© 2017 IJSRST | Volume 3 | Issue 7 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Impact of Water Quality Pertubation on the Zooplankton Community of Orashi River, South- South, Nigeria

Friday Upadhi, *Wokoma O. A. F
Department of Biology, Faculty of Natural and Applied Sciences, Ignatius Ajuru University of Education, Rumuolumeni, P. M. B 5047, Port Harcourt, Rivers State, Nigeria

ABSTRACT

Zooplankton abundance and diversity in any water body is a function of its (water) quality status. Accordingly, the zooplankton community of Orashi River was studied over a six- month period (February -July, 2016) in relation to water quality perturbation. Five sampling stations were established, and standard method was deployed in the collection and analysis of sub- surface water samples for physico-chemical parameters as well as zooplankton identification and enumeration. Numerical estimation of zooplankton was done under microscope using Sedge-Wick Rafter counting chamber. Mean concentrations of the physico-chemical parameters vary across the stations and similar to previous study within the Niger Delta. A total of 27 species of zooplankton belonging to 4 classes were identified and 91 individuals enumerated in this study. The dominant class was Protozoa with 50 individuals (54.94%), followed by Copepoda with 16 individuals (17.58%), Rotifera with 13 individuals (14.29%) was next and finally Cladocera 12 individuals (13.19%). Percentage total occurrence of zooplankton across sampling stations was high in stations 4, 5 and 1 with 31, 27 and 23 individuals respectively, while that of 2 and 3 are low with only 7 and 3 individuals respectively. Only indivduals of class protozoa were observed in all 5 sampling stations, copepod and cladocera were not observed in station 2 and in station 3 rotifera and cladocera were not recorded. Similarly, protozoa was the dominant class in all stations except station 3 where copepod was encountered more, indicating that zooplankton of class protozoa are more favoured to survive in the current environmental condition of the Orashi River. It is therefore concluded that the spatial fluctuations of zooplankton class and species abundance is a response to the variations in the concentration of physicochemical variables of the study area.

Keywords : Zooplankton, Orashi River, Physico-chemical parameters, Protozoa, Rotifera

I. INTRODUCTION

Zooplanktons are free floating aquatic invertebrates, usually described as microscopic since they cannot be seen with the unaided eye, with their size ranging from a few to several micrometers (Ovie, 2011). Zooplankton plays a major role in the functioning and productivity of aquatic ecosystems through its impact on nutrient dynamics and its key position in food webs.

Water of good (or of the required) quality is a necessity for the optimal functioning of all aquatic organisms. Water can be polluted or its quality compromised when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds. Water pollution affects plants, animals and other organisms, living in the water, and in almost all cases the effect is damaging not only to individual species but, also to the natural biological community. Zooplankton makes excellent indicators of environmental conditions and aquatic health within the aquatic environment because they are sensitive to changes in water quality. Indeed, they respond quickly to some factors such as, low dissolved oxygen levels, high nutrient levels, toxic contaminants, poor food quality or abundance, and predation (Khan, 2003; Hassan, 2008). According to Abbai and Sunkad, (2013) the growth and intensity of zooplankton solely depends on biological, chemical and physical factors and they survive under varying degrees of environmental conditions. Similarly, the distribution and abundance of zooplankton in their communities depend on many factors such as, change of climatic condition, physico-chemical parameters and vegetation cover (Ekpo, 2013). The distribution pattern of zooplankton changes in the species composition as well as the diversity; in response to the changes and or deterioration of the water quality. Information on the water quality disturbances on the zooplankton community of Orashi River is lacking and thus the need for this investigation.

II. METHODS AND MATERIAL

Study Area

The Orashi River (which is the study area) is located between latitude 50^{0} $45^{'}$ and 60^{0} 15'N and between

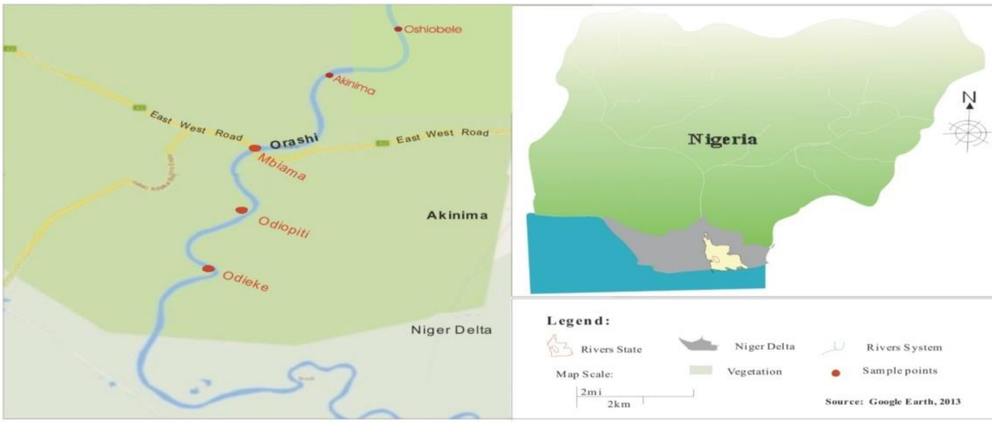

Figure 1 : Map of Orashi River showing sampling stations

longitude 40^{0} 50' and 50^{0} 15'E with an elevation of 270 meters above sea level. The area is inhabited by two (2) ethnic groups (the Engenni's and the Ekpeye's), both on either side of the river. Orashi River, which has its center lying at latitude of 4.73522, and longitude of 6.76014 with an elevation of 270 meters above sea level, (Enetemi and Ebiotu, 2017), is a crucial resource for all the surrounding communities. In dry season, water entering the system comes from flood plains and drainages up-stream such as Onosi, Omoku, Ndoni and Oguta Lake. In wet season, (September -October), the Orashi is swollen by the overflow of the Niger flood which enters the Orashi mainly through Ndoni creek. Human activities along the study area are mainly dredging, illegal crude oil refining, transportation, fishing, markets, dump sites, storage, jetties etc.

FIELD METHODS

Water samples were collected monthly for a period of six months (February-July 2016) at five different stations along the River. Surface water samples were collected, transported to the laboratory and analyzed according to standard methods (APHA, 2005) for physico-chemical parameters such as pH, dissolved oxygen (DO), biological oxygen demand (BOD), nitrate, phosphate, chloride, electrical conductivity (EC) and ammonia, while Temperature was determined in-situ. Water samples for zooplankton were collected using plankton net made of bolting nylon cloth (No; 25 and 60 μ in size) by sieving a known volume of water. Samples were stained with eosin and preserved with 4% formalin in 50 ml bottles before transporting to the laboratory. Numerical estimation of zooplankton was done under microscope using Sedge-Wick Raftar counting chamber. Average 10 counts were made for each sample.

III. RESULTS AND DISCUSSION

The result of water physico-chemical analysis (presented in Table 1) showed spatial variation in all the parameters investigated. It further indicates that the highest value of pH - 6.72±0.27 was observed at station 3, while the lowest value of 5.58±0.27 was gotten in station 4. This could be as a result of the high level of human activities in station 3 relative to the other stations. However, that of temperature varied from a low of $26.65±0.91^{0}$C (observed in station 4) to a high of $27.10±1.29^{o}$C (recorded in station 3) which is in tandem with other studies in similar environment. Nutrient loading resulting from agricultural, industrial and other anthropogenic activities could be responsible for the temperature variations among the stations. The concentration of Dissolved oxygen varied from 4.5±0.84mg/l to 5.1±0.57mg/l obtained from Stations 2 and 3 respectively. Values for Biochemical Oxygen Demand fluctuated from a high of 2.15±0.56 to a low of

1.48±0.34 gotten respectively from stations 2 and 3, indicating that the water is clean, (Hynes, 1960). Peak concentration values of Nitrate and Phosphate were gotten in stations 3 and 2/3 respectively, while the lowest concentrations were observed in stations 5 and 1 respectively. The highest (20±4.69) concentration of Chloride in this investigation was obtained in station 2, while least value (9±0.98) was observed in station 5. TDS highest value of 34±4.99 was obtained in station 2, while lowest value of 19±2.85 was gotten in station 5. The highest (65±10.61) and lowest (36±5.45) values of Electrical conductivity were gotten in stations 2 and 5 respectively.

Table 1: Mean values (±SD) of physico-chemical parameters in surface water of Orashi River

STNS	pH	Temp. (^oC)	DO (mg/l)	BOD (mg/l)	Nitrate mg/l	Phosphate (mg/l)	Chloride (mg/l	TDS (mg/l)	EC (µs/cm)
1	6.38±0.22	26.85±1.07	5.0±1.00	1.83±0.70	2.86±1.81	0.34±0.12	12±2.31	24±2.87	45±6.33
2	5.62±0.34	26.97±1.53	4.5±0.84	2.15±0.56	4.15±2.32	0.52±0.20	20±4.69	34±4.99	65±10.61
3	6.72±0.27	27.10±1.29	5.1±0.57	1.48±0.34	2.86±1.96	0.52±0.20	13±4.99	25±3.08	47±6.85
4	5.58±0.27	26.65±0.91	4.8±0.74	2.07±0.51	2.40±2.62	0.52±0.20	10±1.96	22±4.22	41±8.40
5	6.22±0.17	27.07±1.20	4.9±0.57	2.00±0.36	1.05±1.70	0.26±0.19	9±0.98	19±2.85	36±5.45

Result of the biological assessment presented in Table 2 indicates that a total of 91 individual organisms of zooplankton belonging to 4 classes were enumerated in this study. The most dominant class was Protozoa represented by 50 individuals (54.94%), followed by Copepoda with 16 individuals representing 17.58%, Rotifera 13 individuals representing 14.29% and Cladocera with 12 individuals representing 13.19% in decreasing order of magnitude (see Fig.1). Percentage occurrence of zooplankton across sampling stations indicate that station 4 has the highest occurrence of 30.04% with 31 individuals (Protozoa -16, Copepoda -3, Rotifera -7 and Cladocera -5) followed by Station 5 with 27 individuals representing 29.67% (Protozoa - 17, Copepoda - 2, Rotifera - 2 and Cladocera - 6), next is Station 1 with a total of 23 individuals representing 25.27% (with Protozoa having 10 individuals, Copepoda - 9, Rotifera -3 and Cladocera -1). At the rear are Stations 2 and 3 with 7 individuals -7.69% (Protozoa - 6 individuals and Rotifera -1) and 3 individuals representing 3.30% (Protozoa -1 individual and Copepoda 2) respectively. While Copepoda and Cladocera were not represented in station 2, Cladocera and Rotifera were not observed in station 3 (Fig. 2).

Table 2 : Zooplankton species checklist and total/ percentage abundance in Orashi River

	Taxa	Org/ml	%
S/NO	***Protozoa***	**50**	**54.95**
1.	*Difflugia spp*	18	36
2.	*Tintinnidium entzii*	1	2
3.	*Euglypha alveolata*	1	2
4.	*Paramecium spp*	8	16
5.	*Pseudodifflugia spp*	3	6
6.	*Dileptus binucleatatus*	6	12
7.	*Trinema spp*	7	14
8.	*Uritrichia sapraphila*	1	2
9.	*Notommata aurita*	1	2
10.	*Presodon avura*	3	6

11.	*Alonella exigna*	1	2
	Copepoda	**16**	**17.58**
12.	*Polyphemus pediculus*	2	12.5
13.	*Paracyclops fimbriatus*	2	12.5
14.	*Mesochra suifunensis*	4	25
15.	*Tropocyclops prasinus*	4	25
16.	*Codiaptomus sinensis*	2	12.5
17.	*Thermocyclops taihokuensis*	2	12.5
	Rotifera	**13**	**14.29**
18.	*Dicranophorus forcipatus*	2	15.38
19.	*Brachinus falcatus*	6	46.15
20.	*Epiphanies senta*	2	15.38
21.	*Euchlanis triqutra*	3	23.08
	Cladocera	**12**	**13.19**
22.	*Diaphanosoma*	2	16.67
23.	*Rnynchotalona falcate*	2	16.67
24.	*Cerrochaphina setosa*	2	16.67
25.	*Simocephalus serrulatus*	2	16.67
26.	*Pleuroxus denticulatus*	3	25
27.	*Moinodaphnia macheayii*	1	8.33
	Total	**91**	**100%**

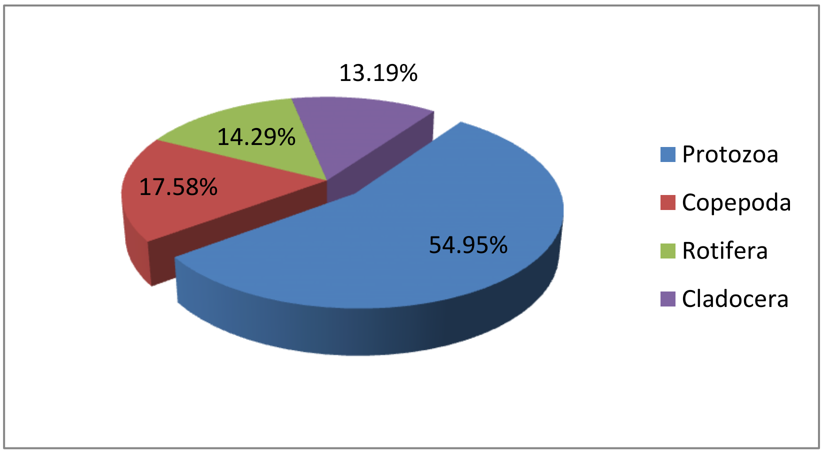

Figure 2 : Zooplankton Percentage Class abundance in Orashi River

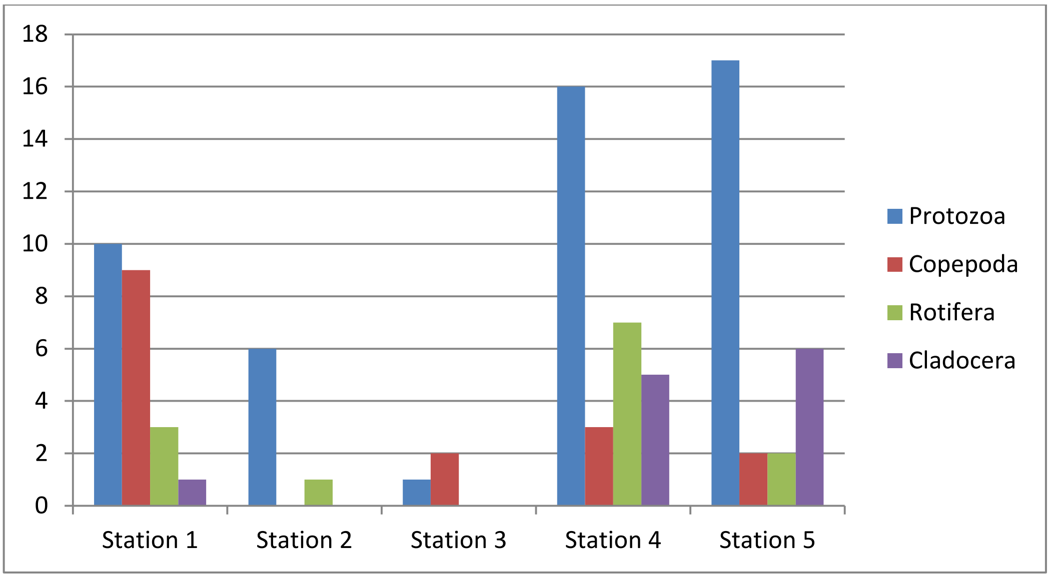

Figure 3 : Spatial variation of Zooplankton class abundance in Orashi River

The 27 species of zooplankton identified in this study was higher than the 17 and 21 species recorded by Ezekiel, Ogamba and Abowei (2011) in the fresh water axis of Sombreiro River and Ude *et al* (2011) in the Echara River, South- Eastern Nigeria respectively, but comparable to the 28 species by Waidi *et al*., (2016) in a Tropical Coastal Estuary, South- West Nigeria and 32 species observed in Elechi Creek by Davies *et al*., (2009). However the result obtained in this study is lower than the 47 species recorded by Maryse *et al*, (2016) in a Tropical Coastal Lagoon, Cote d' Ivoire, 98 species observed by Imaobong (2013) in a Tropical Rain Forest River in the Niger Delta and the 119 species reported by Emmanuel *et al*, (2013) in the Bonny estuary. The dominant class observed in this study was protozoa followed by copepod, rotifer and cladocera. The dominance of protozoa had earlier been reported by Adeyemi *et al.*, (2009) and Onwuteaka and Edoghotu, (2017). Dominance of protozoa in this study is in contrast with the study of Shekhar *et al*, (2008) and Abbai and Sunkad (2013) who reported rotifer as the most dominant species, followed by cladocera and copepoda.

The correlation between Zooplankton total abundance and physico-chemical parameters showed a significant negative relationship with Temperature, Total Dissolved Solids, Electrical Conductivity, Nitrates, Phosphate, and Chloride at 95% confidence limit. It however correlated positively with Dissolved Oxygen and Biochemical Oxygen Demand though not significantly. Chloride showed a strong positive relationship with Total Dissolved Solids, Electrical Conductivity, Nitrate and Phosphate and a significant negative relationship with Dissolved Oxygen. pH and Dissolved Oxygen correlated positively with Temperature but negatively with TDS, EC, and Chloride.

The zooplankton class and species variation across the five sampling stations in this study can be attributed to the spread of anthropogenic activities. Stations 2 and 3 which are the most disturbed had fewer individuals and only two classes of zooplankton relative to the other stations. Zooplankton abundance and distribution observed in this study corroborate the findings of Abbai and Sunkad (2013) that the abundance and distribution of plankton is influenced by the release of domestic wastes, cleaning/washing of vehicles and clothes, floral coverings, bathing and other anthropogenic activities which contaminate or pollute surface water bodies, as well as that of Ekpo (2013) who concluded that the distribution of zooplankton communities depends on many factors, such as physicochemical variables, vegetation cover and climatic condition. The prevalent environmental condition in the study area seem to selectively favour zooplankton of class protozoa over and above the other classes which accounts for over 50% (precisely 54.95%) of the total number of individuals enumerated (see Table 2). This observation is in consonance with the record of Wokoma (2016) who also reported that protozoa accounted for 51% of the total number of individuals enumerated followed by rotifera -24%, copepoda -14% and cladocera -11%. Adeyemi *et al* (2009) had earlier concluded that the variation of zooplankton in terms of abundance and diversity is a function of limnological features as well as the trophic state of the water body.

IV.CONCLUSION

It is therefore concluded that the spatial fluctuations of zooplankton class and species abundance and distribution is a response to the variations in the concentration of physicochemical variables of the study area.

V. REFERENCES

[1] Abbai, S.S. and Sunkad, B.N. 2013. Effect of anthropogenic activities on Zooplankton population of sogal pond, Belgaum District, Karnataka, India. Research Journal of Recent Sciences 2(7): 81-83

[2] Adeyemi, S. O., Adikwu, L. A., Akombu. P.M. and Iyala,J. I. 2009. Survey of zooplankton and macroinvertebrates of Gbedikere lake Bassa, Kogi Stae, Nigeria. International Journal of Lakes and River, 2(1): 37-44

[3] APHA .2005. *Standard Methods for Examination of water and waste water*. Washington DC, American Public Health Association.

[4] Davies O. A., Tawari C. C. and Abowei J. F. N. 2009. Zooplankton of Elechi Creek, Niger Delta, Nigeria. Environ Ecol., 26(4c): 2441 -2446.

[5] Ekpo I.E. 2013. Effect of physico-chemical parameters on Zooplankton Species and density of a tropical rainforest river in Niger Delta, Nigeria using canonical cluster analysis. The Int. J. Eng. Sci. (IJES), 2(4): 13-21.

[6] Emmanuel, U., Jude, O., George, I. U., Raymond, A., Cletus, I. and Isaac, O. A. 2013. The taxa structure and composition of zooplankton communities of Bonny Estuary: A bio-indicator of anthropogenic activities. The pacific J. of Science and Techn: 14(2): 635-641.

[7] Enetimi, I. S. and Ebiotu, P. K. 2017. Diversity and levels of bacteriological contamination in Orashi River, Mbiama Community, Rivers State, Nigeria. Journal of Advances in Microbiology, 4(3), 1 -6.

[8] Ezekiel E. N., Ogamba E. N. and Abowei J. F. N. 2011. The Zooplankton species composition and abundance in Sombreiro River, Niger Delta, Nigeria. Asian Journal of Agricultural Sciences, 3(3): 200 -204.

[9] Khan, R. A. 2003. Fauna diversity of zooplankton in fresh water wetlands of Southeastern West, Bengal zoological survey. Records of the zoological survey of India. Ocassional paper. No. 204, pp107p (published by the director zoological survey of India, Kolkata

[10] Hassan, M. M. 2008. Ecological studies on zooplankton and macrobenthos of lake Edhu, Egypt. Ph. D. Thesis, Ain Shames University, Faculty of Science, Zoology Dept., Cairo Egypt.

[11] Hynes, H. B. N. 1960. The Biology of polluted waters. Liverpool, Liverpool University Press.

[12] Imaobong, E. 2013. Effect of physico-chemical parameters on zooplankton species and density of a tropical rainforest in Niger Delta, Nigeria, using canomical clauster analysis. The Int. J. of Engineering and Science: 2(4): 13-31.

[13] Maryse, N. A., Raphael, N. E. and George, K. B 2016. Anthropogenic activities impacts on zooplankton community in a tropical coastal Lagoon (Ebric Cote D' Ivore). Int. J. of contemporary Applied Science: 3(9), 2308-1365.

[14] Onwuteaka, J. and Edoghotu, A. J. 2017. Zooplankton fauna of a Creek receiving Petroleum Refinery effluent in South-South, Nigeria. Applied Science Reports: 18(2), 41 -46.

[15] Ovie S.I. 2011. A synopsis of the Zooplankton fauna of lakes kainji and jebba. In: Forty years on lake Kainji fisheries research. Eds: Raji, A., Okaeme, A.N. and Ibeun, M.O. NIFFR, *New-Bussa*, Nigeria. 1:133-143.

[16] Shekhar, R. T., Kiran, B.R., Puttaiah, E. T., Shivaraj, Y. and Mahadevan, K.M. 2008. Phytoplankton as index of water quality with reference to industrial pollution. J. Environ. Biol. 29, 747-752.

[17] Ude, E.F; Ugwu, L.L.C. and Mgbenka, B.O. 2011. Evaluation of Zooplankton diversity in Echara River, Nigeria. Continental J. Biological Sciences 4 (1): 1- 5

[18] Waidi, O. A., Kehinde, O. A., Isaac, T. O., Dominc, O. O., Temilola, E. A. and Akinpelu, E. O. 2016. The effects of environmental parameters on zooplankton assemblages in tropical coastal estuary, South-West Nigeria. Egyptian J. of Aquatic research; 42: 281-287.

[19] Wokoma, O. A. F. 2016. Zooplankton species composition and abundance in the brackish water axis of Sombreiro River, Niger Delta. Applied Science Reports, 15(1), 31 -34.