

Fish Species Diversity of Nafada, Ashaka and Almakashi Corridors of River Gongola, Gombe State Nigeria

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Abstract

Fish species diversity and abundance of Nafada, Ashaka and Almakashi corridors of river Gongola were studied. Fish samples were collected from three (3) landing sites on a monthly basis for the period of eighteen (18) months from artisanal fishers. The landing sites were; Nafada, Ashaka and Almakashi along river Gongola. A total of 25 species from 14 distinct families were identified: Almakashi has 23 species followed by Ashaka having 21 and Nafada with 17 species. Almakashi has the highest abundance of fish species (48.37%), followed by Ashaka (30.33%) and Nafada (21.28%). Fish families were dominated by Mormyridae with four (4) species followed by Alestidae and Bagridae with three (3) species each; Cichlidae, Clariidae, Cyprinidae and Schilbeidae have two (2) species each while Characidae, Citharinidae, Gymnarchidae, Malapteruridae, Mochokidae, Arapaimidae and Polypteridae have one (1) species each. Fish species were dominated by *Oreochromis niloticus* of the family Cichlidae with abundance of 37.65% followed by *Clarias gariepinus* of the family Clariidae with 12.54% and the least was *Gymnarchus niloticus* of the family Gymnarchidae with 0.02%. The ranges of Biodiversity indices of the studied sites were species richness (2.41 - 2.95) and species evenness (0.41 - 0.53). Almakashi has a rich fish species diversity but it is facing challenges of structural collapse that necessitates adoption of comprehensive management strategies for the sustainability of the fisheries resources of river Gongola particularly within the corridors.

Introduction

The inland water fisheries resources of Nigeria are on the decline as a result of overfishing and nonproper management of the available inland water bodies (Usman *et al.*, 2019). For the

sustainability of the inland water fisheries resources of Nigeria adequate information of the ichthyofauna, diversity and relative abundance of the water bodies is needed (Yusuf *et al.*, 2024). A good knowledge of the fish species composition of water bodies is paramount for the sustainability of inland water fisheries resources of Nigeria (Yusuf *et al.*, 2023). Investigating the state of the fisheries relative to its composition of stocks is necessary for the proper management of aquatic resources for a long-term sustainability of catches (Nababa *et al.*, 2024); in other words, in order to optimize the quantity that can be timely harvest without jeopardizing the fishing resources and biological or economic sustainability (Yusuf and Abdulkarim, 2015). Fish supplies in Nigeria come from three major sources, namely: artisans, commercial trawlers and fish farmers (Pathak *et al.*, 2013). Human activities have powerfully changed productivity for instance of landings and species richness of the freshwater ecosystems worldwide (Toussaint *et al.*, 2016). At present, inland fisheries are not often a national or regional governance priority and as a result, inland capture fisheries are undervalued and largely overlooked (Cooke, 2016). This study was carried out to evaluate the biodiversity and abundance of fish species in corridors of Ashaka, Nafada and Almakashi of river Gongola, Gombe state Nigeria.

Materials and Methods

Study Area

River Gongola is located at the northeastern region of Nigeria and its one of the principal tributaries of river Benue. The river rises on the eastern slopes of the Jos plateau and falls to the Gongola basin, running northeastern into Nafada local government ($11^{\circ}00'$, $11^{\circ}15'N$ and $11^{\circ}15'E$, $11^{\circ}30'E$), Gombe state. The river continued from Nafada in the northeast direction to lake Chad. It turns south from Nafada passing through the corridors of Ashaka ($10^{\circ}45'$, $11^{\circ}00'N$ and $11^{\circ}30'$ and $11^{\circ}45'E$), Almakashi ($10^{\circ}44'$, $40.584'N$, and $11030'$, $32.574'E$) and Kupto where it continued to Dadin - Kowa reservoir at Yamaltu - Deba local government area of Gombe state (Figure 1).

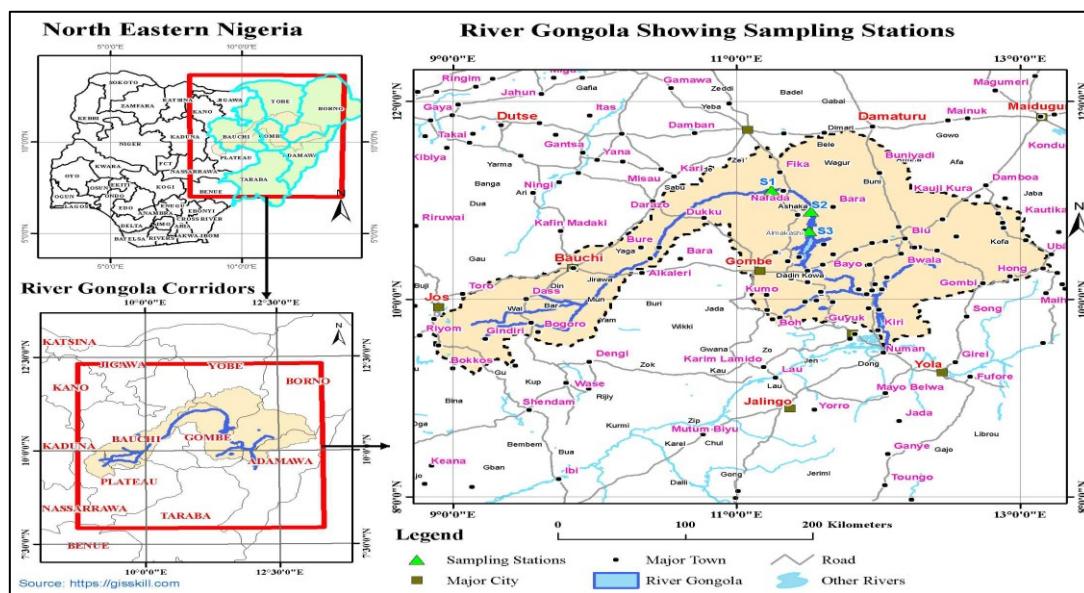


Figure 1: Study Area showing the Sampling Locations

Source: Google Map® (2023).

Sampling and Identification of Fish

The samples collection was done with the help of some artisanal fishers on monthly basis at the three landing sites of Nafada, Ashaka and Almakashi corridors along river Gongola, Gombe state Nigeria. Fish species caught were identified with the aid of keys and descriptions by Idodo - Umeh (2003); Balogun (2006) and Olaosebikan and Raji (2013). The study was carried out for a period of one year and six months (i.e. 18 months): from January, 2020 to June, 2021, thereby covering both dry and wet seasons.

Biological Diversity

Biological diversity was estimated using (with slight modification) the Simpson index = $D = O(n/N)^2$ and Simpson index diversity $(1 - D)$.

Where;

n = total number of species of all families

N = total number of species of all families.

Ecological Balance

The ecological balance of the three landing sites was estimated by the ratio of forage to carnivorous fishes (F/C) ratio both in terms of number as follows;

$F/C = [\text{total foragers (herbivorous + omnivorous)}] / \text{carnivorous}$

Results

Fish species identified

The study indicated that a total of twenty - five (25) fish species from fourteen (14) different families were identified: Almakashi with 23 species followed by Ashaka with 21 and Nafada with 17 species. With cumulative frequency of 3580, station 3 (Almakashi) has the highest abundance of fish species (48.37%), followed by station 2 Ashaka with (30.33%) and station 1, Nafada with the lowest abundance of (21.28%). Fish families identified were dominated by Mormyridae with four (4) species followed by Alestidae and Bagridae with three (3) species each, the families Cichlidae, Clariidae, Cyprinidae and Schilbeidae with two (2) species each, the families Characidae, Citharinidae Gymnarchidae, Malapteruridae, Mochokidae, Arapaimidae and Polypteridae with one (1) species each. Fish species abundance were dominated by *Oreochromis niloticus* of the family Cichlidae (37.65%) followed by *Clarias gariepinus* of the family Clariidae (12.54%) and the least abundant species was *Gymnarchus niloticus* of the family Gymnarchidae with (0.02%) as shown in Table 1.

Table 1: Frequency and Percentage Abundance of Fish Species Identified in Corridors of River Gongola

Fish Species	Nafada	Ashaka	Almakashi	Total	% Abundance
<i>Alestes dentex</i>	30	47	92	169	4.72
<i>Alestes leuciscus</i>	15	32	28	75	2.09
<i>Brycinus nurse</i>	31	58	70	159	4.44
<i>Auchenoglanis occidentalis</i>	27	45	40	112	3.12
<i>Bagrus bayad macropterus</i>	60	73	95	228	6.36
<i>Bagrus docmac</i>	7	20	28	55	1.53
<i>Hydrocynus brevis</i>	21	41	33	95	2.65
<i>Oreochromis niloticus</i>	281	343	722	1346	37.59
<i>Tilapia zilli</i>	0	2	0	2	0.05
<i>Citharinus citharus</i>	18	7	22	47	1.31
<i>Clarias gariepinus</i>	110	132	182	424	11.84

<i>Clarias angularis</i>	0	7	18	25	0.69
<i>Labeo brachypoma</i>	0	0	13	13	0.36
<i>Labeo senegalensis</i>	35	43	81	159	4.44
<i>Gymnarchus niloticus</i>	0	0	1	1	0.02
<i>Malapterurus electricus</i>	0	6	9	15	0.41
<i>Synodontis budgetti</i>	68	97	115	280	7.82
<i>Hyperopisus bebe occidentalis</i>	0	0	7	7	0.19
<i>Mormyrus rume</i>	7	43	29	79	2.20
<i>Mormyrus macrophthalmus</i>	0	0	9	9	0.25
<i>Marcusenius senegalensis</i>	1	2	0	3	0.08
<i>Heterotis niloticus</i>	10	21	34	65	1.81
<i>Erpeitoichthys calabaricus</i>	0	3	2	5	0.13
<i>Parailia pellucida</i>	17	29	43	89	2.48
<i>Schilbe mystus</i>	24	35	59	118	3.29
TOTAL	762	1086	1732	3580	100.00

Fish Family Composition and Abundance

The fish family abundance of the three study sites elucidated that the family Gymnarchidae had the least representation with only 0.02% by one (1) individual fish: *Gymnarchus niloticus*, while the family Cichlidae with a total of 1348 individuals had 37.65% of the total catch; this is followed by family Clariidae with 12.54% by 449 individuals. Family Alestidae had 11.25% and Mochokidae 7.82% accordingly, the remaining families had less than 6.0% of the total fish stock (Table 2).

Table 2: Percentage Composition of Fish Families Identified in Corridors of River Gongola

Family	Total Individuals Per Family	Abundance (%)
Alestidae	403	11.25
Bagridae	395	11.03
Characidae	95	2.65
Cichlidae	1348	37.65
Citharinidae	47	1.31
Clariidae	449	12.54
Cyprinidae	172	4.80
Gymnarchidae	1	0.02
Malapteruridae	15	0.41
Mochokidae	280	7.82
Mormyridae	98	2.73
Arapaimidae	65	1.81
Polypteridae	5	0.13
Schilbeidae	207	5.78

Fish Biodiversity Indices

The biodiversity indices of the three study sites such as species richness range from 2.41 to 2.95 while species evenness range between 0.41 and 0.53 (Table 3).

Table 3 Fish Biodiversity Indices of Corridors of River Gongola

Indicies	Nafada	Ashaka	Almakashi
Taxa_S	17	21	23
Individuals	762	1086	1732
Dominance_D	0.1811	0.1415	0.2031
Simpson_1-D	0.8189	0.8585	0.7969
Shannon_H	2.191	2.415	2.247
Evenness_e^H/S	0.526	0.5331	0.4111
Brillouin	2.141	2.371	2.214
Menhinick	0.6158	0.6372	0.5527
Margalef	2.411	2.861	2.95
Equitability_J	0.7732	0.7934	0.7165
Fisher_alpha	3.083	3.692	3.747
Berger-Parker	0.3688	0.3158	0.4169
Chao-1	17	21	23

Discussion

The fish samples collected during the period of the study comprising of 14 families and 25 species was in agreement with the findings of Nazeef *et al.* (2021) who reported the presence of fourteen (14) families and 28 fish species in Almakashi corridors of river Gongola, Gombe state Nigeria, but were lower than the 15 families and 47 species reported by Zira *et al.* (2017) in Kiri reservoir, Shelleng, Adamawa state, Nigeria and the 15 families and 36 species reported by Abubakar (2006) in lake Geriyo, Adamawa state. The lower number of families and species recorded from this study compared with that of Adeniyi and Akinwale (2016) at lower river Niger, Agenebode, Edo State and Agorua *et al.* (2019) at Oguta lake Imo state, Nigeria probably due to the smaller size of the corridors when compare to the main rivers and lakes. However, the findings of this study were higher than the findings of Usman *et al.* (2019) who reported 6 families and 16 species at Mada river, Akwanga, Nasarawa state. In terms of the relative abundance in species, *Oreochromis niloticus* of the family Cichlidae (37.65%) was the most dominant species, while *Gymnarchus niloticus* of the family Gymnarchidae (0.02%) was the least abundant species. This was in agreement with the findings of Useni *et al.* (2024) who reported that *Coptodon zilli* of the family Cichlidae was the most abundant species in Chakawa reservoir, Mayo - Belwa, Adamawa state, Nigeria. The dominance of *Oreochromis niloticus* of the family Cichlidae could be attributed to its prolific breeding habit. The Cichlids are found to breed about three to four times in a year (Abubakar, 2006). The least number of the fish species *Gymnarchus niloticus* of the family Gymnarchidae which was just one (1) observed throughout the period of this study could be attributed to its ecological notes. Olaosebikan and Raji (2013) reported that *Gymnarchus niloticus* mostly inhabits swamps and floodplains. The variations in the number of fish families and species observed in this study when compared with the findings from other studies might be due to dynamics of the fish population in terms of migration, fishing pressure, size of the water body and the connection of it recharge and discharge points relative to bigger or smaller network of water bodies.

Conclusion

River Gongola along its corridors within Nafada, Ashaka and Almakashi sites of Gombe state Nigeria boast of at least 25 species of freshwater fish belonging to 14 families, with the highest abundance and diversity of fish species found in Almakashi which is located at the downstream followed by Ashaka at the mid-stream and the least in Nafada which is located at upstream corridor along the river Gongola complex, Gombe state Nigeria.

Recommendations

Systematic approach toward management and development of the river is hereby recommended for more efficient fishery conservation and management. This involves appropriate monitoring, control and surveillance (MCS) system. Furthermore, government should take immediate action through public sensitization programmes and education in regulating fishing activities.

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