# Benthic Macroinvertebrates Composition and Water Quality of River Owo Compared with Iba Stream, in Ojo Local Govt. Lagos, Nigeria

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## Abstract

*River Owo is a polluted water body in Agbara Industrial area an outskirts of Ojo Local Government Area due to the dumps of industrial wastes. The body contains diverse soluble and insoluble both of organic and inorganic compounds as well as living organism such as benthic macroinvertebrate fauna. This research work is an intensive studies carried out on constituents of river and compared with Iba stream of no active polluting activities in the same Local Government as a control. Water and macro invertebrate samples were taken from the two sites. Physicochemical and heavy metals analysis were carried out on the water using Atomic Absorption Spectrophotometer. The invertebrates were quantitatively and qualitatively analyzed. Investigations revealed that the water body is slightly acidic with pH of 5.5 to 6.5. It hardness have been mild due to the impact of the constituents that have softened it to extents of about $88mgL^{-1}$. Sulphate level of range 0.07 to.09mgL-1 is significantly low. These physicochemical factors did not contribute adversely to the two water bodies. However, high BOD of 340 to 357 above the limit 30 indicated that the pollution of River Owo mainly comes from organics waste dumps. Decapods such as Palaemonetes sp and amphipods which are common to polluted environment are found in River Owo. The abundance of various forms of insects of which dragon fly nymph Palemonetes sp were most in population are found around River Owo. Therefore River Owo is mainly being polluted with organics substances. However both Physicochemcal parameters and Benthic studies Iba stream indicated that it is free of pollution. This could have been due to the disallowed dumps of domestics and industrial wastes were not allowed into the stream.*

*Keywords: Physiochemical analysis, macro invertebrates, effluents, Mollusks, Paloemonestes species, amphipods, heavy metals, turbidity*

## 1.0 Introduction

River Owo and Iba stream are the two major water bodies in Ojo area of Lagos State are the major source of domestic water for the inhabitants of Agbara, Oto Ijanikin and Iba. The two towns are in the outskirts of Ojo city which homed the headquarters of Local Government. They are the commercial areas where important recreational are sited. Indices of water quality based on benthic macro inveterbrates community compositions indicate a wide range in water in the water quality of the environment. River Owo serves as an avenue for industries around Agbara industrial area to discharge treated and untreated effluents, while Iba Stream is a means of transportation and fishery for people of the locality.

The relationship between benthic macro invertebrate communities and common water pollutants is poorly investigated and understood. Developing an understanding of this relationship is important in establishing a classification system that will assist natural resources managers in decision making (Patrick & Palvage, 1994).

The generation of waste is an integral part of industrial activities and most of these waste produced are in liquid form. The physical and chemical nature of industrial wastes vary from one type of industry to another, depending on the raw materials used in their activities (Odiete, 1999). Many of these wastes contain oil and grease that often form a layer on water surfaces thereby preventing organisms from assessing oxygen and other vital nutrients in water bodies including sunlight needed for the process of photosynthesis (Bhateria *et al*. 2016).

Pollution occurs as a result of anthropogenic activities which concentrate emissions and discharges in areas where people live and work (Odiete, 1999). Furthermore, anthropogenic emissions and discharges increase as population increases and industries expand as people become more affluent in their life style, leading to an increase in waste (Mason et. al. 2004). In water pollution, pollutants may cause hindrance to fishing activities, impairment of the quality of the use of water, reduction of amenities derived from water, and cause harm, danger or injurious to living organisms (Landress *et al*. 1988).

The two sites of interest River Owo and Iba stream were considered out of different water bodies existing in Lagos State, Nigeria, West Africa due to the peculiarity of pollution and economic viability of that area or locality. . River Owo from the south western part of Lagos State along the coast line of Lagos and Ogun States, while Iba stream is linked with other rivers like Iju, Oni and River Owo (Ologe Lagoon) emerging from Ogun State and Otto-Ijanikin area of Lagos State as indicated in Figure 1. This water body receives waste waters from Agbara Industrial area and domestic waste from Agbara, Otto-Ijanikin suburb area along its course.
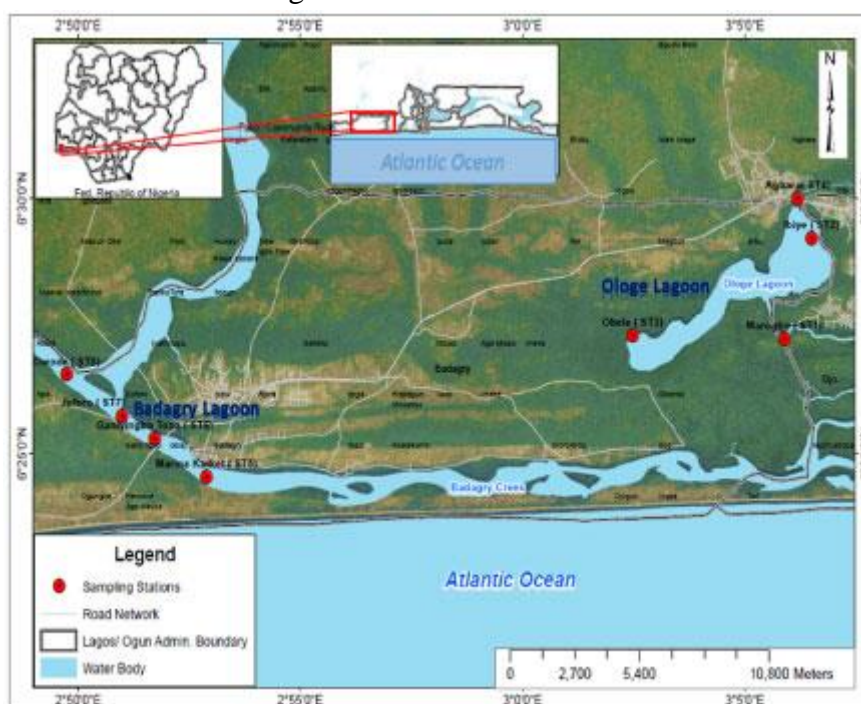


**Figure 1:** Map showing the geographical locations of Ologe lagoon and Iba Stream

The polluted reference sites were further divided into three sample points viz: - pre-effluent sample point, effluent discharge point and post-effluents discharge point.

i.      Pre-effluent point: is the point of sampling before any form of effluents or pollutants is discharged into the water body, a point that is not affected in any way by the discharged effluents due to ricer's pattern or direction of river flow. (Kurtenbach, 1990).

ii.      Effluent discharge point: It is a point at which all forms of pollutants and effluents are being discharged or introduced into the water body, this point will enable us know the level of perturbation the effluents would have on the macro invertebrates and other aquatic organisms of that particular site that received the effluents.

iii.      Post-effluents discharge point:  This point will enable us ascertain the macro invertebrates and other aquatic organisms that can survive in a polluted environment or the benthos that are good bio indicators of pollution.

Iba stream was selected as the unpolluted reference site; it flows through a fresh water swamp forest area in the locality where the catchment, bank and shore are abundant in decaying organic matter as indicated in Figure 2.
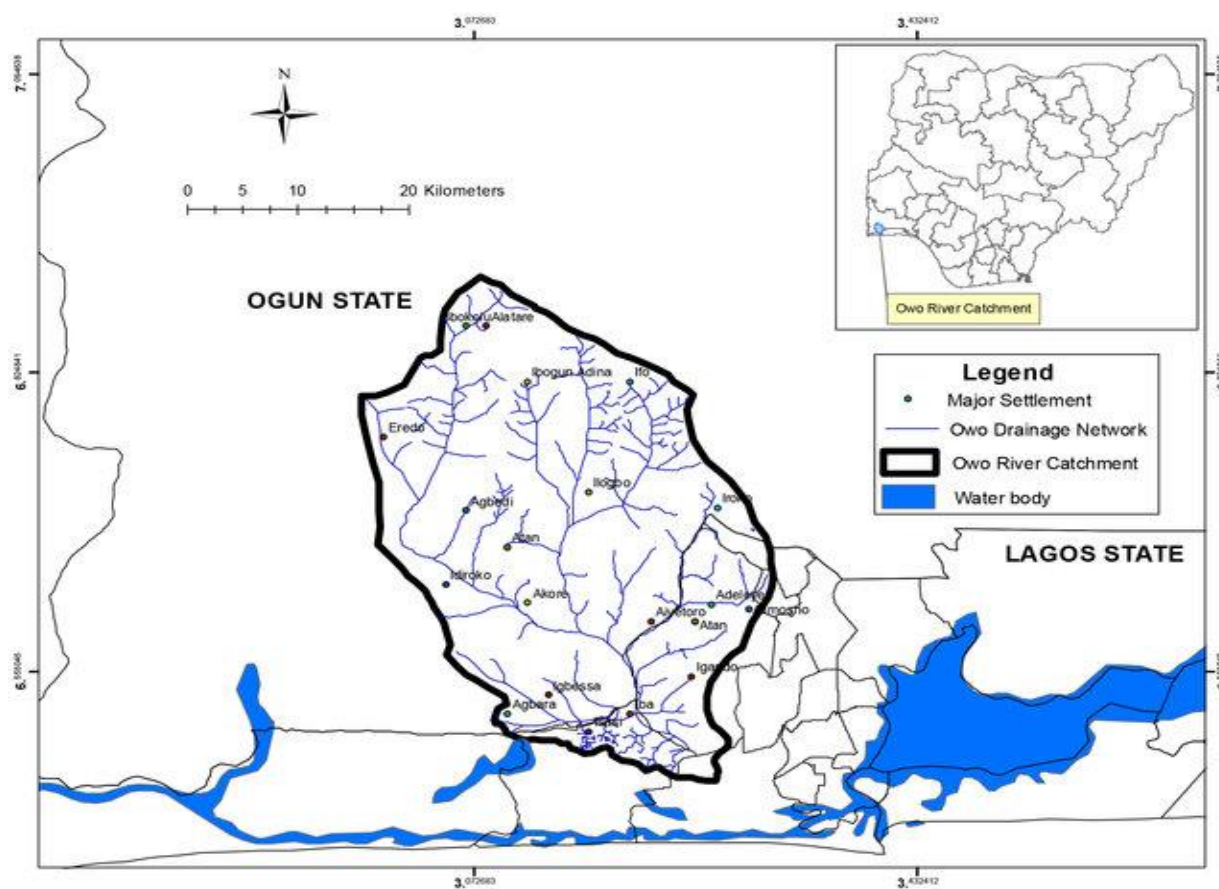


**Figure 2:** Map showing (Owo River) Ologe lagoon and Iba Stream Catchment.

The present study was designed in order to investigate and compare the relationship between pollutants, benthic macroinvertebrates and water quality, also to provide information that may be used for the development of stream, ecosystem health assessment tools.

## 2.0 Materials and Methods

Water samples were collected into labeled 1 litre plastics containers. It was acidified with 0.5ml of concentrated nitric acid. The macro invertebrates using D-frame aquatic net and preserved. A comprehensive identification key was used to identify the macro invertebrates (Michael, 1997). Physiochemical analysis of Temperature,, pH, Total Hardness, Acidity, Alkalinity, Turbidity, Total dissolved Solids (TDS), Biochemical Oxygen Demand (BOD) Salinity. Nitrate, Sulphates Phosphates and Chloride. Heavy metals such as Cadmium (Cd) Copper, Iron (Fe) and Zinc (Zn) were carried out on the water samples.

The sorted sediment samples were oven dried into a labeled baker's and digested with concentrated nitric acid and was then diluted with 25ml of distilled water and heavy metals were determined from it with Atomic Absorption Spectrophotometer (AAS) of Angstrom Advanced Incorporation brand.

## 3.0 Results and Discussions

The results as indicated on Table 1.0 revealed that at effluent point is neutral at pH of 7.2, the Pre and Post-effluent with the control Iba stream has the same value. The Hardness at Pre Effluent Point 89 to 89.1 mgL$^{-1}$ did not alter at Effluent Point as the values at both points are the same. Fe, Cu, Mg and heavy metals determined are below the limits. Chloride, Sulphate and Nitrate are below but Phosphates are above limits. The Biochemical oxygen demand (BOD) which denotes the amount of oxygen needed by micro-organisms for stabilization of decomposable organic matter under aerobic conditions on 340 to 357 are far higher above the limit 30 indicated less of oxygen to support life and indicates organic pollution.

Decapods such as *Palaemonetes sp* and *amphipods* are peculiar to River Owo, there is reduction in their population as the water course get more polluted. Mollusks such as *Mytilus edulis*, *Lymnae cailuadi* and *Plantorbis coniplanatus* are common to both Iba stream and the pre-effluent point of River Owo; this may not be farfetched due to turbidity of the water bodies, which are close of 4 and 3 NTU respectively. This environmental condition favours the decaying of organic matter by which these organism drives.

*Tubifex tubifex, Nereis sp* and *Hirudo medicinalis* were found in Iba stream only. This may be due to muddy nature of the stream's substratum at its bank. The abundance of dragon fly nymph, *Palemonetes sp* are peculiar to post-effluent point in River Owo, which could be linked to their moderately tolerant nature as macro invertebrates of moderately polluted water as reported by Mason *et al,* 2004. As indicated in Table 1 above *Belostoma sp, Erythemus sp, Plecoris sp, Narpus sp, Plea leachi* are the various insects species common in the post-effluent points of River Owo. Their presence and abundance are due to facultative and relatively unpolluted condition of water quality at this point Kerans *et al,* 1994.

**Table 1:** Physiochemical Characteristics of River Owo and Iba Stream

| S/N | Parameters | Standards (FMENV Limits) | River Owo | | | | | | | | | Iba Stream | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-Effluent | | | Effluent Point | | | Post-Effluent | | | Control Site | | |
| | | | A1 | A2 | Mean | B1 | B2 | Mean B1+B2 | C1 | C2 | Mean | D1 | D2 | MEAN |
| 1 | Water Temperatures ($^o$C) | 20-33 | 34.2 | 33.0 | 33.6 | 36.8 | 31.5 | 35.1 | 34.5 | 34.5 | 34.7 | 34.4 | 38.3 | 38.1 |
| 2 | $P^H$ @ 25 $^o$C | 6 - 9 | 6.8 | 6.9 | 6.8 | 7.2 | 7.1 | 7.2 | 7.2 | 7.2 | 7.2 | 6.8 | 6.9 | 6.9 |
| 3 | Total Hardness ($CaCO_3$) $mgL^{-1}$ | NS | 89.1 | 89.0 | 89.0 | 89.1 | 89.1 | 89.1 | 88.2 | 88.0 | 88.0 | 90 | 90 | 90 |
| 4 | Acidity $mgL^{-1}$ | NS | 5.5 | 6.2 | 5.9 | 3.6 | 4.2 | 3.9 | 4.8 | 5.9 | 4.9 | 6.6 | 6.4 | 6.5 |
| 5 | Alkalinity $mgL^{-1}$ | NS | 65.0 | 63.2 | 64.1 | 65.8 | 67.1 | 66.5 | 62.5 | 66.9 | 64.3 | 65.1 | 64.2 | 64.7 |
| 6 | Turbidity (NTU) | NS | 6 | 7 | 6.5 | 7 | 8 | 7.5 | 6 | 6 | 6 | 6 | 6 | 6 |
| 7 | Total Dissolved Solid (TDS)$mgL^{-1}$ | 2000 | 156.0 | 168.1 | 162.1 | 167.1 | 170.0 | 168.6 | 166.2 | 168.0 | 167.1 | 158.2 | 172.0 | 165.1 |
| 8 | Biochemical Oxygen Demand (BOD) v | 30 | 340 | 345 | 342 | 356 | 357 | 356 | 350 | 357 | 354 | 345 | 347 | 346 |
| 9 | Salinity % | NS | 0.120 | 0.110 | 0.113 | 0.113 | 0.119 | 0.118 | 0.113 | 0.117 | 0.115 | 0.118 | 0.115 | 0.11 |
| 10 | Nitrate ($NO_3$) $mgL^{-1}$ | 20 | 4.2 | 4.6 | 4.4 | 4.6 | 4.2 | 4.4 | 5.1 | 4.8 | 5.0 | 5.0 | 5.8 | 5.4 |
| 11 | Phosphate ($PO^3_4$) $mgL^{-1}$ | 5 | 6.9 | 6.3 | 6.6 | 8.0 | 7.2 | 7.5 | 7.0 | 6.9 | 6.9 | 5.4 | 5.4 | 5.4 |
| 13 | Copper $mgL^{-1}$ | 1.0 max | 0.04 | 0.07 | 0.06 | 0.08 | 0.07 | 0.07 | 0.05 | 0.06 | 0.06 | 0.31 | 0.32 | 0.32 |
| 14 | Iron $mgL^{-1}$ | 20 | 0.35 | 0.40 | 0.38 | 0.35 | 0.49 | 0.42 | 0.33 | 0.48 | 0.41 | 0.35 | 0.34 | 0.34 |
| 16 | Zinc $mgL^{-1}$ | 1.0 max | 0.10 | 0.16 | 0.13 | 0.13 | 0.16 | 0.145 | 0.11 | 0.10 | 0.11 | 0.10 | 0.11 | 0.11 |
| 17 | Magnesium $mgL^{-1}$ | 200 | 0.01 | 0.01 | 0.01 | 0.17 | 0.18 | 0.18 | 0.15 | 0.16 | 0.16 | 0.25 | 0.23 | 0.24 |
| 18 | Sulphate $mgL^{-1}$ | 500 | 0.89 | 0.88 | 0.89 | 0.08 | 0.06 | 0.07 | 0.08 | 0.08 | 0.08 | 0.09 | 0.08 | 0.09 |
| 19 | Chloride $mgL^{-1}$ | 600 | 13.0 | 14.2 | 13.6 | 14.8 | 14.5 | 14.7 | 13.4 | 14.4 | 13.9 | 18.8 | 28.7 | 23.6 |

**KEYS**

**A -** Pre-Effluent        **D**    -    Control Site (Iba Stream)

**B -** Effluent Discharge Point    **ND**    -    Not Detected

**C -** Post Effluent Discharge Point    **NS**    -    Not Stated

**4.0 Conclusion**

The high BOD of 340 to 357 above the limit 30 indicated much of organic pollution rather than inorganics. And thus much of the organism couldn't access required oxygen to for the decaying process. Mollusks are common to both Iba stream and the pre-effluent point of River Owo; due to the relative turbidity of their water bodies that favours their existence.

The abundance of various forms of insects of which dragon fly nymph *Palemonetes sp* were most in population are found around River Owo. Therefore River Owo is mainly being polluted with organics substances. However both physicochemcal parameters and Benthic studies of Iba stream indicated that it is free of pollution. This could have been due to the disallowed dumps of domestics and industrial wastes were not allowed into the stream.

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