CATCHES ASSESSMENT AND BIODIVERSITY OF FISH FAUNA IN LAKE RIBADU, ADAMAWA STATE, NIGERIA

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Abstract

The fish fauna of Lake Ribadu, Adamawa State, Nigeria was studied from June to August, 2015. Data were collected through frame and catches composition surveys. The catch assessment was conducted at the landing site; twice a week and fish were indentified using Olaosebikan and Raji (2013) and Idodo-Umeh (2003). Simple descriptive statistical tools such as simple percentage, frequency counts were used to analyze data collected. A total of 5,572 fishes belonging to 15 families and 29 species were identified in the local fisher's catches. In terms of number, the Family Cichlidae dominated the catch, which contributed 28.86% to the total catch. This was followed by the Claridae (28.74%); Schilbeidae (15.54%); Mochokidae (8.0%); Alestidae (4.17%); Mormyridae (3.62%); Protopteridae (2.23%); Bagridae (2.10); Claroteidae (1.94%); Polypteridae 91.78); Dischodontidae (1.42%) and Cyprinadae (1.34%). The families Citharinidae, Anabantidae and Gymnarchidae each contributed less than 1% to the total fishes in the catch. In terms of weight, the Claridae family tops contributing 40.84% to the total weight of fish caught. Mormyridae is the most diversified family which was represented by 4 species. The study showed that *Sarotherodon galilaeus* (21.34%); *Clarias gariepinus* (21.02%); *Schilbe intermedius* (10.43%) and *Clarias anguillaris* (7.72%) were the dominant species in Lake Ribadu. Longer period study should be carried out to confirm the species and families of fish fauna in the present study.

Keywords: Fish species, Lake Ribadu, biodiversity and management

INTRODUCTION

Nigeria is blessed with over 14 million hectares of reservoirs, lakes, ponds and rivers that are capable of producing over 980, 000 metric tons of fish annually (Ibrahim *et al.*, 2009). And most of these inland water bodies lacked proper management (Peter *et al*., 2015). Fish and fish products are vital and affordable sources of food and high quality protein (Food and Agriculture Organization, 2013). Fisheries resources should play important role in development of nations that are endowed with lots of natural freshwater ecosystems like Nigeria, since fishes are obligate aquatic organisms. Apart from being a cheap source of animal protein, fish contains essential nutrients required by the body for healthy living (Francis *et al.*, 2014). According to Peter *et al.* (2015), the benefits of fisheries resources include among others; economic benefits, livelihood benefits, food and nutritional benefits and ecosystem resilience and services. Fishes are renewable resources which should be exploited rationally on sustainable basis. And to derive maximum benefits from them, it is necessary to evolve effective management strategies that will make available the resources now and in the future, at the time we need them, in a very good condition at affordable prices and should improve the economic well-being of fishers, and should be environmentally friendly.

Since fish is one of the cheapest source of animal protein available to man, there is need to protect and manage them. In order for this to be realistic and effective, detail knowledge of the water bodies and the fishers is of great importance. There are a number of growing concerns about problems with the management of fisheries resources and fishing, placing excessive strain on the water ecosystem including lakes and rivers which are major fisheries resources. Consequently, the history of management of inland fisheries worldwide shows low success in containing the growing pressure on the natural resources (Matthew, 2000). Reporting of global inland fisheries production continues to present problem owing to lack of reliable information on catch quantities and species composition (Dan-Kishiya, 2012). Fisheries management requires a good knowledge of fishing gears (Idowu *et al*., 2004), fish species composition, fish quantities and fishers (Peter *et al*., 2015).

According to Abiodun and Miller (2005), catch composition, frequency of size and increase or decrease in total catch are not reliable for most inland waters of Nigeria for more than two decades. Development and improved management of any country's inland water bodies must therefore start with increased knowledge of the water bodies, information on the current status of fisheries and the socio-economic characteristics of fishing communities so that people can be effectively integrated into co-management programmes. Fish are not infinite resources and therefore requires good, long term management and protection from over-exploitation. Lack of substantial data implies poor management. And the trend of fish catches is on the decline due to over-harvesting among other factors (Ekundayo *et al.*, 2014). Poor management of water bodies by relevant government authorities in Nigeria has led to low productivity and consequently low catches by fishers. This has led to the use of undesirable fishing gears and very destructive fishing methods with the sole aim of getting more catch (Peter *et al.*, 2015).

One aspect of studying a lake is to understand its fish fauna diversity, stock assessment and distribution relative to the physical, chemical and biological properties in order to provide effective management strategies. Lakes can provide significant contribution to their global fisheries, but the effectiveness of their contributions depends largely on adequate fish assemblages and proper management of their lake fisheries.

The study involved frame and catch composition surveys of Lake Ribadu, Adamawa State, Nigeria. The primary objectives were to; determine the size and distribution of fishing villages around the lake, the number of fishers, fishing crafts and gears used on the lake and also to assess the catch composition, species abundance and estimate catch per unit effort in the lake. This is aimed at formulating management plan and policies for effective management of the lake so as to enhance sustainable fish production and sustainable fish yield of the Lake, thus improving the living standard of the fishers and fishing communities around the lake.

Materials and Methods

The Study Area: the study site was Lake Ribadu. Lake Ribadu is located in Ribadu Town of Fufore Local Government Area, Adamawa State, Nigeria. Lake Ribadu is a perennial lake situated in latitude 9.12 – 16.51 N and longitude 12.28 – 12.43 E (Linus, 2015).

Lake Ribadu is a wet flood plain adjacent the Upper River Benue. River Farah is a tributary of the lake which takes its course at the far part of Korchiel and empties into River Benue at the south-west foot of Ribadu hills (Linus, 2015). Aquatic vegetation in the lake consist of mass floating weeds such as water

ISSN 2229-5518

lily, water lettuce, water hyacinth, typha grass and wild guinea corn which move on the lake according to the prevailing winds.

Methods of Data Collection: data for the study was collected through frame and catch composition assessment surveys in the months of June and August, 2015. The frame survey involved going round the entire Lake to identify and count communities around the lake, fishers, and the fishing crafts and gears employed by fishers in the Lake.

The catch assessment survey was conducted twice a week from June to August, 2015, at the landing site, and involved detailed examination, actual counting and recording of all fishes caught by the local fishers as well as their price at the landing site. All fish species landed were sorted according to species, counted; weighed using weighing balance and fishing time were recorded. Genus and species identification of all fishes caught were carried out using the revised edition of Olaosebikan and Raji (2013) and Idodo-Umeh (2003).

Data Treatment and Analysis

Descriptive statistics was used to analyze data collected from study. The descriptive statistical tools include frequency counts, simple percentage and tables. Species abundance score was used to ascertain the species abundance. This was achieved following the criteria of Allison *et al.* (1997) as follows: 1-50 rare; 51-100 few; 101-200 common; 201-400 abundant and >400 dominant.

The catch per unit effort (CPUE) was determined using the relationship between the weights of fishes caught at a fixed hour at the Lake. This was achieved using the expression below (Linus, 2015):

$$\text{CPUE} = \frac{\text{total weight of fish caught (kg)}}{\text{Time (hours)}}$$

RESULTS AND DISCUSSIONS

Frame survey: Table 1 shows the distribution of communities, fishers and fishing crafts and gears identified and counted during the study. A total of 4 localities were identified during the frame survey. These communities are inhabited by people all year round. There were a total of 62 fishers of which 40 were part-time and 22 were full-time fishers. Ngurore village has the highest number of fishers (21). This could be because of its nearness to the Lake. A total of 35 dug-out wooden canoes and 268 fishing gears were counted in the study. 64.52% of the fishers in the lake are part-time fishers while 35.48% are full-time fishers. This indicates that most of the fishers engage in non-fishing activities. Linus (2015) reported that fishers in Lake Ribadu engage in other non-fishing activities which include crop farming, livestock rearing and trading among others. A full-time fisher is one who has canoe (s) and fishers for at least 15 days in a month where as a part-time fisher is the one who does not have a canoe but wades in the water to fish and does not fish for up to 15 days in a month (Abiodun and Miller, 2005). The fishers mostly used gill nets (91), cast nets (81), long lines (39), traps (19), lift nets (17) and scoop nets (21). Abiodun and Miller (2005) reported that gill nets are the most used gears in Lake Gerio. This could be because of they are relatively cheap, can be made locally, readily available and durable or their catching efficiency. Visual observation of the catches from the fishers revealed that juveniles caught were wasted by fishers using gears with small mesh size. Fishing-out has negative effects and is capable of killing any fishery (Toyisi and Effiong, 2005).

Catch composition assessment: Table 2 gives the species by number and weight as well as percentage composition and percentage weight, and abundance. A total of 5572 fishes belonging to 15 families and 29 species were identified in the local fisher's catches. The Cichlidae dominated the catch, which contributed 28.86% by number to the total catch. This was followed by the Claridae (28.74%); Schilbeidae (15.54%); Mochokidae (8.0%); Alestidae (4.17%); Mormyridae (3.62%); Protopteridae (2.23%); Bagridae (2.10%); Claroteidae (1.94%); Ployteridae 91.78); Dischodontidae (1.42%) and Cyprinadae (1.34%). The families Citharinidae, Anabantidae and Gymnarchidae each contributed less than 1% to the total fishes in the catch.

In terms of weight, the family Claridae dominated, contributing 40.84% to the total weight of the fish caught. This was followd by Cichlidae (16.72%); Mochokidae (11.25%); Alestidae (4.50%); Mormyridae (3.70%); Protopteridae (3.37%); Claroteidae (2.84%); Bagridae (2.70%); Schilbeidae (2.65%); Distichodontidae (2.11%); Cyprinidae (1.60%); Polypteridae (1.19%) and Citharinidae (1.05%). Anabantidae and Gymnarchidae each contributed less than 1% to the total weight of the fish caught.

The 4 dominant species in the Lake were *Sarotherodon galilaeus* (21.34%); *Clarias gariepinus* (21.02%); *Schilbe intermedius* (10.43) and *Clarias anguillaris* (7.72%). These 4 fishes made up only 13.70% of the total fish caught. The species that were tagged rare were 12 and constitute 41.38% of the total catch. 3 species were abundant and made up 10.34% while the common and few species were 5 each and constitute 17.24%of the total catch. This indicates that a reasonable percentage of fishes in Lake Ribadu are rare and thus threatened.

In terms of diversity, the family Mormyridae was the most diversified, having 4 - species representation which was dominated by *Sarotherodon galilaeus*. The families Anabantidae, Distichodontidae, Citharinidae, Protopteridae, Polypteridae and Gymnarchidae were represented by a species each thus, the least diversified. The catch per unit effort was 4.43 which is close to the average CPUE of 4.30 in the same Lake as reported by Linus (2015).

The fishery of Lake Ribadu is a multi-species and multi-gear fishery, which indicates dynamic variation in terms of size, composition and distribution of fishes. The dominance of the Cichilidae family in the present study agrees favorably with what was reported by many authors. The dominance of the Cichildae family was reported in Kontagora Reservoir (Ibrahim *et al.*, 2009); Tiga Dam (Ita, 1984); Zaria Reservoir (Balogun *et al.*, 2000); Tagwai Lake (Ayanwale *et al*., 2013); Lower Usuma Reservoir (Dan-Kishiya, 2012) and in the West African Arid Zone Lake (Toyisi and Effiong, 2005). Their dominance could be attributed to their adaptation to lentic aquatic environmental qualities, productivity of the lake and changes in the hydrological regime of the lake (Toyisi and Effiong, 2005), their high prolific breeding nature (Dan-Kishiya, 2012) coupled with their good parental care which gives a considerable advantage in the colonization of their habitat (Toyisi and Effiong, 2005). This compares favorably with the findings of Komolefe and Arowomo (2009) and Balogun (2005). *Sarotherodon galilaeus* tops the cichlidae family in terms of number and weight. The dominance of *S. galilaeus* in the Cichlids was also reported in Lake Gerio by Abiodun and Miller (2005). Dunn (1989) reported that the Cichlids apparently requires swam habitat with plenty of organic matter for swamping and feeding of fry. They must have abundant food to thrive upon as the tendencies for most Cichlids to breed early during flood at the margin of the advancing water have been demonstrated (Dunn, 1989). The family Claridae represented by *C. gariepinus* and *C. anguillaris* were abundant in the lake. Their sizes were however found to be smaller which could be as result of mesh size selection of fishing gears or indiscriminate or irresponsible fishing (Peter *et al.*, 2015).

The presence of *Protopterus annectens* in the lake could be due to their adaptive nature to macrophytes acting as shelter and provide food by the decaying vegetation (Silvano and Begossi, 1998). *Schilbe intermedius* was also among the dominant species in the lake. This could be as a result of their abundance in rainy season than in the dry season. Seasonally, the family Schilbeidae is more abundant in the rainy season than in the dry season and are omnivorous, feeding mainly on detritus, insects and fish. This is typical of lakes (Idodo-Umeh, 2003). *Auchenoglanis biscutatus, Hyperopisus bebe, Mormyrops anguilloides, Marcusenius senegalensis, Ctenopoma petherici, Bagrus bajad, Labeo coubie, Raiamas senegalensis, Barbus macrops, Brycinus nurse, Citharinus citharus and Gymnarchus niloticus* are threatened species in the Lake. The most threatened of these fishes are *Ctenopoma petherici* (0.02%) and *Gymnarchus niloticus* (0.02%). Their percentage composition was very low compared to other species in the lake. This could be because they could not adapt to the hydrometeorological variables and fluctuations in the lake. This is typical of *Hyperopisus bebe, Mormyrops anguilloides and Mercusenius senegalensis* (Toyisi and Effiong, 2005). Their very low abundance could also be as a result of heavy exploitation which is known to cause a shift in maturity and abundance of many fishes (Meido and Carrocsco, 2000). Their low abundance could also be because of ecosystem degradation caused by the persistent yearly floods from Lagdo Dam in Cameroon (Ladu *et al*., 2013; Ekundayo *et al.*, 2014). Over-fishing can change species composition and abundance and has important implication on the fisheries (Toyisi and Effiong, 2005; Peter *et al.*, 2015).

Being a flood plain of Upper River Benue with many tributaries forming linkages, Lake Ribadu might have experienced increase or decrease in diversity and composition of fish fauna through the entry and exit of many fishes as a result of the flood. Francis *et al*. (2014) revealed that fish yield in Nigeria is declining due to environmental degradation and adequate management of the fisheries resources. Notwithstanding, fish biodiversity can shift over time though the shift may not be clearly related to factors such as increased water clarity, macrophyte growth or benthic invertebrate communities (Trumpickas *et al.*, 2012). The genus Coptodon was reclassified from Tilapia by Dunz and Schliewen (2013). Therefore, the genus Tilapia was reclassified and replaced by Coptodon, thus the species *Coptodon zilli*. Olaosebikan and Raji (2013).

Economic viability of the fishery: fish is sold at the landing site per basin and a basin is approximately 1kg. *Clarias spp, Auchenoglanis spp* and *Bagrus filamentosus* command higher price than all other species. They are sold at ₦500 per kg while other species are sold at ₦450. Their higher monetary could be as a result of their fleshy nature, taste, consumer preference or value attached to them by tribes. Edward *et al.* (2010) reported that *Clarias spp* have high consumer preference owing to their fleshy nature, good taste, and few bones and are often sold alive as they have accessory breathing organ which enable them to survive for few hours outside water. Ochumba and Manyale (1992) reported that freshly caught fish are most delicious, a treaty for royalty among fishing tribes and secondly a strong consumer preference, which make them the most valued fishes. The monetary value for the total catch was ₦299, 180 with Claridae contributing ₦99, 500 to the total money. The families Mochokidae and Cichlidae contributed ₦48, 555 and ₦24, 600 to the total monetary value respectively. This could be more since fishes are known to be more abundant in the rainy season than in the dry season (Idodo-Umeh, 2003).

ISSN 2229-5518

Linus (2015) reported a total annual monetary income of ₦755, 460 in Lake Ribadu. This indicates that the fishery of Lake Ribadu is economically viable if properly utilized, managed and sustained.

Table 1. Fishing Villages, Number of Fishers (Part-Time and Full-Time, Fishing Canoes and Fishing Gears in Lake Ribadu

Village name	number of fishers	part-time fishers	full-time fishers	number of canoes	number of fishing gears
Barkumo	15	09	06	10	gill nets (91), cast nets (81),
Dillo	17	13	04	08	long lines (hooks; 39), lift nets
Kulere	09	05	04	05	(17), traps (*Gmalian* and basket
Ngurore	21	13	08	12	traps; 19) and scoop nets (21)
Total	**62**	**40**	**22**	**35**	**268**

Table 2. Fish Families, Species, Number, Percentage Composition, Percentage Weight, Monetary value and Abundance in Lake Ribadu Caught from June – August, 2015

Family/ Species	number	weight (kg)	% composition	% weight	value (₦)	abundance
Claridae						
Clarias gariepinus (Burchell, 1822)	1171	140.40	21.02	28.81	70, 200	A
Clarias anguillaris (Linnaeus, 1758)	430	58.60	7.72	12.03	29, 300	A
Sub-total	**1601**	**199**	**28.74**	**40.84**	**99, 500**	
Cichlidae						
Sarotherodon galilaeus (Linnaeus, 1758)	1189	81.50	21.34	16.72	36, 675	A
Oreochromis niloticus (Linnaeus, 1758)	356	20.00	6.39	4.10	9, 000	B
Coptodon zilli (Gervais, 1848)	63	6.40	1.13	1.31	2, 880	D
Sub-total	**1608**	**107.9**	**28.86**	**22.13**	**48, 555**	
Claroteidae						
Auchenoglanis occidentalis (Valenciennes, 1840)	85	10.10	1.53	2.07	5, 050	D
Auchenoglanis biscutatus (Geoffrey Saint-Hilaire, 1808)	23	3.80	0.41	0.78	1, 900	E
Sub-total	**108**	**13.90**	**1.94**	**2.85**	**6, 950**	
Mormyridae						

Mormyrus rume (Valenciennes, 1846)	121	10.20	2.17	2.10	4, 590	C
Hyperopisus bebe (Lacepede, 1803)	38	3.60	0.68	0.74	1, 620	E
Mormyrops anguilloides (Linnaeus, 1758)	21	2.70	0.39	0.55	1, 215	E
Marcusenius senegalensis (Steindachner, 1870)	20	1.60	0.38	0.33	720	E
Sub-total	**200**	**18.10**	**3.62**	**3.72**	**8, 145**	
Anabantidae						
Ctenopoma petherici (Gunther, 1864)	01	0.01	0.02	0.002	45	E
Bagridae						
Bagrus filamentosus (Pellegrin, 1924)	70	9.00	1.26	1.85	4, 500	D
Bagrus bajad (Forsskall, 1775)	47	4.10	0.84	0.84	2, 050	E
Sub-total	**117**	**13.10**	**2.10**	**2.69**	**6, 550**	
Cyprinidae						
Labeo coubie (Ruppell, 1832)	09	0.70	0.16	0.14	315	E
Raiamas senegalensis (Steindachner, 1870)	37	3.40	0.66	0.70	1, 530	E
Barbus macrops (Boulenger, 1901)	29	3.70	0.52	0.76	1, 665	E
Sub-total	**75**	**7.80**	**1.34**	**1.60**	**3, 510**	
Alestisae						
Alestes baremose (De Joannais)	201	18.70	3.61	3.84	8, 415	B
Brycinus nurse (Ruppell, 1832)	31	3.30	0.56	0.68	1, 485	E
Sub-total	**232**	**22.0**	**4.17**	**4.52**	**9, 900**	
Distichodontidae						
Distichodus rostratus (Gunther, 1864)	79	10.30	1.42	2.11	463.5	D
Mochokidae						
Synodontis schall (Bloch and Schneider, 1801)	166	18.60	2.98	3.82	8, 370	C
Synodontis nigrita (Valenciennes, 1840)	107	15.20	1.92	3.12	6, 840	C
Synodontis budgetti (Boulenger, 1911)	173	21.00	3.10	4.31	9, 450	C

Sub-total	**446**	**54.80**	**8.00**	**11.25**	**24, 600**	
Citharinidae						
Citharinus citharus (Geoffrey and Saint-Hilaire, 1809)	15	5.10	0.27	1.05	2, 295	E
Protopteridae						
Protopterus annectens (Owen, 1883)	124	16.40	2.23	3.37	7, 380	C
Polyteridae						
Polyterus senegalus (Cuvier, 1829)	99	5.80	1.78	1.19	1, 160	D
Schilbeidae						
Schilbe intermedius (Ruppell, 1832)	581	9.50	10.43	1.95	4, 275	A
Schilbe mystus (Linne, 1758)	285	3.40	5.11	0.70	1, 530	B
Sub-total	**866**	**12.90**	**15. 54**	**2.65**	**5, 805**	
Gymnarchidae						
Gymnarchus niloticus (Cuvier, 1829)	01	0.20	0.02	0.04	90	E
Grand total	**5572**	**487.31**	**100.01**	**100.00**	**299, 180**	

Keys: 1-50 rare (E); 51-100 few (D); 101-200 common (C); 201-400 abundant (B) and >400 dominant (A) (Allison et al. (1997)

At the landing site, *Clarias spp*, *Auchenoglanis spp* and *Bagrus filamentosus* are sold at ₦500 per basin while all other species are sold at ₦450 per basin. A basin is approximately 1kg.

Conclusion and Recommendations

From this study, it can be concluded that Lake Ribadu has 15 fish families which belonged to 29 species. There were 4 dominant fish families in the Lake. The most dominant family was Cichlidae followed by Claridae, Schilbeidae and Mochokidae. This indicates that the Lake supports more of the family Cichlidae, followed by Claridae, Schilbeidae and Mochokidae. From the species composition of the study, *Sarotherodon galilaues*, *Clarias gariepinus*, *Schilbe intermedius* and *Clarias anguillaris* are the dominant species in the Lake. This result shows that Lake Ribadu like most inland water bodies in Nigeria has great potentials for fisheries exploitation if properly managed and utilized.

Any management plan for Lake Ribadu should not neglect approaches such as ecosystem-based approach, adaptive management and most importantly, community-based and integrated management approaches because the success of any management plan depends, to a great extent on the fishers. The number of fish families and species could be more and this can be confirmed through longer period of study.

It is therefore recommended that longer period study be conducted to confirm the present number of species, genera and families of fish fauna. The present study will serve as a base material for further research in the field of fish population dynamics and related fields.

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