

Fish Species Composition and Physico-Chemical Characteristics of Nafada River, Gombe State, Nigeria

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Abstract— Fish species composition and Physico-chemical characteristics of Nafada river, Gombe State, Nigeria were investigated between April and August, 2018. Fish and Physico-chemical characteristics sampling were conducted fortnightly for a period of six months (March to August, 2018) by using gillnets of different mesh sizes and portable digital meters respectively. The fish collected were transported to the laboratory and identified using pertinent taxonomic keys. The results of fish species composition recorded at Nafada river comprises of a total number of 365 individuals' fish species consists of sixteen (16) types of species among the eleven (11) family of Bagridae, Characidae, Cichlidae, Citharinadae, Claridae, Claroteidae, Cyprinidae, Machokidae, Mormyridae, Schilbedae and Polypteridae were recorded throughout the study period. The Mormyridae was the most abundant and diverse family of fish species comprising of 28.89% of the fish abundance followed by Characidae with 23.56%, Schilbedae with 16.99%, Cyprinidae with 14.25%, Bagridae with 4.93%, Claridae with 4.38%, Machokidae with 2.73%, Cichlidae with 2.19%, Citharinadae with 1.2%, Claroteidae with 0.82% and least abundant Polypteridae with 0.55%. The fish abundance and diversity observed in this study showed that Nafada River is rich in terms of fish species, therefore, its very important to regularly monitor the water quality in order to maintain the ecological equilibrium of the river.

Keywords— Fish species, Abundance, Diversity, Nafada River.

I. INTRODUCTION

Water is the most crucial assets and general solvent that all living organisms depend on for their survival, growth and reproduction (Abbati *et al.*, 2019). Without water living organisms are likely not to exist, developed and reproduced because it's the essence of life (Abbati *et al.*, 2020). Good water quality is obligatory in maintaining the composition of aquatic organisms including fish, declining of the water quality can cause turn down in productivity and biodiversity of aquatic biota (Faithful and Finlayson, 2005).

Fish is a cold-blooded vertebrate adapted to living in all kinds of aquatic environment. Fish is an essential source of proteins. Fishing activities is attracting too much of attention due to its crucial contribution to the global requirement of proteins (Nazeef and Abubakar, 2013).

Nigeria is endowed with numerous natural aquatic ecosystems with a lot of fish resources. Inland water bodies in Nigeria are the most richest in fish abundance in West Africa (Nazeef and Abubakar, 2013). Despite the important of fish

resources as a major source of high protein for human, it also provide copious social and economic values as sources of job creation and raw materials for manufacturing industries as well as recreational activities (Yakub, 2012).

Nigeria's peoples found living close to aquatic ecosystems such as lakes, streams, reservoirs, rivers, swamps and coastal lagoons were depend largely on fisheries resources of such ecosystems for their main source of animal protein and income to satisfy their needs (Abubakar *et al.*, 2006).

In West Africa several researches on fish population structure of freshwater water indicated that over 200 fish species were found in various habitats. Fishing in Nigeria is associated with many areas; the main rivers includes but not necessarily limited to river Niger, river Benue, river Hadeja, river Kaduna, Cross River, river Imo, Sokoto, Gongola river, Lake Chad basin, the coastal creeks and Lagoons (Abdullahi, 2005). Methods of fish harvesting such as use of nets, seines, hooks and lines, Baskets, canoes and fishing engines boats with trawlers for fishing expedition are usually common in different regions of Nigeria (Abubakar *et al.*, 2006).

The evaluation and investigation of fish species in an aquatic ecosystem is the most prior and vital step in understanding the potentials of the ecosystem and exploitation of its fishery resources. Therefore, this research aimed at determining the fish species composition in Nafada river, Gombe, Nigeria.

II. MATERIALS AND METHOD

Study Area

The research work was carried out in Nafada River, located at Nafada local Government area of Gombe State in Northeast of Nigeria. It's lies between latitude 11⁰5''N and longitude 11⁰15''E with a total surface area of 1,586km. The activities around the river includes fishing, irrigation farming, washing, moulding of blocks, bathing and livestock consumption.

Sampling Method and Regime

Fish and physico-chemical characteristics sampling were conducted fortnightly for a period of six months (March to August, 2018) by using gillnets of different mesh sizes (2.0, 2.5, 3.0 inches) and portable digital meters respectively. Fish

samples were transported to the laboratory for identification using appropriate taxonomic keys such as Babatunde and

Raji, (1998).

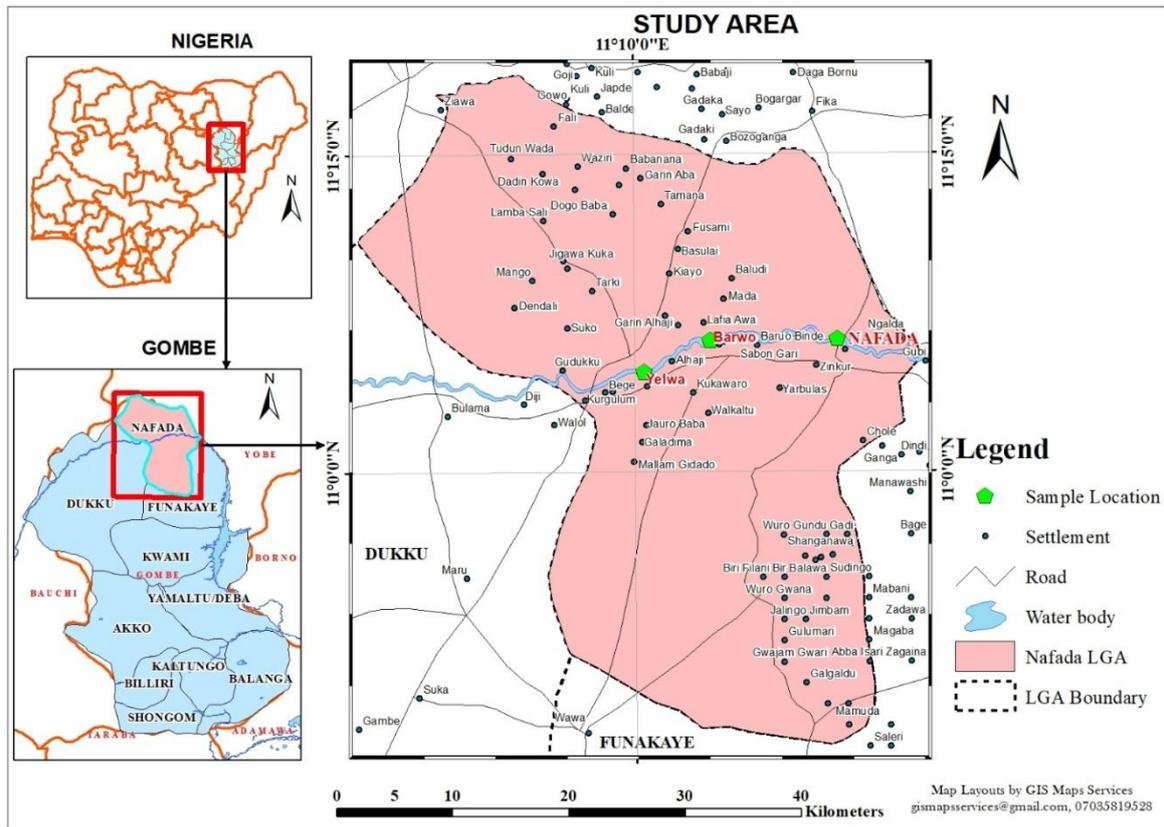


Figure 1: Map Nafada Showing the study area.

III. RESULT

Physico-Chemical Characteristics

The results observed through out the study period in Nafada river was presented in Table 1. The physical and chemical characteristics of water in the river at three various sampling stations A, B, and C were worked out and recorded in table 1. Air temperature ranged between 32.92-33.32°C with the mean values of 33.12°C among the three sampling stations of the river. Station C had the highest mean temperature of 27°C while station B had the lowest temperature of 25.8°C (Table 1). The hydrogen ion concentration (pH) variation indicates that all the stations (A, B and C,) had varied pH values of 7.52, 7.67 and 7.24 respectively with the range of 7.24-7.67. Dissolved oxygen

ranged from 4.7-4.76 mg/L in all the stations. Station A had the highest dissolved oxygen and stream C was lowest (Table 1). The highest turbidity was observed in station A with 5.13 NTU and the least turbidity level was in station C with 5.01 NTU. The electrical conductivity of the three sampling stations ranged from 114.3-116.2 µS/cm. Station A and C recorded the highest with 116.2 while station B had the lowest with 114.3 µS/cm. Total dissolved solid ranged between 62.54-63.64 mg/L, Biochemical oxygen demand had the highest mean value of 2.12 mg/L in station A and least recorded mean value of 2.05 in station B. Nitrate and Phosphate recorded was at the range of 14.73-15.19 mg/L and 11-11.57 mg/L respectively.

TABLE 1: Physico-chemical characteristics of Nafada river throughout the study period (March-August, 2018)

Physico-chemical parameters	Station A Mean±SE	Station B Mean±SE	Station C Mean±SE	Range
Air Temperature (°C)	32.92±0.93	33.13±0.91	33.32±0.96	32.92-33.32
Water Temperature (°C)	26±0.73	25.82±0.67	25.85±0.68	25.82-26
Water pH (°C)	7.52±0.46	7.67±0.49	7.24±0.2	7.24-7.67
Electrical Conductivity (µS/cm)	116.2±5.07	114.3±5.52	116.2±5.22	114.3-116.2
Total Dissolved Solid (mg/L)	62.67±3.54	63.64±3.53	62.54±4.39	62.54-63.64
Turbidity (Cm)	5.13±0.72	5.27±0.72	5.01±0.69	5.01-5.27
Dissolved Oxygen (mg/L)	4.76±0.43	4.73±0.41	4.7±0.44	4.7-4.76
Biochemical Oxygen Demand (mg/L)	2.12±0.26	2.05±0.28	2.08±0.22	2.05-2.12
Nitrate (mg/L)	14.73±0.94	15.19±0.87	15.08±0.85	14.73-15.19
Phosphate (mg/L)	11.57±0.65	11±0.51	11.12±0.54	11-11.57

Fish species

The results of fish species composition recorded at Nafada river comprises of a total number of 365 individuals' fish species consists of sixteen (16) types of species among the eleven (11) family of Bagridae, Characidae, Cichlidae, Citharinadae, Claridae, Claroteidae, Cyprinidae, Machokidae, Mormyridae, Schilbedae and Polypteridae were recorded throughout the study period. The Mormyridae were the most abundant family of fish species comprising of 28.89% of the Fish abundance followed by Characidae with 23.56%, Schilbedae with 16.99%, Cyprinidae with 14.25%, Bagridae with 4.93%, Claridae with 4.38%, Machokidae with 2.73%, Cichlidae with 2.19%, Citharinadae with 1.2%, Claroteidae with 0.82% and least abundant Polypteridae with 0.55%, (table 2, Figure 2)

TABLE 2: Percentage composition of fish species in Nafada River during the study period (March-August, 2018).

Family	Number of Species	Percentage of fish species
Bagridae	18	4.93
Characidae	86	23.56
Cichlidae	8	2.19
Citharinadae	4	1.2
Claridae	16	4.38
Claroteidae	3	0.82
Cyprinidae	52	14.25
Machokidae	10	2.73
Mormyridae	104	28.89
Schilbedae	62	16.99
Polypteridae	2	0.55

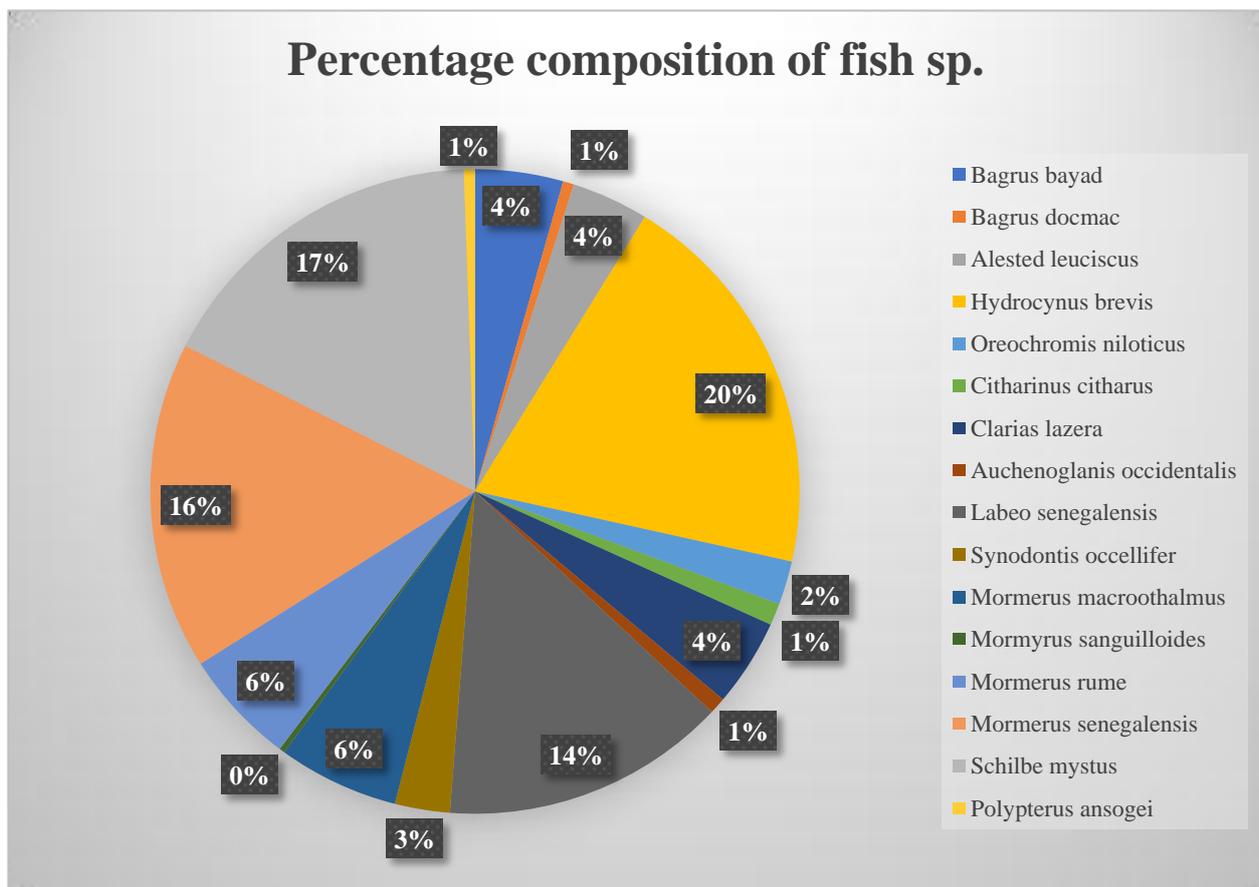


Figure 2: The percentage composition of fish species in Nafada river, throughout the study period (March-August, 2018).

The diversity of fish species identified during the study period were family Mormyridae is the most abundant and diverse with four number of species comprises of *Mormerus macrophthalmus* *Mormerus sangolloides*, *Mormerus rume* and *Mormerus senegalensis* followed by Bagrinidae and Characidae with two species each comprises of *Bagrus bayad*, *Bagrus docmac* and *Alestes leuciscus*, *Hydrocynus brevis* respectively. While all other families consists of single species

each Cicchlidae, Citharinadae, Claridae, Claroteidae, Cyprinidae, Machokidae, Schilbedae and Polypteridae consists of *Oreochromis niloticus*, *Citharinus citharus*, *Clarias lazera*, *Auchenoglanis occidentalis*, *Label senegalensis*, *Synodontis ocellifer*, *Schilbe mystus* and *polypterus ansorgei* respectively (Table 3).

TABLE 3: The diversity and abundance of fish species in Nafada River, Gombe State, Nigeria, 2018.

Family	Species	Number of fish sp.	Abundance (%)
Bagridae	<i>Bagrus bayad</i>	16	4.38
	<i>Bagrus docmac</i>	2	0.55
Characidae	<i>Alested leuciscus</i>	14	3.84
	<i>Hydrocynus brevis</i>	72	19.73
Cichlidae	<i>Oreochromis niloticus</i>	8	2.19
Citharinadae	<i>Citharinus citharus</i>	4	1.2
Claridae	<i>Clarias lazera</i>	16	4.38
Claroteidae	<i>Auchenoglanis occidentalis</i>	3	0.82
Cyprinidae	<i>Labeo senegalensis</i>	52	14.25
Machokidae	<i>Synodontis occellifer</i>	10	2.74
Mormyridae	<i>Mormerus macrothalmus</i>	22	6.03
	<i>Mormyrus sanguilloides</i>	1	0.27
	<i>Mormerus rume</i>	21	5.75
	<i>Mormerus senegalensis</i>	60	16.44
Schilbedae	<i>Schilbe mystus</i>	62	16.99
Polypteridae	<i>Polypterus ansorgei</i>	2	0.55
Total		365	100.11

IV. DISCUSSION

The total number of fish species observed from this research is quite abundant which is in agreement with the finding of Nazeef and Abubakar, (2013) who reported fifteen different types of species under eleven family in Dadin Kowa reservoir, Gombe State, Jafaru and Abubakar who reported 26 species and fourteen families in Dadin Kowa reservoir, Gombe State. The abundance of fish species in Nafada River may be due to availability of food such as zooplankton and phytoplankton as well as conducive physiochemical characteristics for the proliferation, continued existence and growth of fish species. In addition, rivers found in tropical region tend to proliferate rapidly; the rate of reproduction and relatively high primary productivity has been suggested as factors responsible (Oscar *et al.*, 2015). Similar research was conducted at river Benue which recorded 26 number of species by Abdullahi, (2005). The most abundant family of fish species in the river was mormyridae which is coincide with the finding of Jafaru and Abubakar, (2016) their abundance may be due to their capability to acclimatized with varying environmental conditions and the least abundant species family was polypteridae as agreed with the finding of Nazeef and Abubakar, (2013). The dominance by the family Mormyridae with four (4) number of species in Nafada river could be that the ecological resources in the reservoir favored the species. The modifications of the mouthparts as an adaptation strategy in the Mormyridae facilitate feeding on small invertebrate buried in muddy substrates. Fish particularly tilapias and crustaceans form part of the diet for higher organisms while young fishes in the family feed on benthic invertebrates, mostly aquatic insects (Kouamela, *et al.*, 2000). The family Mormyridae was also reported as the dominant taxon with nine (9) species in Nguru wetlands of Nigeria (Abubakar *et al.*, 2015). Consequently, this report is in disagreement to the findings of Balogun (2005), Dankishiya and Abdulrahman (2007), Mustapha (2008) and Dankishiya *et al.*, (2013) that reported the family Cichlidae as the most dominant in various reservoirs in Nigeria. Polypteridae family

was the most rarest in the river which may be as a result of low tolerance to varying ecological conditions and inability to acclimatized with wide environmental variables.

Jafaru and Abubakar, (2015) stated that the increase in the dynamisms in the physical condition the higher the species abundance and various microhabitats available which eventually reduced competition due to resource partitioning. Dynamism in fish diversity and abundance has been attributed to quality of aquatic system, nutrients availability and exploitation (David *et al.*, 2015).

V. CONCLUSION

The river is highly abundant in terms of fish species composition, the abundant of fish species may be due to availability of food and favourable environmental conditions. However, any alterations of the physical and chemical characteristics of the river due to anthropogenic activities around the river may rendered it unfavourable for the reproduction, continued existence and growth of fish species. Consequently, there is need of frequent assessment of water quality in order to maintain the ichthyofauna composition of the river.

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