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Evaluation of Small Fauna Species of Biu Waterfall, Nigerian Army University, Borno State

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ABSTRACT

This research was carried out to determine the relative abundance and distribution of small and micro fauna species in Biu waterfall couple with their physiochemical parameters in Nigerian Army University Campus. Research was done within three months. Data samples were taken via observation, use of different types of traps/nets, trap-camera and plankton nets at regular intervals. Laboratory analysis of the water and zooplankton species was carried in accordance with standard scientific method and taxonomy keys. Statistical tool used are t-Test and Standard Deviation at (0.05) using SPSS. Macrofauna species found are: *Senila senilis*), Portunidae, Pelusios spp, Grayia spp, and small fish (*Tilapia zilli*, *Chrysichthys nigrodigitatus* and *Claria gariepinus*). Other fauna are: *Bufo regularis*, *Ostracods Eucypris virens*, *Lubricus spp* and *Sphaeriidae*. Macroinvertebrate insects were collected with highest value of abundance and distribution (48.7%) whereas Copepoda and Rotifer representing zooplankton had the least (2.7%). Also, intensive agrochemicals farming, active fishing and open waste dumping were observed. Monthly mean of Temperature ($24.08^{0C} \pm 0.23$ - $27.0^{0C} \pm 0.06$), pH (7.32 ± 0.04 – 8.49 ± 0.26), Dissolved Oxygen (7.94 ± 0.04 mg/l– 8.37 ± 0.02 mg/l), respectively. These values falls within National recommended range. It is therefore suggested that extensive researches/networking with indigenes will improve use of aquatic ecosystem for conservation goals.

Keyword: Zooplankton, aquatic macrofauna water ecology, Biu-waterfall

INTRODUCTION

Microscopic wild animals constitutes special part of aquatic environment called fauna. Animals have long been knowing to be biotic components of every ecosystem. There composition, distribution and abundance is an indication of healthiness of any environment. A sustainable water environment is critically determinant of the wildlife species aquatic medium. The pH, Dissolved Oxygen and Temperature of the water are crucial parameters in determining the abundance and distribution of aqua biotic life. Plankton in the aquatic ecosystem is an important biological indicator of water quality (Yakubu *et al.*, 2000). Plankton continual survival is attached

to balanced physicochemical parameters of the water. Alteration in the natural water ecosystem will affects structural composition and abundance of plankton. Zooplankton as fauna components of the plankton plays the role of consumer on one hand and prey on the other. Man has for long been known to use water resources for its need, but the consequences of its uses have not been considered as an indicator of sustainability or depletion of water fauna. Extensive exploration of water for its rich fauna resources have been found to have damaging effects on aquatic ecology. The water medium, biotic and abiotic components suffers from abused use by man. Plankton are essential components of the aquatic food chain Janjua

et al., (2008). Aquatic ecosystem for wildlife survival is an area which requires details study for global sustainability of wild species. This necessitated the research works on fauna inventory, abundance and distribution in Biu waterfall, Nigerian Army University, Borno state. This research further goes on to analyses some physicochemical parameters of the water. Communities' use of the water for agricultural purposes, open refuse dumping, fishing activities and persistence nomadic livestock farming among others might have affected the physico-chemical parameters and wildlife (plankton) composition of the water. The spatio-temporal functional and structural compositions of macroinvertebrate assemblage in any stream system can be influenced by human activities (Arimoro and keke 2016). Thus, this project was embarked on because there has been no research of this type before on Biu Waterfall, Nigerian Army University, Biu, Borno state, Nigeria. This work should be ideal in highlighting Biodiversity conservation and ecological values of the water.

RESEARCH METHODOLOGY

Study Area

The waterfall is situated in the premises of Nigerian Army University Biu town, Borno state. Biu has vegetation features of Northern Guinea Savannah and the Sudan Savannah regions with semi-arid climate. It is located between Latitude: 10° 36' 46.26" N and Longitude: 12° 11' 40.49" E, with an elevation of 762.32 meters (2501.05 feet) above sea level.

Collection of Water Samples for Laboratory Analysis

Water samples for Plankton and physicochemical analysis was obtained and analysed. The study spanned three months of study.

Dissolved Oxygen Measurement (DO)

The Omega Engineering Digital Dissolved Oxygen Meter was employed in carrying out the DO because of its reliability and accuracy. The Dissolved Oxygen (DO) result was display on the screen of the meter.

Temperature of the water

This was carried out with the aid of Omega Engineering digital Thermometer HH63K. Temperature (°C) measurement was done by taken the temperature of the water early in the morning and afternoon repeatedly and an average measurement was recorded.

pH Measurement Record

pH of the aquatic habitat of the water was measured to determines its hydrogen concentration for acidity and alkalinity using calibrated Omega Engineering pH meter following the manufacturer specification to detail. Finally, all data gathered from macrofauna, plankton and physicochemical parameters were subjected to percentage analysis, Student t-Test and Standard Deviation analyses. Finding were presented in pictorial, tabular and graphical form.

Zooplankton, Macroinvertebrate and Small Vertebrate Identification in Water Sample

Zooplankton from the site was collected using plankton net with plastic bottle base of 75ml which was later emptied into 100ml of bottle containing 4% formalin in the Department of Biology Laboratory, Nigerian Army University. The centrifugation via centrifugal equipment was done and binocular microscope was carried out identifying nature and types of zooplankton and phytoplankton in the prepared slide. The taxonomic and classification of the plankton was done. Microscope instrument in the laboratory was used to identify Macroinvertebrate wild species following the guideline of Christian

(2020). Other small vertebrate were equally identified with the aid of standard taxonomic books.

temperature value (24.1°C) was recorded in December and the highest temperature value of 27.0°C was observed in October 2022. The monthly mean temperature of the water body ranged from $24.08^{\circ}\text{C} \pm 0.23$ - $27.0^{\circ}\text{C} \pm 0.06$.

RESULTS

Physicochemical Parameter

Water Temperature

The surface water temperature of the water body is shown in Table1. The lowest

Table 1: Monthly Mean Temperature (°C) in Biu Waterfall from October - December, 2022.

Months	Temperature		Mean	STD
	values	Readings		
October	27.0	27.0	27.1	27.03
November	25.8	25.9	25.9	25.87
December	24.10	23.85	24.30	24.08

Water pH

Considering the result of Table 2, the highest average (mean) pH value of the water stood at 7.32 in December whereas 8.49 was the lowest and it was obtained in the month of October of 2022. The monthly pH standard deviation ranges between $(7.32 \pm 0.04$ - $8.49 \pm 0.26)$.

Table 2: Monthly Mean pH in Biu Waterfall from October - December, 2022

Months	pH			Mean	STD
	values	Readings			
October	8.78	8.29	8.39	8.49	0.26
November	7.97	7.49	7.46	7.64	0.27
December	7.36	7.31	7.29	7.32	0.04

Dissolved Oxygen (DO)

Monthly Mean Dissolved Oxygen in Biu Waterfall from October - December, 2022. Dissolved oxygen varied between 7.94-8.37 mgL-1. The highest values of 8.37 mgL-1 were recorded in December 2022 and the lowest value of 7.94 mgL-1 was recorded in October 2022. The monthly mean Dissolved oxygen of the water body ranged from $7.94 \text{ mgL-1} \pm 0.02$ - $8.37 \text{ mgL-1} \pm 0.04$ as shown in Table 3.

Table 3: Monthly Mean Dissolved Oxygen in Biu Waterfall from October - December, 2022

Months	Dissolved Oxygen			Mean	STD
	values				
October	7.96	7.95	7.92	7.94	0.02
November	8.14	8.10	8.11	8.12	0.02
December	8.38	8.41	8.33	8.37	0.04

Biological Species

Table 4a: Zooplankton species found in Biu waterfall, NAUB, Borno state, Nigeria

Month	Family			Month	Species			
	Copecida	Rotifer	Total		<i>Senila senilis</i>	Portunidae	<i>Pelusios spp</i>	<i>Sphaeridae</i>
October	10	02	12	October	17	4	7	25
November	02	01	03	November	10	2	-	13
December	-	-	-	December	03	1	3	3
Total	12	03	15	Total	30	7	10	41

Table 4b: Small Pisces and Crustacean of Biu waterfall, NAUB, Borno State, Nigeria

S/N	Species	October	November	December	Total
1	<i>Tilapia zilli</i>	43	27	30	100
2	<i>Chrysichthys nigrodigitatus</i>	27	17	7	51
3	<i>Claria gariepinus</i>	10	13	-	23
4	<i>Eucypris virens</i>	2	0	1	03
	Total	82	57	38	177

Table 4c: Small Amphibian found in Biu waterfall, NAUB, Borno state, Nigeria

S/N	Species	October	November	December	Total
1	<i>Bufo regularis</i>	22	12	7	41
2	<i>Grayia spp</i>	2	1	1	4
	Total	24	13	8	45

Aquatic insect class is a one of the most frequent species found in the water ecosystem. Insect play crucial roles in this study. Their distribution is as shown below.

Table 4d: Insects of Biu waterfall, NAUB, Borno state

S/N	Species	October	November	December	Total
1	Anisoptera spp	10	3	5	18
2	Appasus spp	5	3	7	15
3	Zygotera spp	7	-	4	11
	Total	22	6	16	44

Relative Abundance of Zooplankton and smallfauna in Biu waterfall, NAUB Borno state

Macroinvertebrate composition of the water were equally considered. The result is as presented below. The most abundant is macroinvertebrate (47.8%), small Pisces and Crustacean (32.9%), Zooplankton (2.7%), insects (8.2%) and small amphibian (8.4%).

Table 4f: Relative Abundance of Zooplankton and smallfauna in Biu waterfall, NAUB Borno state

S/N	Taxa	Abundance in Number	Relative abundance (%)
1	Small Pisces and Crustacean	177	32.9
2	Zooplankton	15	2.7
3	Insects	44	8.2
4	Macroinvertebrate	257	47.8
5	Small Amphibian	45	8.4

DISCUSSION

Water Temperature

Water temperature definitely defines and regulate activities of biota in every environment. The aquatic ecology is not exempted as to high temperature values disturb metabolic rate of livings things likewise extreme low temperature. However, temperature values in this work conform to recommended 8°C – 35°C by Nigeria Federal Ministry of Environment (2011). For this reason, on the general note, Biu Waterfall Temperature is ideal for fauna physiological optimum performance, needs and development.

Water pH

Level of alkalinity and acidity of a medium determine the metabolic rate in all physiological being. Catabolism and anabolism rates are greatly affected depending on the pH of the medium. pH values is thus crucial in abundance and distribution of species. pH is a

abiotic factors has been used as factor of classification of ecological habitat especially in aquatic environment. The pH values obtained in this case is within the prescribed normal range for Nigeria waterfall. The Federal Environmental Protection Agency FEPA (1991) recommended pH 6.5 – 8.0 for drinking and 6.0-9.0 for aquatic life.

Dissolved Oxygen

Dissolved Oxygen is crucial for the required body oxygen needs of living thing. The respiratory, circulatory, digestive parts of an organism requires constant supply of adequate oxygen. It is the dissolved oxygen that determines the amount of oxygen that body system can use. The value obtained in this result fall into the minimal recommended oxygen value for the survival of aquatic organisms in the Nigeria by Federal Ministry of Environment 2011. It was recorded that Dissolved Oxygen is more available in October than December season because of more breakdown of the water molecule due to increase temperature. The relationship that water quality share with Phytoplankton is reciprocal as the later strongly influence water quality and zooplankton through carbon dioxide uptake and oxygen production (Abdulkarim and Ibrahim, 2018).

Relative Abundance of Zooplankton and smallfauna in Biu waterfall, NAUB Borno state

Bruno *et al.*, (2019) restated that Bioindicators are living organisms such as plants, plankton, animals, and microbes that are used to assess ecosystem health. They goes further to say that “Biotic indices to monitor water quality are helpful tools for evaluating the health of rivers and lakes”. The identified water fauna resources in the waterfall includes: Clams, (*Senila senilis*), Portunidae (swimming crabs), Pelusios spp (Turtle), Grayia spp (Water Snake) and small fish (*Tilapia zilli*, *Chrysichthys nigrodigitatus* and *Claria gariepinus*). Other fauna resources

are: *Bufo regularis*, Tadpole, Crustaceans (Ostracods *Eucypris virens*, *Lubricus* spp (Earthworm), Mollusca (*Sphaeriidae* and *Unionidae* family) and macroinvertebrate.

The zooplankton observed were the copepods represented by Rotifers, Cyclops and copepod egg. The zooplankton in this study have very low abundance and diversity probably has a result of intensive use of the water all-round the year for agricultural purposes that involves heavy dependence on synthetic agro-chemicals. Pollution-sensitive species are generally eliminated while more resistant species show high population growth rates (Matsumura-Tundisi & Tundisi, 2003). Ferdous and Muktadir (2009) opined that among zooplankton, Copepods have the toughest exoskeleton and the longest and the strongest appendages which help them to swim faster than any other zooplankton to escape their predators. This could be responsible for their continual survival in the water more than other Zooplankton. Both micro and macro Fauna covered in this study were presented in Table 4a to Table 4f on the issue of species abundance and distribution in the water. Understanding factors that determine zooplankton abundance, composition, and dispersal provides information needed to improve plankton dynamic predictions and enhance effective water resource management and biodiversity conservation (Zhao *et al.*, 2017).

CONCLUSION

Though there are diverse of fauna species in the water but their abundance and distribution is poor. The waterfall is high in diversity of small vertebrate, macroinvertebrate and Zooplankton.

The aquatic species were seriously threatened because of the surrounding communities' misuse of the waterfall which has led to heavy depletion of the fauna as the physiochemical parameters considered are within the

recommended limits by Federal Ministry of Environment.

Recommendations

The results of abundance and distribution shows that aquatic fauna are under stress. If the water is to recover with abundance of species in foreseeable future, comprehensive Environmental Impacts Assessment (EIA) is required. This conclusion is in agreement with opinion of Liman, (2021) which stated that in the face of changing and intensifying human activity in catchments draining into the stream, there is a need to assess the current status of water quality and benthic fauna assemblage in the river and to determine protocols for future monitoring.

It is therefore recommended that: Ministry of Agriculture and Natural Resources should swing into action through regulatory policies in other to reduce negative impacts of human abuse on the ecological niche of the aquatic wild species. Enforcement of Water protection is urgently required. For all round conservation objectives, government must find a way of incorporating masses relevancies into the sustainable aquatic management. Thus, there must be synergy between the catchment communities and government agencies to forestall possible extinction of aquatic wild species.

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