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An Assessment of Benthic Macro-invertebrate Fauna in Middle Course of Otamiri River, Imo State, South-Eastern Nigeria, Nigeria.

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Abstract: *Assessment of composition and diversity of Benthic Micro-invertebrate fauna of Otamiri River, Imo State was conducted between the months of June and August, 2015. Water samples were collected(fortnightly) from four sampling stations established along the river channel for 3 months.Physico-chemical parameters analyses were done using conventional field and standard laboratory techniques. Hydrogen ion concentration mean value of 5.106ppm was obtained. Dissolved Oxygen recorded a mean value of 4.608ppm, Alkalinity recorded a mean value of 103.917ppm, while Carbon (IV) Oxide recorded a mean value of 12.488ppm. Chloride recorded a mean value of 56.292ppm, Hardness recorded a mean value of 81.583ppm, and BOD recorded a mean value of 0. All these parameters differs significantly ($p<0.05$). Four taxa of benthic micro-invertebrate in two phyla: Mollusca and Arthropoda were identified. Gastropod (Melanoidestuberculata) an indicator of organically polluted water had highest percentage abundance of (53.4%) and highest diversity (Shanon-Wiener's index (H) =2.4%) while Gabiellaafricana had lowest percentage abundance of (6.9%) with diversity (Shanon-Wiener's index (H) =0.900). Meanwhile, Sybiocladisspp was found to be most evenly distributed with equitability(J=0.979) while Gabiellaafricana constituted the least evenness (J=0.819).*

Keyword: *physico-chemical parameters, Benthic macro-invertebrate and Otamiri river*

1. INTRODUCTION

Benthic macro invertebrate fauna are those organisms that live on or inside the deposit at the bottom of a water body (Barnes and Hughes,1988; Idowu and Ugwumba,2005).Many groups of organisms have been used as indicators of water quality or environment changes in fresh water bodies, including Plankton, Macrophytes, protozoan, fish and other animals (Chukuwu and Nwankwo, 2003; Atobatele*et al.*,2005, Woke and Wokoma, 2007). Of these, benthic macro-invertebrates have been most extensively used, especially in lotic waters to monitor and asses overall health of the aquatic environment, as they serves as good candidates for long term monitoring program relating to anthropogenic impacts (Simboura*et. al.*, 1995; Ogbeibu and Oribhador, 2002; Frances and Emeka, 2006; Emere and Nasiru, 2007; Bamikole*et. al.*, 2009; Spaak and Bauchrowitz, 2010); Benthic macro-invertebrate are relatively sedentary and long lived, they occupy an important intermediates tropic position, and they respond differentially to varying environmental conditions.

However, Simboura*et. al.*,**(**1995) reported that benthos vary greatly in their response to variation in water quality, which ranges between relatively tolerant (e.gChironomus larvae, Tubifex larvae, Leehes,*Physaspp, Bulinusspp, Indoplanobisspp*,etc), to sensitive species (Stone flies, May flies, Water beetles, etc).By the foregoing therefore, examining shifts in the benthic communities over time could provide understanding into the major environmental events and process affecting the resident biota (Heyland*et. al.*,1996; Tyokumbur*et al*.,2002; Oben*et al*., 2003; Woke and Wokoma, 2007)).

Otamiri River is constantly being subjected to various anthropogenic contaminants from various activities around the river that ranges from agriculture, industrial and domestic activities. The effect of these contaminants may have a deteroratory effects on the inhabitant organisms and the entire surrounding populace. Though there have been subjects of much research on macro-invertebrate

which includes; the quick assessment of biological resources for conservation purpose and the reduction of pollution through differences between predicted and actual fauna assemblages (Miserendino, 2001), few have being documented on Otamiri river; hence the need for the assessment of composition, abundance and distribution of benthic macro-invertebrate fauna of the river.

2. MATERIALS AND METHODS

Study Area Description

Otamiri River is located within the tropical rainforest belt of Nigeria and lies between latitude $5^{o}23^{o}$N and $5^{o}30^{o}$ and longitude $6^{o}58^{o}$ E to $7^{o}04$ E. The region experiences a mean annual temperature of 27^{o} C and an annual rainfall of 200-300mm, with most of the months (April to November) characterized with high rainfall (Iloeje, 1979). The area is low lying being generally about 300m above sea level (Emmanuel, 2007). The river runs from Egbu, where it has its major recharge resource and cuts through Nekede, Ihiagwa, Eziobodo, Olokwumuisi,Mgbirichi, Umuagwoand finally to Ozuzuin Etche town of river state of Nigeria, where it finally joins to the Atlantic ocean(Anyanwu 2009). The river serves the aforementioned transverse communities as main sources of water for Industrial, Agricultural, and Domestic use.

Sampling Design and Sampling Station

Four (4) sampling stations were selected for study in Otamiri river. The sampling stations were selected based on their proximity to the different effluents discharge point and the different human activities around the river while water sampling for physico-chemical parameters and sediment sampling for benthic macro-invertebrate fauna were carried out fortnightly for three months (June-August, 2015) within 08:00-12:00 hours on sampling days.

Sample Collection

Surface water samples for chemical parameters was collected from all sampling stations in plastic bottles and transported to the laboratory for analysis.

Water sample for dissolved oxygen was collected in 250ml glass sampling bottles. The bottles were filled with water and cork under water, making sure that no air bubble is trapped in the bottle. The bottles was then carefully open and fix with 2ml each of Winkler's solutions A and B accordingly, as described by Mackereth (1963) and transported to the laboratory for analysis.

Watersample for Biochemical Oxygen Demand (BOD) was collected in 250ml amber sampling bottle and incubated in a dark polythene bag and transportation to the laboratory. The sample was later fixed after 120hrs (5 days) with 2ml each of Winkler's Solution A and B respectively as described by (APHA, 1998).

Also, sediment samples for benthic macro-invertebrate sample from each sampling stations were hauled using a van- veen grab into a pre-label polythene bags and transported to the laboratory for further analysis.

Sample Analysis

Analysis was done in two stages: field analysis and laboratory analysis. The fieldwork involved *in situ* measurements and Laboratory analysis of the chemical parameters and benthos was carried out in the Department of Fisheries and Aquaculture Technology Laboratory, Federal University of Technology Owerri, Imo State.

Water temperature was measured with mercury-in-glass thermometer. The thermometer was immersed into the water and allowed to assume the water temperature before reading. The reading was taking while the thermometer was still in water in other to avoid interference with ambient temperature and recorded in degree Celsius (^{O}C).

Also, transparency was measured on field using Secchi-disc as described by Ruttner (1963). The disc was lowered into the water; the visibility point of the disc was measured thereafter with a meter rule and recorded in meter (m).

Likewise, water current was determined with the aid of a floater, meter rule and stop watch.

pH was determined using a pH meter (Jenway; Model-3505). The glasses electrode of the meter was immersed in the water and read off.

Nitrate (NO_3)

This was determined by colorimetric method (APHA, 1992) using a UV/VIS/ Spectrophotometer (Jenway; model-6850).

DO and BOD

Thesewere measured by titration method(APHA, 1998). While other chemical parameters were determined using Lamotte Fresh Water test kit, model AQ/2-3, code 3633-03.

Analysis of the Benthic Macro-invertebrate fauna

In laboratory the sediments collected were washed thoroughly using a sieve of 0.595 mesh size(U.S standard number 30.). The Benthic Macro -invertebrate were sorted, counted and preserved with 10%formalin solution prior to identification. Identification was done using guides provides by Hawking (2000), Odiete1999; APHA/AWWA/WEF/ 1992; Pennak 1978).

Statistical Analysis.

Descriptive statistics was used to analyze the data. One–way Analysis of Variance (ANOVA) was used in all cases for mean comparisons at 5% level of significance, using SPSS Version 22.0 (PEC, 2008).The analysis of the macro benthic invertebrate was made with a combination of indices. Species diversity and evenness was determined with Shanon-Wiener's index (H), Margalef's index (D), and Equitability (J).

3. RESULT

Physico-Chemical Parameters

The result of the physico-chemical parameters of the Otamiri River Imo State, South-Eastern Nigeria which was across the sampling stations from June to August 2015, is shown in Table 1 and figure 1 respectively.

Benthic Macro-invertebrate Fauna of Otamiririver

The distribution pattern of the recorded Benthic Macro-Invertebrate fauna in OtamiriRiver during the study period ispresented in figure 2.Two phyla (Mollusca and Arthropoda) comprises of two classes (Gastropoda, and Insecta), containing four (4) genera were recorded. Mollusca were represented by one class-Gastropoda, while Arthropoda accounted for the other one class; Insecta represented by order Diptera.

*Mellanoidestuberculata*constituted the highest abundance of the total identified organisms, while*Gabiellaafricana*accounted for the least abundance in the river during the study period. Furthermore, *M. tuberculata*generally had the highest diversity index (H = 2.496) in the overall sampled while *Gabiellaafricana* was the least diverse at H = 0.900. However the obtained result revealed *Symbiocladis*sp (Chironomus larvae) accounted for the highest equitability (J = 0.979), followed by *M. tuberculata* (J = 0.946), *Tubifex*sp (J = 0.945), and *Gabiellaafricana* accounted for the least equitability of J = 0.819.

The Spatial variations showed that, the highest diversity index and evenness was constituted by M. *tuberculata*in sampling station 4

Table1. *Descriptive Statistics of the Physico-chemical Parameters of Otamiri River, Imo State between June and August, 2015*

Parameter	Minimum	Maximum	Mean	Standard error
Temperature(^{o}C)	27.0	30.3	28.504	0.208
Transparency(m)	1.1	1.7	1.236	0.035
Current (m/s)	0.1	1.3	0.289	0.049
pH	4.6	6.0	5.106	0.094
Ammonia (ppm)	0.38	1.0	0.686	0.049
Nitrate (ppm)	0.1	0.8	0.362	0.045
Alkalinity (ppm)	4.0	180.0	103.917	11.761
CO_2 (ppm)	5.0	20.0	12.458	0.761
Chloride (ppm)	40.0	85.0	56.292	3.443
Hardness (ppm)	50.0	175.0	81.583	7.568
DO (ppm)	4.0	5.2	4.608	0.089
BOD (ppm)	0.4	1.0	0.810	0.043

CO_2 = Carbon IV Oxide, DO = Dissolved Oxygen and BOD = Biochemical Oxygen Demand

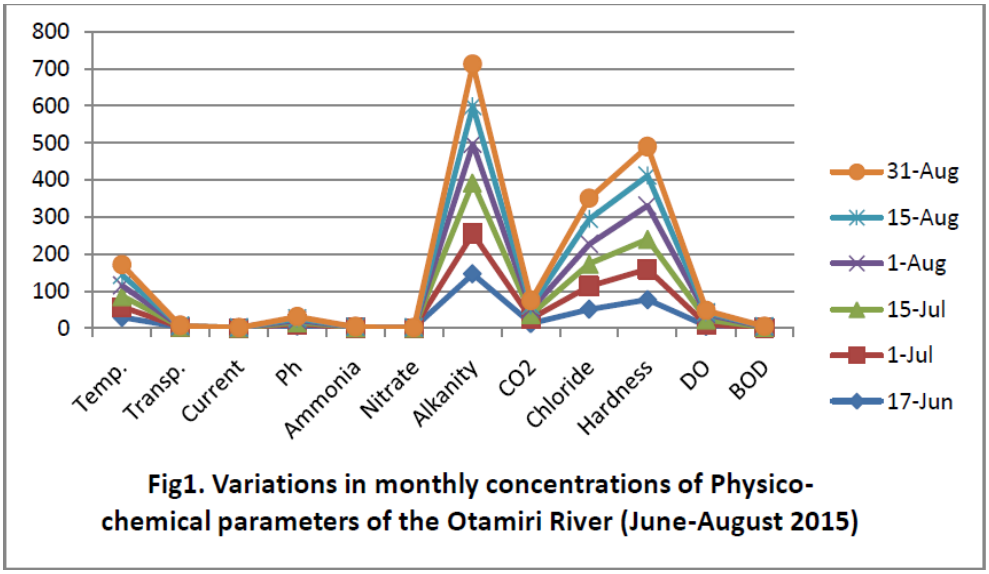

Fig1. Variations in monthly concentrations of Physico-chemical parameters of the Otamiri River (June-August 2015)

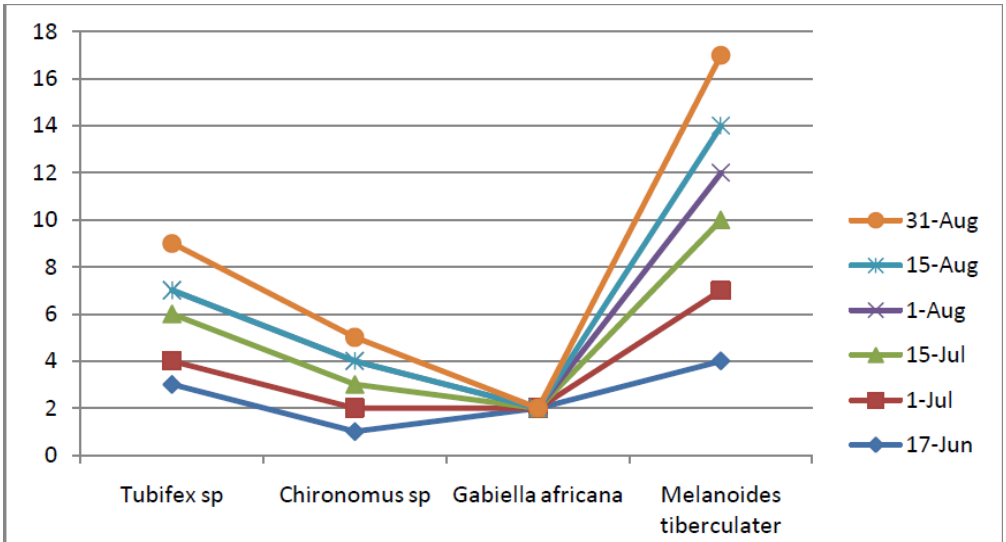

Fig. 2. Variations in monthly concentrations of Benthic Macro-invertebrate fauna of the Otamiri River (June-August 2015)

4. DISCUSSION

Physico-Chemical Parameters Of The River

All the parameters measured fell within the recommended levels for aquatic practices (Boyd, 1979), except transparency that was relatively low. This could be attributed todecreased photosynthetic activities of phytoplankton which may reduce free Carbon (iv)oxide content of the water, dissolutions of ions and high suspended particles, the lotic nature of the rivers and the season of the year, as observed in during the study period (Hall *et al.*, 1977; Egborge, 1994; Ikomi and Owabor 1997; Ikenweiwe and Otubusin, 2005; Gupta and Gupta, 2006, Ayoade*et al.*, 2006;Atobatele and Ugwumba, 2008).

Benthic Macro-Invertebrate Community Of Otamiri River

The Benthic macro-invertebrate fauna composition of Otamiri River was characterized by low taxa number. This is not unusual in tropical waters; for instance, in Lake George. Uganda, the bottom fauna was poor in species (Darlington, 1977). Victor and Dickson (1985) and Umeozor (1995) also observed a similarly low taxa number and diversity in Ikpoba River and Calabar River, Nigeria respectively. Edokpayi*et al.*, (2000), Ogheibu (2001), Adakole and Annune (2003) also reported low taxa number in some tropical streams and rivers. They ascribed this low species diversity to some physicochemical conditions of water like fast flow, high pH, low dissolved oxygen and low conductivity. These factors probably caused disruption of life cycle, reproductive cycle, food chain

and migrations or imposed physiological stress on even the tolerant Benthic macro-invertebrate (Adakole and Annune. 2003). The most important factors which influence the abundance and distribution of macro-invertebrates apart from physical and chemical qualities of water include habitat area, immediate substrate, trophic structure, resource partitioning and predation (Bishop, 1973; Ogbeibu and Victor, 1989;Ogbeibu and Egborge, 1995).

Hence, in the case of Otamiri River, the low taxa number observed agreed with the previous reports which could have result from the perturbation effects of various anthropogenic discharge from its surrounding industries, populace and the agricultural practices.

5. CONCLUSION

The presence of the pollution tolerant benthos species (*M. tuberculata, Symbiocladus*sp and Tubifex larvae) was an indication of a perturbed environment which might be ameliorated by the flowing nature of the river. Also, the dominance nature of *Melanoidestuberculata*in the river confirmed the released of organic contaminants into this environment.

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