IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 13, Issue 8 Ser. II (August. 2019), PP 14-18
www.iosrjournals.org

Diversity and Abundance of Fish Species in Some Selected Riverine Wetlands of Upper Benue River Basin, Nigeria

Bonjoru, R[1]*., K.A Abubakar[2]., Hassan, E.I[2]., & Jerry, T.J[1]
[1]*Department of Biology, College of Education, P.M.B 1021, Zing, Taraba State*
[2]*Department of Zoology, Modibbo Adama University of Technology, P.M.B 2076 Yola, Adamawa State*
Corresponding Author: Bonjoru, R

***Abstract**: This study was carried out to look at the diversity and abundance of fish species in some selected riverine wetlands of the Upper Benue River Basin. The study was carried out for a 6 month period (July to December 2016). Sampling was by direct observation of the fish at the landing sites. Frequency counts, percentages were used to analyze the fish species composition and abundance while ComEcolPaC (a Microsoft Excel 2003 based program) was used to analyze the variation in the diversity indices. A total of 26 species from 16 families were observed in the riverine wetlands studied and the most diverse groups of fish species were: Schilbe spp with 10.95% and the least in abundance is Gymnarchus niloticus with 0.45%. A systematic management approach like comprehensive rational planning, precautionary and adaptive approaches toward management and development of Riverine wetlands is hereby recommended. Furthermore, government should take immediate action through public awareness and education to regulate fishing activities.*

Keywords: *Diversity, Abundance, Fish Species, Wetlands, Upper Benue River Basin.*

Date of Submission: 09-08-2019 Date of Acceptance: 23-08-2019

I. Introduction

Fishes are the best known species of aquatic organisms and they are the only food source harvested from natural populations [1]. More so, fishes are said to be existing at or near the top of the food chain and has been serving as a major indicator of a balanced aquatic ecosystem [2]. Fish has been identified as suitable for biological assessment due to its easy identification and economic value [3]. Furthermore, fishes are often considered as engineers of aquatic ecosystems, not only react to physical and chemical changes in their environment, but they can also drive such changes and have important roles in cleansing and detoxifying their environment [4].

Over the past few decades, fish resources decreased dramatically, and endemic species have faced continuous threats globally [5]. It is a known fact that Overfishing, water diversion, pollution, global climate change, land erosion and other anthropogenic activities are considered as the main threats to fish biodiversity [6, 7]. Therefore, the conservation of fish biodiversity has become more imperative and of utmost importance. Wetlands were often regarded as wastelands because of some problems like disease vectors associated with them [8]. Asibor [9] stated that for an area to be considered a wetland, it must possess water, wetland plants and wetland soils.

Today the fish diversity and associated habitats management is a great challenge and the ability to evaluate the effects of habitat change and other impacts on the fish population required extensive surveying of the fish population before and after the change occur [10]. The fish diversity, community structure and species assemblages in the streams and rivers are interdependent on many abiotic and biotic factors. These factors determine the success or failure of fish species assemblages in the rivers or streams within the range of spatial distribution limits [11]. Parameters such as species composition, species richness**,** abundance have been used in many studies to describe and assess fish community and diversity [12].

Before now, fewer studies on Diversity of Fish species were undertake in the wetlands of Mayo Ranewo to include the studies of [13]. The fisheries productivity of these riverine wetlands could not have been optimized as this majorly depends on the ecological studies which have not been fully undertaken. Hence, the study seeks to investigate the diversity and abundance of fish species in some selected riverine wetlands of the Upper Benue River Basin, Nigeria with the single aim of updating the fish diversity profile of the study area.

II. Materials And Methods

Study area: The Riverine Wetlands are located at Mayo Ranewo, Ardokola Local Government Area, Taraba State, Nigeria. They are located at the confluence of River Fan Mangel with the Upper Benue River Basin. The riverine wetlands are located between latitude $8^{o}47'$ to $8^{o}53'$ N and longitude $10^{o}50'$ to $10^{o}55'$ E (Fig. 1).

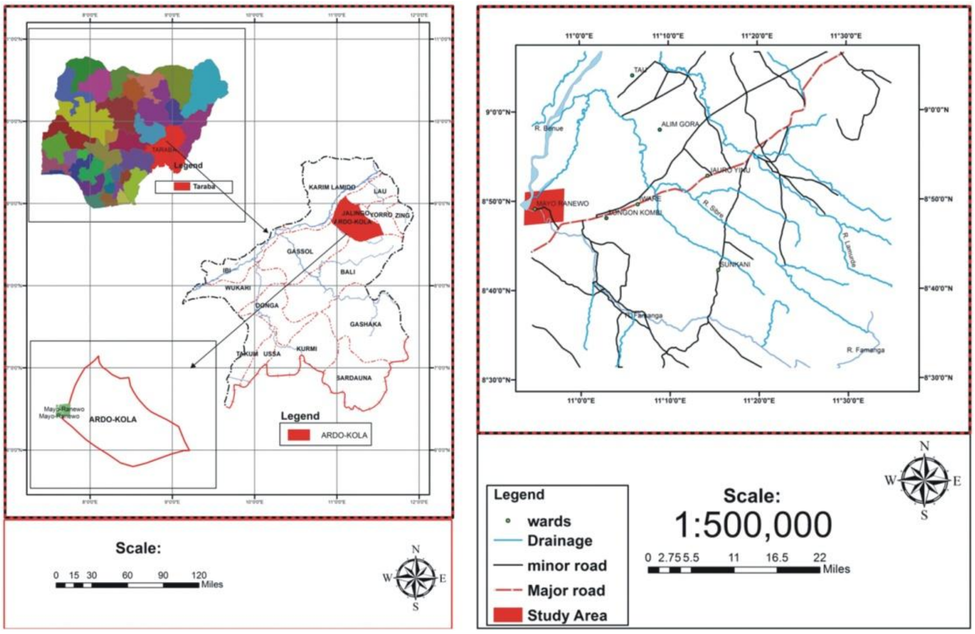

Fig 1: Location Map of the Study area

Method of Data Collection: The study was carried out for a 6 month period (July to December 2016). The study area is characterized by Riverine wetlands and Upper Benue River and thus has different landing sites. The study area was categorized into three sites: site A, B and C. Site A (fishing, farming, washing, bathing, other commercial activities). Site B (fishing farming, commercial activities site), while site C (fishing and farming). The sites were sampled twice monthly for fish species. Sampling was by: Direct observation of the Fish at the landing sites. The Fish were sorted into taxonomic groups, identified to family and species level. All the fish species landed were counted. Fish species that cannot be identified at the landing site were preserved and transported in a cool box and labeled for laboratory identification and analysis. In the laboratory, the fish were preserved in 2% formaldehyde solution [14]. Identification of the fish species was according to Olaosebikan and Raji [15].

Statistical Analysis: Frequency counts, Percentages and ComEcolPaC, a Microsoft Excel 2003 based program was used to calculate: Species richness and species diversity.
Specie richness seeks to ascertain the number of species per sample while species diversity seeks to provide more information about community composition than simply species richness (i.e., the number of species present); they also take the relative abundances of different species into account

H' - Shannon-Wiener diversity index

$$H' = \sum_{i=1}^{s} p_i \cdot \log_2 p_i$$

S - species richness (number of species),
p_i - proportion of species *i*

E – Pielou Evenness Index

$$E = \frac{H'}{H_{\max}}$$

D - Simpson's index

$$D = \sum_{i=1}^{s} p_i^2$$

S - species richness,
p_i - proportion of species *i*

D_{Ma} - Margalef Diversity Index

$$D_{Ma} = \frac{S-1}{\ln N}$$

S - species richness,
N - total abundance

D_{Me} – Menhinick Diversity Index

$$D_{Me} = \frac{S}{\sqrt{N}}$$

S - species richness,
N - total abundance

III. Results

Twenty six (26) species from 16 families were observed in the study sites. The highest abundance were recorded in: *Schilbe spp* with 10.95%, Mormyrus *spp* with 9.75%, and *Synodontis gambiensis* with 8.31%, while the least in abundance are: *Gymnarchus niloticus* with 0.45%, *Heterotis niloticus* with 0.87% and *Protopterus annectens* with 0.84% were recorded on the study sites (Table 1).
Table 2 and 3 of the study revealed the Shannon-Weiner Diversity Index (H') and the Spatial Variation in the Diversity indices of the study.

Table 1: Species Composition and Abundance of fish from the selected wetlands

Family	Specie	English name	Local name	Abundance	% Abundance
Mormyridae	*Momyrus spp* (Valenciennes, 1846)	Trunk fish	Miligi	702	9.75
	Petrocephalus bane (Boulenger, 1902)		Faya	503	6.99
	Marcusenius spp (Boulenger, 1901)		Lali	422	5.86
Mochokidae	*Synodontis gambiensis* (Gunther, 1864),	Updown catfish	Kurungu	598	8.31
	Synodontis clarias (Linneaus, 1758)	Updown catfish	Kurungu	436	6.06
	Synodontis nigrita (Valenciennes,1840)	Updown catfish	Kurungu	267	3.71
Schilbeidae	*Schilbe spp* (Ruppell, 1832)	Silver catfish	Na langa	788	10.95
Claroteidae	*Auchenoglanis spp* (G. Saint-Hilairie, 1808)		Buro	358	4.97
	Clarotes laticeps (Daget, 1954)	Widehead catfish	-	90	1.25
	Chrysichthys spp (Pfaff, 1933)		-	153	2.12
Cyprinidae	*Labeo senegalensis* (Valenciennes, 1842)		Datta	367	5.10
Bagridae	*Bagrus bayad (*Pfaff, 1933)	Bayad	Dinko	362	5.03
	Bagrus docmac (Daget, 1954)	Semutundu	Dinko	131	1.82
Claridae	*Clarias gariepinus* (Burchell,1822)	Catfish	Tarwada	264	3.66
	Heterobranchus spp (G. Saint Hilaire, 1809)	Catfish	Tarwada	139	1.93
Alestidae	*Alestes spp* (Bilham, 1852)	Nurse Tetra	-	359	4.99
	Hydrocynus forskalii (Cuiver, 1819)	Tiger fish	Zawai	73	1.01
Cichlidae	*Tilapia zilli* (Gervais, 1848)	Redbelly Tilapia	Karpasa	251	3.48
	Oreochromis niloticus (Linnaeus, 1758)	Nile Tilapia	Karpasa	145	2.01
Distichodontidae	*Distichodontus rostratus* (Gunther, 1864)		Chi haki	383	5.32
Citharinidae	Citharinus citharus (G. Saint Hilaire, 1809)	Moonfish	Falia	145	2.01
Malapteruridae	*Malapterurus electricus* (Gmeiin, 1789)	Electric catfish	Mijiriya	42	0.58
Arapaimidae	*Heterotis niloticus* (Linnaeus, 1762)	Bony tongue	Bali	63	0.87
Protopteridae	*Protopterus annectens* (Owen, 1883)	Lungfish	Bodami	61	0.84
Centropomidae	*Lates niloticus*	Perch	Ragonruwa	59	0.82
Gymnarchidae	*Gymnarchus niloticus* (Linnaeus, 1758)		Dan sarki	33	0.45
				7194	**100**

Table 2: Shannon-Weiner Diversity Index of the Fish Species from the Study sites

Specie	Site 1				Site 2				Site 3			
	N	Pi	InPi	PiInPi	N	Pi	InPi	PiInPi	N	Pi	InPi	PiInPi
Mormyrus spp	264	0.1049	-2.2544	-0.2364	214	0.0857	-2.4564	-0.2105	224	0.1026	-2.2763	-0.2335
Petrocephalus bane	160	*0.0635*	*-2.7552*	*-0.1749*	178	*0.0713*	*-2.6406*	*-0.1882*	171	*0.0783*	*-2.5463*	*-0.1993*
Marcusenius spp	129	*0.0512*	*-2.9706*	*-0.1520*	155	*0.0620*	*-2.7790*	*-0.1722*	138	*0.0632*	*-2.7607*	*-0.1744*
Synodontis gambiensis	230	*0.0914*	*-2.3923*	*-0.2186*	212	*0.0849*	*-2.4658*	*-0.2093*	152	*0.0696*	*-2.6641*	*-0.1854*
Synodontis clarias	126	*0.0500*	*-2.9941*	*-0.1497*	160	*0.0641*	*-2.7472*	*-0.1761*	150	*0.0687*	*-2.6773*	*-0.1839*
Synodontis schall	65	*0.0258*	*-3.6560*	*-0.0943*	107	*0.0428*	*-3.1496*	*-0.1348*	91	*0.0417*	*-3.1771*	*-0.1324*
Schilbe spp	291	*0.1156*	*-2.1571*	*-0.2493*	253	*0.0576*	*-2.8526*	*-0.1643*	246	*0.0568*	*-2.8677*	*-0.1628*
Auchenoglanis spp	130	*0.0472*	*-3.0513*	*-0.1440*	142	*0.0384*	*-3.2580*	*-0.1251*	86	*0.0362*	*-3.3185*	*-0.1201*
Clarotes laticeps	4	*0.0015*	*-0.0025*	*-3.9745*	60	*0.0240*	*-3.7281*	*-0.0894*	26	*0.0119*	*-4.4299*	*-0.0527*
Chrysichthys spp	32	*0.0083*	*-4.7859*	*-0.0397*	75	*0.0152*	*-4.1848*	*-0.0636*	46	*0.0123*	*-4.3921*	*-0.0540*
Labeo spp	162	*0.0600*	*-2.8131*	*-0.1687*	127	*0.0348*	*-3.3565*	*-0.1168*	78	*0.0197*	*-3.9267*	*-0.0773*
Bagrus bayad	200	*0.0794*	*-2.5321*	*-0.2010*	95	*0.0380*	*-3.2685*	*-0.1242*	67	*0.0307*	*-3.4833*	*-0.1069*
Bagrus docmac	63	*0.0250*	*-3.6872*	*-0.0921*	54	*0.0216*	*-3.8334*	*-0.0828*	14	*0.0064*	*-5.0489*	*-0.0323*
Clarias garienpinus	93	*0.0369*	*-3.2978*	*-0.1216*	105	*0.0420*	*-3.1684*	*-0.1330*	44	*0.0201*	*-3.9038*	*-0.0784*
Clarias anguillaris	44	*0.0131*	*-4.3339*	*-0.0567*	51	*0.0072*	*-4.9320*	*-0.0355*	44	*0.0132*	*-4.3207*	*-0.0570*
Alestes spp	90	*0.0202*	*-3.8985*	*-0.0787*	148	*0.0348*	*-3.3565*	*-0.1168*	121	*0.0302*	*-4.4983*	*-0.1056*
Hydrocynus forskahlii	28	*0.0111*	*-4.4982*	*-0.0499*	29	*0.0116*	*-4.4551*	*-0.0516*	16	*0.0073*	*-4.9154*	*-0.0358*
Tilapia zilli	51	*0.0127*	*-4.3646*	*-0.0554*	94	*0.0208*	*-3.8712*	*-0.0805*	98	*0.0201*	*-3.9038*	*-0.0784*
Oreochromis niloticus	40	*0.0158*	*-4.1415*	*-0.0654*	44	*0.0176*	*-4.0398*	*-0.0711*	61	*0.0279*	*-3.5771*	*-0.0998*
Distichodontus rostratus	190	*0.0755*	*-2.5833*	*-0.1950*	86	*0.0344*	*-3.3680*	*-0.1158*	105	*0.0481*	*-3.0340*	*-0.1459*
Citharinus citherus	55	*0.0218*	*-3.8230*	*-0.0833*	58	*0.0232*	*-3.7620*	*-0.0872*	32	*0.0146*	*-4.2222*	*-0.0616*
Malapterus electricus	14	*0.0055*	*-5.1913*	*-0.0285*	8	*0.0032*	*-5.7034*	*-0.0183*	14	*0.0064*	*-5.0489*	*-0.0323*
Heterotis niloticus	20	*0.0079*	*-4.8346*	*-0.0381*	10	*0.0040*	*-5.5198*	*-0.0220*	33	*0.0151*	*-4.1914*	*-0.0632*
Protopterus annectens	14	*0.0055*	*-5.1913*	*-0.0285*	9	*0.0036*	*-5.6252*	*-0.0202*	38	*0.0174*	*-4.0504*	*-0.0704*
Lates niloticus	12	*0.0047*	*-5.4355*	*-0.0251*	12	*0.0048*	*-5.3375*	*-0.0256*	35	*0.0160*	*-4.1326*	*-0.0661*
Gymnarchus niloticus	9	*0.0035*	*-5.6332*	*-0.0197*	12	*0.0048*	*-5.3375*	*-0.0256*	12	*0.0054*	*-5.2030*	*-0.0280*
Total	**2516**	**1.000**		**4.173**	**2496**	**0.999**		**4.301**	**2182**	**0.980**		**4.291**

Table 3: Spatial Variation in Diversity indices of fish population across the study sites

	Site		
	A	B	C
Shannon-Weiner Diversity Index (H')	4.17	4.30	4.30
Pielou Evenness Index (E)	0.88	0.91	0.91
Simpson's Density Index (D)	0.07	0.06	0.06
Margalef Density Index (DMa)	3.19	3.19	3.25
Menhinick Density Index (DMe)	0.51	0.52	0.56

IV. Discussion

Twenty six (26) species from 16 families were observed in the selected study sites (Table 1). The productivity of the study area is higher than other similar ecosystems. This study is similar to a study conducted in a Lacustrine wetlands of Lau, Taraba State by David *et al.*, [13] which showed that a total sample size of 5044 constituting 15 families were sampled. In a similar study by David *et al.*, [9] conducted in Kiri and Gyawana Lake located in Gombe and Adamawa State respectively showed that 16 families were observed in both lakes. Furthermore, Emmanuel and Modupe [16], showed that 11 species in 10 fish families were present at River Ore in Ogun State, located at South West, Nigeria. However, the studies showed high species richness compared to the studies conducted by Adeyemi, Akombo, and Adikwu [17], which reported an estimate of 12 fish species belonging to 10 families from Gbedikere Lake, Bassa, Kogi state, Nigeria. Furthermore, another study conducted by Idowu and Eyo [18] in Lake Alau, Maiduguri, Borno State recorded a low species richness of 12 families being recorded. This differences recorded was influenced by local fish harvest, removal of water for domestic and commercial purposes, downstream migration of fish in search of food, shelter, spawning and farming activities [13].

Table 2 and 3 of the study revealed the Shannon-Weiner Diversity Index (H') and the Spatial Variation in the Diversity indices of the study. The Shannon-Weiner Diversity Index (H') ranged between 4.17 - 4.30 across the three study sites while the spatial variation in diversity indices of fish population across the three study sites are: Pielou Evenness Index (E) ranged between 0.88 - 0.91; Simpson's Diversity Index (D) ranged between 0.05 - 0.06; Others indices recorded included Margalef Diversity Index (DMa) with the range of 3.19 - 3.25 and Menhinick Diversity Index (DMe) ranged from 0.51 - 0.56. Species richness and diversity was observed to increase in all sites. This may be attributed to increased living space leading to increased number of microhabitats. According to Udoidiong and King [19] diversity is higher in old communities than newly established ones. Riverine Wetlands of Mayo Ranewo, over the past twenty years has attended the status of being classified as an old community. The impacts of high fishing levels on the species are mentioned in Bankole, *et al.*, [14]. The Shannon-Wiener's Diversity Index for the fish species in the three study sites was in line with Gaines *et al.*, [20] who reported that the Shannon-Wiener's Diversity Index ranges from 1.5 to 3.5 and rarely reaches 4.5. It indicates that the fish species in the 3 study sites are very much diverse, this is of great importance to the flora and fauna community of the study area [20].

V. Conclusion

The study was aimed at studying the diversity and abundance of fish species in some selected wetlands of Mayo Ranewo, Ardokola Local Government Area of Taraba State. The results showed that there was more species abundance in all the sites studied in Mayo. Therefore the study recommends that a systematic approach toward management and development of the Riverine wetlands Mayo Ranewo wetlands 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 awareness and education to regulate fishing activities.

References

[1]. Negi RK & Sheetal M. Species Diversity, Abundance and Distribution of Fish Community and Conservation Status of Tons River of Uttarakh and State, India. *Journal of Fisheries and Aquatic Science,* 2013; *8: 617-626*

[2]. National Research Council (2005). Valuing Ecosystem Services: Toward Better Environmental Decision-Making. Washington, DC: The National Academies Press. https://doi.org/10.17226/11139.

[3]. Siligato S & Bohmer J. Using indicators of fish health at multiple levels of biological organization to assess effects of stream pollution in southwest Germany. *Journal of Aquatic Ecosystem Stress and Recovery* 2001; 8: 371–386

[4]. Ostroumov SA. On the multifunctional role of the biota in the self purification of aquatic ecosystem. *Russia Journal of Ecology*; 2005; 36:452-459.

[5]. Guo Q., Liu X., Ao X., Qin J., Wu X & Ouyang S. Fish diversity in the middle and lower reaches of the Ganjiang River of China: Threats and conservation. *PLoS ONE* 2018; 13(11): e0205116. https://doi.org/10.1371/journal.pone.0205116

[6]. Arthington AH, Dulvy NK, Gladstone W & Winfield IJ. Fish conservation in freshwater and marine realms: status, threats and management. *Aquatic Conservation Marine & Freshwater Ecosystems*. 2016; **26(5):** 838–857.

[7]. Fu C, Wu J, Chen J, Wu Q & Lei G. Freshwater fish biodiversity in the Yangtze River basin of china: patterns, threats and conservation. *Biodiversity and Conservation*. 2003; **12:** 1649–1685.

[8]. David DL, Wahedi JA & Zaku QT. Fish Diversity of Two Lacustrine Wetlands of the Upper Benue Basin, Nigeria. *World Academy of Science, Engineering and Technology International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering* 2015; Vol:10, No:5, pp 294-298

[9]. Asibor (2009). Wetlands: values, uses and challenges. A Paper presented to the Nigerian Environmental Society at the Petroleum Training Institute, Effurun, 21st November, 2009.

[10]. Dudgeon D, Arthington AH, Gessner MO, Kawabata ZI & Knowler DJ. Freshwater biodiversity: Importance, threats, status and conservation challenges. *Biol. Rev*., 2006; **81:** 163-182.

[11]. Minns CK. Factors affecting fish species richness in Ontario lakes. *Trans. Am. Fish. Soc*. 1989; 118: 533-545.

[12]. Hewitt ML, Kovacs TG, Dube MG, MacLatchy DL & Martel PH. Altered reproduction in fish exposed to pulp and paper mill effluents: Roles of individual compounds and mill operating conditions. *Environ. Toxicol. Chem*., 2008; **27**: 682-697.

[13]. David DL, Wahedi JA, Buba UN, Ali BD & Barau BW. A study of fish diversity of two lacustrine wetlands in the Upper Benue Basin, Nigeria. *Annual Research & Review in Biology.* 2016; 7(5): 318-328.

[14]. Bankole NO, Sule OD, Okwundu EC & Amadi M. Preliminary investigation into the fish and catch assessment survey of Alau Lake. *Annual Report of National Institute for Freshwater Fisheries Research (NIFFRI)*. 1994; 28pp

[15]. Olaosebika BD & Raji A. *Field Guide to Nigerian Freshwater Fishes*. Revised Edition. 2013

[16]. Emmanuel LO & Modupe OO. Fish diversity in three tributaries of River Ore, South West, Nigeria. *World Journal of Fish and Marine Sciences,* 2010; 2(6): 524-531. ISSN 2078-4589.

[17]. Adeyemi SO, Akombu PM & Adikwu IA. Diversity and abundance of Fish species in Gbedikere Lake, Bassa, Kogi State. *Journal of Research in Forestry, Wildlife and Environment.* 2010; **2(1):** 1-6

[18]. Idowu RT & Eyo JE. Fisheries status and fishing gears of a West African Arid Zone Lake. *Animal Research International.* 2005; **2(2):** 353 – 357

[19]. Udoidiong OM & King RP. Ichthyofaunal assemblages of some Nigerian rainforest streams. *Journal of Aquatic Sciences,* 2010; 15: 1 – 8

[20]. Gaines SD, White C, Carr MH & Palumbi SR. Designing marine reserve networks for both conservation and fisheries management. *Proceedings of National Academy of Sciences*, 2009; 107(1): 18286–18293.