish protein contains the essential amino acids which improve the overall nutritional quality of a mixed diet (Pawar and Sonawane, 2013). Only 140gm of fish can fulfill the 50-60% daily requirement of proteins in an adult human. Fishes are also rich in micronutrients which tend to be more easily available than those from plant food. In comparison to land living animals, fishes are rich sources of protein and have a high content of omega-3 long chain poly unsaturated fatty acids.

Fishes are the cheapest source of animal protein. From health point of view, fish is useful for people as it provides proteins, fats, vitamins and minerals. From nutritional point of view, the macro and micronutrients present in fish are acceptable for human consumption.

Globally, the fish per capita consumption has increased from 14.4kg in the 1990s and has crossed 20.3kg in the 2016s. The annual per capita consumption of fish for the entire population is estimated at 5-6 kg whereas for the fish eating population, it is found to be 8-9 kg. The fisheries are affected by wastes and effluents discharged into the water, and increasing fishing intensity as human population increases. All these activities can have negative impact on the water quality and consequently the diversity and population of fish species within the lake (Yem *et al.,* 2011). Periodic investigation of this water body is therefore essential to understand the dynamics between the water quality and fish diversity, distribution and abundance in the river for enforcement of necessary sustainable measures.

Fish is an excellent source of protein in human diets; it is mostly exploited by man in the environment where they are commonly found (Craig *et al* 2002). They form the basic link in the aquatic food chain (Atobatele and Ugwumba 2008), a source of food; it improves food security and nutritional status of the populace (St. Laurent *et al* 2002) and represents about 55% protein intake in Nigeria (Zabbey, 2013).

The population of fishes in tropical water bodies experience fluctuations due to factors such as food composition and availability, spawning rate and changes in environmental factors (Ipinmoroti *et al* 2018). Welcomme (2001) identified fishing, pollution and eutrophication among others as factors that could bring about series of changes in fish size, species composition and abundance in the aquatic environment. Bisht *et al* (2009) and Soyinka *et al* (2010) reported that changes in environmental factors such as water quality and depth, water current, availability of food and substratum have influence on the occurrence, abundance and distribution of fauna. Aquatic ecosystems are mostly affected by stress imposed by human. Population growth, steep urbanization as well as industrial and agricultural land use have resulted in the discharge of diverse pollutants into water bodies causing a dwindling effect on the aquatic environment and the fisheries (Iyiola, 2015).

Fisheries resources are on the decline in Nigeria due to over exploitation and inadequate management of inland waters.

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. Due to a general lack of data, it is difficult to access the status of the inland water biodiversity. Hence, this study is aimed at evaluating the distribution and abundances of fish species in river Ibi, Nigeria.

Materials and Methods

Study area

Ibi is a local government in Taraba state, on the south bank of the Benue River, opposite the mouth of the Shemankar River. Ibi lies on both bank of River Ibi; within latitudes 5°65`N and longitudes 9°36`E, 8°36`E (Wikipedia, 2009). Most of the inhabitants of river Ibi are normally engaged in fishing.

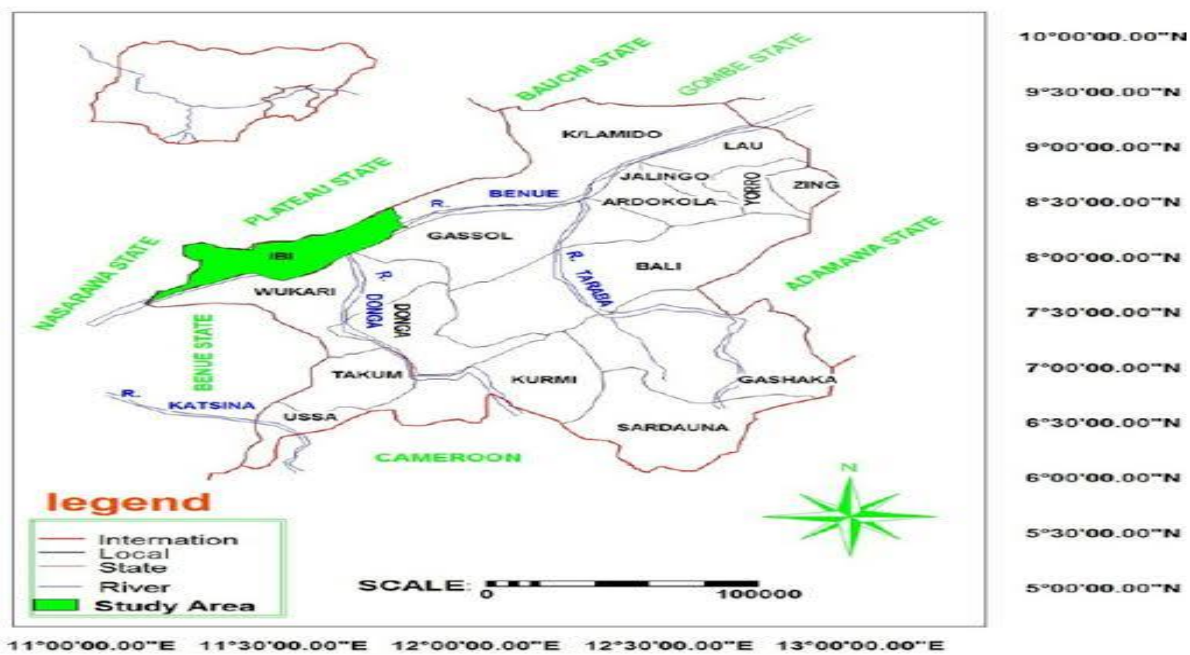

Figure 1. Map of Taraba showing Ibi, the study area (Otitoju and Lewis, 2020)

Sampling design

The river was partitioned into three; the upper section (upstream), the middle section (midstream) and the lower section (dam wall area). Sampling was done fortnightly for a period of three months (September 2023-November 2023).

Assessment of water quality

Water samples were taken within 0.5-1m depth from each of the sampling stations and analyzed for temperature, dissolved oxygen, pH and conductivity. Temperature was measured using a mercury-in-glass thermometer (calibrated in degree Celsius), which was dipped into the water sample in the sampling bottles for two minutes; readings were taken when the mercury level was steady. Dissolved oxygen was measured using DO meter (model-AD 630 DO meter manufactured by Adwa®).

After calibration according to the manufacturer's directions, the probe was inserted into the water sample and reading were taken when the digital meter reading was steady. The pH was measured as described by APHA (2012) and conductivity was measured using a conductivity metre (CDH-222 manufactured by Omega, United Kingdom) as described by the manufacturer.

Sampling of fish

Sampling was done using gill nets of various mesh sizes ranging from 44.45mm to 169.33mm. The ranges of nets were set at various locations in each of the three sampling stations. The choice of gillnets was based on its efficiency in catching various sizes and species depending on the mesh sizes and also on its dominant use by fishers.

Identification of fish

Fishes caught were identified, sorted into species using guides by Olaosebikan and Raji (2013), and counted.

Statistical analysis

The data was analyzed using simple descriptive statistics such as means and percentages. Analysis of Variance (ANOVA) was used to compare the means. Microsoft Excel 2010 and SPSS 23.0 were used for graphing and statistical analysis, respectively.

Results

Table 1: water quality parameters

	Point A	Point B	Point C	Total mean	Water quality standard (WHO,2011)
Temperature (^oC)	27.50 ± 0.31^a	28.30 ± 0.29^a	28.30 ± 0.23^a	28.03 ± 0.28	Ambient
Dissolved oxygen (mg/l)	5.6 ± 0.11^a	5.4 ± 0.16^a	5.8 ± 0.11^a	5.6 ± 0.13	5.0
Ph	6.7 ± 0.28^a	6.5 ± 0.11^a	6.6 ± 0.18^a	6.63 ± 0.19	6.50-8.50
Conductivity (µS/cm)	159.6 ± 0.21^a	159.7 ± 0.52^a	160.1 ± 0.23^a	159.8 ± 0.32	250

Source: Field work

Result present as mean ± standard deviation. Across the rows, result with the same superscript indicate there is no significant difference while result with different superscript across the rows indicate significant difference.

The means of the water quality parameters of river Ibi are presented in Table 4.1. Mean dissolved oxygen, PH, temperature and conductivity were 5.60±0.11mg/l, 6.63±0.19, 28.30±0.23°C, 159.80±0.23µS/cm respectively. Point C and Point B had the recorded the highest temperature (28.30±0.23) while point A had the lowest Temperature (27.50±0.31). Point C had the highest concentration of dissolved oxygen while point B recorded the lowest concentration of dissolved oxygen. PH was reported highest in Point A (6.7±0.28) while Point B (6.5±0.11) had the lowest PH concentration. Conductivity was highest in point C (160.1±0.23) while point A and point B had the lowest Conductivity (159.6±0.21). However, there was no significance different across the study point in the evaluated water parameters.

Table 2: Fish distribution by sampling stations

Family	Species	Point A	Point B	Point C	Total Catch	Percentage distribution (%)
Cichlidae	Coptodon marie	45	30	22	97	11.63
	Coptodon zillii	30	26	18	74	8.87
	Sarotherodon galilaeus	35	25	17	77	9.23
	Oreochromis niloticus	21	17	11	49	5.88
Claroteidae	Chrisichthys nigrodigitatus	35	41	48	124	14.87
Latidae	Lates niloticus	21	9	11	41	4.92
Schilbeidae	Schilbe mystus	45	35	47	127	15.23
Alestidae	Alestes macrolepidotus	51	25	6	82	9.83
	Hydrocynus forskahlii	19	10	13	42	5.04
	Alestes dentex	33	21	4	58	6.95
Hepsetidae	Hepsetus akawo	9	5	4	18	2.16
Mochokidae	Hemisynodontis membranaceous	5	1	5	11	1.32
	Synodontis budgetti	3	1	NE	4	0.48
Cyprinidae	Labeo senegalensis	5	NE	2	7	0.84
Mormyridae	Mormyrus rume	4	3	3	10	1.20
Channidae	Parachana obscura	8	5	NE	13	1.56
Total		369	254	211	834	100
Percentage		44.24	30.46	25.30	100	

Source: Field work

A total of 834 individual fishes were identified from the study, comprising of 16 species namely *Coptodon mariae, C. zillii, Sarotherodon galileaus, Oreochromis niloticus, Chrysichthys nigrodigitatus, Lates niloticus, Schilbe mystus, Alestes macrolepidotus, Hydrocynus forskahlii, A. dentex, Hepsetus akawo, Hemisynodontis membranaceous, Synodontis budgetti, Labeo senegalensis, Mormyrus rume*, and *Parachanna obscura* from 10 families; *Cichlidae, Claroteidae, Latidae, Schilbeidae, Alestidae, Hepsetidae, Mochokidae, Cyprinidae, Mormyridae,* and *Channidae*. *Cichlidae* was the most abundant across the sections studied with 35.61% and four species with *C. marie* as the most abundant (11.63%) species. Point C sampling site had the least abundance (25.30%) with 14 species identified, while Point A had the highest abundance (44.24%) of catch with 16 species identified.

Table 3: Fish abundance by months of fish sampling

Fish species	Nov.	Dec.	Jan.	Total	Total (%)
Coptodon marie	35	37	25	97	11.63
Coptodon zillii	40	20	14	74	8.87
Sarotherodon galilaeus	35	22	10	77	9.23
Oreochromis niloticus	22	15	12	49	5.88
Chrisichthys nigrodigitatus	49	40	35	124	14.87
Lates niloticus	16	15	11	41	4.92
Schilbe mystus	51	41	35	127	15.23
Alestes macrolepidotus	57	20	4	82	9.83
Hydrocynus forskahlii	19	13	10	42	5.04
Alestes dentex	25	21	12	58	6.95
Hepsetus akawo	10	4	4	18	2.16
Hemisynodontis membranaceous	5	3	3	11	1.32
Synodontis budgetti	2	1	1	4	0.48
Labeo senegalensis	3	2	2	7	0.84
Mormyrus rume	4	3	3	10	1.20
Parachana obscura	6	5	2	13	1.56
Total	379	262	183	834	100
Relative percentage	45.44	31.41	21.94	100	

The monthly relative numerical abundance of the species is presented in Table 4.3. Generally, the fish abundance across the months were observed to fluctuate with highest monthly abundance in November (45.44%) and the least in Jan. (21.94%). *Schilbe mystus* recorded the most abundant fish species during the study (15.23%) and the least was *Synodontis budgetti* (0.48%).

Discussions

It was observed from the results that the various physical and chemical parameters measured were within the required ranges for fish survival, growth and reproduction in culture and natural environment. Mean monthly and overall dissolved oxygen concentration was slightly

above the recommended limit of 5mg/l (Obot *et al* 2016). The result observed is similar to reports on tropical Niger Delta (Zabbey, 2013) and Ogunpa River in Ibadan (Iyiola 2015). Slight variations were observed in the mean pH values but results were similar to results by Yem *et al* (2011) and Ipinmoroti (2013) that the pH of 6.5-9.0 is suitable for the growth of phytoplankton. The mean monthly and overall conductivity values for river Ibi were within the limits of unpolluted water. Chapman and Kimstach (1996) reported that conductivity of most freshwater systems ranges from 10 to1000µS/cm but if waters are polluted or receive intense run-offs, it may exceed 1000µS/cm.

Conductivity can be used to determine the level of freshness or pollution in water (Ogbeibu and Egborge 1995). Based on this index and by this estimate and results from this study, river Ibi is not polluted. The similarity in the values of physico-chemical parameters obtained in the different sections of the river during the study could be as a result of the similarity in activities that took place in the various sections of the water body.

The study of abundance and diversity of fish species is essential for monitoring, conservation and management of stock (Guerriero 2017). All fish species were of freshwater origin and the family *Cichlidae* was the most diverse and abundant group while the least diverse families was *Cyprinidae* (0.16%). The high catch in November could be attributed to fish susceptible to gear during the onset of the dry season in that region. Yem *et al* (2011) similarly observed higher abundance during the months of the dry season (November-March) than the rains (April-October). The reduction in fish abundance and distribution may be attributed to various factors such as overfishing, migration of fish species and change in water conditions (Lawson and Olusanya 2010), which are all consequences of climate change. A similar case in disappearance of some species was reported in Lake Victoria and it was attributed to the open access nature of fishing and the use of unregulated fishing gear and efforts (Ogutu-Ohwayo 2005).

They migrate from the open waters to shallow areas thereby reducing their abundance in the open waters. The highest abundance of fish species at the lower section was expected because the obstruction created by the dam wall resulted to the creation of a wide water surface area and depth for accumulation of fish species (Yem *et al*., 2011).

The total number of species identified in this study was low compared with findings of Ipinmoroti (2013) who reported twenty-seven (27) species. The total abundance (834) from this study is however not in consonance with reports by Akinyemi *et al* (1987) and Ipinmoroti (2013) in Lake Asejire.

Conclusion

The water quality parameters measured were within the recommended limits for fish survival, which is probably responsible for the high fish abundance and diversity. Fish abundance was higher during the dry than the rainy season and Cichlidae was the most abundant and diverse family across the months and stations. A total of 834 individual fishes were identified from the study, comprising of 16 species namely *Coptodon mariae, C. zillii, Sarotherodon galileaus, Oreochromis niloticus, Chrysichthys nigrodigitatus, Lates niloticus, Schilbe mystus, Alestes macrolepidotus, Hydrocynus forskahlii, A. dentex, Hepsetus akawo, Hemisynodontis membranaceous, Synodontis budgetti, Labeo senegalensis, Mormyrus rume,* and *Parachanna obscura* from 10 families; *Cichlidae, Claroteidae, Latidae, Schilbeidae, Alestidae, Hepsetidae, Mochokidae, Cyprinidae, Mormyridae, and Channidae. Cichlidae* was the most abundant across the sections studied with 35.61 % and four species with *C. marie* as the most abundant (11.63%) species.

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