Journal of Limnology and Freshwater Fisheries Research

http://www.limnofish.org

Taxonomic Structure of the Benthic Macroinvertebrate Fauna from a Tropical Rainforest River in Southern Nigeria.

Ukpamufo C. OLOWO[1], Nkonyeasua K. EGUN[2*], Precious E. OMORUWOU[3], Avuakporien J. EDOREH[4]

[1, 2] TETFUND Centre of Excellence in Aquaculture and Food Technology, University of Benin, Benin City, Nigeria.

[3] Department of Animal and Environmental Biology, Delta State University of Science and Technology, Ozoro, Delta State, Nigeria.

[4] Department of Zoology, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

ABSTRACT

This study investigates the impact of anthropogenic activities on the benthic macroinvertebrate community structure of Owan River, Edo State Nigeria. A total of 513 individuals, comprising of 11 species distributed in 9 families, 7 orders and two 2 phyla were recorded during the study. Benthic macro-invertebrate distribution was in the order Station 1 > Station 2 > Station 3 > Station 5 > Station 6 > Station 4, with species abundance highest in Station 1 (159) and lowest at Station 4 (28), while diversity was highest in stations 3 and 6. The observed phyla were Arthropoda (8 species) and Mollusca (3 species) from the orders Basommatophora, Caenogastropoda, Decapoda, Diptera, Neotaenioglosa, Odonata and Trichoptera. The species *Tympanotonus fuscatus* (62.18%) of the phylum Mollusca was the most dominant, while the species *Caridina africana* (1.56%), *Clinotanypus* sp (1.36%) and *Corynoneura* sp (1.56%) of the phylum Arthropoda were rare. Diversity indices of Dominance Index (0.27 to 0.48), Evenness index (0.47 to 0.73) and Margalef index (0.79 to 1.50) indicated low species diversity. The dominance of *T. fuscatus* and *M. tuberculatus* is an indication of deteriorating water quality from pollution. The need to forestall further decline in water quality is recommended.

Keywords: Community structure, Specie distribution, Macroinvertebrates, Water pollution, Owan River

ARTICLE INFO

RESEARCH ARTICLE

Received : 26.03.2024
Revised : 27.11.2024
Accepted : 16.12.2024
Published : 30.04.2025

DOI:10.17216/LimnoFish. 1458148

*** CORRESPONDING AUTHOR**

kingsley.egun@uniben.edu
Phone : +234 (0)7032157045

How to Cite

Olowo U.C., Egun N.K., Omoruwou P.E., Edoreh A.J. 2025. Taxonomic Structure of the Benthic Macroinvertebrate Fauna from a Tropical Rainforest River in Southern Nigeria. LimnoFish. 11 (1): 66-77. doi: 10.17216/LimnoFish. 1458148

Introduction

Rivers plays a vital role in the environment as they provide diverse aquatic ecosystem services to man and also home to a diverse group of aquatic organisms (Egun and Oboh 2023; Biose et al. 2024). Benthic macro-invertebrates "Benthos", are organisms that live on, in or near the bottom and consist of crustaceans, molluscs, aquatic worms and larval forms of aquatic insects (Nkwoji et al. 2010; Ochieng et al. 2019; Bate and Sam-Uket 2019; Nkwoji et al. 2020). Benthic macro-invertebrates communities play an important role in the structure and functioning of aquatics ecosystems, as they serve as a critical intermediate pathway for the transportation and utilisation of energy and matter. These roles include mineralization, mixing of sediment and flux of oxygen into sediment, cycling organic matters and for assessing the quality of waters (Adi et al. 2009). With individual taxa responding differently to various kinds of pollutants,

benthic macro-invertebrates are able to serve as indicators of water quality over time (Odume and Muller 2011; Appiah et al. 2017; Keke et al. 2017). They also have the potential utility for assessing other environmental pressures such as sedimentation (Extence et al. 2011). The composition of benthic macroinvertebrates in an aquatic ecosystem is indicative of the prevailing site specific ecological conditions of the water body as their communities are structured by a wide range of biotic and abiotic factors, which are a template for the evolution of species traits, creating selection pressures that adapt these species to successfully occupy a variety of biotopes within the freshwater system (Li et al. 2010; Ogidiaka et al. 2012; Keke et al. 2017).

According to Sengupta and Dalwani (2007), the ubiquitous nature of benthic macro-invertebrates in aquatic ecosystems rivers makes them susceptible to influences from environmental disturbances in many different types of aquatic systems. Kalyoncu and Zeybek (2011) reports that these organisms are also easy to sample and identify, thereby acting as a continuous monitor of the aquatic habitat, enabling long-term analysis of both regular and intermittent discharges, variable concentrations of single and multiple pollutants, and synergistic or antagonistic effects. Also, their sedentary mode of life, sensitive life stages and relative long lifespan enables them to absorb changes in their environment (Nkwoji et al. 2020). As some of these organisms are relatively pollution tolerant, thereby providing vital information for interpreting the cumulative effects of xenobiotic in the ecosystem (Tampo et al. 2021). Therefore, data on their community structure and distribution are considered as useful tools in environmental monitoring programs, and it's also an essential ecological tool to describe spatial and temporal changes in aquatic ecosystems (Arimoro et al. 2007; Badea et al. 2010; Kubosova et al. 2010; Ayoade and Olusegun 2012; Simmou et al. 2015; Aiwerioghene and Ayoade 2016).

The quality of the environmental conditions is also a determining factor in benthic macro-invertebrate assemblages in rivers (Mokgoebo 2019). The knowledge of community composition, distribution and diversity of macroinvertebrate fauna is essential in understanding the impact of anthropogenic activities on freshwater ecosystems. As the predictable response of the community structure and assemblages of benthic macroinvertebrates to environmental changes, has emerged as a basis for evaluating anthropogenic influences on aquatic ecosystems (Boyle and Fraleigh 2003). Several studies on benthic macroinvertebrate communities of different aquatic ecosystems in Nigeria have been documented (Udebuana et al. 2015; Adebayo et al. 2016; Asibor and Adeniyi 2017; Iyagbaye et al. 2017; Onyenwe et al. 2017; Aduwo and Adeniyi 2019; Olaniyan et al. 2019; Onyena 2019). The paucity of information on the benthic macroinvertebrate community structure of the stretch of Owan River that transverses through several rural communities, where it serves as their major source of freshwater and exposed to the impact of commercial agricultural activities is a concern for public health. An assessment of the benthic macroinvertebrate fauna of Owan River at these communities will provide data on the benthic macroinvertebrate fauna and information on the impact of anthropogenic activities on their composition along the river stretch. Also, it will provide an insight on the pollution status of the water, and the plausible community health risks from the consumption of the water and aquatic animals that are higher in the aquatic food chain of the river. The aim of this study is to determine the macrobenthic invertebrate diversity of Owan River at Sabongidda-Ora and Uhonmora-Ora Communities in Edo State Nigeria.

Materials and Methods

Description of the study area

Owan River is an oligotrophic lotic freshwater body that transverses the rain forest belt ecological zone of Edo State (Egun and Oboh 2023). Vegetative canopy comprising of secondary rain forest occurring laterally for most parts of the river bank, and commercial cocoa and plantain farms are found within the Owan river basin. This study was carried out along the stretch of Owan river traversing the communities of Saboginda-Ora (Lat. 6°54'36.5"N and Long. 5°56'13.3"E) (Figure 1) and Uhonmora-Ora (Lat. 6°52'50.6"N and Long. 5°56'26.5"E) (Figure 2) in Edo State, Nigeria. Common plants noticed along the banks at these localities are the bamboo plant (*Bambusa vulgaris*), trees (*Elaeis guineensis*, *Mangifera indica* and *Theobroma cacao*) and grasses (*Megathyrsus maximus* and *Pennisetum purpureum*). Ongoing anthropogenic activities within the watershed of the river stretch include intensive commercial farming activities, domestic and commercial washing activities, use of the river for traditional religion activities, the discharge of surface run offs and effluents processing of agricultural produce.

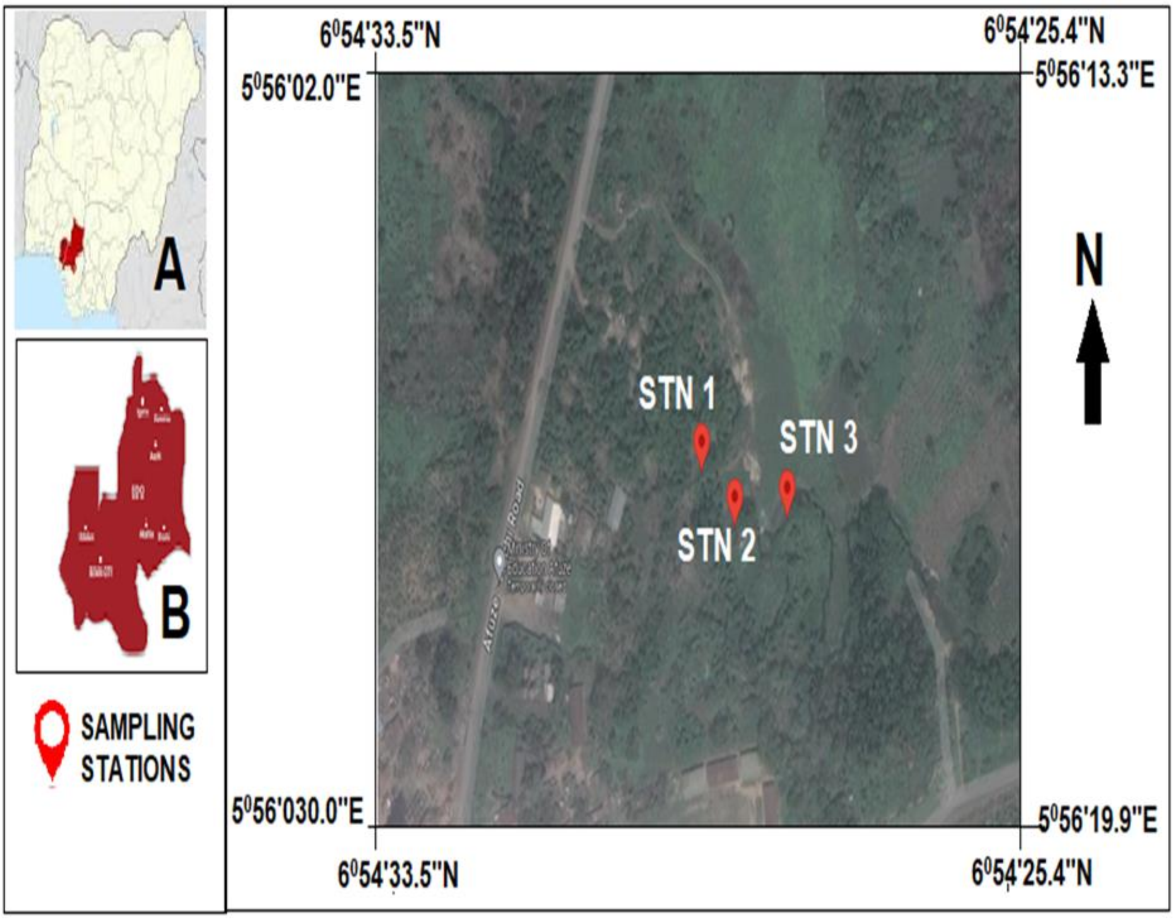

Figure 1: Owan River at Sabongidda-Ora Owan West Local Government Area of Edo State

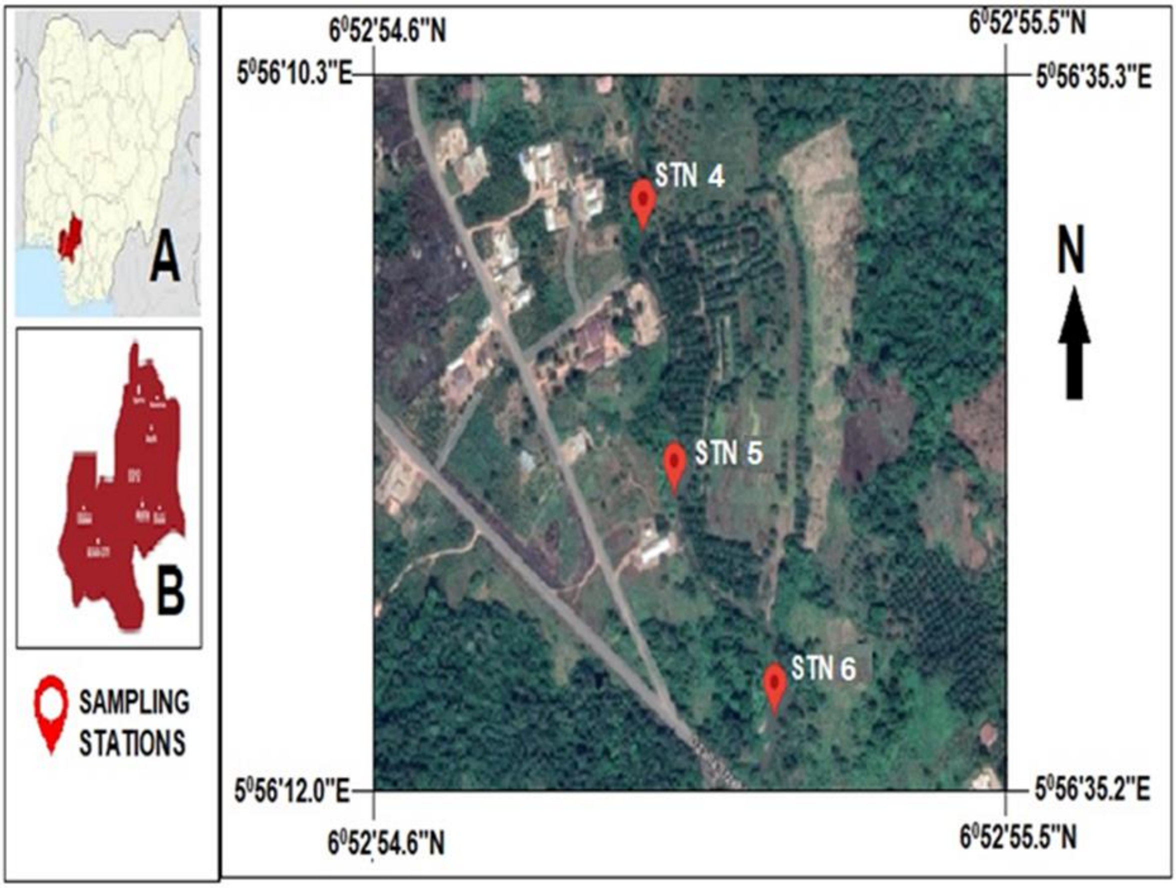

Figure 2: Stretch of Owan River at Uhonmora-Ora in Owan West Local Government Area of Edo State

Sampling stations

For the study, three (3) sampling stations were selected at Sabongidda-Ora and Uhonmora-Ora community respectively along the Owan River, with different level of human disturbances, vegetation types/cover and proximity to domestic dwellings and poultry/agricultural farms. The Sabongidda-Ora and Uhonmora-Ora Communities are located a distance of 4,484 km from the Atlantic Ocean.

Station 1

This station is located upstream of the river at at Sabongidda-Ora community (Lat. 6°54'36.5"N and Long. 5°56'08.4"E). Its bank is flanked by a thick covering of bamboo plants (*Bambusa vulgaris*), with grasses and shrubs, amidst guinea grass (*Megathyrsus maximus*) and elephant grass (*Pennisetum purpureum*).The substratum is sandy with little decaying organic matter. Activities at this point include washing of clothes, bathing and traditional religious activities.

Station 2

This station is located downstream of station 1 ("Lat. 6°54'30.0"N and Long. 5°56'07.5"E" midstream). The vegetation is made up of trees, shrubs and grasses, which include palm trees (*Elaeis guineensis*), rubber tress (*Haveabra siliensis*), elephant grass (*Pennisetum purpureum*) and guinea grass (*Megathyrsus maximus*). The substratum is sandy and contains little organic materials. Human activities along this stretch of the river are washing of clothes and bathing.

Station 3

Station 3 is the downstream point (Lat. 6°54'27.4"N and Long. 5°56'13.3"E), it is surrounded by thick vegetation over of bamboo plants (*Bambusa vulgaris*) and grasses such as elephant grass (*Pennisetum purpureum*) and guinea grass (*Megathyrsus maximus*) Swimming, washing of clothes and kitchen utensils were collective activities observed. The substratum is composed of mainly of mud and decaying organic materials.

Station 4

This station is located upstream of the river at Uhonmora-Ora community (Lat. 6°52'50.6"N and Long. 5°56'21.3"E). Its bank is flanked by vegetation consisting of shrubs, trees, grasses and other plant, amongst which are guinea grass (*Megathyrsus maximus*) and cocoyam species (*Colocasia esculenta* "Red cocoyam" and *Xanthosoma sagittifolium* "White cocoyam"). The substratum is sandy with little decaying organic matter. Human activities along this stretch of are mainly swimming and washing of clothes.

Station 5

This station is located downstream of station 4 ("Lat. 6°52'40.9"N and Long. 5°56'24.1"E" midstream). The vegetation is made up of trees and grasses, which include mango trees (*Mangifera indica*), bush mango (*Irvingia gabonensis*), palm trees (*Elaeis guineensis*) and guinea grass (*Megathyrsus maximus*). Here the substratum is sandy and organic materials at varying stages of decomposition are present. Human activities along this stretch of the river are washing and swimming.

Station 6

Station 6 is the downstream point (Lat. 6°52'39.0"N and Long. 5°56'26.5"E), it is surrounded by thick vegetation comprised primarily of trees (*Elaeis guineensis, Mangifera indica* and *Irvingia gabonensis*), elephant grass (Pennisetum *purpureum*) and guinea grass (*Megathyrsus maximus*) and shrubs. Spiritual cleansing African Traditional Worship, bathing and washing are common on this stretch of the river. The substratum is composed of sand, mud and decaying organic materials.

Study duration

The collection of macroinvertebrates was carried out monthly at each sampling station for a duration of six (6) months - January to March 2023 (dry season) and April to June 2023 (rainy season).

Table 1: GPS Coordinates of Sample Stations selected for the study

Sabongidda-Ora Community		Uhonmora-Ora Community	
Station 1	Lat. 6°54'36.5"N, Long. 5°56'08.4"E	**Station 4**	Lat. 6°52'50.6"N, Long. 5°56'21.3"E
Station 2	Lat. 6°54'30.0"N, Long. 5°56'07.5"E	**Station 5**	Lat. 6°52'40.9"N, Long. 5°56'24.1"E
Station 3	Lat. 6°54'27.4"N, Long. 5°56'13.3"E	**Station 6**	Lat. 6°52'39.0"N, Long. 5°56'26.5"E

Collection of Benthic macroinvertebrates

Benthic macroinvertebrates were collected by kick sampling methods. The kick net used was1 x 1 meter square mesh net of 500 microns with a pole handle on each side. A composite sample comprising four samples were collected at each station to represent a lone sample (Arimoro and Muller 2010). The substrate was agitated, with the sampling moved gradually upstream. Collected samples were preserved in 10% formalin. Samples collected between 7 am and 11 am on each sampling day starting from station 1 and ending at station 6.

At the laboratory the samples were washed through a sieve of 1mm x 1mm mesh size to remove debris/sand and collect the benthos (Idowu and Ugwumba 2005). The organisms were sorted using the American Optical Dissecting Microscope (LB-570, Bausch and Lomb Optical Co.). The sorting was made effective by adding moderate volume of water into the container to improve visibility. Large benthos was hand-picked using forceps while the smaller ones were pipetted out. The organisms were sorted into their different groups and preserved in 4% formalin in labelled specimen bottles for identification and counting. Identification was done using relevant keys and the counted.

Data analysis

Benthic macroinvertebrates diversity was assessed with Margalef's index (species richness), Shannon-Wiener and Simpson's indices (species diversity) and Equitability index (evenness). These indices were estimated using PAST 3.18. The Duncan Multiple Range (DMR) test was utilized in testing for significant difference among the benthic macroinvertebrate population across the sample stations at $p < 0.05$.

Results

Benthic macroinvertebrate Fauna

The study showed that the taxonomic structure for the studied locations consisted of eleven (11) species distributed in nine (9) Families, seven (7) order and two (2) phyla with a total of 518 individuals (Tables 2 and 3). Observed benthic macroinvertebrates belonged to the Phyla Arthropoda (18.13%) and Mollusca (81.87%). The total number of taxa present in Stations 1, 2, 3, 4, 5 and 6 respectively, were 159, 111, 82, 28, 73 and 60 individuals (Table 3). It was observed that the order Diptera had the highest species diversity, with the benthic macro-invertebrate species *Pentaneura* sp, *Clinotanypus* sp and *Corynoneura* sp recorded.

Table 2: Checklist of Benthic macroinvertebrates from Owan River at Sabongidda-Ora and Uhonmora-Ora Communities (January to June, 2023)

KINGDOM:	**ANIMALIA**
Phylum	**Arthropoda**
Subphylum:	Crustacea
Class:	Malacostraca
Order:	Decapoda
Family:	Gecarcinidae
Genus:	Cardiosoma
Species	***Cardiosoma* sp**
Family:	Atyidae
Genus:	*Caridina*
Species:	***Caridina africana* (Kingsley 1883)**
Class:	Insecta
Order:	Trichoptera
Family:	Polycentropodidae
Genus:	*Polycentropus* (Curtis 1835)
Species	***Polycentropus* sp**
Family:	Hydropsyche
Genus:	*Hydropsychidae*
Species	***Hydropsychidae* sp**
Order:	Diptera
Family:	Chironomidae
Subfamily:	Tanypodinae
Species	***Pentaneura* sp**
Family:	Chironomidae
Species:	***Clinotanypus* sp**
Species:	***Corynoneura* sp**
Order:	Odonata
Suborder:	Anisoptera
Family:	Libellulidae
Species:	***Sympetrum* sp**
Phylum	**Mollusca**
Class	Gastropoda
Order	Caenogastropoda
Family	Potamididae
Genus	Tympanotamus
Species	***Tympanotamus fuscatus* (Linnaues 1758)**
Sub- class:	Heterobranchia
Order	Basommatophora
Family	Planoribidae
Genus	*Ferrisia* (Walker, 1903)
Species	***Ferrisia* sp**
Order	Neotaenioglossa
Family	Thiaridae
Genus	*Melanoides*
Species	***Melanoides tuberculatus***

Table 3: Composition, Distribution, and Relative Abundance of Benthic macroinvertebrates in Owan River.

	Taxa	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Number	Relative Abundance (%)
Arthropoda	*Cardiosoma* sp	8	-	9	-	-	-	17	3.31
	Polycentropus sp	-	11	5	-	-	-	16	3.12
	Hydropsychidae sp	7	-	5	-	-	-	12	2.34
	Pentaneura sp	-	10	3	-	-	-	13	2.53
	Caridina africana	-	-	-	1	1	6	8	1.56
	Clinotonypus sp.	-	-	-	3	-	4	7	1.37
	Corynoneura sp.	-	-	-	1	-	7	8	1.56
	Sympetrum sp.	-	-	-	5	2	5	12	2.34
Mollusca	*Tympanotamus fuscatus*	106	68	55	17	45	28	319	62.18
	Ferrisia sp	21	11	3	-	8	5	48	9.36
	Melanoides	17	11	2	1	17	5	53	10.33
Number of Species		**5**	**5**	**7**	**6**	**5**	**7**	**11**	**11**
Number of Individuals		**159**	**111**	**82**	**28**	**73**	**60**	**513**	**100**

Relative Abundance of Benthic Macro-invertebrates

The relative abundance of benthic macro-invertebrate was in the order Station 1 > Station 2 > Station 3, Station 5 > Station 6 > Station 4, with species abundance highest in Station 1 (159 individuals) and lowest at Station 4 (28 individuals) (Table 3). Spatial distribution of benthic macro-invertebrate composition indicated no significant difference between the two phyla across the sampled stations (Table 4). Figures 3 and 4 shows the spatial and temporal variations in the total faunal density for the benthic macro-invertebrates while the percentage abundance is shown in Figure 5.

Table 4: Spatial Distribution of Benthic macro-invertebrates Composition from Owan River

Taxa	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	P-Value
Arthropoda	15	21	22	10	3	22	$P > 0.05$
Mollusca	144	90	60	18	70	38	$p > 0.05$
Total	**159**	**111**	**82**	**28**	**73**	**60**	

Note: $P > 0.05$ = No Significant difference.

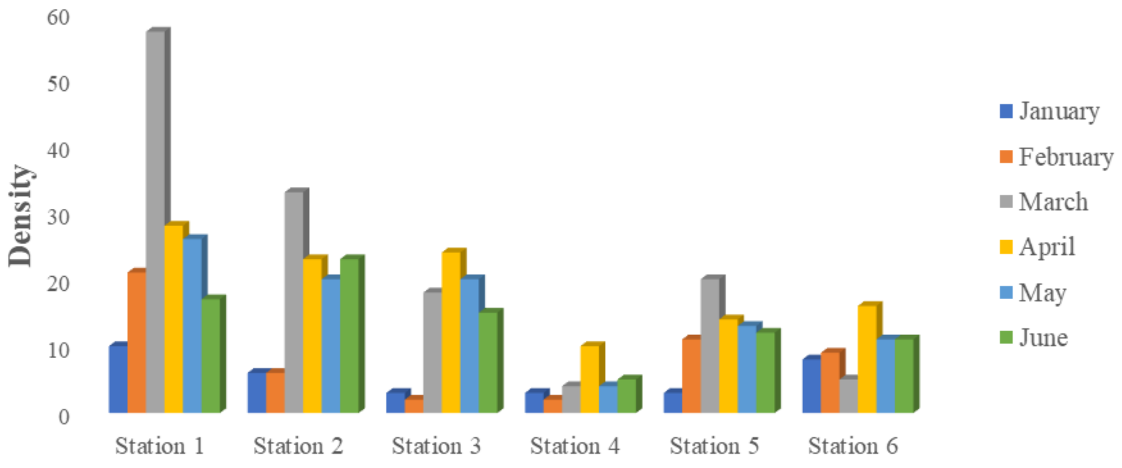

Figure 3: Spatial variations in the total faunal density of Benthic macroinvertebrates from Owan River

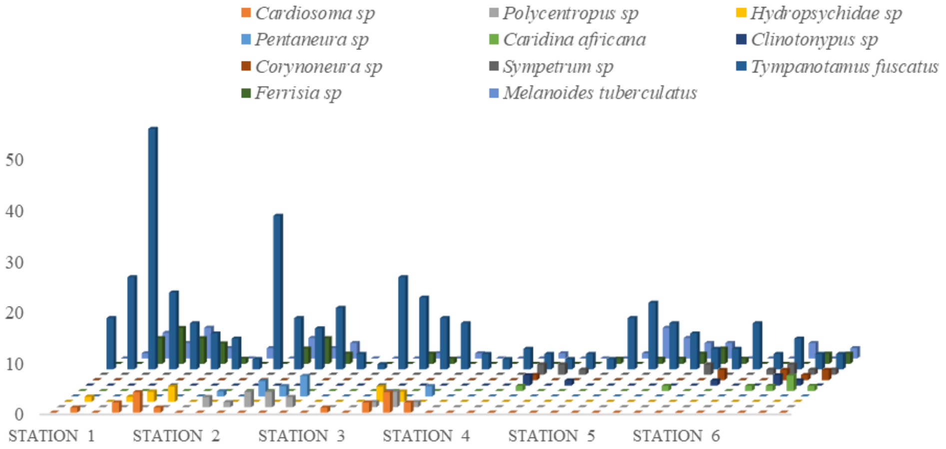

Figure 4: Temporal variations in total faunal density of Benthic macroinvertebrates from Owan River

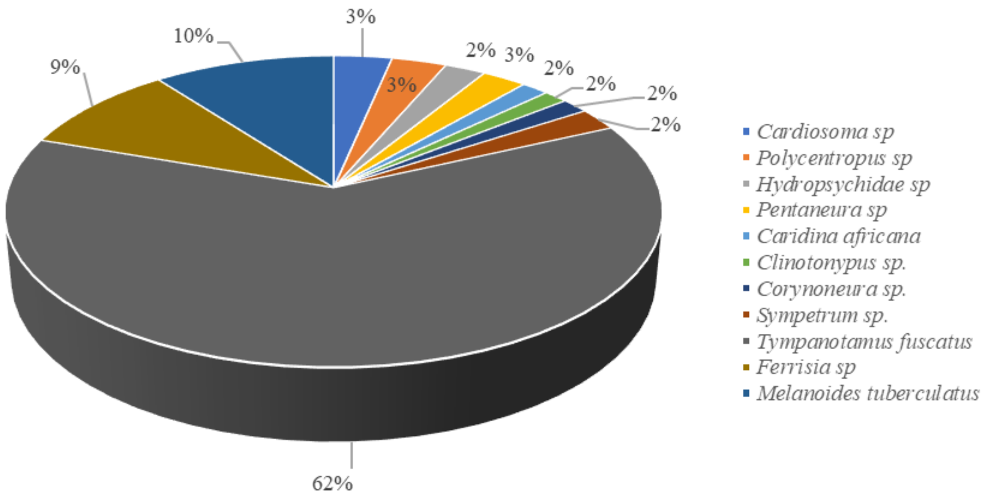

Figure 5: Percentage Abundance of Benthic macroinvertebrates from Owan River

Dominant and Sub-dominant Order of Benthic macroinvertebrates

The distribution of microbenthic invertebrate assemblages from the various stations showed that Caenogastropoda (62.18%), and Neotaenioglosa (10.33%) were dominant order, while Basommatophora (9.36%), Decapoda (4.87%), Diptera (5.46%), Odonata (2.34%) and Trichoptera (5.46%) were sub-dominant (Table 5

Table 5: Relative Percentage Composition of Taxonomic Groups Including the Dominant and Sub-Dominant Groups

Taxa	Number of individuals	Percentage Occurrence (%)
Caenogastropoda	319	62.18
Basommatophora	48	9.36
Decapoda	25	4.87
Diptera	28	5.46
Odonata	12	2.34
Neotaenioglosa	53	10.33
Trichoptera	28	5.46
Total	**513**	**100**

Diversity Indices

The abundance, number of taxa, Dominance, Shannon-Wiener, Simpson, Evenness and Margalef were estimated (Table 6). Station 1 had the highest abundance of individuals, while station 4 recorded the least values. Stations 2 and 6 had the highest Taxa with the least values observed for the other stations. The values for Dominance varied from 0.27 to 0.48, and were recorded in Stations 6 and 1 respectively. Shannon-Wiener diversity peaked at station 6 and recorded the least values at station 1, while Simpson was highest at station 2 and lowest at station 1. Evenness was highest at station 6 and lowest at station 3, with a range of 0.47 to 0.73, while Margalef values varied from 0.79 to 1.50, and peaked at station 4 with the least value recorded at station 1. Equitability was highest at station of 3 and lowest at station 6.

Table 6: Summary of the Diversity Indices of Benthic macroinvertebrates from Owan River

DIVERSITY INDICES	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
Taxa_S	5	5	7	6	5	7
Individuals	159	112	82	28	77	60
Dominance_D	0.48	0.41	0.47	0.42	0.42	0.27
Shannon_H	1.07	1.21	1.18	1.21	1.09	1.64
Simpson_1-D	0.52	0.59	0.53	0.58	0.58	0.73
Evenness_eˆH/S	0.58	0.67	0.47	0.56	0.59	0.73
Margalef	0.79	0.85	1.36	1.50	0.92	1.47

Discussion

The benthic macroinvertebrate fauna of the stretch of Owan River investigated was generally low (11 taxa), with common species often found in freshwater habitats of Western Africa. According to Neumann and Dudgeon (2002) decrease in benthic macroinvertebrate taxa especially group of sensitive benthic fauna in a water body, is reflective of poor water quality caused by anthropogenic activities within the watershed. In a similar study, lower benthic macroinvertebrate composition (7 taxa) was recorded at the stretch of Ikpoba River impacted by brewery effluents (Ibezute et al. 2016). Conversely, higher benthic macroinvertebrate taxa of 26 taxa (Udebuana et al. 2015), 132 taxa (Kaboré et al. 2016), 50 taxa (Ibemenuga et al. 2017), 18 taxa (Odigie and Olomukoro 2016), 39 taxa (Olomukoro et al. 2016), 23 taxa (Asibor and Adeniyi 2017), 26 taxa (Enwemiwe and Arimoro 2017), 45 taxa (Iyagbaye et al. 2017), 24 taxa (Usman and Adakole 2017), 17 taxa (Olaniyan et al. 2019), 17 taxa (Zahraddeen et al. 2019), 52 taxa (Motchié et al. 2020) and 13 taxa (Shreya et al. 2022) has been reported for various water bodies in their respective studies.

Hydrological parameters such as nutrients contents, pH, electric conductivity and substrate organic matter, which are mostly related to anthropogenic activities within a watershed are known to influence benthic community structure of aquatic ecosystem (Milesi et al. 2019). In this study, the distribution of benthic macroinvertebrates fauna decreased in the order Station 1 > Station 2 > Station 3, Station 5 > Station 6 > Station 4. The high abundance of macrobenthic invertebrates in station 1 can be attributed to the location's exposure to air, sunlight and abundance of organic debris which support the photosynthetic activity of aquatic plants and availability of food resources for macrobenthic invertebrates. According to Magbanua et al. (2015), air exposure and light availability to aquatic ecosystems determines photosynthetic rates and food availability for macrobenthic invertebrates which influences their community structure.

The presence and dominance of the phyla Arthropods and Mollusca recorded in this study, has been reported in similar studies to be present in lotic freshwater bodies in Nigeria (Olomukoro and Dirisu 2014; Adebayo et al. 2016; Asibor and Adeniyi 2017; Enwemiwe and Arimoro 2017; Iyagbaye et al. 2017; Keke et al. 2017; Usman and Adakole 2017; Aduwo and Adeniyi 2019; Olaniyan et al. 2019; Abbati et al. 2020; Mohammed et al. 2021), Côte d'Ivoire (Motchié et al. 2020), Kenya (Abongo et al. 2015), and India (Shreya et al. 2022). The dominance of Caenogastropoda (*Tympanotamus fuscatus*) can be attributed to the presence of grasses and the shallow nature of the littoral zone of the river, which the viviparidae can easily take shelter. Also, the dominance of relatively pollution sensitive and tolerant species such as *Tympanotamus fuscatus* is an indicator of a decline in water quality (Nkwoji et al. 2020). Also, the presence of Chironomids (*Pentaneura* sp. *Clinotanypus* sp. and *Corynoneura* sp.) are indicative of organic pollution of the river from surrounding anthropogenic activities (Adu and Oyeniyi 2019; Prat and Castro-López 2023). The presence of species such as *Caridina africana*, *Clinotanypus* sp, *Corynoneura* sp and *Sympetrum* sp recorded in this study have also been reported by Enwemiwe and Arimoro (2017) and Iyagbaye et al. (2017).

The enrichment of aquatic systems with discharges from anthropogenic activities influences the presence and abundance of macroinvertebrate species in them (Nelson et al. 2019; Duque et al. 2022). In this study, the estimates for Dominance (0.27 to 0.48), Shannon-Wiener (1.07 to 1.64), Evenness (0.47 to 0.73) and Margalef (0.79 to 1.50) indices were indicative of low species diversity and the dominance of a few species. The observed declines in the numerical composition of species, are often induced by environmental degradation due to anthropogenic pressures and various biotic factors (Bassey et al. 2020). According to Shanthala et al. (2009), the Shannon-Wiener diversity index is also indicative of the level of pollution of a water body. As the low species diversity index (1.07 – 1.64) in this study indicates that the stretch of Owan River is moderately polluted. The generally low abundance and diversity of benthic macroinvertebrates is study locations indicate an overall decline in the surface water quality and ecosystem health of Owan River.

The taxa composition and abundance of the benthic macroinvertebrates from this stretch of the Owan River could be referred to as poor, when compared to rivers of similar sizes in Southern Nigeria. This is indicative of the influence of anthropogenic activities within the watershed on the water quality and the benthic macroinvertebrate fauna, as shown by the low diversity recorded at sampled points. Also, the dominance of pollution tolerant species - *T. fuscatus* and *M. tuberculatus* and Shannon-Wiener diversity index values indicates that the river is moderately polluted. It is recommended that microbenthic studies be carried out on other stretches of Owan River to establish a better spatial species diversity and distribution of macroinvertebrates and identify non- pollution tolerant species for water quality monitoring. Also, there is need for an integrated management framework for the protection of the water body through the enforcement of riparian buffer zones to help to reduce some of the observed negative effects of agricultural activities on the river system especially in the wet seasons.

References

Abbati MA, Usman UF, Alkali A. 2020. Distribution and Abundance of Benthic Macrosinvertebrate in Lande stream, Tumu, Gombe State, Nigeria. International Journal of Current Research 12(1): 9178 – 9181**.**

Abongo DA, Wandiga SO, Jumba IO, Van den Brink PJ., Naziriwo BB, Madadi VO, Wafula GA, Nkedi-Kizza P, Henrik K. 2015. Occurrence, abundance and distribution of benthic macroinvertebrates in the Nyando River catchment, Kenya. African Journal of Aquatic Science. 40(4): 373 – 392. doi: 10.2989/16085914.2015.1113397

Adebayo ET., Ebeniro LA, Oyediran AG, Oluwatosin TJC. 2016. An Assessment of Benthic Macro-invertebrate Fauna in Middle Course of Otamiri River, Imo State, South-Eastern Nigeria, Nigeria. International Journal of Innovative Studies in Aquatic Biology and Fisheries. 2(1): 29 – 35.

Adi G, Abowei JFN, Daka ER. 2009. Benthic macroinvertebrate fauna and physico-chemical parameters in Okpoka Creeks sediments, Niger Delta, Nigeria. International Journal of Animal and Veterinary Advance. 1(2): 59 – 65.

Adu BW, Oyeniyi EA. 2019. Water quality parameters and aquatic insect diversity in Aahoo stream, southwestern Nigeria. *JoBAZ*, 80 (15) doi: 10.1186/s41936-019-0085-3

Aduwo AI, Adeniyi IF. 2019. The Benthic Macro-Invertebrate Fauna of Owalla Reservoir, Osun State, Southwest, Nigeria. Egyptian Journal of Aquatic Biology and Fisheries. 23(5): 341 – 356. doi: 10.21608/ejabf.2019.67372

Aiwerioghene AO, Ayoade AA. 2016. Evaluation of some Physico-chemical Parameters and Benthic Macroinvertebrates of Ikere Gorge Reservoir in Oyo State, Nigeria. Journal of Applied Science in Environmental Management. 20(4):1097 – 1103.

Appiah SY, Etilé RN, Kouamé AK, Kouaméla PE. 2017. Benthic Macroinvertebrates Composition and Spatiotemporal Variation in Relationship with Environmental Parameters in a Coastal Tropical Lagoon (Ebrié Lagoon, Côte D'ivoire). International Journal of Science and Research Methodology. 7 (4): 149 – 169.

Arimoro FO, Ikomi RB, Efemena E. 2007. Macroinvertebrate Community Patterns and diversity in relation to water quality status of River Ase, Niger Delta, Nigeria. J. Fishe. Aqua. Sci. 2(5): 337 – 344. doi: 10.3923/jfas.2007.337.344

Arimoro FO, Muller WJ. 2010. Mayfly (Insecta: Ephemeroptera) Community Structure as an Indicator of the Ecological Status of a Stream in the Niger Delta Area of Nigeria. Environmental Monitoring and Assessment, 166, 581 - 594. doi: 10.1007/s10661-009-1025-3

Asibor G, Adeniyi F. 2017. Benthic macro-invertebrates of Asejire reservoir, Southwest Nigeria. International Journal of Fauna and Biological Studies. 4(3): 119 – 124.

Ayoade AA, Olusegun OA. 2012. Impacts of effluents on the limnology of a tropical river, Southwestern Nigeria. J Appl. Sci. Environ. Management. 16(2): 201 – 207.

Badea BA, Gagyi-Palffy A, Stoian LC, Stan G. 2010. Preliminary studies of quality assessment of aquatic environments from Cluj suburban areas, based on some invertebrate bioindicators and chemical indicators. AACL Bioflux. 3(1):35 – 41.

Bassey BO, Nosazeogie EO, Abdullahi IM, Bello B, Abiodun O, Olapoju O, Ajani G, Igbo J, Balogun JK, Yakub AS. 2020. Diversity of Macrobenthic Invertebrates in Relations to Some Selected Water Quality Parameters in Lagos Lagoon, Nigeria. Biomedical Journal of Scientific & Technical Research. 30(1): **22993 –** 23002.

doi: 10.26717/BJSTR.2020.30.004885
Bate GB, Sam–Uket NO. 2019. Macroinvertebrates' Pollution Tolerance Index in Calabar River, Cross River State, Nigeria. Nigerian Journal of Environmental Sciences and Technology. 3(2): 292 – 297.
doi: 10.36263/nijest.2019.02.0154
Biose E, Egun NK, Uzoh N, Omoigberale MO. 2024. Assessment of water quality and associated human health risk of a tropical freshwater body in Edo State, Nigeria. African Journal of Aquatic Science, 49 (1).
doi: 10.2989/16085914.2023.2292125
Boyle TP, Fraleigh HD. 2003. Natural and anthropogenic factors affecting the structure of the benthic macroinvertebrate community in an effluent-dominated reach of the Santa Cruz river, Az Ecol. Indic., 3: 93 – 117.
doi: 10.1016/S1470-160X(03)00014-1
Duque G, Gamboa-García DE, Molina A, Cogua P. 2022. Influence of water quality on the macroinvertebrate community in a tropical estuary (Buenaventura Bay). Integr. Environ Assess Manag, 18:796–812.
doi: 10.1002/ieam.4521
Egun NK, Oboh IP. 2023. Assessment of water quality for suitability and human health risk: a study of the Owan River, Edo State, Nigeria. African Journal of Aquatic Science,
doi:10.2989/16085914.2022.2156468
Enwemiwe VN, Arimoro FO. 2017. Density Diversity Assessment of Macroinvertebrates of River Illah, Delta State, Nigeria. International Journal of Advanced Research and Publication. 1(4): 184 – 190.
Extence CA, Chadd RP, England J, Dunbar MJ, Wood PJ, Taylor ED. 2011. The Assessment of fine sediment accumulation in rivers using Macroinvertebrate community response. River Research and Applications. 4: 234 – 241.
Ibemenuga KN, Nduba BC, Eyo JE. 2017. The Influence of Abattior Wastes on Macroinvertebrate Distribution in River Idemili, obosi, South-Eastern Nigeria. Not Sci Biol. 9(4): 480 – 486.
doi: 10.15835/nsb9410071
Ibezute AC, Asibor GI, Ibezute SU. 2016. Ecological Assessment of Brewery Effluent Impact on the Macrobenthic Invertebrates of Ikpoba River, Edo State, Nigeria. International Journal of Ecosystem. 6(3): 47 – 54.
doi:10.5923/j.ije.20160603.01
Idowu EO, Ugwumba AAA. 2005. Physical, Chemical and Benthic Faunal Characteristics of a Southern Nigerian Reservoir. The Zoologist, 3, 15-25.
Iyagbaye LA, Iyagbaye RO, Omoigberale MO. 2017. Assessment of Benthic Macro-Invertebrates of Freshwater Ecosystem: A Case Study of Ovia River (Iguoriakhi), Edo State, Nigeria. European Scientific Journal. 2017; 13(26): 405 – 422
doi: 10.19044/esj.2017.v13n26p405
Kaboré I, Moog O, Alp M, Guenda W, Koblinger T, Mano K, Ouéda A, Ouédraogo R, Trauner D, Melcher AH. 2016. Using macroinvertebrates for ecosystem health assessment in semi-arid streams of Burkina Faso. Hydrobiologia 766 (1): 57-74.
doi:10.1007/s10750-015- 2443-6
Kalyoncu H, Zeybek M. 2011. An application of different biotic and diversity indices for assessing water quality: A case study in the Rivers Çukurca and Isparta (Turkey). Africa Journal of Agricultural Research. 6(1): 19 – 27.
doi: 10.5897/AJAR09.323
Keke UN, Arimoro FO, Auta YI, Ayanwale AV. 2017. Temporal and spatial variability in macroinvertebrate community structure in relation to environmental variables in Gbako River, Niger State, Nigeria. Tropical Ecology. 58(2): 1 – 14.
Kubosova K, Brabec K, Jarkovsky J, Syrovatka V. 2010. Selection of indicative taxa for river habitats: a case study on benthic macroinvertebrates using indicator species analysis and the random forest methods. Hydrobiologia. 651: 101 – 114.
doi:10.1007/s10750-010-0280-1
Li L, Zheng B, Liu L. 2010. Biomonitoring and bioindicators used for river ecosystems: definitions, approaches and trends. Procedia Environmental Sciences. 2: 1510 – 1524.
doi: 10.1016/j.proenv.2010.10.164
Magbanua F S, Mendoza N Y B, Uy C J C, Matthaei C D, Ong P S. 2015. Water physicochemistry and benthic macroinvertebrate communities in a tropical reservoir: The role of water level fluctuations and water depth. Limnologica, 55: 13-20.
doi.org/10.1016/j.limno.2015.10.002.
Milesi SV, Melo AS, Dolédec S. 2019. Assessing community functional attributes during substrate colonization: A field experiment using stream insects. Hydrobiologia. 838: 183 – 192. doi:10.1007/s10750-019-03988-2
Mohammed YM, Arimoro FO, Ayanwale AV, Adamu KM, Keke UN, Abubakar MD, Achebe AC. 2021. The current state of water quality and benthic invertebrate fauna in Chikke Stream (North-Central Nigeria). Ukrainian Journal of Ecology. 11(3): 26 – 34.
doi: 10.15421/2021_138
Mokgoebo MJ. 2019. The use of water quality, aquatic species composition and aquatic habitat conditions to assess the river health condition of the Nzhelele River, Limpopo Province, South Africa. PhD Thesis College of Agriculture and Environmental Science Department of Environmental Sciences, University of South Africa Florida Campus Promoter. 170 pp.
http://hdl.handle.net/10500/27064
Motchié FE, Konan YA, Koffi KB, Etilé NR, Gooré BG. 2020. Diversity and structure of benthic macroinvertebrates community in relation to environmental variables in Lake Ehuikro, Côte d'Ivoire. International Journal of Research in Environmental Studies. 7: 1 – 13.
Nelson JA, Johnson DS, Deegan LA, Spivak AC, Sommer NR. 2019. Feedbacks between nutrient enrichment and geomorphology alter bottom-up control on food webs. Ecosystems 22:229–242.
https://doi.org/10.1007/s10021-018-0265-x
Neumann M, Dudgeon D. 2002. The impact of agricultural runoff on stream benthos in Hong Kong, China. Water Research. 36 (12): 3103 – 3109.
doi:10.1016/S0043-1354(01)00540-1.

Nkwoji JA, Ugbana SI, Ina-Salwany MY. 2020. Impacts of land-based pollutants on water chemistry and benthic macroinvertebrates community in a coastal lagoon, Lagos, Nigeria. Scientific African, 7. doi:10.1016/j.sciaf.2019.e00220.

Nkwoji JA, Onyema IC, Igbo JK. 2010. Wet season spatial occurrence of phytoplankton and zooplankton in Lagos Lagoon. Nigeria Science World Journal. 5(5): 7 – 14. doi:10.4314/swj.v5i2.61487

Ochieng H, Okot-Okumu J, Odong R. 2019. Taxonomic challenges associated with identification guides of benthic macro-invertebrates for bio-monitoring freshwater bodies in East Africa: A Review. African Journal of Aquatic Science. 44: 113 – 126. doi:10.2989/16085914.2019.1612319

Odigie JO, Olomukoro JO. 2016. Species diversity and abundance of oligochaeta fauna in a tropical rain forest lake in South-Southern, Nigeria. Journal of Aquatic Sciences. 31 (2B): 391 – 400. doi:10.4314/jas.v31i2B.6

Odume ON, Muller WJ. 2011. Diversity and structure of Chironomidae communities in relation to water quality differences in the Swartkops River. Physics and Chemistry of the Earth. 36: 929 – 938. doi: 10.1016/j.pce.2011.07.063

Ogidiaka E, Esenowo IK, Ugwumba AAA. 2012. Physico-chemical parameters and benthic macroinvertebrate of Ogunpa River at Bodija, Ibadan, Oyo State. European Journal of Scientific Research.85(1): 89 – 97.

Olaniyan RF, Ugwumba AO, Ayoade AA. 2019. Macro-Invertebrates Status of Oluwa River in Ondo State, Southwest, Nigeria. Research and Reviews: Journal of Ecology and Environmental Sciences. 7(1): 24 – 31.

Olomukoro JO, Dirisu AR, Edema CO. 2016. Effects of ecosystem disturbance on zoobenthos of a River in Western Nigeria. Journal of Aquatic Sciences. 31(1B):143 – 155. doi:10.4314/jas.v31i1.12

Olomukoro JO, Dirisu AR. 2014. Macroinvertebrate Community and Pollution Tolerance Index in Edion and Omodo Rivers in Derived Savannah Wetlands in Southern Nigeria. Jordan Journal of Biological Sciences. 7(1): 19 – 24. doi: 10.12816/0008208

Onyena AP. 2019. Composition, Distribution, and Diversity of Benthic Macroinvertebrate from Creeks around Lagos Lagoon, Nigeria. J. Appl. Sci. Environ. Management. 23(5): 857 – 863. doi: 10.4314/jasem.v23i5.14

Onyenwe E, Ekedo CM, Ifeakanwa CN. 2017. Physico Chemical and Benthic Macro Invertebrate Analysis of Usumani Stream in Abiriba, Ohafia L.G.A. Abia State. International Journal of Innovative Science, Engineering and Technology. 4 (4): 152 – 173.

Prat N, Castro-López, D. 2023. Chironomidae as indicators of water pollution in Pesquería River (México). Journal of Entomological and Acarological Research, 55(1). doi:10.4081/jear.2023.10861

Sengupta M, Dalwani R. 2007. Benthic invertebrates – A crucial tool in biomonitoring of lakes. Proceedings of Taal 2007: The 12th world lake conference. 95 - 98.

Shanthala M, Hosmani SP, Hosetti BB. 2009. Diversity of phytoplanktons in a waste stabilization pond at Shimoga Town, Karnataka State, India. Environ Monit Assess. 151(1–4):437–43. doi:10.1007/s10661-008-0287-5

Shreya R, Canciyal J, Supriti B, Trupti RM, Archisman R, Manisha B, Himanshu SS, Basanta KD. 2022. Macrobenthic Pollution Bioindicator for Ecological Monitoring in Riverine Ecosystem. International Journal of Environmental Sciences and Natural Resources. 29(5): 556273. doi:10.19080/IJESNR.2022.29.556273

Simmou YJ, Bamba M, Konan YA, Kouassi KP, Koné T. 2015. Impact des Activités anthropogéniques sur la Distribution des Macroinvertébrés Benthiques et la qualité des eaux de quatre petits cours d'eaux de Côte D'ivoire. European Journal of Scientific Research. 136 (2): 122 – 137.

Tampo L, Kaboré I, Alhassan EH, Ouéda A, Bawa LM, Djaneye-Boundjou G. 2021. Benthic Macroinvertebrates as Ecological Indicators: Their Sensitivity to the Water Quality and Human Disturbances in a Tropical River. Frontiers in Water. 3:662765. doi:10.3389/frwa.2021.662765

Udebuana OO, Irubor K, Mansoor S. 2015. Physiochemical factors affecting macrobenthic invertebrate distribution in the bottom sediments of Okhuo River. International Research Journal of Natural Sciences. 3(3): 33 – 49.

Usman LU, Adakole JA. 2017. Biodiversity Assessment of Some Benthic Macro Invertebrates in Ajiwa Reservoir, Katsina State, Nigeria. UMYU Journal of Microbiology Research. 2(1): 107 – 113. doi:10.47430/ujmr.1721.017

Zahraddeen HY, Babangida A, Isiyaku II. 2019. Diversity and Distribution of Benthic Macroinvertebrate Fauna of Nasarawa Reservoir in Jibia, Katsina State Nigeria. FUDMA Journal of Sciences. 3(1): 146 – 151.