Assessment of Anthropogenic Influences on the Benthic Invertebrate Community of Oghan River in Edo State, Nigeria

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ABSTRACT: The influence of anthropogenic activities on a freshwater ecosystem was investigated by sampling for physicochemical parameters, heavy metals and benthic invertebrates of Oghan River in Ora Community, Ovia South-West Local Government Area of Edo State, Nigeria. Samples were collected monthly for a ten months period across three stations between 09:00 and 12:00 hrs on each sampling day for laboratory analysis following standard procedure. No significant variation (P > 0.05) was observed between the parameters, although heavy metals in sediments were above the WHO recommended limit for freshwater ecosystems. For benthic organisms, about 386 individuals belonging to 23 taxa, 11 families and 6 orders were recorded. Among the orders, the most dominant were Diptera (44.94%), Odonata (28.31%), Ephemeroptera (13.77%) while the least was Diplogasterida (0.26%). The families were dominated by Chironomidae (32.47%), Baetidae (13.77%) and Libellulidae (12.73%). Species diversity (2.677) and richness (4.002) were highest in station 1 and lowest in stations 2 (2.357) and 3 (2.745) while species evenness was highest in station 3 (0.791) and lowest in station 1 (0.6924). The elevated levels of heavy metals and the decrease in sensitive benthic taxa observed in the river is an indication that anthropogenic activities could be impacting the water quality and benthic invertebrate community of the river.

Water resources management is essential to the well-being of aquatic life and communities that interacts direct or indirectly with natural water bodies. The increasing urbanization and industrialization across Nigeria make it essential to generate baseline and regular data regarding the status of inland water bodies across the nation for effective water resources management. Efforts to assess and understand the status of freshwater resources in Nigeria started over five decades ago (Egborge, 1981). Although water and sediments quality are useful indicators in water resources assessment, the ecology, diversity and distribution of biological resources particularly benthic invertebrate assemblages of a water body act as essential bioindicators of the general health condition of freshwater ecosystems (Egborge, 1981; Olomukoro and Victor, 1999; Olomukoro and Egborge, 2003; Osemwegie and Olomukoro, 2004; Omoigberale and Ogbeibu, 2010). Water and sediment play a vital role in the transport and fate of contaminants in aquatic environments. Sediments act as a sink for different categories of anthropogenic and natural contaminants entering the aquatic environment (Vinodhini and Narayanan, 2008; Nadia *et al.,* 2009). Additionally, pollutants released from industrial and domestic activities like laundry, agriculture, mining and processing can accumulate to elevated levels in sediments with direct exposure to benthic organisms (Chindah *et al.,* 2009). Physicochemical characteristics of sediment influence the occurrence

and abundance of benthic species in such aquatic ecosystems (Mclusky and Elliot, 1981). The important factors governing the occurrence and distribution of macroinvertebrates are the physicochemical qualities of the river and the nature of immediate substrates (Umeozor, 1995). The presence and the contamination of aquatic ecosystems by nutrients load and heavy metals, especially in sediment, is one of the most challenging pollution issues due to the toxicity, abundance, persistence, and subsequent bio-accumulation of these materials from major industrial processes by bottom-dwelling organisms (Barra *et al.,* 2005). The composition and diversity of macrobenthic invertebrate assemblages present in an aquatic environment to a large extent reflect the quality of the ecosystem. Benthic organisms are good indicators of localized conditions because of their limited mobility and migration patterns and sometimes are the first casualty of any environmental disturbance and thus, are useful for examining site-specific impacts (Olomukoro and Ezemonye, 2007). Assessing water quality using physical, chemical and benthic invertebrate communities is an important part of monitoring and restoring the biological function and integrity of aquatic ecosystems as well as protecting aquatic biodiversity and human health. Extensive studies on the physical and chemical characteristics and benthic community in rivers, streams and creeks

in southern Nigeria have been undertaken regularly and are still ongoing (Egborge, 1981; Umeozor, 1995; Olomukoro and Victor, 1999; Olomukoro and Egborge, 2003; Arimoro *et al.,* 2007; Omoigberale and Ogbeibu, 2010; Olomukoro et al., 2013; Iloba and Ruejoma, 2014). This study is the first to assess the sediment and benthic invertebrates of Oghan River, providing a preliminary baseline on the composition, abundance and seasonal variation of the benthic macroinvertebrates and physicochemical conditions of the river which is vital for the effective monitoring and assessment of freshwater bodies in Nigeria for economic development. This study aimed to determine the physicochemical parameters, heavy metals and benthic invertebrate assemblage of Oghan River in Ora community in Ovia South-West Local Government Area of Edo State, Nigeria.

MATERIALS AND METHOD

Study Area: Oghan River is located in Ora community in Ovia South-West Local Government Area of Edo State, Nigeria. It lies between latitude 06˚29″80.31′N and longitude 005˚24″21.55′E with an elevation of 83 metres above sea level. The river is fed principally by an aquifer in the rocky forest zone of Ikpeba community (Fig. 1).
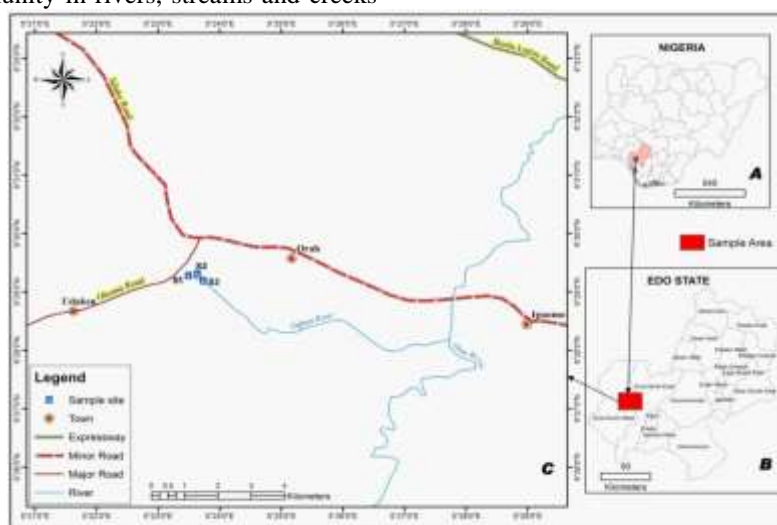

Fig 1: Map of study area showing sampling stations

The river flows through the community and empties into Ovia River through Iguoriakhi waterside. Over the years, severe gully erosion has significantly impacted the river making it very shallow and narrow. The region has a characteristic tropical climate of two distinct annual seasons: a dry season (November - March) and a wet season (April - October). The rainfall pattern is influenced by the movements of the Southern-west monsoon wind across the Atlantic

Ocean and the timing of these movements varies from year to year. The mean annual temperature is 32.25 ℃ with a mean annual relative humidity of 96%. The dominant vegetation in the area includes bamboo (*Bambusa vulgaris*), rubber (*Havea brasiliensis*), oil palm (*Elaeis guineensis*) and epiphytic ferns such as *Cytosperma senegalense*, *Dryopteris felix-mas* and *Nephrolepis biserrata*. Anthropogenic activities include defecation by humans and livestock, fishing

using dug-out canoes, laundry, swimming and traditional religious activities.

Sampling Stations: Three sampling stations were selected to represent the upstream, midstream and downstream of the river. Station 1 (06˚29″26.87′N and 005˚23″62.28′E) was more impacted by gully erosion than station 2 (06˚29″25.62′N and 005˚23″59.64′E) and 3 (06˚29″24.97′N and 005˚23″60.60′E) in the river system. The three stations are shallow in nature and due to the gully erosion have laterite composition largely at the bottom sediments, rather than the conventional dark brown debris known for bottom sediments in freshwater ecosystems in southern Nigeria.

Sample Collection: Sample collection for physicochemical parameters and heavy metals was carried out in the three stations at monthly intervals between May 2013 and February 2014, covering the dry and wet seasons. Samples were collected between 09:00 and 12:00 hours on each sampling trip. In each station, samples were collected in a randomized fashion to form a composite sample. Sediment samples were collected with a sediment sampler into appropriate sampling bottles that were properly labelled and kept in ice packs before transportation to the laboratory for analysis. Parameters such as temperature and pH were measured *in situ* in the field using digital metres.

Benthic Invertebrates: Samples for benthic organisms were collected fortnightly all through the sampling period covering both seasons, using the modified 'Kick Sampling Technique' (Armitage, 1978; Lenat et al., 1981). The substrate was disturbed vigorously by kicking to dislodge benthic invertebrates from aquatic plants and macrophytes into the water and sediment at each station. A 50-100 mm D-frame net of 500 µm mesh size was used for the collection at four different points to form one composite sample per station. Samples collected and sieved with the net were preserved with 10% formaldehyde and transported to the lab for analysis.

Sorting and Identification: At the laboratory, samples were washed in a 500 µm mesh sieve to remove debris. Samples were poured into a petri dish and benthic organisms were then sorted from the substratum under a dissecting microscope (American Optical Binocular Microscope 570). All the organisms sorted in each sample from the three stations were kept in different specimen bottles and preserved in 4% formalin. Temporary slides were made of specimens and viewed under the microscope. The observed specimens were

photographed using a digital camera with 17.1 megapixels. The organisms were counted and identified under the microscope (Olympus WF10X) with the aid of identification keys (Birmingham et al., 2005; Tagliapietra and Sigovini, 2010; Robertson et al., 2012).

Laboratory Analysis: Physicochemical parameters such as pH, conductivity, TDS were determined using pH (Hanna HI9813), conductivity and TDS (Hanna HI9812) metres. Carbon, organic matter and chloride were determined using filtration and titration methods. Calcium, magnesium, nitrogen, phosphate, sodium, potassium, sulphate, nitrate and chloride were determined using EDTA and Brucine method. Sediments samples for the analysis of heavy metals such as iron, manganese, zinc, copper, chromium, cadmium and nickel were first digested, air-dried and then dissolved with perchloric acids. The solution was heated and filtered. The filtrate and the standard solutions for each element were aspirated into the air-acetylene flame (fast sequential) of the Atomic Absorption Spectrophotometer (Buck Scientific Model-210) for heavy metal analysis following APHA (1998) method. All reagents used were analytical grades.

Statistical Analysis: Data obtained were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS 16.0). Descriptive statistics such as mean, standard error, and range values were obtained while one-way analysis of variance (ANOVA) was used to test for the level of significance at 0.05 probability levels. Pearson correlation was used to check the relationship between the physicochemical parameters and macrobenthic fauna. PAST ver. 2 was used for the biological indices such as Shannon-Weiner (H), Margalef (d) and Evenness (E) indices.

RESULTS AND DISCUSSION

Physicochemical Characteristics: The mean values of the physicochemical characteristics are shown in Table 1. There was no significant variation ($P > 0.05$, $F = 0.683$) between the parameters across the sampled stations and all the values were within the WHO recommended limit for freshwater bodies. Spatially, pH, conductivity, organic matter and sulphate, were highest in station 3 but lowest in station 2 while phosphate, calcium, magnesium, sodium, potassium and nitrate were highest in station 3 but lowest in station 1. Nitrogen remains the same across the stations.

Heavy Metals: Across the stations, iron, zinc, copper, manganese, cadmium and nickel were highest in

station 3 but lowest in station 2 while chromium was highest in station 3 but lowest in station 1. There was no significant variation (P > 0.05, F = 0.947) between the heavy metals across the sampled stations but the values were above the WHO recommended limit for freshwater ecosystems (Fig. 2). Across the month, iron, zinc, copper and manganese were highest in January; chromium in August while cadmium and nickel in September.

Table 1: Mean ± SE values of physicochemical parameters in sediments of Oghan River

|	Station 1			Station 2			Station 3			P-Value
	Mean ± SE	Min	Max	Mean ± SE	Min	Max	Mean ± SE	Min	Max	
Water Temp (ºC)	26.33±0.20	25.56	27.50	26.31±0.31	26.00	27.00	26.41±0.21	26.00	28.00	P>0.05
Ph	6.19±0.10	5.40	6.50	6.13±0.12	5.20	6.50	6.20±0.14	5.10	6.80	P>0.05
EC (μs/cm)	161.70±6.92	130.00	192.00	157.11±7.68	120.10	192.00	162.50±5.92	124.00	185.00	P>0.05
TDS (mg/kg)	80.85±3.46	65.00	96.00	88.69±8.81	60.00	162.00	81.45±2.82	64.00	92.50	P>0.05
Carbon (%)	0.53±0.05	0.25	0.66	0.48±0.05	0.22	0.64	0.50±0.06	0.28	0.68	P>0.05
Organic Matter (%)	0.86±0.09	0.43	1.14	0.83±0.08	0.39	1.11	0.87±0.09	0.48	1.17	P>0.05
Nitrogen (%)	0.02±0.00	0.01	0.04	0.02±0.00	0.01	0.03	0.02±0.00	0.01	0.04	P>0.05
Phosphate (mg/kg)	6.64±0.43	5.02	9.04	7.62±0.56	5.02	11.04	8.08±0.66	5.21	11.04	P>0.05
Calcium (meq/100g)	1.62±0.08	1.16	1.86	1.65±0.08	1.12	1.92	1.82±0.12	1.28	2.40	P>0.05
Magnesium (meq/100g)	0.69±0.11	0.09	1.26	0.75±0.11	0.08	1.20	0.84±0.11	0.08	1.30	P>0.05
Sodium (meq/100g)	0.77±0.09	0.48	1.21	0.82±0.09	0.41	1.29	0.88±0.08	0.51	1.31	P>0.05
Potassium (meq/100g)	0.80±0.16	0.12	1.53	0.82±0.20	0.07	2.25	0.92±0.21	0.06	2.26	P>0.05
Sulphate (mg/kg)	0.32±0.02	0.26	0.42	0.29±0.02	0.20	0.41	0.33±0.03	0.21	0.52	P>0.05
Nitrate (mg/kg)	0.52±0.09	0.10	0.92	0.65±0.01	0.62	0.72	0.71±0.08	0.12	0.96	P>0.05
Chloride (mg/kg)	51.57±2.20	41.60	61.44	50.34±2.60	38.43	63.36	51.46±1.90	39.68	59.20	P>0.05
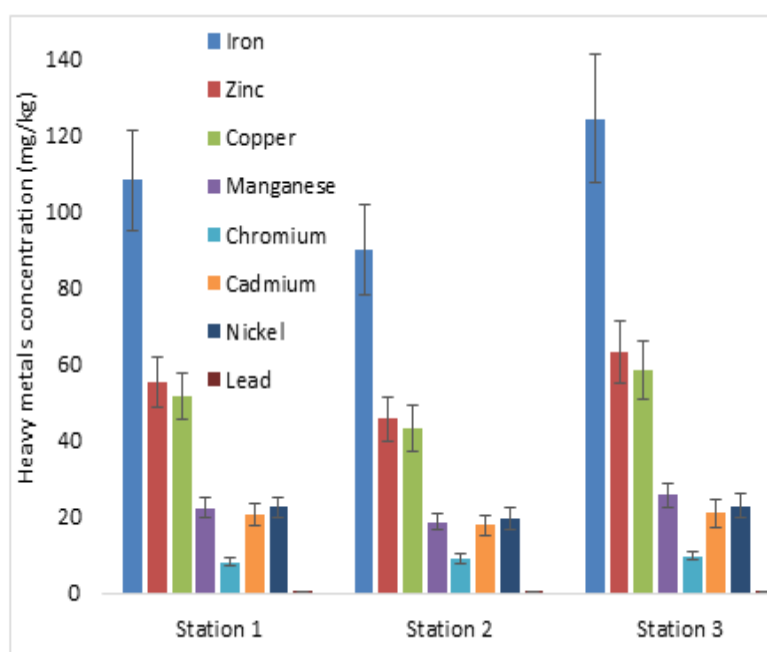
Fig 2. Heavy metals distribution in sediments of Oghan River

Macrobenthic Invertebrates: The overall taxa composition, distribution and abundance of benthic fauna recorded during the study period are presented in Tables 2 and 3. A total of 385 macrobenthic organisms belonging to twenty-three (23) taxa, eleven (11) families and six (6) orders were reported (Figure 3). The highest taxa observed include *Phyllogomphus* sp. (12.73%), *Pentaneura* sp. (12.47%), *Lestes* sp. (11.95%), *Enallagma* sp. (11.17%), *Ablabesmyia* sp. (9.35%) and *Polypedilum* sp. (9.35%). The families include Atyidae (3.38%), Baetidae (3.64%), Chironomidae (32.47%), Coenagrionidae (14.29%), Corduliidae (0.52%), Diplogastridae (0.26%), Gomphidae (12.73%), Naididae (1.30%), Tanypodinae (12.47%), Tubificidae (7.01%) and Lestidae (11.95%), while the orders are Decapoda (3.38%), Diplogasterida (0.26%), Diptera (44.94%), Ephemeroptera (3.64), Haplotaxida (8.31%) and Odonata (39.48%).

Relationship between Physicochemical Parameters, Heavy Metals and Macrobenthic Fauna: The relationship between the physicochemical parameters, heavy metals and macrobenthic fauna was assessed

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using Pearson's correlation. *Ablebesmyia* sp, *Clinotanypus maculatus* and *Coenagrion scitulum* had a positive relationship with potassium. *Chaetogaster* sp, *Diplogaster* sp, *Nadium osborni*, *Nais simplex* and *Rhabditolaimus* sp have a negative association with pH and chromium. *Epicordulia* sp had a positive relationship with nitrogen and a negative relationship with nitrate. *Polypodium* sp had a negative relationship

with nitrate, *Phyllogomphus* sp with magnesium and *Tubifex* sp with pH and a positive relationship with calcium. *Chironomus fractilobus* had a positive relationship with nitrogen and sulphate, *Centriptilium* sp with carbon, organic matter and nitrogen while *Baetis* sp with conductivity, sulphate, nitrate, chloride, chromium and nickel.

Table 2: Diversity of benthic invertebrates' fauna across the stations in Oghan River

Species	Station 1	Station 2	Station 3	Total
Baetis sp.	1	0	3	4
Caridina Africana	13	0	0	13
Afroptilium sp.	5	2	3	10
Ablabesmyia sp.	8	11	17	36
Chironomus fractilobus	5	6	5	16
Chironomus transvaalensis	3	12	4	19
Clinotanypus maculatus	7	6	5	18
Polypedilum sp.	14	14	8	36
Coenagrion scitulum	5	3	4	12
Enallagma sp.	16	12	15	43
Epicordulia sp.	2	0	0	2
Diplogater sp.	1	0	0	1
Rhabditolaimus sp	1	0	0	1
Phyllogomphus sp.	5	28	16	49
Chaetogaster sp.	1	0	0	1
Dero sp.	3	1	0	4
Pentaneura sp.	23	11	14	48
Nadium osborni	1	0	0	1
Nais simplex	1	0	0	1
Nais sp.	8	1	2	11
Nais communis	7	3	3	13
Tubifex sp.	0	1	0	1
Lestes sp.	19	12	15	46
	149	**123**	**114**	**386**
	38.60%	**31.86%**	**29.53%**	

Biological Indices: The computation of biological indices such as Shannon-Wiener (diversity index), Margalef (richness index) and Evenness index in the study showed (Figure 4) that station 1 had the highest diversity (2.677) with station 2 recording the lowest (2.357). Station 1 had the highest species richness (4.002) with station 3 recording the lowest (2.745) while station 3 had the highest evenness (0.791) and station 1 had the least evenness (0.6924).

Assessments of anthropogenic activities on the macrobenthic invertebrate community of freshwater ecosystems are crucial in determining the ecological status of inland waters for effective water resources management. No significant variation was observed for the physicochemical parameters and heavy metals across the sample stations, although, the concentration of metals in sediment exceeded the recommended limit for freshwater bodies (WHO 2006). The pH of sediment was slightly acidic which is typical of water bodies undergoing some levels of stress as a result of urbanization in southern Nigeria as reported by

previous workers (Umeozor, 1995; Olomukoro and Egborge, 2003; Osemwegie and Olomukoro, 2004; Olomukoro and Ezemonye, 2007; Olomukoro et al., 2013). The high conductivity reported in the sampled stations indicates that effluent discharged into the river may contain constituents of charged particles which could raise the conductivity levels in sediments. The increase in dissolved solids particularly in May could be attributed to the high level of rainfall observed in this period of the year which may have led to the washing of debris and other materials through run-off into the river. The TDS reported in our study was higher than that reported by Edegbene et al. (2012) at Atakpo River. Increased phosphate, sulphate and nitrate in freshwater bodies are indicators of organic pollution. The increased level of phosphate observed in this study was higher than those reported by Imoobe and Koye (2011), Olomokoro et al. (2013) and Iloba and Ruejoma (2014). The increased phosphate level could be said to be associated with human activities around the host community which drains into the river via erosion. Sulphate and nitrate were lower and

similar to that reported by Ogbaugu et al. (2011) at Imo River, but contrasted with the lower values reported by Arimoro and Muller (2010), Adeogun and Fafioye (2011) and Imoobe and Koye (2011) in southern Nigerian rivers and reservoir. Chloride was similar to that reported by Obot et al. (2014) at Ediene Stream but higher than that reported by Edegbene et al. (2012) at Atakpo River.

Table 3: Families of macrobenthic organisms across the stations in Oghan River

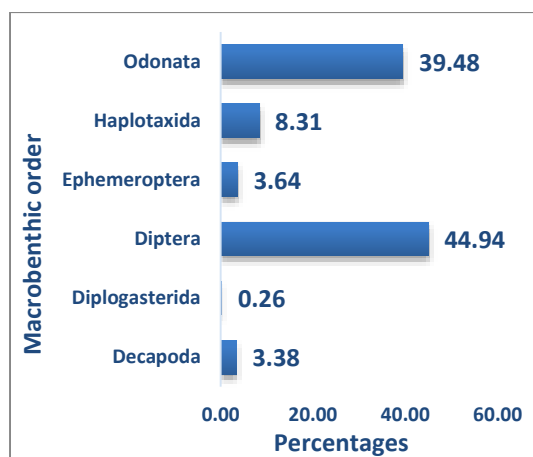| Family	Station 1	Station 2	Station 3	Total
Atyidae	13	0	0	13
Baetidae	6	2	6	14
Chironomidae	37	49	39	125
Coenagrionidae	21	15	19	55
Corduliidae	2	0	0	2
Diplogastridae	1	0	0	1
Gomphidae	5	28	16	49
Naididae	4	1	0	5
Tanypodinae	23	11	14	48
Tubificidae	17	5	5	27
Lestidae	19	12	15	46
Total	**149**	**123**	**114**	**386**

Fig 3. Order of macrobenthic invertebrates recorded in Oghan River

Heavy metals such as iron, zinc, copper, manganese, chromium, cadmium and nickel in sediment show a non-significant variation across the three stations, but the values were above the WHO recommended limit for sediment in freshwater bodies (WHO 2006). Station 3 had the highest heavy metals mean values, followed by station 2 and the least was in station 1. Station 2 is the main point of domestic activities and other natural input into the river, but the high values found in station 3 may be connected with sediment migration and transport as a result of erosion from the point of discharge in station 2 to station 3. The values for heavy metals reported in this study exceeded the values reported by Adakole et al. (2008) on a man-

made lake in Zaria, Adeogun *et al.* (2011) at Awba Stream and Obiakor et al. (2013) at Anambra River. The benthic organisms recorded in this study are typical of the benthic organisms associated with freshwater ecosystems across the tropics. A total of 23 macrobenthic taxa comprising 385 individuals were recorded.
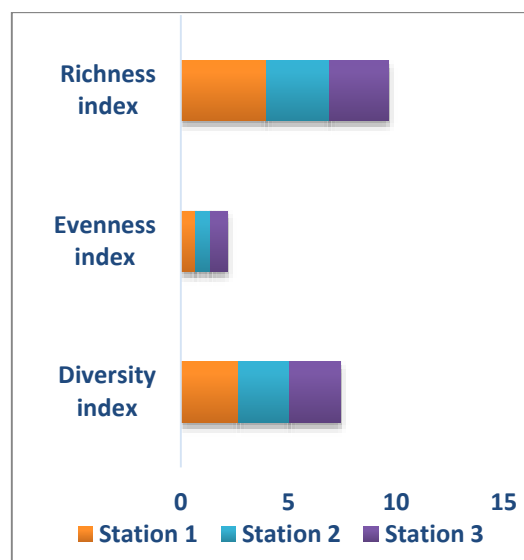

Fig 4. Biological indices of macrobenthic fauna in Oghan River

The low level of taxa reported in this study may be attributed to the severe erosion affecting the river which may have impacted the sediment type and macrobenthic diversity in the river. Several researchers in different parts of Nigeria have reported similar taxonomic distribution as observed in this study. Arimoro and Osakwe (2006) and Akaahan (2014) reported a total of 21 taxa at Benin River in Edo State and River Benue in Benue State respectively. Both rivers are also undergoing some level of anthropogenic disturbances due to urbanization and economic development. Edward and Ugwumba (2011) reported 18 taxa at Egbe Reservoir, which is low and may be attributed to the impoundment of the reservoir. Emere and Nasiru (2009) reported 27 taxa in an urbanized stream in Kaduna State.

Among the six orders of benthic organisms, the highest was recorded with the orders Diptera, Odonata and Haplotaxida. Members of these orders are known to thrive in moderately and severely polluted waters. Others include Ephemeroptera, Decapoda and Diplogasterida. Olomukoro and Ezemonye (2007) reported Diptera as the most dominant fauna prevalent in rivers in Edo State while Olomukoro and Dirisu (2014) found Ephemeroptera, Diptera and Decapoda as the dominant groups in Edion and Omodo Rivers in

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Edo State. In contrast, Emere and Nasiru (2009) reported Coleoptera, Diptera, Plecoptera and Odonata as the most dominant in a stream in Kaduna while Omoigberale and Ogbeibu (2010) reported Ephemeroptera, Decapoda, Diptera, Oligochaeta, Odonata as dominant groups.

Eleven families of benthic organisms were recorded in this study. Dipterans were represented by two families, Chironomidae and Tanypodinae. Chironomidae comprises of five species, *Ablabesmyia* sp*., Chironomus fractilobus, Chironomus transvaalensis, Clinotanypus maculatus* and *Polypedilum* sp*.* while Tanypodinae comprises of a single species, *Pentaneura* sp. Both families were evenly distributed across the three stations with much presence in stations 2 and 3. Members of the dipterans are less dependent on dissolved oxygen for respiration in water, rather they rely on a special breathing apparatus known as snorkel to capture enough oxygen at the water surface (Hadley, 2015). An abundance of dipterans suggests that the environmental conditions in a freshwater ecosystem may have deteriorated (Hadley, 2015). Erosional materials deposited into station 2 are transported along the river into station 3 which may have also affected the diversity of benthic organisms present in station 3. Odonata, the second dominant group consists of the families Coenagrionidae (*Coenagrion scitulum*), Corduliidae (*Epicordulia* sp.), Gomphidae (*Phyllogomphus* sp.) and Lestidae (*Lestes* sp.) which were evenly distributed across the three stations with the highest in stations 2 (midstream) and 3 (downstream) compared to station 1. Odonata such as dragonflies (nymphs) has the adaptive potentials to tolerate some levels of degradation of water quality (Hadley, 2015). Members of the order found in the family Corduliidae and Lestidae are known to access dissolved oxygen in water via the gills, which is located in the abdomen for developing stages of dragonfly and damselfly. Other adaptive methods for oxygen intake include moist skin. Some members of Lestidae move to the surface of the water to expose their abdomen and push air into their internal gills (Hadley, 2015).

Members of the Haplotaxida with families such as Naididae and Tubificidae were the third dominant group in this study. Members of the order are known to be present in a polluted environment. The fourth dominant family known as Baetidae from the ephemeropterans group consist of two species such as *Baetis* sp. and *Afroptilium* sp. which are evenly distributed across the three stations with the highest in station 1 compared to the two other stations. Members of the order Ephemeroptera are known to inhabit areas in streams or rivers that are devoid of pollution due to their lifestyle. The increased abundance in station 1 compared to station 2 and 3 is a further indication that station 2 and 3 could be facing some level of water quality degradation.

The orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) are pollution sensitive taxa which give the EPT index in water quality assessment. The index measures the ratio or percentages of benthic organisms in the three orders present in a sample to assess the water quality of a given water body. In this study, the EPT index cannot be determined since taxa in the order Plecoptera and Trichoptera were not observed in this study. The factor responsible for the absence of species in both orders is not clear but it could be due to the severe erosion affecting the river. Their absence may as well indicate the declining condition of the water quality of Oghan River along the sampled stations, especially in stations 2 and 3.

Across the three stations, the highest number of species was recorded in station 1, followed by station 2 while the least was recorded in station 3. The high abundance of benthic organisms in station 1 of the river, which is the upstream was expected. Careful observation showed reduced anthropogenic activities in station 1 which may be attributed to the inaccessible terrain of the station, unlike station 2. In relation to biological indices, station 1 had the highest species diversity, richness and lowest species evenness, while station 2 had the least species diversity. Station 3 recorded the least species richness and the highest species evenness. The result of the indices also corroborates the fact that anthropogenic activities may be affecting the diversity of benthic organisms at midstream and downstream of the river compared to the upstream.

The correlation matrix shows that a significant relationship exists between the physicochemical parameters, heavy metals and the benthic fauna recorded in this study. The result indicated that physicochemical parameters and heavy metals have a direct or indirect relationship in the abundance and decline of certain benthic organisms in an aquatic ecosystem. Although most physicochemical parameters and heavy metals show varying (positive and negative) correlations with benthic fauna, pH and chromium show a consistent negative correlation with *Chaetogaster* sp., *Diplogaster* sp., *Nadium osborni, Nais simplex, Rhabditolaimus* sp. and *Tubifex* sp. across the stations while *Cardina africana, Chirinomous transvaalensis, Dero* sp*., Nais* sp*. and Pentaneura* sp*.* did not show any significant

correlations with the physicochemical parameters and heavy metals in the study. Arimoro *et al*. (2007) reported that dissolved oxygen, biochemical oxygen demand and nitrates were positively correlated with macroinvertebrate density of Ase River.

Conclusion: The biogeochemical cycles in sediments and benthic invertebrate diversity present are useful indicators of the prevailing factors in freshwater ecosystems. The elevated levels of organic pollutants and heavy metals reported in this study and the abundance of chironomid species indicated that anthropogenic activities could be impacting the water quality and benthic community of the river. There is a need for regular assessment of the river to monitor the water quality and its implication for aquatic biodiversity, water resources management and public health.

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