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Zooplankton Distributions, Relative Abundance and Seasonal Variation Of Bodna River In Kwali Area Council, Abuja.

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ABSTRACT
Rivers are vital and vulnerable freshwater systems that are critical for the sustenance of all lives. One of the resourceful Rivers in Kwali Council is River Bodna. This River zooplankton species distribution, relative abundance and seasonal variation were investigated for information to ascertain effects of human activities on the biological properties of the River to enhance their conservation and management. The zooplankton samples were collected with standard zooplankton net of 50µm mesh size by horizontal trawling in the River sampling stations. Collected samples were poured into a zooplankton bottle to the level of 100ml and one ml of 4% formalin was added. 10ml of water sample was used to examined the zooplankton in a counting chamber viewed with Olympus Biological Microscope. Descriptive analysis, and Analysis of variance (ANOVA) were used to analyze the Zooplankton species distribution, relative abundance and seasonal variation in sampled stations. The results showed three major families and 14 species of zooplankton and they are Rotifera with Brachionus species, Trichocera species, Lecane species, Asplanchna species and Pytgra species. Cladocera with Bosmina species, Moina species, Nauplii species and Diaphanosoma species. Copepoda with Cyclopoid copepods and Copepodites. The family Rotifera with the species Brahionus calyciflorus has the highest abundance of 21.2%. The seasonal variation showed higher percentage of zooplankton of 73.4% in the wet season and was lower with 26.6% in the dry season. Variations occurred from station to station with 20%, 18% and 0% across the stations respectively in Cyclopoid copepods species. The findings of this study will be helpful to the community for conservation and management of sustainability of live food for the biological composition of the Bodna River.
Key words: *Zooplankton, distribution, percentage abundance, seasonal and Bodna. River*

Introduction

Water is a unique liquid that essential for life and the most important medium through which aquatic living organisms can grow and flourish. Rivers are vital and vulnerable freshwater systems that are critical for the sustenance of all lives providing main water resources for domestic, industrial and agricultural purposes (Farah *et al*., 2002). Unfortunately, river waters are being polluted by indiscriminate disposal of sewage, industrial waste and a plethora of human activities that affect their physicochemical parameters and microbiological quality (Oboh *et al*., 2017, Efe, 2000). Aquatic ecosystem is a critical component of the global environment that contributes to biodiversity and ecological productivity. Tthey also provide a variety of services for the human population such as irrigation, recreational opportunity and habitat for economically important fishes (Dankishiya *et al.,* 2013).

Zooplankton are free-floating, aquatic invertebrates, often described as microscopic because of their normal small sizes that range from few to several micron and are not often exceeding a millimeter (Boyd *et al*., 2000). In aquaculture, small sized zooplankton e.g. rotifers are often used as food for fish larvae. In nature, phytoplankton is fed on by zooplankton, which is fed on by other higher animals such as larger zooplankton, fin fish and shellfish. Almost all aquatic lives depend on zooplankton at least at an early stage of their lives (Okunsebor and Ofojekwu, 2016). Zooplankton is valuable pointers of the future fisheries strength as they are food source of

organisms at higher trophic levels (Davies *et al*., 2009). They are recognized as a vital component of the aquatic ecosystems, (Okogwu, 2010) and they aid regulation of algal productivity through grazing - transfer of primary productivity to fishes and other consumers; (Dejen *et al*., 2004). The response of zooplankton to the water quality variation of ecosystem and species dependence varies in and between the lakes (Ovie, 2011). Some specific type of zooplankton adapted to the factors such as light, temperature, turbulence and salinity in its habitat. Zooplankton not only play a vital role in the stability ecosystem but they also serve as an indicator of water quality, since they are affected by slight changes in the environment (Barlow *et al.,* 2006).

Bodna River, a tributary to lower Usman dam serves as source of employment opportunities to some of the community members but, less attention has been given to it despite its importance in the lives of the inhabitants of the area, who rely mainly on the river for drinking, domestic water supply, fishing, farming, and sand mining. The river is being polluted by the human activities such as; bathing, washing, refuse dumping and defeacation around the river banks. These activities in one way or the other may affects the physico-chemical parameters of the water body which can affect zooplankton distribution and relative abundance in ecosystem

Materials and Method

Study Area

kwali is one of six area council in Abuja, about 45km away from the federal capital city. It is located at the north eastern part along lokoja road to kogi state between latitude 12^{o} 40^{1} N 13^{o} 60^{1} N longitudes 10^{o} 20^{1} E and 11^{o} E. Bodna River in kwali Area Council of FCT, is a tributary to lower Usman dam. The river has a tremendous economic importance to the indigenous settlers which ranges from domestic usage, irrigation for agricultural activities and fishing. Four sampling stations were used for this research with the distance of 10km from each station. The village surrounding the river includes Tukuruwa, Oversea quarters, Bonongo and Koroko villages all in Kwali Area Council.

Station 1 (Tukurwa): The River flows from the same source with a distance 10km from the source. This area is surrounded sparsely by houses; fishing and irrigation farming is the predominant activity. The station coordinates are: Latitude 8^{0} 50^{1} N, longitude 7^{0} 2^{1} E.

Station 2 (Oversea quarters): This River runs along the main source across settlements. It is used mostly for domestic purposes and block molding with station coordinates at latitude 8^{0} 49^{1} N and longitude 7^{0} 3^{1} E.

Station 3 (Bonugo): This site is equally surrounded by houses; farming activities, washing and block molding as the major activities. Evacuation of soil also takes place as they dig out the soil for building construction. Station coordinates are: Latitude 8^{0} 49^{1} N and longitude 7^{0} 1^{1} E.

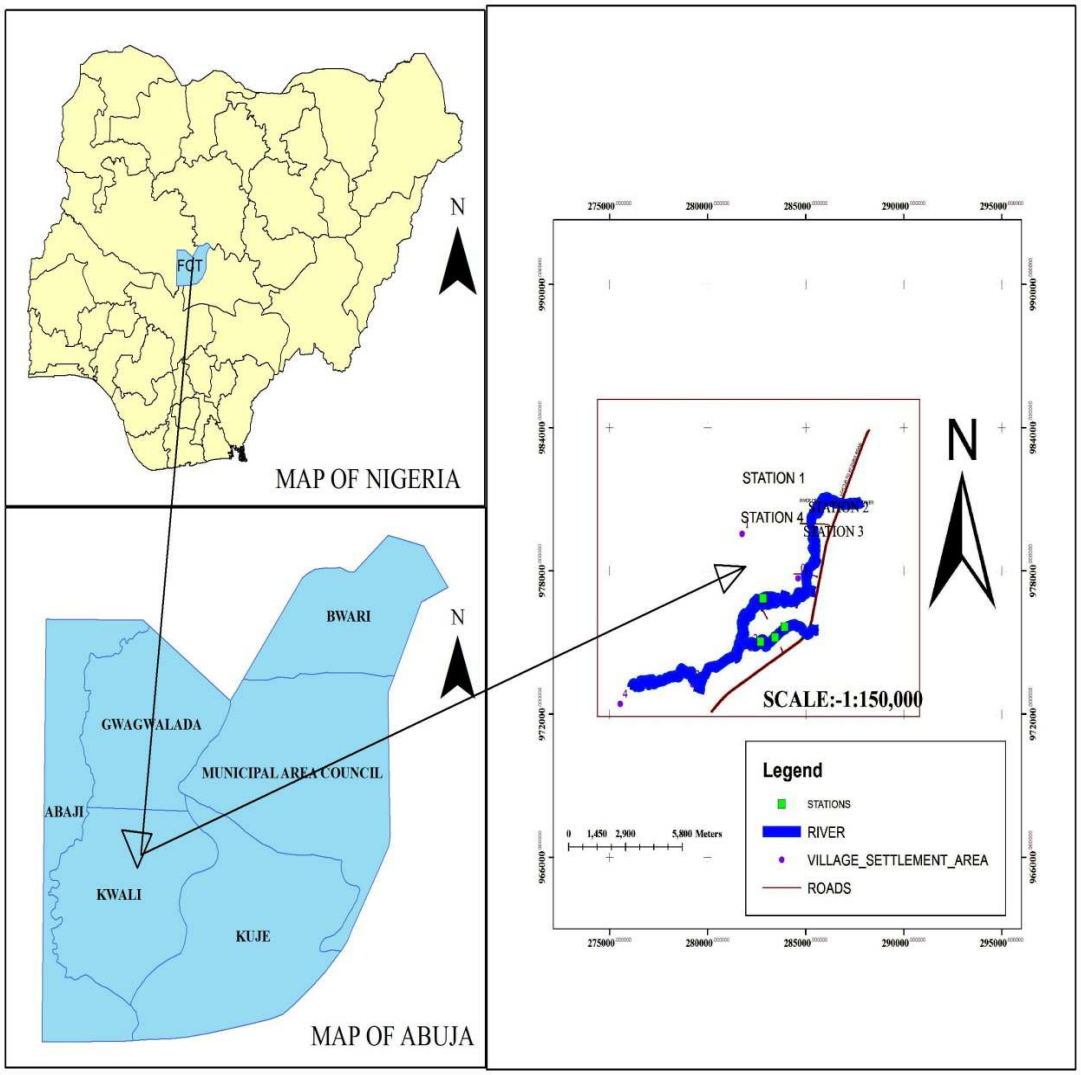
Station 4 (Koroko): This River is surrounded sparsely by houses; irrigation farming is majorly practiced. Excavation of the top soil also takes place for building constructions. Station coordinates are: Latitude 8^{0} 49^{1} N and longitude 7^{0} 2^{1} E.

Experimental Procedures

Zooplankton Enumeration

The zooplankton sample was collected with standard zooplankton net of 50µm mesh size by horizontal trawling in the river sampling stations. Each sample was made up to 100ml in zooplankton bottle, 4% formalin was added (1ml of the 4% formalin to 100ml of water sample bottle). This enables the sample to concentrate or sediment for 24 hours. After 24 hours, the

bottle containing the sample was decanted using sieve mesh size of 50 µm out 90ml and left behind 10ml. However, the volume of the sample size filtered, the distance of trawls horizontally, the diameter and radius of the net were recorded. The volume filtered for expression of zooplankton density in number per litre was calculated using the standard formula: $V = \pi r^2 h$ (the formula for calculating volume of cone) since the plankton net is in form of a cone. Where V = volume of water filtered, π = constant ($^{22}/_{7}$), r = radius of the mouth of the net and h = distance of trawl. The 10ml of water sample left behind was poured into a counting Grid chamber, mounted on the stage of Olympus Biological Microscope (model CHA and CHV) to count the presence of bulky zooplanktons in the sample, (Wetzel, 1983). The counting Grid chamber is divided into 9 big squares, where each square is 1mm long and 1mm wide ($1mm^2$ area) to count the species



SOURCE: ADMINISTRATIVE MAP KWALI AREA COUNCIL (2018)

Figure 1.Map of Abuja showing the study Area in Kwali.

Statistical analysis

Descriptive analysis, and Analysis of variance (ANOVA) were used to analyze the Zooplankton species distribution, relative abundance and seasonal variation in sampled stations. Analysis of data was based on monthly data collection by identification and counting. Analysis of variance (ANOVA) was used to analyse the data using SPSS (2015) version 26 statistical package at 95% confidence level.

Results

Distribution and Relative Abundance of Zooplankton in the Bodna River.

The relative abundance of zooplankton in Bodna River was presented in Table 1 and percentage distribution in Figure 2. There were 3 major families and 14 species of zooplankton found in the study area which include; *Rotifera, Claclocera* and *copepod. Rotiferera* has 8 species: *Branchionus angularis, Branchionus calyciflorus, Branchionus fulcatus, Trichocera Cylindrica, lecane decipiens, lecane papuana, Asplanchna species and Pytgra species, Cladocera* has 3 species: *Basmina species, Moina micrura* and *Naupli species*. The last family copepod also has 3 species which includes *Diaphanosoma exicum,* Cyclopoid copepods and *Copepodite species.*

The total relative abundance of zooplankton species recorded in Bodna River from May 2018 to April 2019 was 4463 with the highest species in *Branchionus calyciflorus,* with the value 947(21.2%) followed by Cyclopoid copepods with the value 792 (17.7%) and the least were *Pytgra species,* with the value 39 (0.90%) and *Naupli species* with the value 35 (0.80%). (Figure 1).

The distribution and abundance of zooplankton according to stations in Bodna River were shown in Table 3. In station I, *Cyclopoid copepods* has the highest value with 20.5% followed by *Brachionus Calyciflorus with 20%* and the least were *pytgra species* and *Naupli species* with 0.1% respectively. In station II, *Brachionus Calyciflorus* has the highest value with 27.5% followed by *Cyclopoid copepods* with 18.9% and the least were *Lecane papuana* with 2.9% and *D. exicum* with 2.3%. Similarly, in station III, *Lecane papuana* has the highest value of 27.8% followed by *Lacane decipiens* with 20.5% while the least were *Asplanchna species with* 1% and *Brachionus fulcatus* with 1%. Finally, station IV recorded highest value in *Brachionus Calyciflorus* with 29.8% followed by *Lacane decipiens* with 24.2% and the least were *Lacane papuana* and *Trichocera cylindrical with 3.2%* respectively. Station I significantly ($P<0.05$) had a total abundance of 3,495 than station II, III and IV with the values 440, 288 and 276 respectively. However, some stations had no species recorded and as such had no values. The monthly distribution of Zooplankton in the Bodna River is shown in Table 2. In the month of October 2018 to March 2019, some species were not recorded which resulted in low values of some species in the Bodna River. The mean seasonal variation of zooplankton was shown in Table 3. The wet season recorded the highest value of zooplankton species with 3,276 (73.4%) and *Brachionus Calyciflorus* as the most abundant with 627 followed by *Cyclopoid copepods* with 568. It was observed that both later species were highly distributed and abundance in both wet and dry seasons. Dry season recorded low percentage at 26.6%.

Table 1: Relative Abundance of Zooplanktons in Bodna River During the Study Period (2018 to 2019)

Phylla	Species	Number	Percentage (%)
CLADOCERA	*Bosmina species*	198 ± …….	4.4
	Moina micrura	142	3.2
	Naupli species	35	0.8
	Diaphanosoma exicum	478	10.7
COPEPODA	*Cyclopoid copepods*	792	17.7
	Copepodites species	481	10.8
ROTIFERA	*Brachionus angularis*	108	2.4
	Brachionus calyciflorus	947	21.2
	Brachionus fulcatus	256	5.7
	Trichocera cylindrical	332	7.4
	Lecane decipiens	295	6.6
	Lecane papuana	80	1.8
	Asplanchna species	280	6.3
	Pytgra species	39	0.9
TOTAL		4463	100

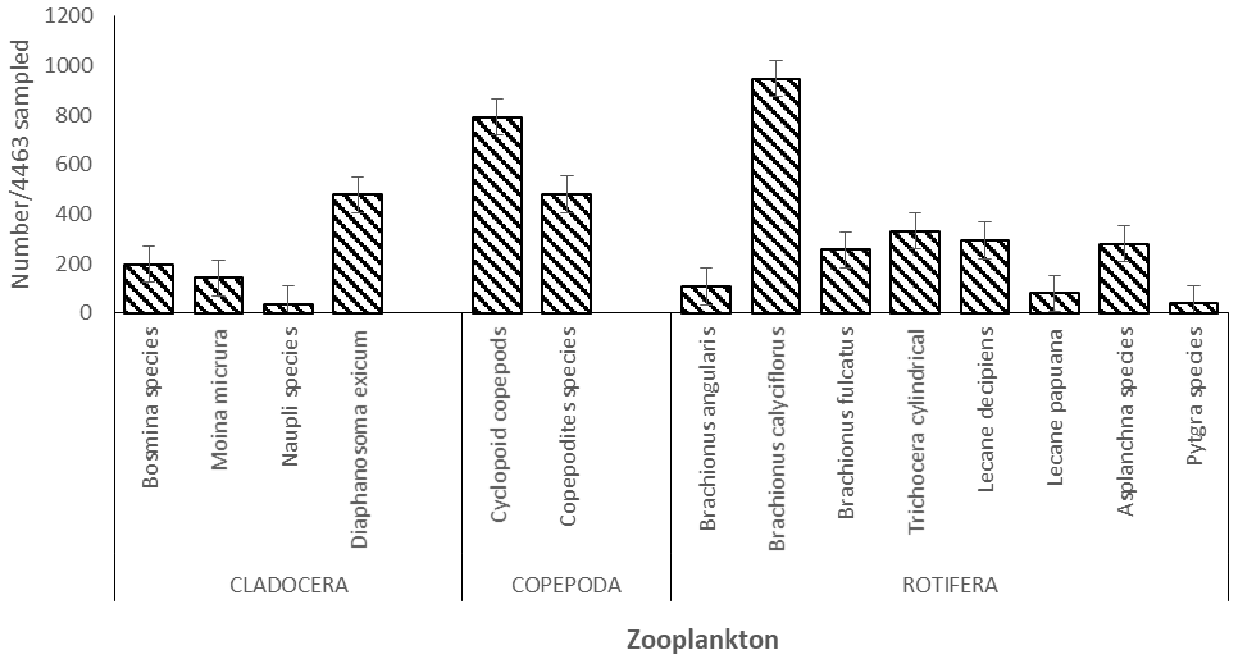


Figure 2: The Percentage Distribution of Zooplankton Abundance in Bodna River

Table 2: Stations distribution of Zooplankton in Bodna River 2018 to 2019

	Stations							
	I		II		III		IV	
Species of Zooplankton	Sum	Percentage %	Sum	Percentage %	Sum	Percentage %	Sum	Percentage %
Brachionus angularis	8.0	0.23	31	7.01	50	17.36	19	6.88
Brachionus calyciflorus	695.0	20.09	121	27.5	49	17.01	82	29.71
Brachionus fulcatus	153.0	4.42	59	13.41	3	1.04	41	14.86
Trichocera cylindrical	241.0	6.97	31	7.01	51	17.71	9	3.23
Lecane decipiens	128.0	3.70	41	9.32	59	20.49	67	24.28
Lecane papuana	50.0	1.45	13	2.95	80	27.78	9	3.26
Asplanchna spp	226.0	6.53	-	-	5	1.74	49	17.75
Pytgra spp	5.0	0.14	34	7.73	-	-	-	-
Bosmina spp	198.0	5.72	-	-	-	-	-	-
Moina micrura	142.0	4.11	-	-	-	-	-	-
Naupli spp	2.0	0.06	-	-	33	11.46	-	-
Diaphanosoma exicum	468.0	13.53	10	2.28	-	-	-	-
Cyclopoid copepods	709.0	20.50	83	18.86	-	-	-	-
Copepodites Spp	434	12.55	17	3.86	30	10.42	-	-
Total	**3459**		**440**		**288**		**276**	

Note: Stations with (-) means absence of species

Table 3: Mean Seasonal Variation of Zooplankton Distribution in Bodna River 2018 to 2019

Species	**Seasons**			
	Wet		**Dry**	
	No.	**Percentage %**	**No.**	**Percentage %**
Brachionus angularis	84	2.5	24	2.0
Brachionus calyciflorus	627	19.1	320	26.9
Brachionus fulcatus	197	6.1	59	4.9
Trichocera cylindrical	255	11.1	77	6.5
Lecane decipiens	220	6.72	75	6.3
Lecane papuana	67	2.0	13	1.1
Asplanchna species	220	11.1	60	5.1
Pytgra species	33	1.0	6	2.8
Bosmina species	163	4.9	35	13.7
Moina micrura	101	3.1	21	8.5
Naupli species	27	0.8	8	0.67
Diaphanosoma exicum	348	10.6	130	10.9
Cyclopoid copepods	568	17.3	224	18.8
Copepodites species	366	11.2	115	9.6
Total	**3,276**			**1,167**

Note: Highest percentage of Zooplankton was found in the Wet season at 73.4% and lower in the dry season at 26.6%.

Discussion

The dominance of *Rotifera* agrees with the report by Idowu, (2013), Jeje, (1986), Gibloon (1992) but contradicts the observation of Ovie (2011) and Adeniji (1985) in the Lakes of Southern Nigeria which indicated that *Cladocerans* were dominant over other zooplankton. Temperature and water current may inhibit *Cladocerans* more than *Rotifers* thereby increasing the relative abundance of *Rotifers* in zooplankton communities.

The low abundance of Copepods in this study is in agreement with the findings of Idowu *et al.* (2013), in Lake Alau, Jeje, (1986) who reported that predatory *Copepods* were particularly low in abundance in the tropics compared to *Rotifers*. The highest densities and species composition of zooplankton in station I may be attributed to the availability of food compared with other stations. The rainy season recorded highest abundance of zooplankton population of 73% to dry season. This agrees with the work of Idowu *et al.* (2013) of Lake Alau. It is likely that the rainy season which gives organisms more opportunity to colonize different habitats contributed to the abundance.

Conclusion

The zooplankton community in the Bodna River are represented by three main groups which includes; *Rotifera, Cladocera* and *Copepoda*. There was species variation within the sampling stations and from season to season while the highest abundance was observed in the wet season in *Rotiferans*.

Recommendation

Bodna River from this finding is productive and should be managed properly and further studies should focus on some specific useful phytoplankton and zooplankton in the river as live food for the fish species to enhance management and sustainability of fishing resources in Kwali Area Council.

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