Greener Journal of Geology and Earth Sciences

ISSN: 2354-2268

Submitted: 21/12/2016
Accepted: 23/12/2016
Published: 27/12/2016

DOI: http://doi.org/10.15580/GJGES.2016.3.122116218

Sedimentary Assessment of Basic River in the Niger Delta: A Case Study of Orashi River in the Eastern Niger Delta of Nigeria

By

Seiyaboh EI
Alagha WE
Angaye TCN

Research Article (DOI: http://doi.org/10.15580/GJGES.2016.3.122116218)

Sedimentary Assessment of Basic River in the Niger Delta: A Case Study of Orashi River in the Eastern Niger Delta of Nigeria

[1]Seiyaboh EI, [2]Alagha WE and [1*]Angaye TCN

[1]Department of Biological Science, Faculty of Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria
[2] School of Applied Sciences, Federal Polytechnic of Oil & Gas Ekowe, Bayelsa State, Nigeria

*Corresponding Author's E-mail: maktarry@ yahoo.com

ABSTRACT

Ecosystem in the Niger Delta has become a sanctuary for most endangered species, including mangrove and several forest reserve. The ketstone role of River Orashi in the Niger Delta is remarkable. The quality of River sediment very key in defining the bioavailability of aquatic system. The sedimentary assessment of River Orashi was carried out in six sampling stations (Mbiama, Agbo, Akiogbologbo, Okaki and Okparaki), in both Dry and wet seasons. Result showed that; pH ranged from 6.53 - 7.05, while Electrical Conductivity ranged from 124.31 – 590.01 µS/cm. While nitrite was 0.12 - 0.47 mg/kg, nitrate ranged from 0.72 – 3.76 mg/kg. The values of Sulphate and Phosphate were; 0.33 - 0.85 mg/kg and 0.24 - 0.43 mg/kg. Calcium ranged from 3.68 – 8.03 mg/kg, while magnesium was 1.99 – 6.86 mg/kg. Sodium and potassium were reported as 2.23 – 4.47 mg/kg and 1.41 – 3.62 mg/kg respectively. Other results reported includes; Nitrogen (2.52 - 4.63 mg/kg), Organic carbon (7.78 - 10.51 mg/kg), Carbon-Nitrogen (2.23 - 3.51 mg/kg), Total Hydrocarbon Content as in THC (4.96 - 9.62 mg/kg). Also on a general note, other parameters monitored were moderate, while electrical conductivity (EC) and all nutrients (Calcium, Magnesium, Sodium, Potassium, Nitrite, Nitrate, Sulphate and Phosphate), were higher in the Dry season. Our findings revealed mild anthropogenic activities within the Orashi River. We therefore call on all stake holders and inhabitants around the River Orashi to desist from anthropogenic activities that could infringe on biodiversity or public health.

Key words: Sediment, Bioavailability, Biodiversity, Orashi River, Anthropogenic agents, Niger Delta

1.0 INTRODUCTION

Physico-chemical parameters play vital role in determining the bioavailability of an ecosystem (Abowei et al., 2010), they affect the productivity of aquatic organisms (Tobor, 1992; Deekae et al., 2010). There are several physicochemical parameters that affects water quality; they include but not limited to; temperature, dissolved oxygen, pH, salinity etc (Abowei 2010; Abowei et al., 2010). Interrelationships, to some degree exist between these parameters. For instance, temperature is an imperative abiotic parameter in determining the bioavalability of aquatic ecosystem including; mesophile, psycophyles, thermophiles, hyperthermophiles and other extrimophilic organisms.

Sediments are biological basal remnant or substances which are carried by the processes of abrasion the results from precipitation, especially through wind, water or ice, and sink down the abyss as sediment by gravitational force. Just like the soil in terrestrial ecosystem, sediment forms substrate with life-supporting agents like nutrients that inhabits micro flora and fauna and other aquatic organisms (Kautsky and Bolviken 1998; Obaje et al., 2014). Sediment also reflects the entire dissolved solids (TDS), or suspended solid which remarkably affects the depth, turbulence, allochthnous run-offs and also the flow dynamics of any river (Olorode et al., 2015). Sediment is a vital component of any aquatic system, due to the keystone role it plays in determining aquatic biodiversity of any aquatic system, and the pollution level (Waziri, 2014).

Provision of adequate potable water is essential in the combat against water related diseases (Ike & Ugodulunwa, 1999), especially in indigent community where inhabitant lack basic amenities (Agedah et al., 2015). From the foregoing, streams of waste from industrial, domestic and agricultural have become media of pollution of environmental pollution (Aremu *et al*., 2011), especially water pollution. The pollution of water bodies has become a global threat, which can result to public health problems and rapid decline in biodiversity.

The aesthetic value of river Orashi cannot be overemphasized, being a basic tributary that forms the triangular Niger Delta wetland basin. Sediment largely reflects anthropogenic activity of most river system (Waziri, 2014; Obaje, 2014). Due to precarious and unhygienic activities of uninformed inhabitants whose abode

align the Orashi river, the need to be cautious of anthropogenic activities around this river is worthy of note; as such it will be utmost to evaluate the level of sedimentary level of the river.

2.0 MATERIAL AND METHOD

2.1 Study Area

Orashi River is situated in Ahoda West Local Government Area of Rivers State in Nigeria. It is one of the three major tributary in Eastern Niger Delta. The Orashi River lies between latitudes 50º 45″ and 60º 35″ N and longitudes 40º 50″and 50º 15″ E. The Niger Delta is a wetland covering whose area is approximately 70,000 km2, rich in biodiversity with several keystone and endangered species. The under studied sample stations of the Orashi river includes: Mbiama, Agbo, Akiogbologbo, Okaki and Okparaki.

2.2 Sampling

Sediment samples were randomly collected in triplicates from the aforementioned sampling stations in both wet and dry seasons, using steel Ekman Grab (0.0225m^2), and dispensed appropriately into labelled containers. At each sampling point, the grab was cleaned prior sampling, the grab sampler was deployed and then heaved out with sediments after a successful grab bite. The sediment was scooped from the grab cup into a foil plate, and afterward transferred into various containers based on parameters to be analyzed. The samples were afterward transported to the Laboratory for analysis. All sampling methods followed standard protocol as described by APHA 1998 and American Society for Testing and Materials (ASTM).

2.3 Sample Analysis

The following parameters were analysed – pH, conductivity, Nitrite, Nitrate, Sulphate, available phosphate, Calcium, Magnesium, Sodium and Potassium, % Organic Carbon, Carbon/Nitrogen Ratio, Total Nitrogen (TN), and Total Hydrocarbon (THC). Prior to laboratory analysis the samples were air- dried, then ground in a mortar and sieved using a 2.00mm sieve (for pH and particle size) and 0.55mm for other analysis. All sampling protocols followed methodology as described by Sabo et al., (2013) and Issa et al., (2014).

2.4 Statistical Analysis

For the purpose of statistical in this research version 16 of SPSS software was applied. Results were recorded as mean ± standard deviation. Microsoft Excel package (2013 version), was used to plot all graphs.

3.0 RESULTS AND DISCUSSIONS

Figure 1 presents the pH and Electrical conductivity of the sediment. The pH of the sampling stations in this study, was lower in dry season (6.53 - 6.59), compared to wet season (6.84 - 7.05). While higher pH is alkalinic, lower pH is acidic, moderate pH within the range of 6.5 – 8.5 is recommended as safe by the World Health Organisation. As such pH values of Orashi River sediment fall within the stated range. Other Niger Delta authors have reported pH of sediment; the sediment of trans-okpoka creek, located in bonny Estuary, had pH values ranging from 4.45 ± 0.13 in Dry season and 5.80 ± 0.11 in wet season (Davies and Tawari, 2010), Ekerekana and Buguma Creek 6.6 to 7.2 (Makinde et al., 2015).

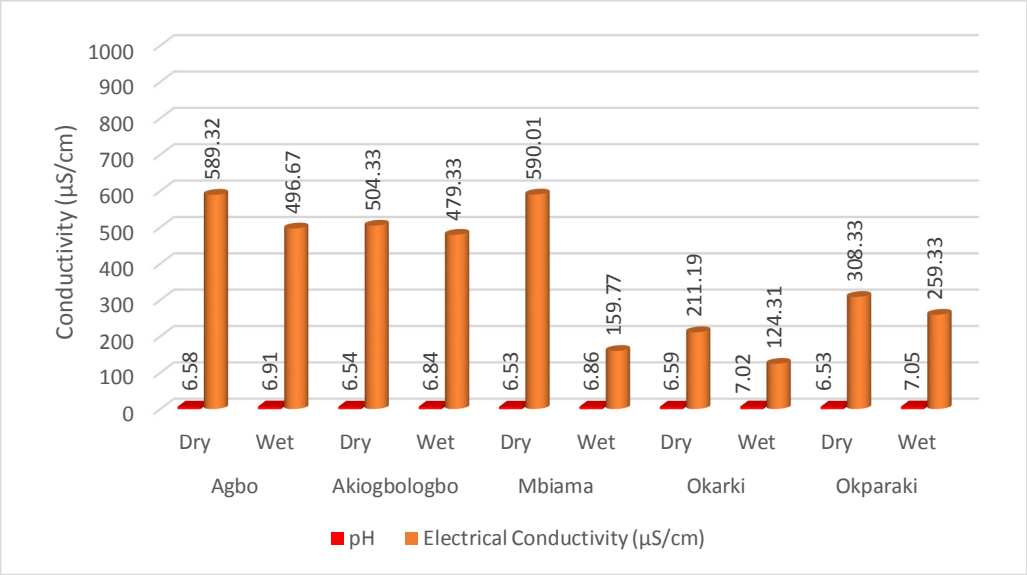

Figure 1: pH and Electrical Conductivity of Orashi River

The Electrical conductivity (EC) of Orashi river indicated significant differences, in both dry (211.19 – 590.01 µS/cm) and wet seasons (124.31 – 496.67 µS/cm). The EC value of this study, recorded a conformance with the regulatory limits of WHO, which is 1000 µS/cm. This value comparable to the values reported by Davies and Tawari (2010) who recorded significant difference in EC values of 4577.78 ± 323.82µs/cm in wet season and, 4080.00 ±321.56µs/cm in dry season with significant (P>0.05). They also confirm that conductivity was higher in wet season compared to dry season.

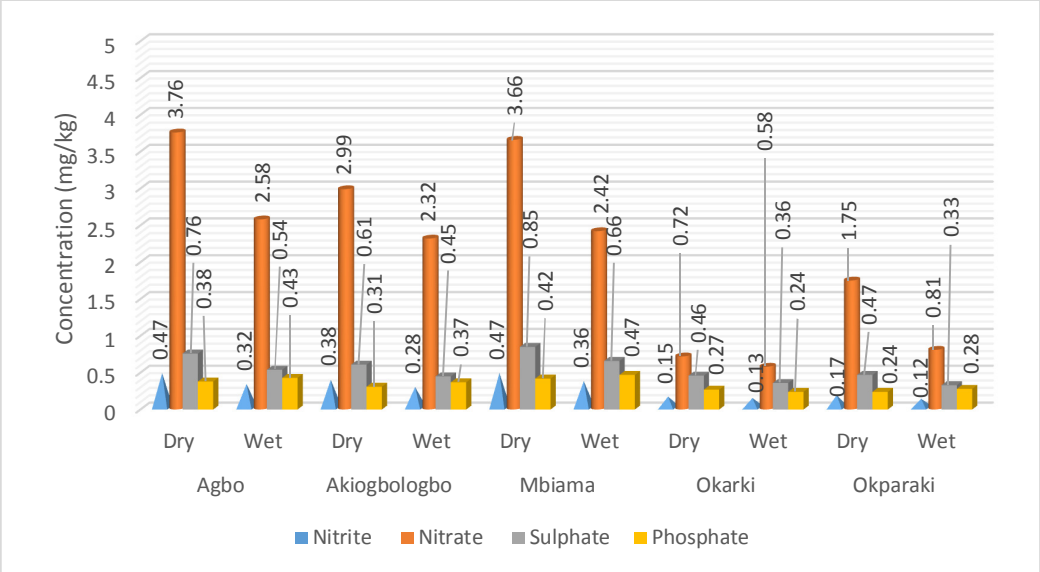

Figure 2. Some nutrients of Orashi River

Figure 2 shows the mean levels of some nutrients of Orashi River; including nitrite (0.15 - 0.47 mg/kg in dry season and 0.12 - 0.36 mg/kg in wet season), nitrate (0.72 - 3.36 mg/kg in dry season and 0.58 - 2.58 mg/kg in wet season). Also sulphate ranged from 0.46 – 0.76 mg/kg in dry season and 0.33 – 0.66 mg/kg in wet season, while phosphate was 0.24 – 0.42 mg/kg in dry season and 0.24 – 0.47 mg/kg in wet season. Nutrients are needed for metabolic rate of aquatic organism, but on the contrary, high level of nutrient indicates pollution, which might induce the bioavalability of invasive species. Hence infringing on biodiversity.

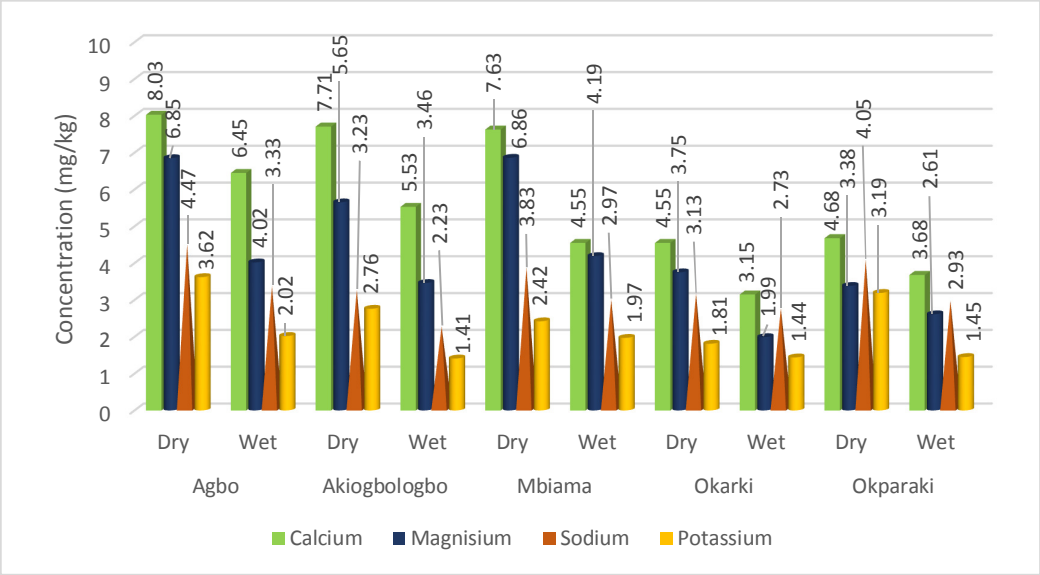

Figure 3: Some mineral salt of Orashi River

While the calcium levels of Orashi River ranged from 4.55 – 8.03 mg/kg in dry season; wet season values which were relatively lower with values of 3.15 – 6.45 mg/kg (Figure 3). The concentration of magnesium was reported as 3.38 – 6.86 mg/kg in dry season was higher compared to 1.99 – 4.19 mg/kg values in wet season. The seasonal variation of sodium and potassium in dry and wet seasons were; 3.13 – 4.47 and 2.23 – 3.33 mg/kg as well as 1.81 – 3.62 and 1.41 – 2.02 mg/kg respectively (Figure 3). The low levels of all mineral salts in wet season is largely attributed to high tide due to consistent precipitation (Izonfuo and Bariweni, 2001).

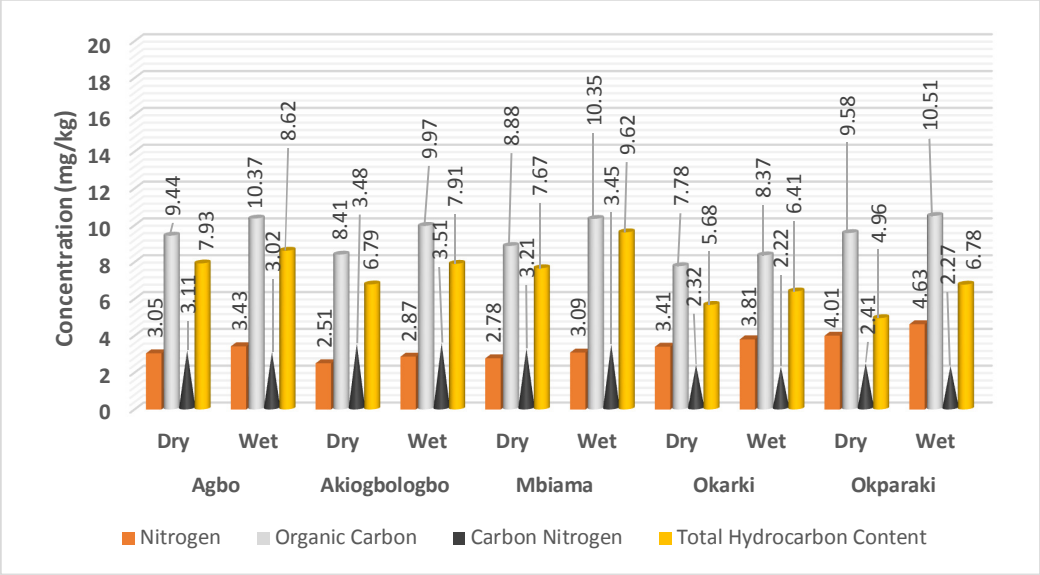

Figure 4: Nitrogen and other carbon contents

As presented in Table 4, Nitrogen values of Orashi river ranged from 2.51 – 4.01 mg/kg in dry season and 2.87 – 4.63 mg/kg. While Organic carbon (OC), concentration was 7.78 – 9.58 mg/kg in dry season, a higher value was recorded in wet season (8.37 – 10.37 mg/kg). Seasonal variation in concentrations of Carbon-Nitrogen (CN) was observed in dry season (2.32 – 2.48 mg/kg) against wet season (2.22 – 3.51 mg/kg). Meanwhile as presented in Figure 4, THC, was higher in wet season (6.41 – 9.62 mg/kg) than dry season (4.96 – 7.93 mg/kg). Davies and Tawari (2010), reported slight THC values during low tide (0.24 ± 0.02µg/g), compared to higher tide (0.18± 0.03µg/g). They also reported Total organic carbon (TOC) of 1.37 ± 0.08%, in dry season than wet season's value of 1.14 ± 0.06%.

CONCLUSION

The sedimentary quality of Orashi River was assessed at randomly selected stations along the coast. In a two season comparative assessment. Our findings, indicated mild anthropogenic activities, within the threshold of permissible limit stated by WHO Standards. However, the incipient adverse effects of activities around this important river should not be taken for granted. Consequent upon this, we therefore urge all stakeholders and Government agency to intervene in sensitizing the populace and inhabitants around the Orashi River, on safe and sanitary attributed aimed at preserving biodiversity and sustaining public health.

REFERENCES

Tobor, J. G. (1992). Fin and shellfish of conservation interest in Nigeria. NIOMR Tech Paper No 79:1 -23.

Abowei, J.F.N., Davies, O.A., and Eli, A.A. (2010). Physico-Chemical Characteristics, Morphology and Abundance of Five Fish Species from Nkoro River, Niger Delta, Nigeria. International Journal of Pharma and Bio Sciences, 1(2): 1-11.

Olorode, O.A., Bamigbola E.A., Ogba, O.M. (2015). Comparative Studies of some River Waters in Port Harcourt based on Their Physico - Chemical and Microbiological analysis, Niger Delta Region of Nigeria. International Journal of Basic and Applied Science, 3(3): 29 - 37.

Agedah, E.C., Ineyougha, E.R., Izah, S.C., & Orutugu, L.A. (2015). Enumeration of total heterotrophic bacteria and some physico-chemical characteristics of surface water used for drinking sources in Wilberforce Island, Nigeria. Journal of Environmental Treatment Techniques. 3(1), 28 – 34.

Ezeribe, A. I., Oshieke, K. C., and Jauro, A. (2012). Physico-Chemical Properties of Well Water Samples from Some Villages in Nigeria with Cases of Stained and Mottle Teeth. Science World Journal 7(1): 1 - 3.

Abowei, J.F.N. (2010). Salinity, dissolved oxygen, pH and surface water temperature conditions in Nkoro River, Niger Delta, Nigeria. Advance Journal of Food Science and Technology, 2(1): 36 – 40.

Ike, E. E. &Ugodulunwa. F.X.O. (1999). *History and philosophy of Science*, University of Jos Consultancy Limited, Jos, 134-136.

Obaje S.O., Ugbe, F.C., Akpoborie I.A., Chinyem F.I. (2014). Environmental Geochemical Assessment of River Gora Sediments in Minna, North-Central Nigeria. Journal of Environment and Earth Science, 4(22): 109 – 116.

Kautsky, G., Bolviken, N. (1998). Geochemical Atlas of Northern fennoscandia Nordkalott project, Geol. Surv. Sweden, pp. 19.

Waziri, N.M. (2014). Environmental geochemistry of soils and stream sediments from Birnin-Gwari artisanal gold mining areas, North-western Nigeria, *Universal Journal of Geoscience* 2(1), 18-27.

Sabo, A., Gani A.M, and Ibrahim A. Q. "Pollution Status of Heavy Metals in Water and Bottom Sediment of River Delimi in Jos, Nigeria." American Journal of Environmental Protection 1.3 (2013): 47-53.

Issa, B.R., Arimoro, F.O., Ibrahim, M., Birma, G.J and Fadairo E.A (2011). Assessment of Sediment Contamination by Heavy Metals in River Orogodo (Agbor, Delta State, Nigeria). Current World Environment, 6(1): 29-38.

Davies, O.A. and Tawari, C.C. (2010). Season and Tide Effects On Sediment Characteristics of Trans-Okpoka Creek, Upper Bonny Estuary, Nigeria. Agric. Biol. J. N. Am., 1(2): 89-96.

Makinde O. O., Edun O. M., Akinrotimi O. A. (2015). Comparative Assessment of Physical and Chemical characteristics of Water in Ekerekana and Buguma Creeks, Niger Delta Nigeria. Journal of Environment Protection and Sustainable Development, 1(3): 126 – 133.

Izonfuo, L.W.A. & Bariweni, A.P. (2001). The effect of urban runoff water and human activities on some physico-chemical parameters of the Epie Creek in the Niger Delta. *Journal of Applied Sciences and Environmental Management,* 5(1):47-55.

American Public Health Association (APHA) (1998). Standard methods for the evaluation of water and waste waters. 20th Ed. Wahington DC. American Public health.

Cite this Article: Seiyaboh EI, Alagha WE and Angaye TCN (2016). Sedimentary Assessment of Basic River in the Niger Delta: A Case Study of Orashi River in the Eastern Niger Delta of Nigeria. Greener Journal of Geology and Earth Sciences, 4(3): 051-055, http://doi.org/10.15580/GJGES.2016.3.122116218