

The Diversity of Fish Species, Composition and Abundance from Bodna River in Kwali Area Council, Abuja.

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Abstract

The Diversity of fish species, composition and abundance from Bodna River in Kwali Area Council, Abuja was studied between May 2018 to April 2019. The aim of the study was to determine the management and sustainable use of the fisheries resources of the Area council. About 1331 fish were collected from the artisanal fishermen during the study period and morphometric indices were determined using standard methods. The fish were identified and counted. Sex ratio 1:2:1 (Males to Females) was obtained indicating a male dominated population. Length –weight measurement indicated that the fish exhibited positive allometric growth pattern. The highest percentage abundant species in the site were *Oreochromis niloticus* with 34.8% *Clarias garienpinus* with 28.0% and *Pellonula leonensis* with 17.6% and the least occurring species were *Nannocharax shariensis* with 11.0% *Mormyrus valenciensis* with 7.7%. The seasonal variation of fish distribution was observed to be higher in the wet season with 66.2% than the dry season. Nutrient displayed greater impact on fish abundance in the wet season. The Simpson and Shannon Weiner's diversity index values were (0.976) and (-1.456) in both richness and evenness respectively. The findings of the study could be helpful to the artisanal fishermen and the community for fisheries sustainability.

Key words: Diversity, composition, abundance and Bodna River.

Introduction

Water is a unique liquid, it is essential for life and the most important medium through which living organisms can grow and flourish, (Bellingham, 2012). Rivers are vital and vulnerable freshwater systems that are critical for the sustenance of all life, providing main water resources for domestic, industrial and agricultural purposes (Farah *et al.* 2002). Aquatic eco systems are critical component of global environment. In addition to being essential contribution to biodiversity and ecological productivity, it also provides a variety of services for human population such as water for drinking, irrigation, recreational opportunity and habitat for economically important fishes, (Dankishiya *et. al.*,2013). A healthy environment is necessary for any organism because life depends upon the continuance of a proper exchange of essential substances and energies between the organism and aquatic surrounding (Omoigberale *et. al.*, 2007). The importance of protein in the diet of man cannot be over emphasized. Fish is one of the cheapest sources of animal protein; it contains important minerals needed by the body, such as calcium, iron, iodine and vitamins. Fish is highly perishable especially in the tropics, where high temperature and humidity accelerates spoilage of fish. However, poor handling, inadequate processing facilities, lack of ice or storage facilities, remoteness of the fishing villages to urban market centers, poor transportation system and poor distribution channel have drastically reduced fish utilization in the tropics, (Ayeloja *et. al.*, 2016).

The diversity and composition of fish resources in Nigeria have been observed and documented by many authors (Ali *et al.*, 2017). Ayoade and Ikulala (2007) reported that length-weight relationships (LWRs) of fishes are important in fisheries biology because they allow the estimation of the average by establishing a mathematical relationship between the relative wellbeing of the fish population. They further asserted that length-weight relationships have a number of important applications in fish stock assessment. Among these applications are:

estimating the standing stock biomass and comparing ontogeny of fish population from different regions. This information would enhance management, conservation and culture of these species. Length-weight relationships (LWR) is represented by the power curve, $W = aL^b$ where the W = weight (g), L = total length (cm), a = constant and b = growth exponentially (Ayoade and Ikulala, 2007). When b is equal to 3, growth in fish is said to be isometric that is fish become more robust with increasing length (Bagenal, 1978). Similarly, when b is less or greater than 3, growth in the fish is allometric; that is fish become thinner with increasing length. King, (1996) noted that only a few estimates of species-specific length-weight relationship parameters are available for Nigerian fishes. Similarly, Hannifer *et al.*, (2006) investigated LWRs of *Channapunctata* from Western River in which the study showed no significant difference ($p > 0.05$) in the LWR as a function of sex. Miranda *et al.*, (2006) also reported 'b' value range from 3.47 to 7.28 in an investigation of the LWR of *cyprinid* fishes of Liberian peninsula. Laleye, (2006) in an investigation of length-weight and LWR of Quame. River Benin (West Africa), recorded b values which range from 2.3307 to 3.5185 and revealed that 38.5% of the species had b values significantly different from 3.

Materials and Methods

Study Area

The Bodna River is located at north-eastern part along Lokoja road to Kogi state between latitude $12^{\circ}40'N$ and $13^{\circ}60'N$ and longitudes $10^{\circ}20'E$ and $11^{\circ}00'E$. (Fig.1) The River is surrounded with settlements of people. The Bodna River in Kwali Area Council originated from lower Usman dam called 'sumwa' in gbarri language meaning - usman water. The river passes through Giri, Gwako, Gwagwalada, Sheda (shadna), Epeanya, Koroko and passes on to join the river Gurara. The river is used by the settlers for domestic purposes, fishing and irrigation for farming. The people

engaged in fishing and crop farming activities both in rainy and dry season.

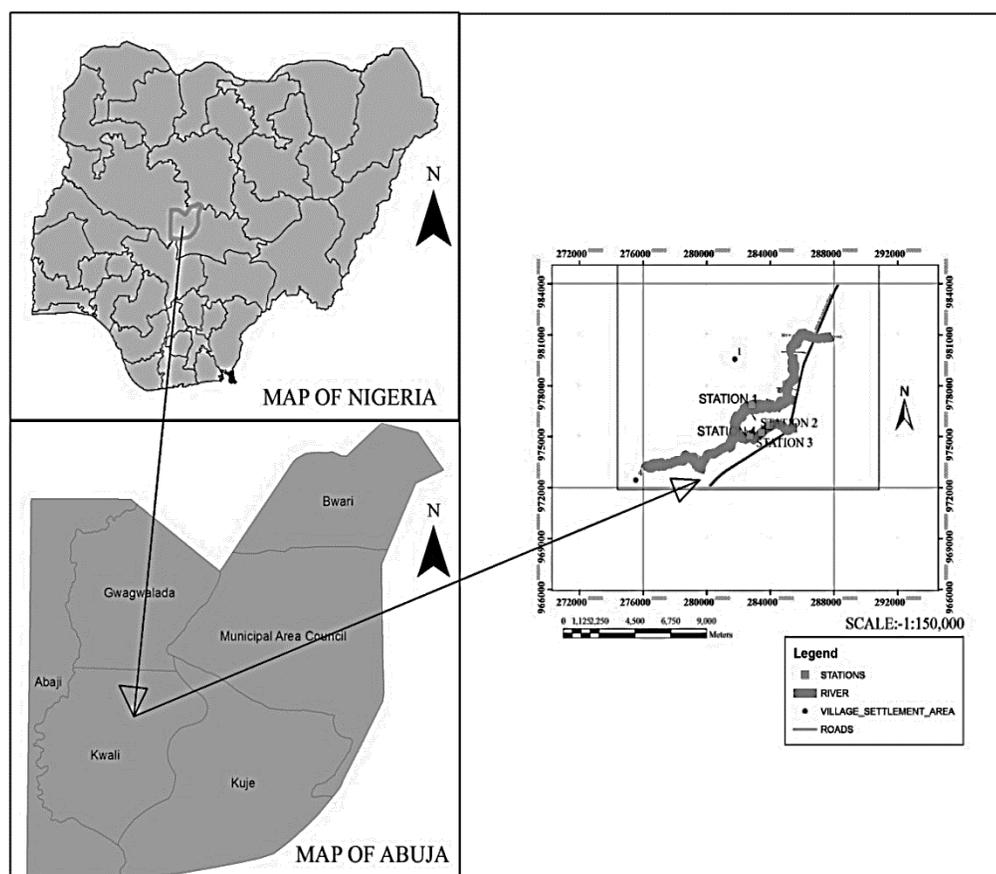


FIGURE 1:- MAP SHOWING THE STUDY AREA

Fish Sampling

The fish for this study were randomly collected from the artisanal fishermen using different fishing gears such as; fishing dragging nets, calabash, baskets, etc; at Tukurua landing site of Bodna River. The morphometric features of the fish were taken. The fish collected were counted (sorting out males and females), the weight and length (standard and total lengths) were taken at spot using a calibrated machine. The fish species were identified using relevant keys and textbooks of Reed, (1997) and Idodo- Umeh, (2003). The number of fishers operating on the site was counted and the types of gears used were identified. The period of the survey covered 12 months (May, 2018 to April, 2019).

Experimental artisanal fish sampling was conducted using fish nets made up of multifilament nets of 38mm (1.5), 57.15mm (2.25)”, 76.2mm (3.0), 101.6 (4.0)-127.0mm (5.0), 152.4mm (6.0)’ and 177.8mm (7.0) stretched meshes were used to sample the

shore surface and bottom water habitat at the sampling station. Each net measured 30 meters long and 3meter deep. The nets were set simultaneously to sample the shore at about 5pm and checked at about 7am the next day. The fish caught in each net were transferred into separate plastic bowls, counted in both males and females. Some fish were sampled out, weighed (g) measured for standard and total length (cm).

Morphometric Data

The weights of fish were determined using a weighing balance (model TH-5000 PEC MEDICAL USA) with the capacity of 5000g. The standard and total length of each fish sampled was determined using a measuring board. The total length was measure from the tip of snout to the longest lobe of the filament of the caudal fin. The standard length was measured from the tip of the snout to the point of attachment of the caudal rays (cm).

Determination of Biodiversity indices

Simpson’s index (D) Simpson’s index diversity (I-D) Simpson’s reciprocal index (I/D), Simpson – Weiner index (H) and Shannon’s equitability (evenness) (EH) were employ to evaluate species diversity.

Simpson’s index $D = \frac{1}{\sum (n/N)^2}$

Where n= the total number of organisms of a particular species

N = the total number of organism of all species

Shannon index $H = -\sum (PI) (\ln PI)$

Where p =the proportion of total number of individuals in the population that is in the species ‘I’

Shannon is evenness (EH) = $H/\ln S$

Where S =total number of species in the community (richness)

Ln = is natural logarithms.

Statistical Analysis

Analysis of data was based on monthly data collection by identification, counting and weighing of the fish. Analysis of variance (ANOVA)was used to analyse the data using SPSS packages version 24 in the statistical analysis of 95%confidence.Descriptive analysis and pie chart were used to determine the percentage abundance of species in Bodna River.

Results

The mean abundance and composition of fish in Bodna River are presented in table 1.Five fish species belonging to five families were recovered in Bodna River from May, 2018 to April, 2019. The families were *Clariidae*, *Cichlidae*, *Mormyridae*, *Clupeidae* and *Distichodontidae*. *Clariidae* was represented by a species *Clarias garienpinus*, *Cichlidae* with a species *Oreochromis niloticus*, *Mormyridae* with a species *Mormyrus valenciensis*, *Clupeidae* with a species *Pellonulaleonensis* and *Distichodontidae* was represented by a species *Nannocharax shariensis*. The total fish abundance collected during the period study was 1,331 in which 881 were males and 450 were female given the ratio 1:2:1 high male population of the fish total abundance in the water.

The mean percentage abundance of the fish was shown in figure 2. *Oreochromis niloticus* was observed to have the highest percentage abundance with 35% followed by *Clarias garienpinus* (29%). Then *Pellonulaleonensis* (17%) and the least percentage value were observed in *Nannocharax shariensis* (11%) and *Mormyrus valenciensis* (8%). The mean weight and length of the fish were presented in Table 4. The overall weight of the fish was 28.91 ± 5.24 with the range of 21.00-34.6 and the overall total length was 34.74 ± 20.73 with the range of 25.3-42.8. The overall standard length was $24.2 \pm 5.28.0$ with the range of 16.5-30.6 using analysis of variance (ANOVA).

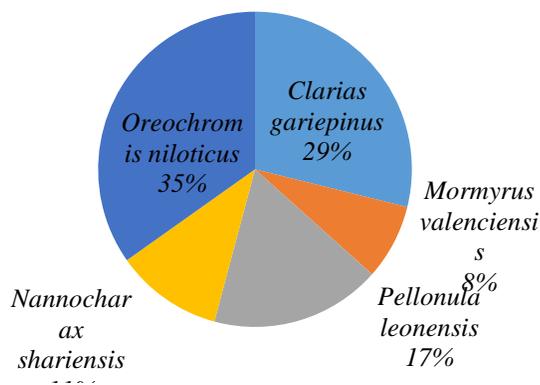


Figure 2: Percentage fish composition in Bodna River from May 2018 to April 2019

Table 1: Diversity Indices of Fish Species in Bodna River from May 2018 to April 2019.

Diversity Index	Bodna River
Total Number of Families	5
Total Number of Species	5
Total Number of Individual Fish	1331
Simpson's Index (D)	0.994
Simpson Index of Diversity (I - D)	0.006
Simpson's Reciprocal Index I/D	1.006
Shannon's Index (H)	1.469
Shannon equitability or Evenness E _H (J)	0.912

Species/Month	May	June	July	August	September	October	November	December	January	February	March	April	Total	%
	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	%				
<i>Clarias</i>	48.3.6	41.6.3	41.3.1	0 0	35.2.6	26.2.0	38.2.9	38.2.9	30.2.3	27.2.10	15.1.1	1 0.2	364	29
<i>Mormyrus</i>	27.2.0	21.1.6	20.1.5	0 0	23.1.9	10.0.8	0 0	0 0	0 11	0 0	0 0	0 0	10.1	8
<i>Pellonula</i>	50.4.2	63.4.7	49.3.7	0 0	36.2.7	20.1.3	10.0.81	10.0.1	0 10	0 0	0 0	0 0	234	17.1
<i>leonensis</i>	34.2.4	26.2.0	39.2.9	0 0	25.1.9	23.1.9	0 0	0 0	0 10	0 0	0 0	0 0	247	11.1
<i>Nannocharax</i>	23.1.7	11.3.3	32.2.1	0 0	45.3.1	29.2.1	33.2.5	33.2.5	48.3.6	0 0	56.1.2	72.5.1	163	31.8
<i>shariensis</i>	156	238	181	0 0	166	110	81	81	78	27	71	74	331	100%
<i>Oreochromis</i>														
<i>niloticus</i>														
Total	14.0%	17%	13%	0 %	12%	8%	6.1%	8.9%	5.95%	2.10	5.3%	5.6%		

Note: (0) shows the absence of fish species
 (No.) means number of species and
 (%) means percentage of the fish species.

Table 3: Seasonal Variation of Fish distribution in Bodna River from May 2018 to April 2019

Species	Seasons			
	Wet		Dry	
	Sum	Percentage %	Sum	Percentage %
<i>Clariasgariensis</i>	234	17.6	150	11.3
<i>Mormyrusvalenciensis</i>	103	7.7	0	0
<i>Pellonulaleonensis</i>	224	16.8	10	0.8
<i>Nannocharaxshariensis</i>	147	11.0	0	0
<i>Oreochromisniloticus</i>	173	13.0	290	21.8
Total	881	66.2%	450	33.8%

Note: (0) means absence of fish species

Discussion

The study of fish species of Bodna River revealed that (5) species of fish belonging to (5) families were recorded. The result can be compared with what was obtained in Kontagora reservoir where (7) species were reported by Ibrahim, (2009), Ayanwole *et al.*, (2013) equally reported low diversity of fish species in lower Usuma dam, Bwari, Abuja of (11) species belonging to (5) families. Also, Banyigy, (2016). recorded (11) species of fish belonging to (6) families in Doma reservoir, Nasarawa.

This Bodna River results indicates low species diversity when compared with other studies like Ita, (1993) who reported 101 species of fish in lake Kainji and 52 species in Jebba. Similarly, 32 species of fish were reported in Umidike water reservoir (Avoaja, 2011) and 27 species in Asejerelake (Ipinmoroti, 2013).

This study revealed that the family Cichlidae with species *Oreochromis niloticus* dominated with the total abundance of 463 with mean percentage of 35%. The dominance of *Oreochromis niloticus* over other fish agrees

with the previous findings of Quarcupome *et al.*, (2011), where he reported *O. niloticus* as an ever present important species in Kpong reservoir right from impoundment up to 25 years after impoundment. Mustapha, (2009) equally reported *Tilapia zilli* as the most abundant species in Cichlidae family in Oyunreservoir, Offa. Also, Banyigyi, (2016) reported that the family Cichlidae was found dominant in all stations and seasons during the sampling period in Doma reservoir. Similarly, studies revealed the dominance of Cichlidae in the following reservoir, Ikere gorge (Adeosun *et al.*, 2011), Erinle Lake (Komolafe 2011), Egbe reservoir (Edward, 2013), Dankishiya (2013) reported that the family Cichlidae dominated the lower Usuma reservoir in Bwari, *Tillapia zilli* and *Sarotherodon alilaeus* were the most abundant in Tagwai lake, Minna (Ayanwale *et al.*, 2013). The dominance of the members of the family Cichlidae can be attributed to their ability to thrive on wide variety of food items and the good parental care of the members of the family Cichlidae which have given them advantage over other species to thrive well in their habitat.

The seasonal variation of the fish species distribution in this study was observed to be higher in the wet season with 66.2%. This agrees with the findings of Iorchor *et al.*, (2007) recorded higher fish abundance in the wet season than dry season in the main channel of the lower Benue River. Higher abundance of *Parallia pellucida* during rainy season and dry season in fresh water reaches of Num River, Niger Delta was reported by Allison *et al.*, (2007). On the other hand, higher fish abundance was recorded in the dry season than rainy season in the lower Bonny Estuary Chindah (1994). Offem *et al.*, (2011) reported higher values for the fish species richness and diversity in the dry season than rainy season. Falaye *et al.*, (2015) observed that fish abundance was significantly higher in the dry season than the wet season and Banyigyi, (2016) equally reported higher fish species and abundance in the dry season than wet season in Doma reservoir.

The mean weight and length of *Clarias gariepinus* in this study was observed to be higher than other species. This agrees with Kumolu-Johnson, (2011) who reported similar growth for *gariepinus* and *Tilapia zilli* in Ologe Lagoon, Lagos.

Species richness (D), species diversity (H) and species evenness (J) were lesser as recorded in Bodna River, D=0.976, H= 1.456 and J= 0.904 compared to D=2.13, H=2.14 and J= 0.70 as reported by Ali *et al.*, (2017). The values were equally lesser than what was reported by Quarcupome *et al.*, (2008), for two Ghanaian tropical reservoir recorded D= 1.11, H= 1.55 and J= 0.40, while Libga reservoir recorded D= 2.4, H= 2.36 and J= 0.52 for species richness. However, the values of this study were higher than the D=0.70, H= 1.52 and J= 0.80 reported by Dankishiya *et al.* (2013) for a tropical reservoir in Nigeria.

Conclusion

Study on fish species abundance in Bodna River indicated the presence of 5 species belonging to Families which are of economical values. The family Cichlidae formed the dominant family. There were monthly and seasonal variations in the fish species composition in Bodna River. Family Cichlidae and Claridae with species *Oreochromis niloticus* and *Clarias gariepinus* dominated in most of the months and season.

Recommendation

The Bodna River needs a systematic approach by constituting authorities to take charge of the river and possibly transform into a reservoir for the management and sustainability of fishery resources in Kwali Area Council. It is recommended to monitor human activities and fishing intensity in the river in order not to destroy the fish diversity. Also, the fishers should be advised to use approved gill net and cast net of mesh size 7.6cm or others recommended by government for all inland gill net fishing to prevent over exploitation.

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