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Assessment of water quality and macroinvertebrate community of Ero River, Ikun-Ekiti, Ekiti State, Nigeria

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Abstract
This research was designed to assess the water quality of Ero River, Ikun Ekiti using the macroinvertebrates community structure. Water and macroinvertebrate samples were collected bimonthly from September to November 2025, using standard methods of APHA (2008). Eighteen physicochemical parameters were determined in this study, notable among which are pH, Temperature, Dissolved Oxygen, Total Dissolved Solid and Total Hardness with values 5.4 - 6.7, 26.1˚C - 27.3˚C, 4.69 mg/L- 6.98 mg/L, 71.04 mg/L - 119.68 mg/L and 102.4 mg/L - 173.6 mg/L, respectively. A total of 12 species of macroinvertebrates were recorded in all the sampling points. They include *Ranatra sp.* (10.24%), *Baetis sp.* (7.24%), *Gerris remiges* (6.56%), *Hydrophilus sp.* (6.89), *Nepa cinerea* (9.17%), *Lethocerus africanus* (8.74%), *Chironomus sp.* (8.35%), *Eristalis sp.* (6.71%), *Lanistes libycus* (10.06%), *Potadoma moerchi* (9.45%), *Bulimus globosus* (8.06%) and *Notonecta sp.* (8.63%), respectively. Most of the species recorded in this study are pollution-tolerant species, thus indicating that Ero River water is organically polluted. There is a need for regular monitoring of the river and appropriate measures should be employed in order to checkmate the pollution to prevent further degradation and eutrophication.

Keywords: Water quality, macroinvertebrates, Ero River, pollution, Ikun-Ekiti

Introduction

Freshwater ecosystems, comprising rivers, streams, lakes, and wetlands, are among the most vital natural resources on Earth. They provide essential ecosystem services including water supply, food production, recreation, and habitat for a vast array of organisms. Among the biotic components of these aquatic systems, macroinvertebrates organisms without backbones that are large enough to be seen with the naked eye, such as insect larvae, crustaceans, mollusks, and worms play a critical role in the ecological functioning of freshwater habitats. Importantly, they also serve as reliable bioindicators of water quality.

The relationship between water quality and macroinvertebrates is both intricate and informative. These organisms are highly sensitive to a range of physicochemical parameters such as dissolved oxygen, pH, temperature, turbidity, and the presence of pollutants such as heavy metals, pesticides, and organic waste. Because macroinvertebrates have varying levels of tolerance to environmental stressors, their presence, absence, or relative abundance can provide valuable insights into the health of a freshwater ecosystem. For example, the presence of pollution-sensitive taxa such as Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) typically signifies good water quality, while a dominance of tolerant species like Chironomidae (non-biting midges) and Oligochaeta (aquatic worms) may indicate degradation or pollution.

Unlike snapshot chemical analyses, macroinvertebrates integrate the effects of water quality over time, making them particularly useful in long-term environmental monitoring and assessment. This ecological characteristic has led to the widespread adoption of biomonitoring techniques using macroinvertebrate assemblages in both developed and developing countries. In Nigeria and other parts of West Africa, growing research has demonstrated the effectiveness of macroinvertebrate-based indices in evaluating water quality and guiding water resource management, especially in contexts where conventional laboratory-based monitoring is logistically or financially constrained (Arimoro and Muller, 2010; Ogbeibu and Oribhabor, 2002; Edokpayi *et al*., 2017) [3, 17, 6].

Understanding the link between water quality and macroinvertebrate communities is essential not only for ecological research but also for informed policy-making, sustainable water management, and biodiversity conservation. As anthropogenic pressures on freshwater systems intensify through activities such as agriculture, urbanization, and industrial discharge, there is an urgent need to adopt integrated approaches that leverage biological indicators for assessing ecosystem health and protecting freshwater biodiversity.

In Nigeria, and specifically in Ekiti State, research efforts have increasingly focused on macroinvertebrate-based assessments of freshwater quality, especially in response to rising anthropogenic pressures from agriculture, urbanization, and inadequate waste management. In a study conducted on the Elemi and Ureje Rivers in Ado-Ekiti, macroinvertebrate diversity and abundance were shown to decline significantly downstream of urban discharge points, corresponding with increased levels of biochemical oxygen demand (BOD), reduced dissolved oxygen, and elevated nutrient concentrations. The findings supported the use of biotic indices such as the Family Biotic Index (FBI) and the Ephemeroptera-Plecoptera-Trichoptera (EPT) index as practical tools for water quality evaluation in regional monitoring frameworks.

Study Area

The study was carried out in Ero River, at Ikun Ekiti, Ekiti State, Nigeria. Ero Dam is located on intersect of latitude 7˚351’N of the equator and on longitude 5˚311’E of the Greenwich meridian. It is in the southern guinea savannah region characterized by wet and dry seasons. The wet season starts in the end of March/beginning of April and ends in October/November while the dry season falls between October and April.

Sample Collection and Analysis

Four sampling locations were selected on the river, which was about 35m from the other location (Fig. 1). Surface water samples were collected from the four sampling points twice monthly, starting from September to November 2024 (covering both wet and dry seasons) in the early hours of the morning from 7.30 am to 9 am at a depth of 20cm according to USEPA (2014) [21] procedures. Water and sediments were collected at each point.

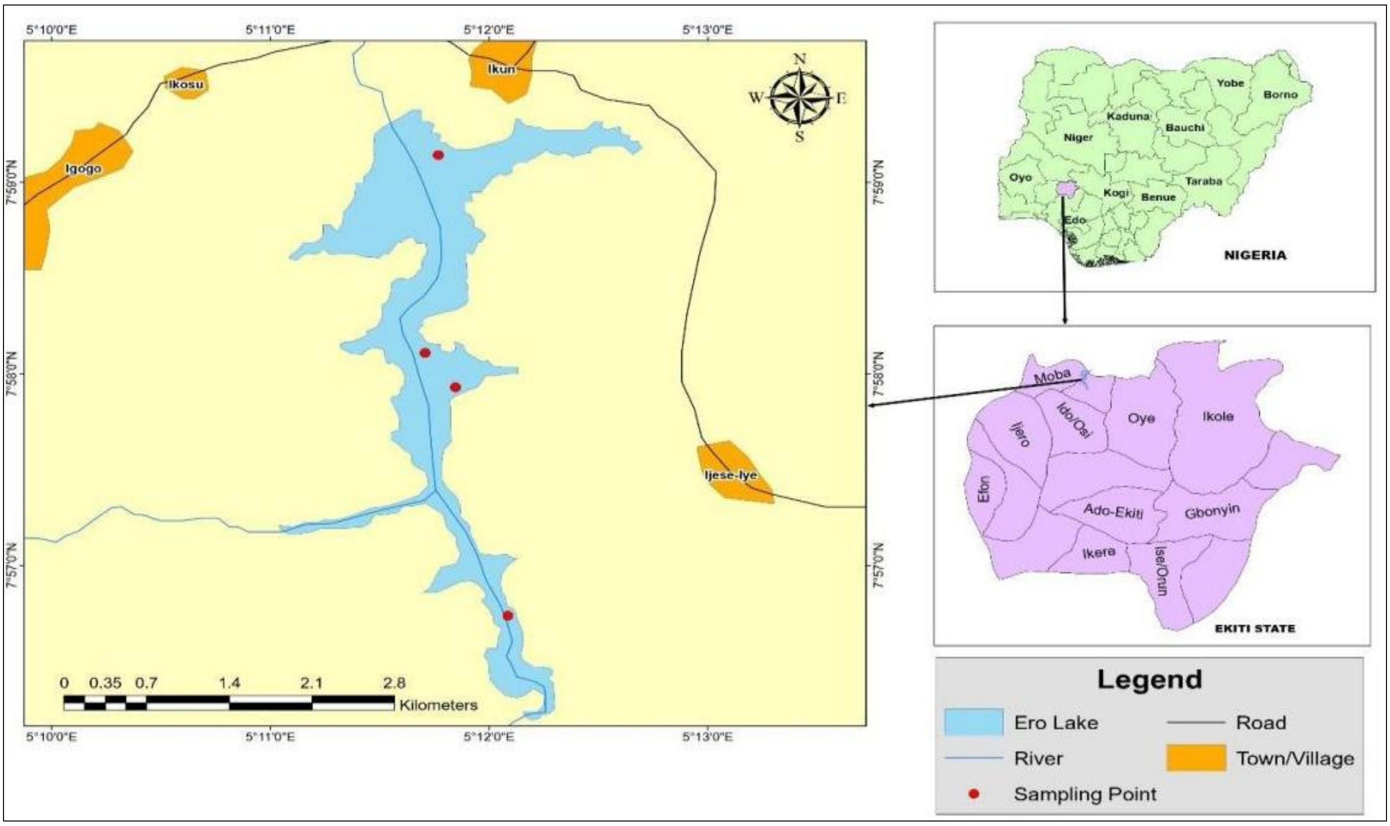

Fig 1: Map of Ero River showing the sampling locations

Physical and chemical parameters were measured at each station before macroinvertebrates were sampled. Conductivity was measured in-situ using a conductivity meter, while temperature and pH were also measured in-situ by a pH meter (pHep Hanna Model) and temperature with a mercury-in-glass thermometer. The Winkler method was used to determine dissolved oxygen (DO) and biological oxygen demand (BOD). Other parameters including chemical oxygen demand (COD), total hardness, turbidity, phosphate, nitrate, sulphate, total dissolved solid (TDS), total suspended solid (TSS), total solid (TS), alkalinity, calcium, copper, lead and zinc were determined using standard methods of APHA (2012).

Sediments samples from the bottom of the reservoir were collected in a big can with the use of a Van Veen grab ($0.25m^2$) by opening the jaws of the sample and lowering it to the waterbed, whereupon contact, a release mechanism automatically close the jaws, capturing sediment samples. The samples were washed through three different sieve sizes of 1mm, 500 µm, and 250 µm, respectively to remove the debris. The washed sediments were poured into a white plastic tray and macroinvertebrates sighted were sorted out by picking them with the aid of forceps and kept in clean vials. In the Laboratory, easy observation of the macroinvertebrates were enhanced by staining them with Rose Bengal solution. Sorted macroinvertebrates were observed under a microscope and identified to the lowest taxonomic rank. Each taxonomic group was placed in a specimen bottle containing 4% formalin and labelled properly. Aquatic organisms sampled were enumerated and identification to specific level was done accordingly. Identification of the animals was carried out using several identification guides including Yoloye (1988) [25], Egborge (1994) [7], Freshwater Biological Association, (2011). Animals that could not be easily identified were closely examined under a microscope (Max II 1202.4000 model).

Statistical Analysis

The data obtained were subjected to descriptive statistics to determine the mean ± Std of the physicochemical parameters. One-way analysis of variance (ANOVA) determined spatial variance equality (homogeneity) in the means of the physicochemical parameters.

Results

Physicochemical Parameters

Table 1 presents a summary of the physicochemical parameters analyzed from water samples collected at four sampling points (A, B, C, D) on Ero Reservoir during September to November, 2024. The analysis provides insights into the water quality status and potential environmental implications of the water if polluted.

The pH of the water samples ranged from 5.4 (at Point B) to 6.7 (at Point D), with an overall mean of 6.20. These values were within the WHO and NSDWQ (2017) [24] recommended values. The temperature of the water samples ranged from 26.1°C (Point A) to 27.3°C (Point D), with a mean of 26.88°C. The mean value falls within the stipulated value of 30 - 32°C recommended by WHO and NSDWQ (2017) [24].

Dissolved Oxygen (DO) had values that ranged from 4.88 mg/L (Point A) to 6.98 mg/L (Point B), with a mean of 5.45 mg/L. DO showed a strong negative correlation with pH (-0.988). The mean value recorded for DO was observed to be above the recommended limits of 5.00 mg/L as stipulated by WHO (2017) [24] and NSDWQ (2017) [24]. Biochemical Oxygen Demand (BOD) content of the water samples had values ranging from 1.76 mg/L (Point B) to 1.97 mg/L (Point C), with a mean of 1.85 mg/L, while Chemical Oxygen Demand (COD) ranged from 2.32 mg/L (Point D) to 3.21 mg/L (Points A and C), with a mean of 2.77 mg/L. COD showed a negative correlation with temperature (-0.797). The mean value of these parameters were below the recommended values given by WHO (2017) [24] and NSDWQ (2017) [24].

For the hardness and solids, total hardness of the water samples ranged from 102.4 mg/L (Point D) to 173.6 mg/L (Point A), with a mean of 147.45 mg/L. It correlated negatively with pH (-0.535) and temperature (-0.645), and positively with COD (0.501). Turbidity ranged from 0.1 NTU (Points B, C, D) to 0.2 NTU (Point A), with a mean of 0.13 NTU. Turbidity was negatively correlated with temperature (-0.950) and positively with COD (0.577). Total dissolved solids (TDS) ranged from 71.04 mg/L (Point A) to 119.68 mg/L (Point C), mean = 97.60 mg/L. TDS correlated positively with temperature (0.651), BOD (0.596), and negatively with turbidity (-0.850) and sulphate (-0.690). Total suspended solids (TSS) ranged from 1.02 mg/L (Point D) to 1.72 mg/L (Point C), with a mean value of 1.31 mg/L. TSS showed positive correlation with BOD (0.623), COD (0.758), and TDS (0.550); and negative with nitrate (-0.801) (Table 2). The total solid content of the water samples (TS) ranged from 72.33 mg/L (Point A) to 121.4 mg/L (Point C), mean = 98.91 mg/L. TS correlated positively with temperature, BOD, TDS, and TSS, and negatively with turbidity and sulphate (Table 2). Phosphate content of the water samples ranged from 0.21 mg/L (Points C and D) to 0.31 mg/L (Point B), with a mean of 0.25 mg/L. It showed mixed correlations: negatively with pH (-0.738) and BOD (-0.878), and positively with DO (0.777) and total hardness (0.723). The nitrate content of the water ranged from 0.12 mg/L (Points A and C) to 0.15 mg/L (Point D), with a mean of 0.13 mg/L. It correlated positively with temperature (0.786) and negatively with COD (-0.967), total hardness (-0.690), and turbidity (-0.556). Sulphate ranged from 68.35 mg/L (Point B) to 76.20 mg/L (Point A), with a mean of 72.80 mg/L. Sulphate correlated positively with pH (0.918) and COD (0.536), but negatively with temperature (-0.652), DO (-0.927), and turbidity (-0.682). Alkalinity ranged from 34.9 mg/L (Point A) to 77.2 mg/L (Point B), with a mean value of 51.05 mg/L. Alkalinity had complex relationships: negative with pH, COD, turbidity, sulphate; and positive with temperature, DO, phosphate, nitrate, and copper (Table 2).

Table 1: Mean Values of the Physicochemical Parameters of Ero Reservoir

Parameters	Point A	Point B	Point C	Point D	Overall Mean ± Std	WHO (2017) [24]	NSDWQ (2017)
pH	6.5	5.4	6.2	6.7	6.20 ± 0.57	6.5 - 8.5	6.5 - 8.5
Temp (°C)	26.1	27.2	26.9	27.3	26.88 ±0.54	30 - 32	Ambient
DO (mg/L)	4.88	6.98	5.23	4.69	5.45 ± 1.05	5.00	5.00
BOD (mg/L)	1.78	1.76	1.97	1.87	1.85 ± 0.10	≤ 5	-
Alk (mg/L)	34.9	77.2	44,8	47.3	51.05 ± 18.23	200	100
COD (mg/L)	3.21	2.34	3.21	2.32	2.77 ± 0.51	40	-
Hard (mg/L)	173.6	165.6	148.2	102.4	147.45 ± 31.85	300	150
PO_4 (mg/L)	0.2	0.1	0.1	0.1	0.13 ±0.05	5.0	5.0
SO_4 (mg/L)	0.27	0.31	0.21	0.21	0.25 ± 0.49	250	100
NO_3 (mg/L)	0.12	0.14	0.12	0.15	0.13 ± 0.01	45	10
Turb (NTU)	76.20	68.35	72.55	74.10	72.80 ± 3.32	≥ 200	5.0
TDS (mg/L)	71.04	106.88	119.68	92.80	97.60 ± 20.88	1000.0	500
TSS (mg/L)	1.29	1.22	1.72	1.02	1.31 ± 0,29	≤ 5	5
TS (mg/L)	72.33	108.81	121.4	93.82	98.91 ± 21.10	-	-
Ca (mg/L)	98.3	78.5	78.3	65.4	80.13 ± 13.58	75	75
Cu (mg/L)	0.13	0.14	0.13	0.13	0.13 ± 0.01	2.00	1.00
Pb (mg/L)	0.14	0.14	0.15	0.15	0.15± 0.01	0.05	0.05
Zn (mg/L)	2.53	3.94	3.34	3.51	3.33 ± 0.59	3.00	3.00

Table 2: Correlation Coefficients of Physicochemical Parameters and Macroinvertebrates of Ero Reservoir.

	pH	Temp.	DO	BOD	Alk.	COD	Hard	PO4	SO4	NO3	Turb.	TDS	TSS	TS	Ca	Cu	Pb	Zn	Hemiptera	Ephemeroptera	Coleoptera	Diptera	Gastropoda
pH	1.000																						
Temp.	-0.300																						
DO	-0.988*	0.357																					
BOD	0.370	0.233	-0.462																				
Alk.	-0.884*	0.647*	0.932*	-0.390																			
COD	0.288	-0.797*	-0.416	0.353	-0.698*																		
Hard	-0.535*	-0.644*	0.469	-0.466	0.124	0.501*																	
PO4	0.350	-0.950*	-0.360	-0.451	-0.590*	0.577*	0.547*																
SO4	-0.738*	-0.175	0.777*	-0.878*	0.614*	-0.222	0.723*	0.272															
NO3	-0.039	0.786*	0.171	-0.220	0.500*	-0.966*	-0.690*	-0.556*	0.003														
Turb.	0.918*	-0.652*	-0.927*	0.165	-0.960*	0.536*	-0.159	0.682*	-0.494	-0.334													
TDS	-0.498	0.650*	0.430	0.596*	0.484	-0.120	-0.147	-0.850*	-0.217	0.044	-0.690*												
TSS	-0.156	-0.264	0.004	0.623*	-0.217	0.758*	0.398	-0.051	-0.245	-0.801*	-0.050	0.550*											
TS	-0.510*	0.645*	0.441	0.587*	0.491	-0.117	-0.134	-0.845*	-0.204	0.038	-0.697*	1.000*	0.554*										
Ca	-0.026	-0.944*	-0.029	-0.419	-0.363	0.701*	0.854*	0.892*	0.465	-0.776*	0.372	-0.551*	0.275	-0.541*									
Cu	-0.933*	0.398	0.977*	-0.590*	0.956*	-0.564*	0.380	-0.333	0.816*	0.333	-0.893*	0.297	-0.209	0.307	-0.080								
Pb	0.505*	0.478	-0.535*	0.901*	-0.317	-0.011	-0.803*	-0.577*	-0.943*	0.192	0.182	0.479	0.225	0.466	-0.704*	-0.577*							
Zn	-0.631*	0.930*	0.674*	0.035	0.871*	-0.768*	-0.318	-0.904*	0.150	0.663*	-0.885*	0.712*	-0.167	0.712*	-0.757*	0.689*	0.186						
Hemiptera	-0.235	-0.232	0.340	-0.988*	0.302	-0.384	0.354	0.479	0.793*	0.286	-0.056	-0.684*	-0.717*	-0.677*	0.376	0.490	-0.839*	-0.086					
Ephemeroptera	0.988*	-0.163	-0.958*	0.358	-0.801*	0.139	-0.649*	0.243	-0.751*	0.115	0.854*	-0.466	-0.264	-0.478	-0.161	-0.881*	0.553*	-0.513*	-0.214				
Coleoptera	-0.713*	-0.451	0.650*	-0.451	0.333	0.359	0.973*	0.345	0.777*	-0.582*	-0.383	0.041	0.408	0.055	0.710*	0.554*	-0.778*	-0.092	0.320	-0.807*			
Diptera	0.125	-0.758*	-0.261	0.325	-0.568*	0.986*	0.598*	0.517*	-0.120	-0.993*	0.389	-0.015	0.826*	-0.011	0.714*	-0.427	-0.077	-0.674*	-0.381	-0.026	0.485		
Gastropoda	0.880*	-0.694*	-0.877*	0.034	-0.922*	0.499	-0.096	0.753*	-0.382	-0.313	0.991*	-0.779*	-0.131	-0.785*	0.436	-0.826*	0.063	-0.903*	0.075	0.816*	-0.324	0.354	1

For the heavy metals, calcium content of the water samples ranged from 65.4 mg/L (Point D) to 98.3 mg/L (Point A), with a mean value of 80.13 mg/L. Calcium correlated negatively with temperature, nitrate, TDS, and TS; positively with COD, total hardness, and turbidity. Copper (Cu) ranged from 0.129 mg/L (Point A) to 0.144 mg/L (Point B), and had a mean value of 0.13 mg/L. Copper had significant positive correlation with DO, phosphate, TDS, TS, and alkalinity; and negative with pH, COD, turbidity, and sulphate. Lead (Pb) ranged from 0.136 mg/L (Point B) to 0.154 mg/L (Point C), mean = 0.15 mg/L. Lead correlated positively with pH and BOD; and negatively with DO, total hardness, phosphate, alkalinity, and Cu. Zinc (Zn) had values that ranged from 2.53 mg/L (Point A) to 3.94 mg/L (Point B), with a mean value of 3.33 mg/L. Zinc showed positive correlations with temperature, DO, nitrate, TDS, TS, alkalinity, and Cu; and negative with pH, COD, turbidity, sulphate, and calcium.

Macroinvertebrate Community of Ero Reservoir

The results in Table 2 showed the different macro-invertebrate species recorded at the four different sampling points on Ero Reservoir during the study. A total of twelve (12) macroinvertebrate species belonging to five classes of Hemiptera, Ephemeroptera, Coleoptera, Diptera and Gastropoda were encountered in this study. Hemiptera were the most abundant macroinvertsbrate taxa in Ero River during this study, contributing 42.86% with 1,707 individuals. Next in abundance were the gastropoda making up 26.70% and accounting for 1,065 individuals. The diptera were next in abundance making up 15.55% and made up of 619 individuals, while ephemeroptera consisted of 301 individuals and accounted for 7.56% of the total macroinvertebrate abundance. The least abundant taxa was coleoptera, which had 7.31% of the total macroinvertebrates and accounted for 291 individuals.

Table 3: Percentage Abundance of Macroinvertebrates Encountered in Ero Reservoir During the period of Study.

Species/Class Encountered	Point A		Point B		Point C		Point D		Total Abundance	
	Abund	% Abund	Abund	% Abund	Abund	% Abund	Abund	% Abund	Abund	% Abund
Hemiptera										
Ranatra sp.	104	9.29	121	12.49	67	7.25	94	9.69	386	9.69
Nepa cinerea	111	9.91	73	7.53	90	9.74	81	8.35	355	8.91
Gerris remiges	83	7.41	103	10.63	37	4.00	60	6.19	283	7.11
Lethocercus africanus	90	8.04	95	9.80	67	7.25	91	9.38	343	8.61
Notonecta sp.	83	7.41	80	8.26	80	8.66	97	10.00	340	8.54
Total	471	42.06	472	48.71	341	36.90	423	43.61	1,707	42.86
Ephemeroptera										
Baetis sp.	80	7.14	58	5.99	74	8.01	89	9.18	301	7.56
Total	80	7.14	58	5.99	74	8.01	89	9.18	301	7.56
Coleoptera										
Hydrophilus sp	81	7.23	86	8.88	74	8.01	50	5.61	291	7.31
Total	81	7.23	86	8.88	74	8.01	50	5.61	291	7.31
Diptera										
Chironomus sp.	91	8.13	74	7.64	95	10.28	72	7.42	332	8.34
Eristalis sp.	84	7.50	64	6.60	84	9.09	55	5.67	287	7.21
Total	175	15.63	138	14,24	179	19.37	127	13.09	619	15.55
Gastropoda										
Lanistes libycus	123	10.98	89	9.18	79	8.55	89	9.18	380	9.54
Potadoma moerchi	95	8.48	77	7.95	97	10.50	93	9.59	362	9.09
Bulinus globosus	95	8.48	49	5.06	80	8.66	99	10.21	323	8.11
Total	313	27.94	215	22.19	256	27.71	281	28.98	1,065	26.74
Grand Total	1.120		969		924		970		3,983	

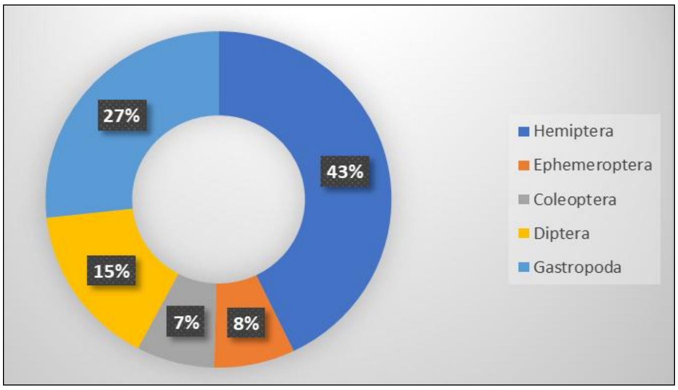

Fig 2: Percentage abundance of the major groups of macroinvertebrates of Ero Reservoir during the period of study.

Macroinvertebrate Diversity and Richness

Table 4: Diversity Indices of Macroinvertebrates of Ero Reservoir, Ikun-Ekiti

Taxa/Location	Point A	Point B	Point C	Point D
Taxa_S	12	12	12	12
Individuals	1120	969	924	970
Dominance_D	0.085	0.088	0.087	0.087
Simpson_1-D	0.915	0.912	0.913	0.913
Shannon_H	2.476	2.457	2.463	2.463
Evenness_e^H/S	0.991	0.973	0.978	0.978
Margalef	1.567	1.6	1.611	1.599
Equitability_J	0.996	0.989	0.991	0.991
Menhinick	0.3586	0.3855	0.3948	0.3853
Fisher_alpha	1.877	1.929	1.947	1.928
Berger-Parker	0.1098	0.1249	0.105	0.1021
Brillouin	2.446	2.423	2.428	2.429

There are twelve species in the dataset. The highest percentage of macroinvertebrates was encountered at point A (Individuals =1120) while the least was encountered at point C. Dominance value at all points indicates that no specie dominates in the frequency of macroinvertebrates encountered. (Dominance_D <0.5). There exists low diversity between species (Simpson 1-D > 0.5) as the lowest diversity was found at point A.
Shanon Wiener Diversity Index (H) value implies that there exists low diversity in the specie across all points ($2 \leq H < 2.5$). Also, there exists high level of specie dominance across all points (Eveness~1). Brillouin index indicates a great specie diversity with the greatest specie diversity at point A. The highest species richness was found at point C (Menhinick's Index =0.3948) while the least was found at point A.
The greatest number of species in the sample, suggesting higher species richness and potentially greater biodiversity was observed at point C (Margalef Index =0.611) while the least was observed at point A. Equitability index measured across all points indicates higher evenness, meaning all species are equally abundant.
According to Fisher's Alpha index obtained, the greatest specie diversity was recorded at point C while the least was recorded at point A. And Berger-Parker index value across all points indicates that species are more evenly distributed, with no single species dominating the community. This indicates a higher diversity and more even distribution of individuals across the species (Berger-Parker index ~ 0).

Discussion

A total of five (5) taxa belonging to twelve (12) genera were recorded in this study. The genera are Hemiptera, Ephemeroptera, Coleoptera, and Gastropoda. The low diversity of macroinvertebrates observed in Ero River could be as a result of decline in environments dominated by harsh physical conditions Odum (2007) [16]. Water quality, food availability, presence and abundance of predator species as well as the degree of effective competition are factors that control the abundance and distribution of macroinvertebrates' fauna in the aquatic environment Akawo *et al.*, (2021) [11]. Such stressors can disrupt aquatic fauna's life cycles, reproduction, and migration patterns and impose physiological stress even on tolerant species (Adakole and Annune, 2008) [1]. All the species were recorded at all sampling locations, indicating their adaptability and ecological resilience. Their widespread occurrence may be attributed to their varied feeding strategies and tolerance to habitat changes.
Fluctuations in water quality parameters—especially DO, BOD, and nutrients—were observed during the study, suggesting spatio-temporal variation in organic matter input. These changes could significantly influenced the distribution and abundance of macroinvertebrates. macroinvertebrate communities have been found to be influenced or regulated by multiple environmental and biological factors, including water and sediment quality, food availability, predation, and competition (Ngodhe *et al.*, 2013; Fierro *et al*. 2017; Iloba *et al.*, 2018; Brooks *et al.* 2021) [13, 9, 11, 5].
Parameters such as temperature, pH, DO, and BOD had a direct impact on species richness. High concentrations of dissolved oxygen, lower nutrient, and BOD levels indicated that the water was only slightly disturbed by anthropogenic activities. This may be as a result of the fact that the self purification mechanism of the river is still high due to minimal human interference.
High levels of total suspended solids (TSS) and total dissolved solids (TDS) likely reduced light penetration, inhibiting photosynthesis, reducing the water temperature, and further decreasing oxygen availability. Such conditions threaten sensitive aquatic species, potentially leading to migration or population decline. This situation may also be attributed to the low abundance of macroinvertebrate in Ero River during this study period. Heavy metal analysis showed that copper (0.13 mg/L) and lead (0.15 mg/L) were within WHO and NESREA permissible limits (WHO, 2017; NESREA, 2009) [24], indicating that the river, if properly managed, could support agriculture and recreational activities. Generally, the WHO and NESREA standard limits showed the physicochemical results of Ero River had relatively fair environmental quality, the stations were not significantly polluted along anthropogenic stress gradient. The results collaborate with studies within the southern part of Nigeria (Arimoro *et al.*, 2015; Odigie and Olomukoro, 2020) [4, 15] where they reported similar high values of DO and relatively low values of BOD5 which they attributed to high organic matter input from the riparian zones of the rivers they studied. Phosphate, EC, Nitrate, Sulphate and BOD were within the recommended standard of WHO (WHO, 2011) [23] and the permissible limit of Nigeria Water Quality standard for inland surface water. Anthropogenic activities such as indiscriminate defecation, use of fertilizer/pesticide, industrialization, urbanization, dredging, over dependent on the river for household use, polluted effluents and bunkering are causes of river systems degradation in Sub Saharan Africa (Olatunji *et al.*, 2019).

Conclusion

The macroinvertebrate-based bioassessment of Ero River reveals no significant ecological stress arising from either anthropogenic, urbanization or industrial activities. The major anthropogenic influence observed on the river are indiscriminate defecation, fertlizers and pesticide use for agricultural purposes on the surrounding farmlands and discharge of household wastes into the river. The effects of all these have been discovered to be of minimal impact on the river maybe due to the large volume of the river that allowed for increased self-purification of the water body. The taxa of macroinvertbrates encountered in this study were composed of a mixture of both clean water and polluted water species. This indicates that the water body is experiencing some degree of pollution, but is not severely impacted. The presence of clean-water species suggests variable water quality, indicating that the water quality is still generally good, but the presence of pollution-tolerant species indicates the presence of some pollutants which may be organic or inorganic. This situation highlights the importance of conserving this freshwater habitat. The conservation of macroinvertebrates biodiversity and maintaining a good microhabitat should be prioritized, to avoid degradation of the water quality, maintain biodiversity and safeguard the ecosystem services that the water management ultimately depends on. Targeted management of biodiversity would be part of broad strategies towards the sustainable water security in this rural community. Consequently, there should be public awareness to educate the community members about the environmental implications of disposing wastes into the river. Also, there should be continuous monitoring of the water quality to ensure compliance with national and international standards as this water serves as the major source of drinking and agricultural purposes in this locality and the neighbouring towns,

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