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ABUNDANCE AND DISTRIBUTION OF ZOOPLANKTONS SPECIES IN TUDUN KUKA RIVER KUMO AKKO, GOMBE STATE

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ABSTRACT

Management of water resources is of paramount importance especially in rural area facing problems such as lack of access to clean water. Most identifiable sources of water to such areas are mainly rivers and are reported to have serious pollution due anthropogenic activities. Samples of Zooplankton species were collected from Tudun-kuka River using plankton net according to the five minute kicking techniques. Results of Zooplankton analysis shows that total of 165 individuals species were identified, belonging to five (5) different taxa throughout the study period. Out of their total number, Malacostraca has the highest number of species (4) which constituting (40%) of the overall taxa, *Actinopterygii* and *Hexanauplia* both has (2) number of species which constitute about (20%) each of them, Polychaeta and Insecta each possess (2) number of Species which constitute about (10%). Physicochemical parameters measured include temperature, turbidity, conductivity and nitrate and they were measured using standard method as recommended APHA. The results indicated that the highest water temperature was recorded at 31°C during July period (month) at site C. For September period, low amount of Temperature of 28°C was measured in site A. For the period of July, highest and lowest water pH of 8.6 and 7.5 was observed at site C and all the three sites (A, B and C) accordingly. Highest turbidity value 11.0 cm was observed in the month of September at site A and the lowest 7.5cm in the month of July at site C. Results of Dissolve Oxygen was found at ranges between 2.70-1.7 mg/L during the period of August plus September at site C. Similarly, the phosphate values were recorded were at ranges of 38.5-33.5 mg/L during the period of July and August at side C. Findings of this research could be useful in generating checklist of zooplankton species found at the river.

Keyword: Checklist, Physicochemical parameters, Species, Water resource, Zooplankton

INTRODUCTION

Group of aquatic biota consisting of small protozoan and large metazoan are termed zooplanktons. They also include holoplanktonic and meroplankton organisms. The former spend their life activities in water body like ocean, lake and others while the latter spend half their life process in water body before later move and become bottom dwelling organism (Moses *et al*., 2017). This organism does not manufacture their food substances by themselves meaning they live as heterotrophic organism. Floating on the surface of water is other characteristics of zooplanktons and when

they float other aquatic biota can easily identify them and feed on them (Goldman and Home, 2010). Moreover, the presence or absence of this zooplankton indicated how health the water body is. For instance, certain species could thrive in high polluted water body and can be describe as polluted tolerant species while others can only tolerate fresh water hence described as fresh water species. These could possibly the reason why several water research was focus on studying the diversity and abundance of zooplankton in relation to their habitat structure (Bhatnagar and Devi, 2013).

In spite of the several role zooplanktons play in aquatic environment, their survival has been subjected to a severe threat which is as results of human activities. These activities include fertilizer application, livestock farming, irrigation and washing of clothes (Saidu *et al*., 2016). The water flowing into the river carries along pesticide and other agricultural chemicals including nutrients such as nitrate, phosphate and heavy metals. The chemical substance increase or decreases the water quality parameters while the nutrients subject the aquatic phytoplanktons into excessive growth thereby causing aesthetic pollution (Muhammed *et al*., 2019; Saidu *et al*., 2017a; Saidu *et al*., 2017b). Both the two condition have potential to affect the diversity of water thriving organisms in the aquatic environment. This is why efforts are being made in order to provide scientific information about the interaction of water thriving organism as well as the physical chemistry of the aquatic environment. For instance, Ikeda (2008) observed the impact of unusual lowering of salinity on planktons in the Madras coastal area, while Grindley (2010) studied the the changes that occur as a results of increase or decrease in salt level causing spatiotemporal changes of habitat of estuarine plankton. Saidu *et al*., (2016) survey the plankton composition of Balanga Dam and encounter 21 *phytoplankton species identified belonging to about seven taxa viz; Chlorophyceae Baccillariophyceae, Cyanophyceae, Desmidiaceae and Chrysophyceae,* Euglenophyceae and Rhaphidiophyceae. Furthermore, Moses *et al*. (2017) conducted a research on the how human activities around shore alter the diversity of zooplanktons found at Kwadon stream and reported that 61,521 species were encountered. Results of the research indicated that these species fall within the several Coleoptera, Trichoptera, Ephemeroptera and Pieces taxas. Among them, pisces were found to be severely altered as a results of the variation of physical chemical indices of the aquatic body. Similar scenario as also reported by the same author using phytoplanktons species (Moses *et al*., 2016).

The Tudun-kuka a small town located in Kumo, Akko LGA area of Gombe State. The river is located about 45km to the South-West of Gombe town, and provides drinking source of water to the community. Over 70% of Tudun-kuka town inhabitants are mainly farmers with many fisher men as their activities contribute a lot to the food supply in the State. Close to the river is where several agricultural activities take place such as farming, irrigation, and washing of clothes. Such activities are liable to reduce or increase the ambient condition of the water thereby posing a threat to the stable survival of the plankton's species. This paper therefore survey the zooplankton species composition in relation to variation in the physicochemical parameters found at the Tudun-kuka town of Akko, Gombe State. Such research will go a long way in establishing the checklist of zooplanktons species found at the river and to provide

useful information on management strategies of aquatic ecosystems.

MATERIALS AND METHODS

Study Area

The research was conducted at Tudun-Kuka River near Maiganga village which is located in Kumo Akko LGA (Gombe State). It is located 6 km off Gombe -Yola road. Tudun-Kuka near Maiganga village, is located west of Kumo town between Latitude 09°l8' and 11°59'E. The study area, Tudun-Kuka River near Maiganga community covers an area of about 20,129.47 Acres (48.16 Km^2).

Sample Collection

For the purpose of generating robust data, about 3 point of collecting samples identified and named; Site A, B and C. Sample of biological material were done two times in a months. The justification of having different sampling point is because several human activities are done at the sites. This include irrigational activities, fishing activities feeding animal, all are done in site A, washing of agricultural material and laundry are activities done in site B, whereas site C activities consist mainly plant watering and laundry. The sample of aquatic indices was taken to the laboratory for measurement. This index includes temperature, pH, conductivity, transparency, turbidity, dissolve oxygen, nitrate and phosphate as described by American Public Health Association for examining water (APHA, 2005).

For determination of biological characteristics, Zooplanktons sample were collected using plankton net. The configuration of the net consists of 50ml capacity bottle from the bottle. The net were then thrown at a relatively far distance approximately one meter. Samples were then taken to laboratory, sorted out to remove the unwanted material, and then fixed on light microscope for observation and possible naming of organism as described by identification keys (APHA, 2005).

Determination of Physico-chemical

Water Temperature

Thermometer made up of mercury was inserted at three different stations of the water body for about 4cm depth. It was then left to stay for few minutes before reading was taking. The aquatic water temperature was read and monitored from the thermometer in degree Celsius (°C).

Water pH

The pH of the water samples was determined using Bran scientific pH meter of pH-25model was used for this study. The pH is obtained by immersing the meter inside the dam at three different stations (APHA, 2005).

Water Conductivity

The conductivity meter of HARCH Model was employed for the purpose of determining the level at which water conduct electric current. The instrument was switched on and calibrated. The electrode was immersed into the water sample and the conductivity reading of each sample was monitored and recorded.

Water Turbidity

Turbidity tube was used to measure the clarity level of the water. Samples were appended into the tube, the tube has a star at the bottom of the tube, and the water was continuously added up to the level where the star disappeared. The points where the

meniscus disappears indicate the level of water turbidity.

Dissolve Oxygen

The level of available oxygen in the aquatic environment was measured using simple titration with reference to Winkler's method (APHA, 2005). Dissolve oxygen was determine using dissolve oxygen meter. The meter was switched on and graduated with clean water. The electrode was immersed into the water sample and reading were monitored or taken.

Water Transparency

The water transparency was measured by using a flattened material called Secchi Disc. The instrument work by inserting it into the water until its upper view cannot be seen. Water transparency was measured in (cm).

Determination of Chemical Characteristics of Water Sample

Phosphate was determined by setting up 3 test tubes labeled Sample (SP), Standard (SD) and Control (CT). 5.0 ml water was appended to SP tube; 0.5 m1 of working standard was added to SD tube; 4.5 ml and 5.0 ml of trichloroacetic acid (TCA) were added to SD tube and CT tube respectively. 1.0 ml of ammonium molybdate chemicals was appended to each tube. 1.0 ml of metol chemical was also appended to each tube. All tubes were left untouched for 30 minutes so as to observe the pattern of color formation. Specific light absorbance of all tubes was determined using Jenway 6300 spectrophotometer against the blank at 680 nm.

Test for Nitrate (NO_3). The nitrate concentrations of the samples were determined using Brucine Colorimetric method (AOAC, 1990). Method: 10 ml sample was pipetted into tubes and were swirled. 10 ml 13 N H2804 was added to each tube and swirled and were allowed to come to thermal equilibrium. 0.5 ml brucine reagent was added to all tubes and swirled. The entire rack containing all tubes was placed in a boiling water bath for exactly 25 minutes.

Statistical Analysis

Physicochemical parameters were analyzed statistically using SPSS package. Significance differences within the three stations were analyzed while the biological samples was evaluated using simple percentage.

RESULTS AND DISCUSSION

Physicochemical parameters

Temperature

The water temperature ranged between 28°C-31^{0}C. Highest temperature was recorded during first collection in the month of July at site C, while during the third collection, lowest value was obtained in the month of September at site A.(Table 1 and 3).

Water pH

The water pH at the three sampling sites ranged from 7.5-8.6 with highest value recorded in first collection during the period of July at site C. and a fall of value was recorded in the second collection in September at sites (Table 1 and 2).

Turbidity

The turbidity of the water at the three sampling sites ranged from 7.5-11.0cm with the highest value recorded in the third observation in the month of September at site A. and the lowest value recorded in the first observation in the month of July at site C. also (Table 1 and 3).

Dissolve Oxygen (DO)

The dissolve oxygen at the three (3) sampling sites ranged from 1.70-2.70 mg/L with the highest recorded value in the second collection during the period of August at site C. and lowest recorded score was found at in the third collection in the month of September at C. (Table 2 and 3)

Conductivity

The conductivity result of the study were tested and found the result ranged from 90.6-109uS with the highest recorded value in the first collection in the month of July at site B. and the recorded value in the third collection of sample in the month of September at site A (Table 1 and 3).

Phosphate (PO_4^3)

The phosphate result of the study were tested and found the result ranged from33.5-38.5mg/L with the highest recorded value in the First collection during the period of July at site C. and the least value obtained were found in the third collection of sample in the month of August at site C. also (Table 1 and 2).

Nitrate (NO_3^-)

The Nitrate of the water at the three sampling sites ranged from 1485-1695 with the highest value recorded in the first observation during the period of July at site A. The least score was recorded in the third observation in the month of August at site C. also (Table 1 and 2).

Biological Characteristics of Zooplanktons

Survey of zooplankton characteristics according to identification guide yield the existence of 10 species, these species were found to belong to five (5) different taxa throughout the study period. In which Malacostraca has the highest number of species (4) which constituting (40%) of the overall taxa, Actinopterygii and Hexanauplia both has (2) number of species which constitute about (20%) each of them, Polychaeta and Insecta each possess (2) number of species which constituting about (10%) in both (Table: 4).

Diversity of Zooplanktons

This table showing ten (10) species belonging to five (5) different taxa in which Copepod has the highest numbers of species belong to the taxa Hexanauplia and the lowest species which is Polychaete worm belong to the taxa Chaetopteridae (Table 5).

Table 1: Physicochemical parameters of Tudun Kuka River for the month of July

Physico-chemical indices	SITES		
	Site A	Site B	Site C
Water Temperature (^{0}C)	30	30	31
pH	8.4	8.5	8.6
Turbidity (cm)	7.7	8.0	7.5
D.O (mg/L)	2.15	2.01	2.30
Nitrate (mg/L)	169.5	163.5	161.0
Phosphate (mg/L)	38.3	36.8	38.5
Conductivity	98	109	103

Table 2: Physicochemical parameters of Tudun Kuka River Sampled for the month of August

Physico-chemical indices	Sites		
	Site A	Site B	Site C
Water Temperature (^{0}C)	30	29	31
pH	8.10	7.80	8.00
Turbidity (cm)	8.00	8.7	9.0
Nitrate (Mg/L)	163.5	148.5	158.5
Phosphate (mg/L)	34.50	35.75	33.50
D.O (mg/L)	2.50	2.00	2.70
Conductivity (Us/cm)	100	96.2	97

Table 3: Physicochemical parameters of Tudun Kuka River Sampled for the month of September

Physico-chemical indices	Sites		
	Site A	Site B	Site C
Water Temperature (^{0}C)	28	29	29
pH	7.5	8.1	8.05
Turbidity (cm)	11	10.5	10.0
Nitrate (mg/L)	160	161.3	158
Phosphate (mg/L)	38.22	36.50	37.00
D.O (mg/L)	2.22	2.17	1.70
Conductivity (uS)	90.6	95.3	93.0

Table 4: Percentage abundance of Zooplankton Species per Taxa for three months (July, August and September)

Taxa/Class	Number of Species	Percentage (%)
Polychaeta	1	10
Malacostraca	4	40
Actinopterygii	2	20
Hexanauplia	2	20
Insecta	1	10
Total	10	100

Table 5: Diversity of zooplankton species sampled in Tudun-Kuka River for three months

Taxa	Species	St1.	St2.	St3.	Total
Polychaete	Chaetopteridae	2	1	1	4
Molacostraca	Amphipod	8	8	10	26
	Isopod	5	3	7	15
	Crowfish	4	6	4	14
	Shrimp	2	4	3	9
Hexanauplia	Copepod	17	18	20	55
	Copepod Larvae	9	8	4	21
Actinopterygii	Herring Fish	1	0	1	2
	Tilapia fish	1	0	1	2
Insecta	Insects	8	5	3	16
Total					165

DISCUSSION

The result of physicochemical parameters and zooplanktons assemblage of Tudun-kuka shows that physicochemical parameters such as (turbidity, pH) increases with increase in the volume of the River. Other important activities that can let to in increase in the volume of river are rainfall and inflow of water from the irrigation site. Nutrient such as nitrogen, phosphorus and decayed organic compound that is present in the farm sites are washed into the River. Also the domestic activities around such as washing and bathing also increase the level of the physicochemical parameters. With all these increase, site C. varies much than other sites which has the physicochemical parameters as: (water temperature; 290 (3-32^{0}C, pH; 6-8.7, nitrate; l48.5-169.5 mg/L, phosphate; 33.5-38.5 mg/L, turbidity; 6.0 - 12.0 cm, D.O; 1.70 mg/L-2.70 mg/L, and conductivity much in site A. with value 96.8Us-109uS.

In the case of zooplanktons the study recorded 165 individuals from all the sampling station for the period of 3 months. The classes of zooplanktons in the river include Actinopterygii, hexanonplia, insecta, malacostraca, polychacta. Literature has reported the findings of the other research conducted in Nigeria. For instance, in Port Harcourt, Edogbatu (1998) surveyed some zooplankton species in Elechi Creek, while Chinda and Pudo (1991) surveyed that of Oginigba creek. The former, encountered a total zooplankton species of 143 while the latter had 148. Similarly, Adeniyi (1978) and Chinda and Keremah (2001) conducted a similar and reported the encounter of total

zooplanktons to be 305 (Kainji Lake) and 89 species (Bonny estuary). According to Welcome (1985), the influential reason determining the diversity of plankton in different aquatic structure are enormous, however few of them include temperature, water speed, nutrient availability, pH and light. However, result of this research differs considerably with the finding of the research done in Nigerian waters (Kemdirim, 2001; Khan *et al*., 1983). Furthermore, Yakubu, *et al*., (2000) recorded a total of 34 species of zooplankton in (Nkisa river) and 208 Pecies (Orashi river). However, the study recorded about 191 individuals of Zooplankton from different taxa that comprise Cnidaria, protozoans, insect, crustacean and fish larvae.

CONCLUSION

Diversity of zooplanktons species found in Tudun Kuka river Kumo was conducted with a view to determine the impact of anthropogenic activities on the aquatic ecosystem. The results revealed that the presence of 10 zooplanktons belonging to Polychaeta, Malacostraca, Actinopterygii, Hexanauplia and Insecta. The most abundance taxa were found to be Malacostraca (40%) while the least was Polychaeta and Insecta with 10% composition. Government should enact environmental laws that will regulate activities near rivers, dams and reservoirs especially with regards to effluent discharged and the indiscriminate of use of farming chemical.

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