



Research Article

The Distribution and Abundance of Macroinvertebrates in
Wawan-Rafi Lake, Kazaure, Jigawa State

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ABSTRACT

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Monitoring the changes in water quality of streams and lakes can be performed through studies of macroinvertebrates living therein. Wawan-Rafi Lake Kazaure was studied from the month of May to December 2019 with the view to assessing the Macroinvertebrates composition, distribution and abundance. Five sampling sites were chosen based on anthropogenic activities and vegetational patterns around the lake. Samples collected were analyzed using standard methods and organisms collected were identified to the lowest taxa level using standard keys and American Public Health Association (APHA). A total of 1448 macroinvertebrates belonging to 11 taxa and 24 different species were collected from the five (5) different stations. The overall microinvertebrates recorded in this study comprised of Nematoda (0.97 %), Annelida (1.24 %), Mollusca (72.23 %), Arachnida (3.52 %), the Arthropoda of the groups; Diptera (5.38 %), Plecoptera (1.11 %), Coleoptera (2.56 %), Lepidoptera (1.24 %), Hemiptera (8.29 %), Trichoptera (0.83 %), and Odonata (2.63 %). Low number of macro-invertebrates was observed among which are pollution tolerant species like the *Chironomids* sp., *Melanooides* sp. and *Tubifex* sp.. This is an indication that the lake is under stress and is relatively polluted with organic pollutants.

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INTRODUCTION

All over the world, fresh water resources have been subjected to an increasing pollution load from contaminated runoff due

to manmade activities, leading to eutrophication. The adverse effects of human impacts on the aquatics include water-borne diseases, alteration of aquatic biota

composition, eutrophication and reduction or destruction of ecosystem integrity. Several studies on aquatic ecosystem impairment have been reported in Nigerian water bodies. The relative importance of factors affecting the diversity of aquatic Macroinvertebrates differs among studies, suggesting that there is considerable inter-habitat and inter-climatic variation. It is therefore important to document factors correlated with invertebrate diversity, for a range of habitats and climates. Wawan-Rafi lake is located at Wawan-Rafi village in Kazaure Local Government area of Jigawa State. It is a freshwater bodies with a history of existence dated back over 100 years. Neighboring communities depend on this reservoir for various purposes ranging from drinking water, washing, fishing and agricultural activities (Ahmed 2015). The adverse effects of such anthropogenic activities on the aquatics include water-borne diseases, alteration of aquatic biota composition, eutrophication and reduction or destruction of ecosystem integrity. This makes the water body to be subjected to increasing pollution load and eutrophication, thereby affecting its quality.

Macroinvertebrates are sensitive to stress and can reveal the effects of perturbations and habitat alteration. Macroinvertebrate assemblages and distribution frequently change in response to pollution stress in predictable ways, thus their importance as biological criteria for evaluation of anthropogenic influences of aquatic systems (Boyle and Fraleigh, 2003). Therefore, monitoring the changes of water quality in streams and rivers can be performed through studies of macroinvertebrates living therein (Arimoro and Osakwe, 2006).

MATERIALS AND METHODS

Study area

The study was conducted at Wawan-Rafi lake, a fresh water body located at Wawan-Rafi village 2 Km west of Kazaure town, Kazaure Local Government area of Jigawa State. The Lake is geographically located on latitude 12° 62' 50" N – 12° 62' 88" and longitude 8° 37' 02" E – 8° 37' 73". It has the depth of 14.2 meters and crests length of 1402 meters and generally covers almost 1.5 km². It is one of the oldest water body with history of existence over 100 years without completely drying up.

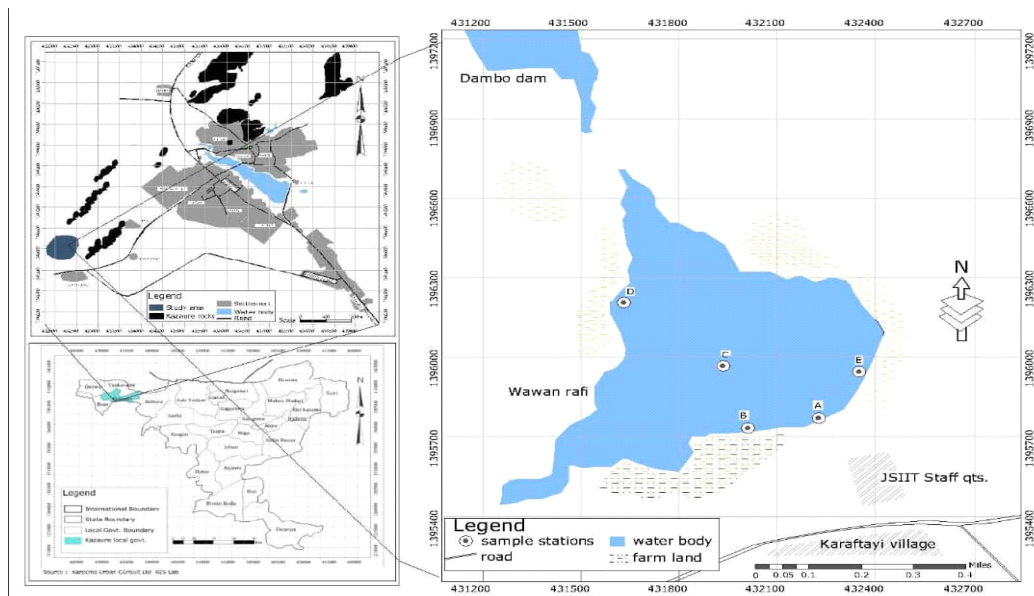


Figure 1: Map of Wawan-Rafi Lake Showing the five sampling stations (A, B, C, D and E).

Five sampling stations (A, B, C, D and E) were chosen within the lake after a reconnaissance survey. Station A was at the main entrance of the lake (latitude 12° 62' 54" N and longitude 8° 37' 61" E) where human activities like washing and bathing are taking place while B was at the other edge near an irrigation site (latitude 12° 62' 50" N and longitude 8° 37' 39" E) where Agricultural activities are taking place. Station C was at the middle of the lake (latitude 12° 62' 65" N and longitude 8° 37' 28" E) where there is less human activities and station D was at the downstream of the lake (latitude 12° 62' 88" N and longitude 8° 37' 02" E) where there may be little or no human impact especially during rainy season when the water level rises. This is an area where the lake joins with Dambo dam (another water body) during rainy season. Station E was the fishermen landing site at the other edge of the Lake (latitude 12° 62' 70" N and longitude 8° 37' 73" E).

Sample Collection

Each site was sampled once every month for a period of eight months (May – December, 2019) and Samples were collected during morning hours between 7.00 a.m. to 08.00 a.m. using plastic containers washed with Nitric acid (Boyd 1990). Macroinvertebrates in water were collected with plankton net of mesh size 300 µm. The net was tied to a metal rod and toyed to a fixed distance of about two meters and Macro-benthic invertebrates were sampled with a modified **Ekman grab** that samples bottom sediment. Benthic fauna was separated from silty sediments by the modified sugar floatation technique and in very shallow waters the benthos was collected by scooping the sediment with small container. Organisms collected were stained with Rose Bengal for easy identification to the lowest taxa possible

using standard keys and APHA (2005) as described by Abubakar and Yakasai (2015).

Sweep net method of collecting flying insects during flight was also used to sample insects on vegetation and insects near water bodies and insects collected were killed using hot water at about 65C⁰ and preserved in 10% formalin or 70% ethanol (Williams 1987).

RESULTS AND DISCUSSION

A total of 1448 macroinvertebrates belonging to 11 taxa and 24 different species were collected from five (5) different location/stations in Wawan-Rafi lake. The organisms were collected, sorted, counted and identified. Table 1. below shows the relative abundance of the organisms encountered at different sampling stations, while the percentage composition of each taxa group is shown in Table 2.

Ogbeibu and Egborge (1995) stated that high biodiversity is expected in ecosystems devoid of significant anthropogenic impacts. However, in the case of Wawan rafi lake, the overall microinvertebrates recorded in this study comprises of Nematoda (0.97 %), Annelida (1.24 %), Mollusca (72.23 %), Arachnida (3.52 %), the Arthropoda of the groups; Diptera (5.38 %), Plecoptera (1.11 %), Coleoptera (2.56 %), Lepidoptera (1.24 %), Hemiptera (8.29 %), Trichoptera (0.83 %), and Odonata (2.63 %).

The eleven 11 taxa comprising of 1448 individuals were very low when compared with 27 taxa recorded by Emere and Nasiru (2009) in river Kaduna and 33 taxa recorded by John and Abdurrahman (2004) in wetlands of Southern Nigeria. The low number of macroinvertebrates observed could be due to some ecological imbalance arising from alteration of some important factors, including water quality, immediate substrate for occupation and food availability. The presence of pollution tolerant species

(*Chironomids* sp., *Melanoides* sp., and *Tubifex* sp.) as dominant species suggest that the lake is relatively under stress of organic pollution from anthropogenic sources.

Moreover, the result is almost similar to the 9 taxa and 1162 individuals obtained by Ibrahim and Nafiu (2017) in Thomas Dam, Danbatta Kano. This is an indication that both

Thomas dam and Wawan-Rafi lake experience introduction of organic pollution in physical and chemical conditions of the water bodies. These factors may lead to the disappearance of some macroinvertebrates in the water bodies, as suggested by Ibrahim and Nafiu (2017).

Table 1: Composition, Abundance and Distribution of Micro-invertebrates in Wawan-Rafi lake Kazaure (May-Dec, 2019)

Taxa/Species composition	Stat A	Stat B	Stat C	Stat D	Stat E	Total	%prev.
ARTHROPODA							
Diptera (True Flies)							
<i>Sinulium</i> sp.	-	3	-	-	4	7	0.48
<i>Culicidae</i> larvae	3	1	-	5	2	11	0.76
<i>Chaobrus</i> sp.	-	1	-	-	1	2	0.14
<i>Chelifera</i> sp.	1	1	2	4	1	9	0.62
<i>Chironomus</i> sp.	14	6	3	8	17	48	3.31
<i>Nephrotoma</i> sp.	1	-	-	-	-	1	0.07
Plecoptera (Stone Flies)							
<i>Ostrocerca</i> sp.	5	1	1	4	2	13	0.90
<i>Leuctra</i> sp.	2	-	-	1	-	3	0.21
Coleoptera (Beetles)							
<i>Dineutus</i> sp. (Swirligig Beetle)	11	4	2	6	14	37	2.56
Lepidoptera (Butterfly & Moths)							
<i>Lepidoptera</i> larvae	4	5	-	7	2	18	1.24
Hemiptera (Water Bugs)							
<i>Hesperocorixa</i> sp.	3	2	-	4	1	10	0.69
<i>Aquarius</i> sp. (Water Strider)	31	14	9	11	45	110	7.60
Trichoptera							
<i>Macrostemum</i> sp.	4	1	-	1	3	9	0.62
<i>Setodes</i> sp.	2	-	-	1	-	3	0.21
Odonata (Dragon Fly & Damsel Fly)							
<i>Brachythemis</i> sp.	6	8	1	5	9	29	2.00
<i>Libellula</i> sp.	-	1	-	2	1	4	0.28
<i>Callibaetis</i> sp.	-	2	-	2	1	5	0.35
MOLLUSCA							
<i>Amnicola</i> sp.	10	7	2	5	13	37	2.55
<i>Melanoides</i> sp.	188	241	54	132	296	911	62.91
<i>Bellamyia</i> sp.	18	23	5	24	28	98	6.77
ARACHNIDA							
<i>Nephila</i> sp. (Banana Spider)	3	6	-	19	4	32	2.21
<i>Dolomedes</i> sp. (Fishing Spider)	-	3	-	5	11	19	1.31
ANNELIDA							
<i>Tubifex</i> sp.	2	6	3	4	3	18	1.24
NEMATODA							
<i>Diplogaster</i> sp.	-	2	-	4	8	14	0.97
Total no. of Organisms/station	302	327	79	243	461	1448	100
Number of Species per station	18	21	10	21	21		

Table 2: Percentage composition of Taxonomic Groups

Taxa Groups	Percentage (%)	Number of individuals
Diptera	5.38	78
Plecoptera	1.11	16
Coleoptera	2.56	37
Lepidoptera	1.24	18
Hemiptera	8.29	120
Trichoptera	0.83	12
Odonata	2.63	38
Molluscs	72.23	1046
Arachnids	3.52	51
Annelida	1.24	18
Nematoda	0.97	14
Total	100%	1448

Mollusca had the highest diversity with 72.23 % and 1046 individuals out of which *Melanooides* sp. constitute almost 63 %. The abundance of *Melanooides* sp. was observed to be favoured by their tolerance to habitat variability due to a very strong and thick shell and their parthenogenetic females that are capable of multiplying within short time (Contreras-Arquita 1998).

In terms of family richness, Arthropoda appeared to be dominant with seven different orders and a total of 22.04 % and 319

individuals. Among these orders, Diptera has the highest diversity with 6 different species and 78 individuals. The arthropods adaptation to living in different habitat are due to their mode of feeding, behaviour, physiology, and adaptation to wide range of physicochemical parameters (Mellanby 1997). Nematoda was the least diverse in terms of species richness, with only 14 individuals (0.97 %) and followed by Annelida with 18 individuals (1.24 %) composition.

The Diversity Index for the five sampling stations is shown in table 3 below.

Table 3: Summary of diversity and faunal indices for each station

Biotic Index	Station A	Station B	Station C	Station D	Station E
Number of taxa group	10	11	7	11	11
No. of species per station	18	21	10	21	21
No. of individuals	308	338	82	254	464
Shannon diversity (H)	1.59	1.38	1.31	1.95	1.53
Margalef's index (D)	2.97	3.44	2.04	3.61	3.26
Odums index	5.84	6.21	12.19	8.27	4.53

CONCLUSION AND RECOMMENDATION

The samples were collected from five sampling stations (A, B, C, D and E) during morning hours of 7:00 am and 8:00 am. Low number of macro-invertebrates was recorded among which are pollution tolerant species like the *Chironomids* sp., *Melanoides* sp. and *Tubifex* sp.. This is an indication that the lake is under stress and is relatively polluted with organic pollutants from surrounding anthropogenic sources. It was observed during the study period that the lake serves as a critical water source for various activities

like bathing, washing, fishing, agricultural activities among others. These might have contributed to the varying degrees of degradation in water quality, especially in stations A, B and E that are more exposed to human impacts. Proper mitigation measures should be implemented to reduce the organic loads in the lake and prevent future deterioration in the condition of the lake through controlling organic pollutants coming into the lake from anthropogenic and other sources of pollution in order to conserve and preserve the biodiversity in the lake.

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