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RESEARCH ARTICLE

DISTRIBUTION AND ABUNDANCE OF BENTHIC MACROINVERTEBRATE IN LANDE STREAM, TUMU, GOMBE STATE, NIGERIA

¹*Abbati, Mohammed Alhaji, ²Usman, ¹Umar Faruk and ²Alkali, Alhassan

¹Department of Biological Sciences, Federal University of Kashere, Gombe, Nigeria

²Department of Biological Sciences, Yobe State University, Damaturu, Nigeria

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ABSTRACT

Abundance and distribution of Macroinvertebrate of Lande Stream, Tumu, Gombe State were evaluated. Three sampling sites (A, B, and C) were selected. Macro invertebrates sampled fortnightly for three months (September-November, 2019). The collected Macro invertebrates were identified using taxonomic keys. Simpson's index was employed to determine the abundance in each sampling station. The results showed a total of 189 individual species of Macroinvertebrate in 7 family among the five invertebrates taxa of Plecoptera, Coleoptera, Hemiptera, Odonata and Mollusca. The taxa abundance of Lande Stream arranged in descending trend as Mollusca > Odonata > Coleoptera > Hemiptera > Plecoptera with respective total invertebrates values of 37.73%, 25.4%, 20.63%, 8.47% and 7.94%. The Simpson's Species diversity index for the three sampling stations of A, B and C were 0.922, 0.9004 and 0.8613 respectively (Table 2, Figure 5) while the Dominance index of A, B and C were 0.078, 0.0996 and 0.1387 respectively. The Macro invertebrate abundance and distribution observed in this study showed Lande Stream can support the survival, growth and reproduction of organisms and has a potential for broaden ecological studies.

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INTRODUCTION

Proliferation, continued existence and development of water organisms depend fundamentally on the quality of water (Abbati et al., 2019). Due to increase in population density and abuse of humans, water quality is declining daily (Alrumman et al., 2016). Water necessities in all living organisms are intensifying day after day, but the source of water for drinking is a decisive issue, as all water supplies have got to the point of predicament due to urbanization and industrial revolution (Bibbiet al., 2016). Pollution of water occurred when there is alteration in the physical, chemical or biological condition in the ecosystem which disastrously affects the treasure of human life together with other fauna and flora (Ojitikuet al., 2018). Freshwater benthic invertebrates are small animals (ranging in size from minute to larger organisms) which lack vertebral column (Umar et al., 2013). Benthic invertebrates possess several proliferative strategies and life cycles, with some categories such as snails and worms spending their entire lives in aquatic ecosystem, while others, for example some insect larvae or nymphs, only spend part of their life in the water, their winged adults live in terrestrial ecosystem (Umar et al., 2013).

*Corresponding author: Abbati, Mohammed Alhaji,
Department of Biological Sciences, Federal University of Kashere,
Gombe, Nigeria.

Benthic invertebrates can be abundant in freshwater and can be used as indicators of changes in water quality; they also form an important part of aquatic food webs. Because of their capability to respond to physico-chemical changes in freshwater conditions, benthic invertebrates are mostly used as biomarkers and can provide vital information on the level of biogenic and anthropogenic disturbance (Umar et al., 2013). Macro invertebrates are organisms that can be seen with the naked eyes found living in the bottom of the water body such as lakes, stream, river and ponds. They are mostly multidimensional found restricted at the benthic zone of the stream for their feeding and at the surface for respiration. They play a crucial role in movement and transfer of nutrients from one trophic level to another in a food chain. They are classified as shredders, filter feeders, molders, scrappers and cobblers depending on their functional feeding habit (Umar et al., 2014). Macro invertebrates are organisms used as a biological indicators of water quality base on their sensitivity to changes in ecological conditions of the area, some can only be found when the water quality is within the tolerable limit while others can only be found when the water quality is totally deteriorated (Umar, 2017). Macro invertebrates study is very vital in determination of good water quality and ecological equilibrium of aquatic ecosystem, despite numerous study of Macro invertebrates in Gombe state water bodies, the information of Macro invertebrates abundance in Lande stream is omitted

based on the literature consulted; therefore, this research ascertained the abundance of Macro invertebrates present in the stream and served as a baseline information for further ecosystem study.

METHODOLOGY

Study Area: Lande Stream positioned in the eastern part of Tumu Village in Akko Local Government Area of Gombe State. This Stream sourced its water from hilly rocks and discharge the water to Lande river. It forms part of the abundant ecological niches connected with Freshwater ecosystems in Gombe State. The Stream lies between latitude 10.03⁰N and longitude 11.02⁰E.



Figure 1. Map of study area, showing Tumu, Akko Local Government, Gombe State

Sampling method: The samples was collected at each station for benthic macro invertebrates. The Macro invertebrates collected using scoop net of mesh size 500mm in each sampling site following the method employed by Umar *et al.*, (2014). The sample was collected fortnightly for a period of three months (September-November, 2019). Samples collected were cautiously preserved in 70% ethanol and 4% formalin and transported to the laboratory for sorting and identification to the lowest possible taxonomic level, using binocular microscope and taxa keys such as Umar *et al.*, (2013).

Macro benthic Abundance and Distribution Estimation: The Macro invertebrates abundance were analyzed and presented using Excel Microsoft office. Simpson’s biodiversity index was employed to determine the Macro invertebrates abundance of each sampling station in Lande Stream. Simpson’s equation is given by:

$$D = \frac{[ni(ni-1)]}{[N(N-1)]}$$

Where:

n_i = the number of individuals in i^{th} genera,

N = the total number of individual

RESULTS

A total of 189 individuals’ organisms of Macro invertebrates encompass of 7 numbers of family among the five taxa of Plecoptera, Hemiptera, Coleoptera, Odonata and Mollusca were recorded during the study period. The Mollusca were the most abundant invertebrates taxon comprising 37.57% of the invertebrates abundance followed by Odonata 25.4%, Coleoptera 20.63%, Hemiptera 8.47%, and least abundant plecoptera with 7.94% (Table 1, Fig. 2).

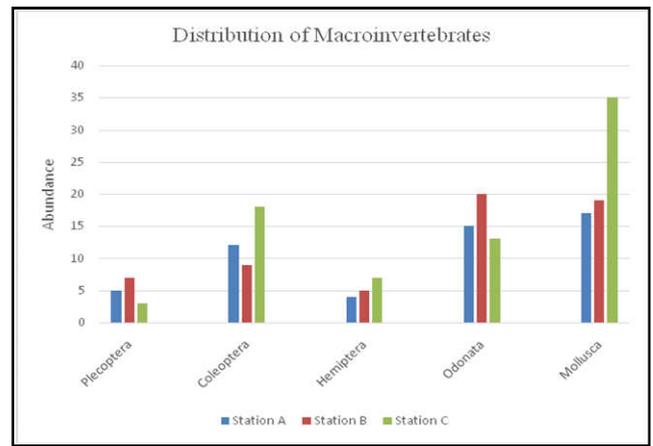


Figure 2. Distribution and Abundance of Macro invertebrates among three sampling stations in Lande Stream, Tumu, Gombe State, Nigeria, 2019

Table 1. Checklist of the abundance and distribution of Macro invertebrates present in LandeStream during the study period all together, 2019.

Macroinvertebrate	Station A	Station B	Station C	Total taxa
Plecoptera				
Neoparla	5	7	3	15
Coleoptera				
Dytisidae	12	9	18	39
Hemiptera				
Notonectidae	4	5	7	16
Odonata				
Aeshnidae	3	6	4	13
Gomphidae	12	14	9	35
Mollusca				
Lymnadaea	5	10	7	22
Thiriadae	12	19	18	49
Total	53	60	76	189
Distribution	28.04%	31.75%	40.21%	

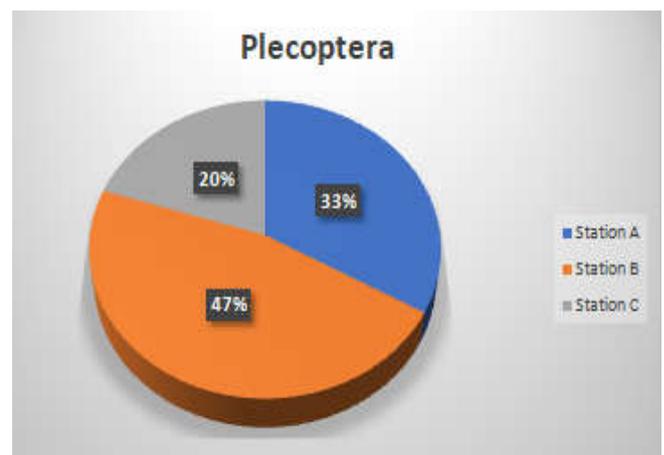


Figure 2. Distribution of Plecoptera among three sampling stations in Lande Stream, 2019

Plecoptera: In Lande Stream a total of 15 Plecoptera were sampled, with single kind of organisms (Table 1), representing 7.94% of the total Invertebrates population. Stations variation showed that station A, B and C recorded percentage population of 33, 47 and 20% of individuals organisms respectively, this showed that station B has the highest population followed by Station A and C (Figure 2). The Plecoptera identified during the study period include Neoparla species.

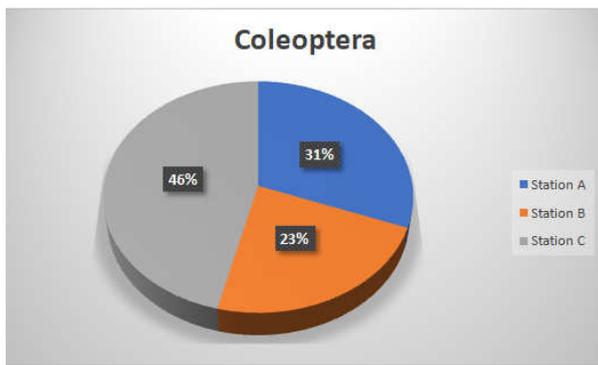


Figure 3. Distribution of Coleoptera among three sampling Stations in Lande Stream, Tumu, Gombe State, Nigeria, 2019

Coleoptera: Stations variation of Coleoptera showed that there was highest population count at station C and lowest count at station B (Figure 3). Stations variation showed that stations C and A with total population count of 18 and 12 individual organisms respectively higher than stations B with total population count of 9 individual organisms (Table 2). The Coleoptera identified during the study period include family Dytisidae (Table 1).

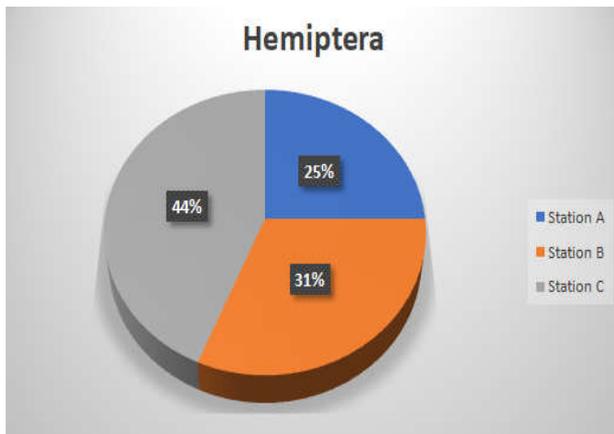


Figure 4. Distribution of Hemiptera among three sampling stations in Lande Stream, Tumu, Gombe State, Nigeria

Hemiptera: The Hemiptera accounted for 8.47 % of the population count of Macro invertebrate (189) with a total of sixteen (16) individual organisms identified during the study period (Table 2). The study revealed that there was higher Hemiptera in station C with 44% of individuals followed by station B with 31%, and C with 23% (Fig. 4). Hemiptera identified during the study period include family Notonectidae

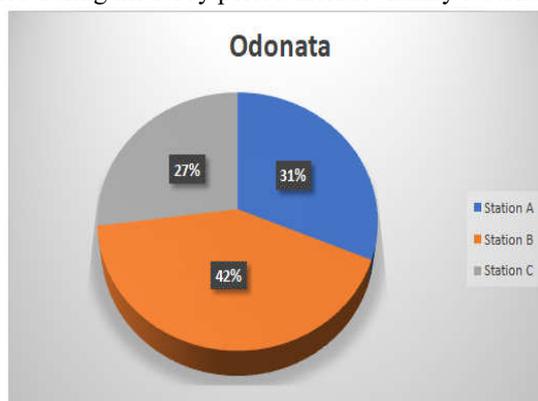


Figure 5: Distribution of Odonata among three sampling stations in Lande Stream, Tumu, Gombe State, Nigeria

Odonata: The Odonata accounted for 25.4% of the population count of Macro invertebrate (189) with a total of forty eight (48) individual organisms identified during the study period (Table 2). The study revealed that there was higher Odonata in station B with 42% of individuals followed by station A with 31%, and C with 27% (Fig. 5). Odonata identified during the study period include family Ashnidae and Gomphidae.

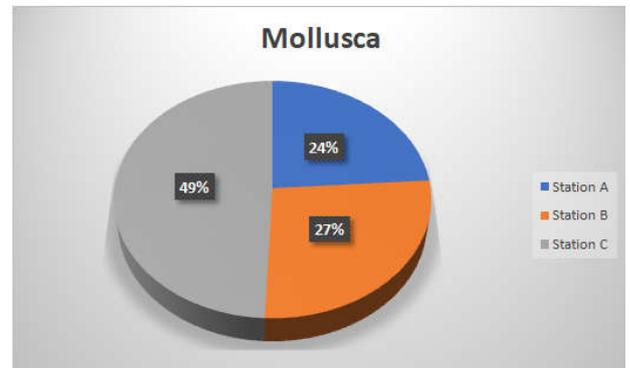


Figure 6. Distribution of Mollusca among three sampling stations in Lande Stream, Tumu, Gombe State, Nigeria

Taxa	Station A	Station B	Station C	Total	Abundance (%)
Plecoptera	5	7	3	15	7.94
Coleoptera	12	9	18	39	20.63
Hemiptera	4	5	7	16	8.47
Odonata	15	20	13	48	25.4
Mollusca	17	19	35	71	37.57
Total	53	60	76	189	
Dominance	0.078	0.0996	0.1387		
Simpson 1-D	0.922	0.9004	0.8613		

Mollusca: Stations variation of Mollusca showed that there was highest population count at station C and lowest count at station A (Figure 6). Stations variation showed that stations C and B with total population count of 35 and 19 individual organisms respectively higher than stations A with total population count of 17 individual organisms (Table 2). The Mollusca identified during the study period include Thiaridae and Lymnadae (Table 1). The Simpson’s Species diversity index for the three sampling stations of A, B and C were 0.922, 0.9004 and 0.8613 respectively while the Dominance index of A, B and C were 0.078, 0.0996 and 0.1387 respectively (Table 2).

DISCUSSION

The amount of organisms recorded from this research is quite abundant and this is supported by the fact that tropical streams generally occupy a large number of organisms compared to temperate streams (Sharma and Samita, 2011). Moreover, rivers found in tropical region tend to proliferate spontaneously; the rate of proliferation and relatively high primary production has been suggested as factors responsible (Oscar *et al.*, 2015). Macro invertebrates are very vital in indicating environmental dynamism in aquatic ecosystem in relation to anthropogenic activities. Benthic invertebrates distribution is often affected by the availability of nutrients and habitat rather than the physical and chemical parameters (Oscar *et al.*, 2015). Similar results of distribution and abundance of Macro invertebrates have been reported by Hassan and Umar (2018) stated that Mollusca is the most

frequent organisms found in Kodon Stream, Gombe State and contrary to the finding of Umar *et al.*, (2014) who reported Odonata as the most abundant benthic invertebrates in three contrasting streams in Dadin Kowa Gombe State Nigeria. The abundance of Mollusca in Lande Stream, Tumumay be due to acclimatization to altering ecological condition and capability to bear up varying ecological hassle. Dynamism and changes in the composition of substrate around the Stream station resulted from anthropogenic processes such as washing, bathing and car washing is believed to add more foreign substance into the water which eventually changes the entire physical and chemical characteristics of the water and hence rendered it an unfavorable condition for reproduction, survival and growth of aquatic organisms. This is in agreement with a work reported by Hassan and Umar, (2018) and Hynes, (1970) who simultaneously reported that the alteration of substrate composition associated with various types of organic pollution have major impact on the benthic community. Mostly, the benthic invertebrates found in the Stream served as a biological indicator or biomarkers of water quality. Therefore, any inputs of substances from riparian land used may deplete the amount of oxygen present and damagingly affect the organisms that largely utilized an oxygen for their metabolic processes. The higher the organisms that require more oxygen, the higher will be the water quality and vice versa. Therefore, Mollusca are organisms that can tolerate high ecological hassle (Umar, 2014). The abundance of Mollusca in Lande Stream Tumu indicated that, the Stream is very prone to pollution.

Conclusion

The Macro invertebrates abundance and distribution observed shows that the Mollusca are the most abundant in the stream this indicated that the stream is susceptible to pollution due to riparian land use. Routine monitoring of water quality is very important to maintain the ecological integrity and biodiversity of invertebrates present in the stream.

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