Nwanna, L. C.; Ajani, E. K.; Omitoyin, B. O.; Magawata, I. Ayoola, S. O.; Orisasona, O.; Kareem, O. K and Abubakar, M. Y. (Eds.) (2004) ***Proceedings of the Fifth Conference of Association of Nigerian Fisheries Scientists.*** **"SUSTAINABLE FISHERIES AND AQUACULTURE PRODUCTION FOR ENHANCING LIVELIHOOD IN NIGERIAN ECONOMIC DEVELOPMENT"** 9TH – 11TH JULY, 2024 In the University of Lagos, Lagos, Nigeria

Composition, Relative abundance and Diversity of Benthic Macroinvertebrates Fauna of Lekki Lagoon, Iwopin, Ogun State, Nigeria.

***Rafiu, R.A.[1], Adeosun, O.[2], Amusat A.I.[3] and Awofodu, B.O.[4]**

[1234]Oyo State College of Agriculture and Technology, Igboora Oyo State Nigeria

Corresponding author: rarafiu@gmail.com, 08107664516

ABSTRACT

Benthic Macroinvertebrate fauna of Lekki Lagoon, Iwopin, Ogun State Nigeria was assessed for its Composition, Relative abundance and Diversity. A total of 1,457 benthic Macroinvertebrates fauna were recorded from three families, Unionidae, Thiaridae and Subulinidae. Family Unionidae with one species; *Anadonta cygnea* was the highest with 667 samples occupying 45.78% of the population. The family Subulinidae with species *Subulina octona* recorded the lowest composition 5.97% (82) in all the Stations. The highest Relative Abundance 37.95% of macroinvertebrates fauna was recorded in Station 1 comprising all the species while the least was recorded from Station 2 (10.64%). The species diversity indices recorded were less than 1 which shows a heavy polluted water body which may be due to anthropogenic activities in the area. Monitoring measures should be used to control the activities of farmers to reduce the rate of pollution which in turn increases the growth and survival of fish species.

Keywords:
Unionidae, population, diversity indices, anthropogenic, Lekki Lagoon

Introduction

Benthic macro invertebrates are the fauna that lives on or inside the deposit of water body which are larger than microscopic organisms but are generally ubiquitous in fresh water environment and play vital roles in the aquatic food web (Davide and Marcosigovini 2010; Sekiranda *et. al.* 2004). According to lyiola and Aseda 2020 macroinvertebrates are ubiquitous to aquatic system and play different roles like mixing of sediment, mineralization, flux of oxygen into sediment and organic matter cycling. Benthic organisms are generally classified based on size into micro benthos (>1.0mm), macro benthos (<10.00mm) and sometimes mega benthos (>10.00mm) (Castelli, Lardicci and Tagliapietra 2004). They can also be differentiated in the bottom sediment based on the position they occupy into in-fauna for those that live in sediment and epi-fauna for those that live on the surface of bottom sediment (Davide and Macosigovini, 2010). Macroinvertebrates form an important food source for animal through decaying after death by releasing nutrient that are reused by aquatic plants and animals in the food chain (Stockley, Oxford and Ormond 1998).

Timm and Mois (2008) reported benthic macroinvertebrates as biological quality element needed for the classification of biological status of water bodies. They are also useful as bio-indicators that provide

more accurate understanding of changing in aquatic condition than chemical and microbiological data which only gives short term fluctuation (Okafor *et. al.* 2012). The role of macro invertebrate in water bodies cannot be underestimated; several studies have been made on the documentation of the ecology, spatial distribution, composition and biodiversity of benthic macroinvertebrate community of Nigeria rivers (Ogbeigbu and Victor 1989, Osemwieigie and Okumokoro 2004). Andem *et. al.* 2012 has established a pattern of relationship between macro invertebrate fauna, depth, substrate and organic control of sediment. Amusat *et. al.* (2021) also reported the role of macroinvertebrate in circulation and recirculation of nutrient in aquatic environment while Adebisi (1989) and Oke (1990) stated that benthic organisms feed on debris in the bottom of water which they in turn serve as food for wide range of fishes and also accelerate the breakdown of decayed organic matters into simpler organic forms. These studies reported several research work on composition of benthic macroinvertebrate in Nigeria water bodies but there is paucity of knowledge on the benthic macroinvertebrate activities and it impact on water bodies of Lekki Lagoon, Iwopin Ogun State Nigeria. Therefore, this study aimed at investigating the composition, relative abundance and diversity of benthic macroinvertebrate fauna of Lekki Lagoon, Iwopin Ogun State.

Materials and Methods

Study Area

Lekki Lagoon, Iwopin, Ogun State is situated between longitude $4^0 15' - 4^0 30^1$ and latitude $6^0 20^1$ N – $6^0 45^1$ N and bounded in the East by Lekki Lagoon and down South by Bight of Benin. The Lagoon covers an area of $26km^2$ and connected by tri-axis called "Agari" to the Lagos and Lekki Lagoon and also to some Creeks (Adekoya, 1995). The Lagoon empties into the Atlantic Ocean via Lagos habour. The Lagoon is essentially freshwater which is open to saltwater intrusion, at times. Natural resources found in Iwopin freshwater Ecotype of Lekki Lagoon include extensive fertile soil, rocks and mineral deposits (Adekoya, 1995) as shown in Fig. 1. The water body was divided into four stations labeled 1 to 4 (Wharf, Agbalegiyo, Ilamo and Ebute Oni) based on fisheries activities and other anthropogenic activities in the water body.

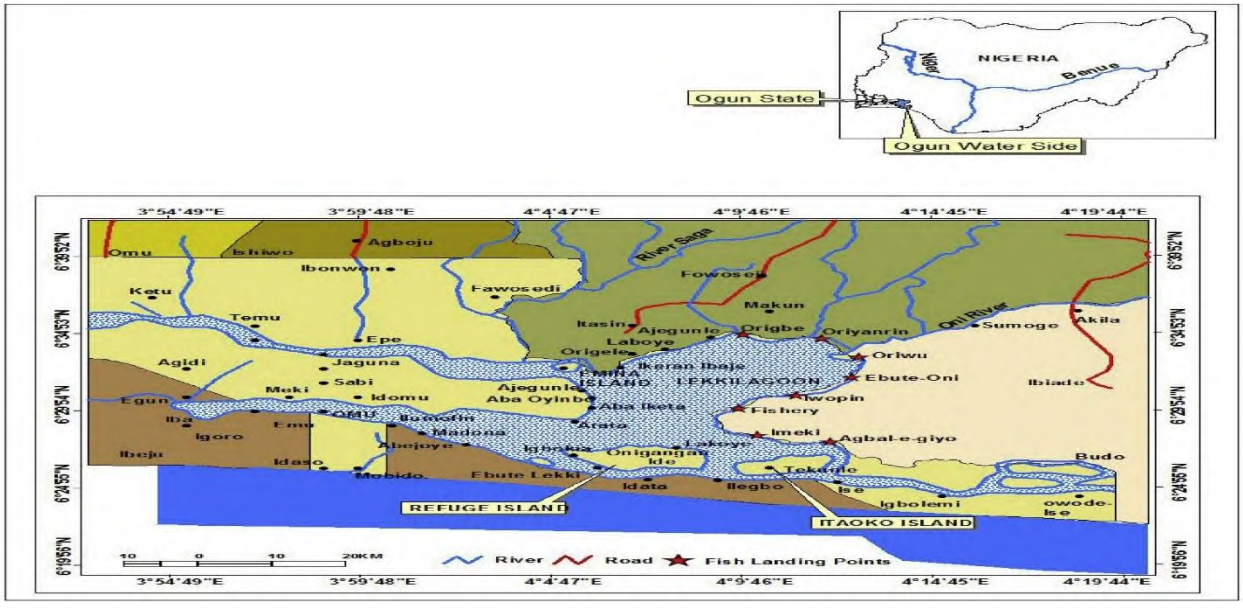

Fig. 1: Map of Lekki Lagoon Iwopin Ogun Waterside Local Government Area

Agbalegiyo is the upper water body where the use of gillnet with small mesh size was commonly used which is far from human activities and looks unpolluted. Wharf is the mid-stream where the main fishing activities takes place with other arable crop farming activities. And also dominated with different human activities like waste discharge. Ilamo is upper water body closed to upper part of Lekki lagoon designated majorly for barrier fishing activities while Ebute oni is the downstream which is closer to the lagoon at the lower end with little or less anthropogenic activities.

Sampling Procedure

Sediments were collected monthly between the hour of 8.00 am and 11:00am from each sampling station using Van Veen Grab. Collected sediments were carefully poured into labelled polythene bag and transported off shore for sieving. The samples were sieved for macroinvertebrates collection using a sieve of mesh size 0.5mm to eliminate excess sediments until clean water is observed. Fauna collected were sorted and stored in a 4% formalin container for further identification. Macroinvertebrates were identified under 0.90mm hand lenses and compound microscope in the Fisheries. Technology Laboratory, Oyo State College of Agriculture and Technology Igboora. Water physico-chemical parameters were measured and recorded as shown in Table 1.

Statistical Analysis

The monthly Composition and Relative Abundance of macro invertebrates were calculated. Biological indices; Margalef's Index (D), Shannon – Weiner Index (H) and Evenness Index (E) were used to calculate taxa richness, diversity and evenness. Margalef's Index (D) is the measure of species richness according to Margalef (1967) and expressed:

Diversity index (D) = $\frac{S-1}{lnN}$……(1)

Where S= Number of species

N = Total number of organism

Shannon-Weiner index (H) expressed as

H = $\frac{NlogN-\sum f1logf1}{N}$ ……..…..(2)

Shannon and Weiner (1949)

Evenness index (E) is a measure of equally or evenly distribution of species in the community and expressed as:

Evenness index (E) = $\frac{H}{logS}$ ……..……(3)

Where H is Shannon – Weiner index

S is no of Species in sample

Results

Table 1: Mean and Standard deviation of water Physico-chemical parrameters of the stations

Parameters	S1	S2	S3	S4	MEAN
Temperature (ºC)	27.20 ± 0.13	27.07 ± 0.15	28.21 ± 0.12	28.35 ± 0.15	27.21 ± 0.15
Ph	7.32 ± 0.12	7.37 ± 0.16	7.30 ± 0.10	7.35 ± 0.13	7.34 ± 0.17
DO (mg/l)	7.25 ± 0.17	3.25 ± 0.15	4.97 ± 1.12	6.07 ± 0.51	5.39 ± 1.12
Transparency (cm)	97.45 ± 5.45	95.30 ± 4.67	92.02 ± 5.22	94.33 ± 5.51	94.78 ± 5.63

Table 2: Composition of Benthic Macroinvertebrates in Lekki Lagoon, Iwopin, Ogun State Nigeria

Composition	S1	%	S2	%	S3	%	S4	%	Total	%
Unionidae										
Anadonta cygnea	323	58.41	52	33.56	83	29.86	209	44.37	667	45.78
Thiaridae										
Melanoides tuberculate	134	24.23	52	33.55	115	41.37	135	28.66	436	29.92
Subulinidae										
Subulina stratella	26	4.07	16	10.32	25	8.99	43	9.13	110	7.55
S. octona	16	2.89	17	10.97	17	6.12	37	7.86	87	5.97
Rumina decollate	54	9.77	18	11.61	38	13.67	47	9.98	157	10.78
Total	553		155		278		471		1,457	

Table 3: Relative Abundance of Benthic Macroinvertebrates of Lekki Lagoon, Iwopin, Ogun State Nigeria

Family	Species	S1	S2	S3	S4	Total	Relative Abundance (%)
Unionidae	*Anadonta cygnea*	323	52	83	209	667	45.78
Thiaridae	*Melanoides tuberculata*	134	52	115	135	436	29.92
Subulinidae	*Subulina stratella*	26	16	25	43	110	7.55
	S. octona	16	17	17	37	87	5.97
	Rumina decollate	54	18	38	47	157	10.78
	Total	553	155	278	471	1457	
	Relative Abundance(%)	37.95	10.64	19.08	32.33	100	100

Table 4: Diversity Indices of Benthic Macroinvertebrates ofLekki Lagoon, Iwopin, Ogun State

Indices	Station 1	Station 2	Station 3	Station 4
Number of Taxa	5	5	5	5
Number of Individuals	3	3	3	3
Margelef's Index (D)	0.06	0.026	0.014	0.009
Shannon- Weiner Index (H)	0.45	0.13	0.241	0.35
Evennes Index (E)	0.65	0.19	0.34	0.50

The water physico-chemical parameters of the four stations was shown in Table 1. The mean temperature was 27.71 ± 0.15 and mean pH was 7.34 ± 0.17 while the mean Dissolved Oxygen and transparency were 5.39 ± 1.12 and 94.78 ± 5.63 respectively**.**

The Composition and Relative abundance of benthic macroinvertebrates fauna sampled from stations 1 to 4 in Lekki Lagoon, Iwopin Ogun state was represented in Table 2 and 3 respectively. A total of 1,457 fauna belonging to four families and five species were recorded. Highest fauna composition of 323 species was recorded in station 1 from the family Unionidae having one species (*Anadonta Cygnea*)

while the least composition 16 was recorded from the family Subilinidae with three species *Subulina octona* as shown in Table 1. The family Unionidae species *Anadonta Cygnea* accounted for the overall highest fauna composition of 667 across the stations while the species *Subulina octona* recorded the least composition of 87 across the station (Table 2). The family Subulinidae comprises of three species; *Subulina stratella*, *Rumina decollate* and *Subulina octona* form the least occurred species across the four stations as the number of species found was low in all stations especially in species *Subulina octona* and *S. stratella* respectively.

The family Unionidae with single species *Anadonta cygnea* has the highest relative abundance 45.78% while the least relative abundance 5.97% was recorded from the family Subulinidae; species *Subulina stratella.* Family Thiaridae with species *Melanoides tuberculata* has average relative abundance 29.92% when compared to other macroinvertebrates found in the water body as shown in Table 3. The biological diversity indices of benthic Macroinvertebrates were calculated using three indices; Margelef's Index (D), Shannon-Weiner Index (H), and Evenness Index (E) as shown in Table 4. Station 4 recorded the lowest D-value of 0.009 while the highest value was recorded in station 2 (0.026). Shannon-Weiner index (H) recorded the highest in Station 1 (0.45) and least was also recorded in Station 2 (0.13). The Evenness index (E) ranges from 0.19 to 0.65 where highest index was recorded in station 1 and least in Station 2.

Discussion

Water quality is an important tool for species abundance and biological properties in an aquatic environment (Ibrahim and Nafi'u 2017). According to Iyiola, 2015; it can also be affected by prevailing environmental conditions due to anthropogenic activities. The temperature ranges fall within the WHO (2001) recommendation of between 21-30 ^{o}C. The Dissolved Oxygen (DO) was low in Station 2 and 4 (3.25 ± 0.15 and 4.97 ± 1.12) respectively which may be due to heavy human activities that hinders oxygen concentration in these stations (Idowu and Ugwumba, 2005). The mean pH (7.34 ± 0.17) recorded was neutral and falls within the recommended range of 6.6-8.5 according to Boyd and Linchtkoppler (1979). The high water transparency which was almost the same in all stations of Lekki Lagoon, Iwopin Ogun State might have favoured high photosynthesis thereby increase primary productivity (Mason 1990).

The highest abundance of *Anadonta cygnea* and *Malaniodes tuberculata* recorded in Lekki Lagoon, Iwopin, Ogun State maybe related to the water condition, availability of food and the quality of substrate of the water body according to Iyiola and Asedu (2020). Lekki Lagoon, Iwopin is open or used for different fresh fish rearing activities by private bodies or individual which enhances the productivity of the water body dues to decay of feed remnant's and the practice of aggregate fishing method engaged in by local fish farmers in the area thereby increasing the availability of food and high quality of substrate in the water body. More so, the abundance of *A. cygnea* and *M. tuberculata* in Stations 1,3 and 4 could be attributed to moderately polluted area of the reservoir as reported by Amusat *et al* 2021 in Erelu reservoir recorded highest 92.73% occurrence of this species. This is in line with the report of Adebayo (2009) reporting *M. tuberculata* as fairly tolerant benthic organisms in Eleyele reservoir Oyo State. The number of family Subulinidae especially *Subulina octona* was generally low across all the Stations, this may be due to some ecological imbalance governing the abundance and distribution of these benthic organisms in the communities according to Andem *et al*, 2012 and low occurrence of all

the species in Station 2 could be attributed to heavy anthropogenic activities in the area. This may lead to pollution of the water body as pollution stress have direct impact on the abundance and diversity of macroinvertebrates species in rivers (Yap, *et.al.*2003)

Margelef's index calculated reveals low species richness as the value recorded are less than 1 which could be an indicator of heavy pollution according to Amusat *et al* 2021. More so, this may be due to the bigger size of the lotic water body as reported by Tyokumber *et al* 2002 and Andem *et al* 2012 that the bigger the size of the lotic water body the poorer the macroinvertebrates richness. Low species diversity and Evenness was also recorded using Shannon- Weiner (H) and Evenness (E) equation is in line with Andem *et al* 2012 that reported low species diversity in Ona River Southwest Nigeria.

Conclusion

The result of Margelef's index (D) for the Benthic Macroinvertebrates fauna of Lekki Lagoon, Iwopin Ogun State Nigeria indicate heavy pollution as the values are less than 1. This may be due to pollution from organic pollutant due to anthropogenic activities of the farming activities in the water body. Therefore, monitoring measure should be put in place to control the activities of these water body in order to reduce the pollution due to different anthropogenic activities in the area.

Acknowledgement

We are grateful to Almighty God for strengthening the group with knowledge and wisdom for researching and writing this article. We are also grateful to TETFUND for their financial support towards the success of the article.

References

Adebayo, T. (2009). The Dynamics of the Macro benthic nvertebrates fauna of Eleyele and Awba reservoir. An unpublished MSc. Thesis submitted to the Department of Zoology, Pp 23-50.

Adebisi, A.A. (1989). The physico chemical hydrology of tropical seasonal river- Upper Ogun River *Hydrobiologia* 79: 157-165.

Adekoya, B.B., 1995. A Report on the Diagnostic Survey of Small Capture and Culture Fisheries in Ogun State. OGADEP, Abeokuta, p. 17.

Amusat, A.I., Popoola, K.O.K., Adedokun, M.A. and Rafiu,R.A. (2021). Composition, Abundance and Diversity of Macro-Benthic Fauna and Aquatic Insectsof Erelu Reservoir and its physical properties. *Journal of Agriculture and Management Technology(JAMTECH)*.1: 157-168.

Andem, A.B., Okafor, K.A., Udofia,U., Okete, J.A.and Ugwumba, A.A.A. (2012). Composition, Distribution and Diversity of Benthic Macroinvertebrtes of Ona River, South-west, Nigeria. *European Journal of Zoological Research*, **2012,** 1 (2): 47-53.

Brinkhurst, R.O. (1970). Organic pollution, In: Pollution; causes, effect and control, Ed. Harrison, R.R. the Royal Society of Chemistry, London, 1970; pp. 103.

Boyd, C.E. and Linchtkoppler, F.R. (1979). Water quality management in fish pond culture. International centre for Aquaculture, Agric experimental station, Auburn University, USA. p.20.

Castelli, A., Lardicci and Tagliapietra, D. (2004). Soft-bottom Macro-benthos, in M.C. Gambi and M. Dappiano (Eds), Meditteranean marine benthos. A manual of methods for its sampling and study. Biological Marine Meditteranean (SIBM-PATICRAM), 11 (suppl.1). 99-131.

Davide, T. and Marcosigovini, (2010). Benthic fauna: collection and identification of microbenthic invertebrates instituto di scienze marine consiglioNationatedellerRicerche (NR- ISMAR) Riva settemarturi 1364/a 30122, Venice Italy. Near Curricum in National Environmental Science, Terret Environmental, Vol 88, Pp 253-261

George, A.D.I., Abowei, J.F.N. and Daka, E.R. (2009). Benthic macroinvertebrate fauna and Physico-chemical parameter in Okpoka Creek sediments, Niger Delta,Nigeria. *International Journal of Animal and Veterinary Advances*, **1**: 59-65.

Ibrahim, S. and Nafi'u, S.A. (2017). Macroinvertebrates as indicators of Water Quality in Thomas Dam, Dambatta, Kano State, Nigeria. UMYU Journal of Microbiology Research, 2(1): 1-13

Idowu, E.O. and Ugwumba, A.A.A. (2005). Physical, Chemical and Benthic Faunal Characteristics of Southern Nigeria Reservoir. *The Zoologist,* **3**, 15-25

Iyiola, A.O. and Asiedu, B. (2020). Benthic Macro- Invertebrates as Indicators of Water Quality in Ogunpa River South-Western Nigeria. *West African Journal of Applied Ecology*, **28**(1), 85-95

Lenat. D.R., Smock, L.A. and Penrose, D.L. (1980). Use of benthic macroinvertebrates as indicators of environmental quality In: Biological Monitoring for Environmental effects, Lexinton Books, Toronto, Canada, Pp. 7-114

Margalef, R. (1967). Diversity and stability: A practical proposal and a model of interdependence. *Brookhaven Symposium on Biology*; **22**: 25-37.

Mason, C.F. (1991). *Biology of Freshwater Pollution.* Longman Scientific Technical, New York, USA, p 350.

Ogbeibu, A.E. and Victor, R. (1989)**.** The effects of road and bridge construction on the bank root macro-benthic invertebrates of a southern Nigerian stream. *Journal of Environmental Pollution*, **56**: 85-100.

Okafor,K.A, Andem, A.B., Okete, J.A. and Ettah, S.E. (2012). The Composition, Distribution and Abundance of Macroinvertebrates in the Shores of the Great Kwa River, Cross River State, South-east, Nigeria. *European Journal of Zoological Research,* **1**(2): 31-36

Oke, O.O. (1990). Limnology and macro-benthos of Owena Reservoir, M.Phil. Thesis, submitted to the Department of Zoology, University of Ibadan, Ibadan Nigeria Pp. 70-75.

Osemweigie, F.O. and Olomukoro, J.O. (2004) Studies on microbenthic fauna associated with microhabitats in backwater of Ikpoba River Benin city Nigeria. *Tropical Journal Environmental Resources* **15**, 279-29.

Ravera, O. (1998). *Annali de chemical* **88**, 909-913.

Sekiranda, S.B.K., Okot-Okumu, J., Bugenyi, F.W.B., Ndawula, L.M. and Gandhi, P. (2004). Variation in composition of nacro-benthic invertebrates as an indication of water quality status in three bays in Lake Victoria. *Uganda Journal of Agricultural Sciences,* 2004, **9**: 396-411

Shannon, C. E. and Weiner, W. (1949). *The Mathematical Theory of Communication*. The University of Illinois Press, Urbana, pp 117.

Stockley, R.A., Oxford, G.S and Ormond, R.F.G**.** (1998)**.** Do invertebrates matter? Detrital processing in the River Swale-Ouse. S*cience of the Total Environment*. **210**: 427–435.

Suleiman, K and Abdullahi, I. L. (2011)**.** Biological Assessment of Water Quality: A study of Challawa River Water, Kano, Nigeria. *Bayero Journal of Pure and Applied Sciences*, **4(2):** 121 –127.

Timm, H. and Mois, T. (2008). *Verh. Int. Verein. Limnol*. 30: 138-140

Tyokumbar, J., Okorie, T.G. and Ugwumba, O.A. (2002). The Zoologist **1**(2): 59-69

Yap, C.K., Rahum, I.A., Ismail, A. and Tan, S.G. (2003). Species diversity of Macrobenthic invertebrates in the Semenyih River Penisular Malaysia. *Pertaniker Journal of Tropical Agriculture Science*, **26**: 139-146.

World Health Organization, (2001). Water Quality: Guidelines, standards and health Assessment of risk and risk management for water-related infectious disease. https://www.who.int/water_sanitation_health/publications/whoiwa/en/

ANIFS 2024
© 2024
***Proceedings of the Fifth Conference of Association of Nigerian Fisheries Scientists.* "SUSTAINABLE FISHERIES AND AQUACULTURE PRODUCTION FOR ENHANCING LIVELIHOOD IN NIGERIAN ECONOMIC DEVELOPMENT"**
9TH – 11TH JULY, 2024 in the University of Lagos, Lagos, Nigeria