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Jebba Lake, Nigeria
Malapterurus electricus

Fish Abundance, Diversity, and Identification in Jebba Lake

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ABSTRACT

This study was carried out to determine the fish composition, diversity and abundance of the Jebba Lake. Three fishing communities were used for these studies (Fakun, Gbajibo and New-Awuru). During the study period, a total of 141 fishes comprising 19 species from 12 families at Fakun, 258 fishes with 22 species from 11 families at Gbajibo and 319 fishes with 38 species from 15 families at new Awuru were recorded. Fish were procured from artisanal fishermen and middlemen at landing sites on the lake. The collected fish samples were sorted and identified to families, genera and species levels, using the identification keys. The identified species were weighed to the nearest 0.1 g using a weighing balance and total and standard lengths were determined to the nearest 0.1mm using a measuring board and recorded on the data record sheet. Description statistics were used to calculate the total number and percentage weight of the species. The families included Mochokidae and Mormyridae, has the highest diversity in all three stations with six (6) species each, followed by Alestidae with five (5) species while Clariidae and Clarotidae have four (4) species each, Bagridae, Cichlidae and Schilbeldae with three (3) species each, follow by Cyprinidae with two (2) species and the least families are Citharinidae, Distichodontidae, Osteoglossidae, Tetraodontidae with one (1) species each. This makes a total of seven hundred and eighteen (718) fishes, forty (42) species and fifteen (15) families in all three stations. Fish species in Nigerian lakes are invaluable as bioindicators and biomarkers for environmental and food security research. They provide critical insights into the health and quality of aquatic ecosystems, helping to detect pollution, assess ecological integrity, and guide conservation efforts. Continued research and monitoring using fish bioindicators and biomarkers are essential for sustainable water resource management in Nigeria.

INTRODUCTION

Nigeria is endowed with numerous water bodies, including lakes and rivers, which host a rich variety of fish species that vary in composition, diversity, and abundance. Species diversity, a key aspect of community structure, provides insights into the productivity of aquatic environments, as it is closely linked to species composition, abundance, and distribution. Furthermore, the identification and assessment of biodiversity are fundamental components of fishery research and the evaluation of natural reserves. These activities are essential for understanding and managing the ecological health and sustainable exploitation of aquatic resources [1]. Fish identification and studies on fishery diversity in aquatic ecosystems are crucial initial steps that enable the comprehensive utilization of these resources. Such studies lay the groundwork for effective management and conservation strategies, ensuring the long-term sustainability of fisheries and the protection of biodiversity [2,3]. Jebba Lake, which is among Nigeria's most important water bodies, holds immense importance for the surrounding villages and communities due to its multifaceted roles. This lake not only serves as a primary source of water for domestic activities such as cooking, drinking, and washing but also supports a wide range of agricultural activities, including irrigation and livestock farming. In addition, it contributes significantly to the livelihood of the local population through fishing, which remains a vital economic activity in the region. Despite its importance, there is a pressing need for up-to-date information about the lake's fishery diversity, as existing data is insufficient to guide effective management and conservation strategies. The current lack of recent studies limits our ability to implement evidence-based interventions that could protect the lake's biodiversity while ensuring the sustainable use of its resources.

Thus, the aim of this study is to comprehensively assess the fish composition, diversity, and abundance in Jebba Lake. This research will not only provide crucial data to enhance our ecological understanding of the lake but also serve as a foundation for future conservation and resource management strategies [4]. By determining the current status of the fish population, this study hopes to address gaps in knowledge and support the development of sustainable fishery management practices that will benefit both the environment and the communities that rely on it. Without such critical insights, the long-term health of the lake and the livelihoods of those depending on it remain at risk.

MATERIALS AND METHODS

Study Area

The study was conducted in three fishing communities around Jebba Lake: Fakun, Gbajibo, and New-Awuru. These sites were selected to provide a comprehensive overview of the fish composition, diversity, and abundance across different regions of the lake.

Sample Collection

Fish samples were procured from artisanal fishermen and middlemen at landing sites within each of the three communities. The fishermen utilized a variety of fishing gear including cast nets, gillnets, hook and line, long lines, and traps to ensure a wide representation of fish species.

Identification and Measurement

Upon collection, the fish samples were immediately sorted and identified to the family, genus, and species levels using identification keys provided by references [5] and [6]. Identification was performed on-site to minimize handling time and stress to the fish. The identified species were then weighed using a precision weighing balance, accurate to the nearest 0.1g. Total length and standard length measurements were taken to the nearest 0.1mm using a measuring board. All measurements were recorded meticulously on data record sheets.

Data Analysis

Descriptive statistics were employed to calculate the total number of fish and the percentage weight of each species. The analysis included:

i. Total Fish Count: The number of individual fish collected from each site.
ii. Species Richness: The number of different species identified at each site.
iii. Family Distribution: The number of species within each family identified across all sites.
iv. Weight Distribution: The total and percentage weight of each species.

RESULTS AND DISCUSSION

During the study period, a total of 141 fishes comprising 19 species from 12 families at Fakun, 258 fishes with 22 species from 11 families at Gbajibo and 319 fishes with 38 species from 15 families at New Awuru were recorded (Tables 1, 2, and 3). The families included Mochokidae and Mormyridae, has the highest diversity in all three stations with six (6) species each, followed by Alestidae with five (5) species while Clariidae and Clarotidae have four (4) species each, Bagridae, Cichlidae and Schilbeldae with three (3) species each, follow by Cyprinidae with two (2) species and the least families are Citharinidae, Distichodontidae, Osteoglossidae, Tetraodontidae with one (1) species each. This makes a total of seven hundred and eighteen (718) fishes, forty (42) species and fifteen (15) families in all three stations. This current record was higher in families and low in species when compared to 51 species (12 families) recorded by [7]**.** The present study lacks benefits from having broader coverage and a more comprehensive sampling across Jebba Lake. During the study period, a total of 141 fishes comprising 19 species from 12 families at Fakun, 258 fishes with 22 species from 11 families at Gbajibo, and 319 fishes with 38 species from 15 families at New Awuru were recorded (Tables 1, 2, and 3). The families Mochokidae and Mormyridae exhibited the highest diversity across all three stations with six species each, followed by Alestidae with five species. Clariidae and Clarotidae each had four species, while Bagridae, Cichlidae, and Schilbeldae each had three species. Cyprinidae was represented by two species, and the least represented families, each with one species, were Citharinidae, Distichodontidae, Osteoglossidae, and Tetraodontidae. This cumulative data resulted in a total of 718 fishes, 42 species, and 15 families across the three stations.

When compared to previous studies, this record shows a higher number of families but a lower number of species than the 51 species from 12 families reported by previous researchers [7]. The diversity observed in this study is consistent with findings from other tropical freshwater ecosystems, where certain families such as Mochokidae and Mormyridae are known to dominate due to their adaptability to a wide range of environmental conditions. This high diversity within certain families highlights the ecological importance of these groups in maintaining the balance and functionality of the aquatic ecosystem. However, the present study's findings underscore the necessity for broader coverage and more comprehensive sampling across Jebba Lake. The spatial and temporal limitations of this study may have resulted in underestimations of species richness and abundance. Comprehensive studies involving extensive sampling across different seasons and microhabitats are crucial for a more accurate assessment of the lake's ichthyofauna. Such extensive surveys are vital for formulating effective conservation strategies and understanding the impacts of environmental changes and anthropogenic activities on fish biodiversity.

Table 1: Fish Abundance and Diversity of Jebba Lake at Fakun.

Family /Species	No	%No	Wt	%Wt
Alestidae				
Alestes barimus	1	0.71	100	0.19
Hydrocynus Forskhali	3	2.13	800	1.51
Bagridae				
Bagrus bayad	1	0.71	450	0.85
Centropomidae				
Lates niloticus	2	1.42	1150	2.17
Cichlidae				
Sarotherodon galilaeus	1	0.71	100	0.19
Citharinidea				
Citharinus citharus	3	2.13	2750	5.19
Clariidae				
Heterobranchus longifilis	1	0.71	1750	3.30
Clarotidae				
Chrycsichthys auratus longifilis	1	0.71	200	0.38
Chrycsichthys nigrodigitatus	39	27.66	5126.8	9.68
Cyprinidae				
Labeo coubie	5	3.55	7250	13.68
Labeo senegalensis	21	14.89	6950.3	13.12
Distichodontidae				
Distichodus rostratus	3	2.13	9700	18.31
Mochokidae				
Synodontis membranaceus	38	26.95	10759.73	20.31
Synodontis shall	2	1.42	450	0.85
Synodontis sorex	1	0.71	100	0.19
Mormyridae				
Hyperopisus bebe	2	1.42	150.5	0.28
Mormyrops angulloides	5	3.55	2050	3.87
Mormyrus rume	5	3.55	2750	5.19
Schilbeidae				
Schilbe mystus	7	4.96	395	0.75
Total	141	100.00%	52982.33	100.00%

Table 2: Fish Abundance and Diversity of Jebba Lake at Gbajibo.

Family /Species	No	%No	Wt	%Wt
Alestidae				
Hydrocynus Forskhali	51	19.77	1720	7.03
Bagridae				
Auchenoglani soccidentalis	8	3.10	1985	8.12
Bagrus bayad	4	1.55	575	2.35
Centropomidae				
Lates niloticus	5	1.94	400	1.64
Cichlidae				
Oreochromis niloticus	3	1.16	145	0.59
Tilapia zilli	7	2.71	325	1.33
Citharinidea				
Citharinus citharus	1	0.39	700	2.86
Clariidae				
Clarias anguillaris	2	0.78	100	0.41
Clarotidae				
Chrycsichthys auratus longifilis	1	0.39	26	0.11
Chrycsichthys nigrodigitatus	117	45.35	475	1.94
Clarotes laticeps	5	1.94	1624	6.64
Cyprinidae				
Labeo senegalensis	7	2.71	565	2.31
Malapteruridae				
Malapterurus electricus	2	0.78	800	3.27
Mochokidae				
Synodontis membranaceus	13	5.04	7200	29.44
Synodontis shall	5	1.94	600	2.45
Synodontis gambiensis	2	0.78	850	3.47
Mormyridae				
Gnathonemus abadii	4	1.55	300	1.23
Hyperopisus bebe	12	4.65	3700	15.13
Mormyrops angulloides	6	2.33	1800	7.36
Mormyrus rume	1	0.39	350	1.43
Osteoglossidae				
Heterotis niloticus	1	0.39	20.5	0.08
Tetraodontidae				
Tetraodon fahakas trigosus	1	0.39	200	0.82
Total	258	100.00%	24460.5	100.00%

Fish Population and Weight Distribution

The fish population and weight distribution at Fakun show that the families Mochokidae and Clarotidae dominated the fish population, comprising 29.08% and 28.37% of the total fish population, respectively (**Fig. 1**). In terms of weight, the family Cyprinidae dominated with 26.8% of the total fish weight. Conversely, families Bagridae, Cichlidae, and Clariidae recorded the lowest population numbers, each contributing only 0.71%. The family Schilbeidae had the least fish weight, accounting for just 0.75%. **Fig. 2** shows the fish population and weight distribution at Gbajibo.

The family Clarotidae had the highest population, representing 47.68% of the total fish population, while the family Mochokidae dominated the fish weight, comprising 35.63% of the total. The families Citharinidae, Osteoglossidae, and Tetraodontidae recorded the least population numbers, each contributing 0.39%. The family Osteoglossidae had the least fish weight, with only 0.08%. **Fig. 3** depicts the fish population and weight distribution at New-Awuru. The family Bagridae had the highest population, representing 35.73% of the total fish population, while the family Mormyridae dominated the fish weight, accounting for 26.08% of the total. The families Channidae and Malapteruridae recorded the lowest population numbers, each contributing 0.31%. The family Channidae had the least fish weight, with only 0.07%.

Table 3. Fish Abundance and Diversity of Jebba Lake at New-Awuru.

Family /Species	No	%No	Wt	%Wt
Alestidae				
Alestes bariums	1	0.31	25	0.03
Alestes dentex	18	5.64	3675	4.87
Brycinus macrolepidotus	8	2.51	4800	6.36
Brycinus nurse	1	0.31	20	0.03
Hydrocynus Forskhali	2	0.63	175	0.23
Bagridae				
Auchenoglanis occidentalis	1	0.31	300	0.40
Bagrus bayad	93	29.15	5235	6.93
Bagrus docmac	20	6.27	1885	2.50
Centropomidae				
Lates niloticus	2	0.63	2550	3.38
Cichlidae				
Oreochromis niloticus	4	1.25	1350	1.79
Sarotherodon galilaeus	1	0.31	350	0.46
Tilapia zilli	2	0.63	55	0.07
Citharinidea				
Citharinus citharus	4	1.25	1120	1.48
Channidae				
Parachanna obscura	1	0.31	50	0.07
Clariidae				
Clarias gariepinus	3	0.94	1800	2.38
Heterobran chusbidorsalis	2	0.63	50	0.07
Clarotidae				
Chrycsichthys nigrodigitatus	6	1.88	850	1.13
Clarotes laticeps	2	0.63	1400	1.85
Cyprinidae				
Labeo senegalensis	4	1.25	675	0.89
Labeo coubie	2	0.63	2300	3.05
Distichodontidae				
Distichodus rostratus	7	2.19	10550	13.97
Malapteruridae				
Malapterurus electricus	1	0.31	600	0.79
Mochokidae				
Synodontis eupterus	1	0.31	25	0.03
Synodontis gambiensis	11	3.45	2800	3.71
Synodontis membranaceus	14	4.39	8550	11.32
Synodontis ocellifer	2	0.63	50	0.07
Synodontis shall	17	5.33	1375	1.82
Synodontis sorex	18	5.64	2660	3.52
Mormyridae				
Gnathonemus abadii	1	0.31	300	0.40
Hyperopisus bebe	7	2.19	1900	2.52
Mormyrops angulloides	12	3.76	6550	8.67
Mormyrus rume	11	3.45	8100	10.72
Gnathonemus senegalensis	1	0.31	100	0.13
Gnathonemus tamandua	11	3.45	2750	3.64
Schilbeidae				
Parailia pellucid	1	0.31	20	0.03
Shilbe intermedius	18	5.64	125	0.17
Schilbe mystus	7	2.19	222	0.29
Tetraodontidae				
Tetraodon fahakas trigosus	2	0.63	187	0.25
Total	319	%100.00	75529	%100.00

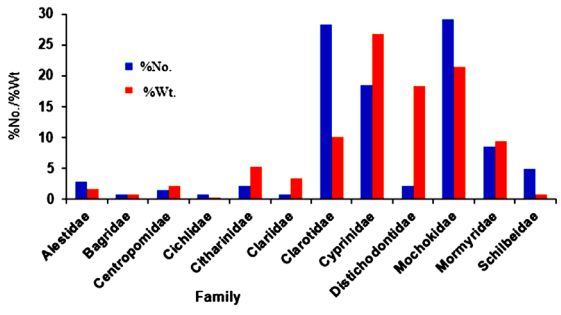

Fig. 1. Percentage Number and Weight of Fish Families at Fakun of Jebba Lake.

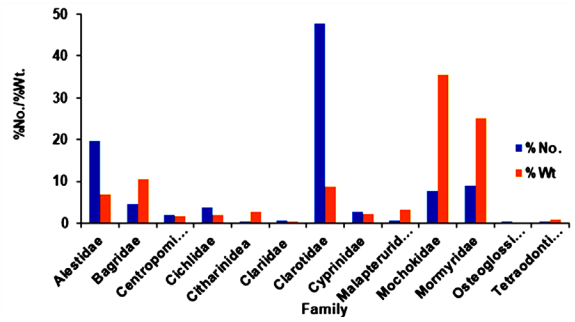

Fig. 2. Percentage Number and Weight of Fish Families at Gbajibo of Jebba Lake.

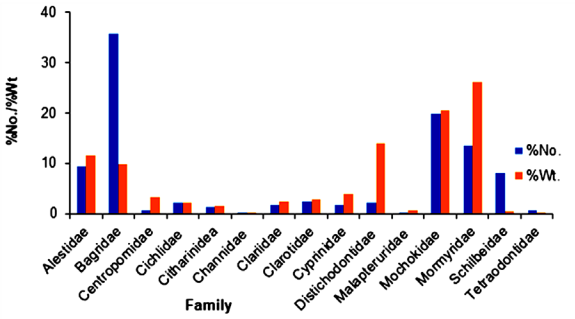

Fig. 3. Percentage Number and Weight of Fish Families at New-Awuru of Jebba Lake.

These findings align with the broader patterns observed in tropical freshwater ecosystems, where certain fish families tend to dominate due to their ecological adaptability and reproductive strategies. For instance, Mochokidae and Clarotidae, which were dominant in Fakun and Gbajibo, are known for their resilience in diverse environmental conditions and their efficient foraging behaviors. The dominance of these families suggests that they play a crucial role in the local aquatic food webs and are likely to be key indicators of ecosystem health [4,7-10]. Photos of the fish species caught in Jebba Lake is shown in **Fig. 4**.

Diversity and Distribution

The findings obtained in this study reflect the findings of Oladipo et al. [8] who conducted a comprehensive study on the ichthyofaunal diversity and distribution across the Jebba Hydro-Electric Power (HEP) dam in north-central Nigeria. The study reported a high level of ichthyofaunal diversity in the Jebba HEP dam, with a total of 42 species belonging to 15 families identified. This diversity reflects the ecological richness of the dam and its surrounding aquatic environments. The families Cichlidae, Mormyridae, and Mochokidae were identified as the most dominant in terms of both abundance and species richness. These families are known for their adaptability to varying environmental conditions and their importance in the local aquatic food web. In addition, the study shows that the distribution of fish species varied significantly across different sections of the dam. Certain species were more prevalent in specific areas, suggesting that habitat preferences and environmental conditions play a crucial role in shaping the distribution patterns [8-10].

Fig. 4. A diverse array of fish species captured from Jebba Lake.

Conversely, the lower abundance and weight of families such as Schilbeidae, Osteoglossidae, and Channidae may indicate specific habitat preferences or sensitivities to environmental changes. Schilbeidae, for example, is often found in slow-moving waters and may be less competitive in environments with higher predation or fishing pressure [8]. The variability in fish populations and weights among the different communities underscores the importance of site-specific management strategies. For example, the high dominance of Bagridae in New-Awuru suggests a thriving population that may benefit from targeted conservation efforts to maintain their habitats and reduce overfishing pressures. The family Bagridae is one of the indigenous fish families commonly identified in lakes Kainji and Jebba in Nigeria.

One study concentrates on the significance of local fish identification methods used by artisanal fishermen, which play a crucial role in the sustainable management and conservation of fish biodiversity in these lakes [9]. The Bagridae family, often referred to as bagrid catfish, comprises species that are well-adapted to a variety of freshwater habitats, including rivers, lakes, and reservoirs. These fish are recognized for their hardy nature and ability to thrive in diverse environmental conditions, making them a key component of the aquatic ecosystem.

In the study conducted in Jebba Lake, Bagridae was among the families with notable population numbers and diversity. The family Bagridae had the highest fish population at New-Awuru, representing 35.73% of the total fish population. This dominance suggests that bagrid catfish are particularly well-suited to the environmental conditions in this part of the lake. The species within this family are typically benthic, feeding on a variety of invertebrates, smaller fish, and detritus, which makes them integral to the lake's food web. Their presence in Jebba Lake, as reported by Bwala et al. [9], underscores their ecological importance and resilience.

Fish species in Nigerian lakes play a crucial role not only as a source of protein but also in environmental monitoring and assessment, serving as potential bioindicators or biomarkers. These aquatic organisms are sensitive to changes in their environment, making them valuable for detecting and understanding the impacts of pollution, habitat degradation, and other ecological disturbances. The diversity and abundance of fish species can indicate the overall health of an aquatic ecosystem. A diverse fish community typically signifies a healthy ecosystem, while a decline in diversity may indicate environmental stress or degradation [12].

Regular monitoring of fish populations can provide data on long-term ecological changes. Such biomonitoring programs are essential for the sustainable management of water resources and the conservation of biodiversity. This study can serve as future potential works in bioindicators or biomarkers of pollution for agricultural purposes. Fish can serve as biomarkers for various physiological and biochemical responses to environmental stressors. Biomarkers such as DNA damage, enzyme activities, and hormone levels in fish can reveal sub-lethal effects of pollutants. For instance, changes in the activity of enzymes like acetylcholinesterase in fish can indicate exposure to organophosphate pesticides [23].

The expression of stress proteins, such as heat shock proteins (HSPs), in fish, can serve as an early warning system for environmental stress. These proteins help protect cells from damage and are upregulated in response to various stressors, including pollutants and temperature changes [11]. Fish reproductive biomarkers, such as gonad development and spawning behaviour, can indicate the presence of endocrine-disrupting chemicals in the environment. These chemicals can interfere with hormone function, leading to reproductive impairments [25].

Numerous studies have demonstrated the importance of fish as bioindicators and biomarkers in Nigerian lakes. Research conducted on fish from Lagos Lagoon and other Nigerian water bodies has documented significant levels of heavy metals, such as lead, cadmium, and mercury, in fish tissues, highlighting the extent of pollution and its potential impact on human health and aquatic life [24]. Studies on the activities of enzymes like cholinesterases, lactate dehydrogenase (LDH) and alanine aminotransferase (ALT) in fish have shown their potential as biomarkers for assessing water pollution in Nigerian rivers [13] and other countries . Fish species composition and diversity have been used to assess the ecological status of Nigerian lakes, providing valuable data for conservation and management efforts. For example, studies on Jebba Lake have utilized fish diversity indices to monitor the impacts of hydroelectric power generation on the aquatic ecosystem [8].

CONCLUSION

This research investigated the types, variety and numbers of fish in three fishing villages (Fakun, Gbajibo and New Awuru), near Jebba Lake. The findings showed a total of 718 fish belonging to 42 species from 15 families. Fakun had 141 fish from 19 species and 12 families Gbajibo had 258 fish from 22 species and 11 families while New Awuru had 319 fish from 38 species and 15 families. The Mochokidae and Mormyridae families displayed diversity with six species each followed by Alestidae with five species. Other notable families included Clariidae and Clarotidae with four species each as Bagridae, Cichlidae and Schilbeldae with three species each. The study offers insights into the variety and abundance of fish in Jebba Lake by highlighting differences in species distribution among various communities. However, the study's scope was limited as it did not cover the lake extensively. Future research would benefit from coverage and extensive sampling throughout Jebba Lake to gain a comprehensive understanding of the lake's fish biodiversity, for effective conservation and management strategies.

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