



## River Nworie in Owerri, Imo State, Nigeria: A Public Health Hazard?

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### Abstract

Nworie River is a river that traverses Owerri City, the capital of Imo State, Nigeria. It is of intense use by residents of Owerri and industries in its vicinity. This results in the discharge of various contaminants into it and thereby making it a health hazard, especially for people of low economic status who use it for drinking when public water supply fails. A previous study clearly established that Nworie River was facing substantial organic pollution. The purpose of this study was to reassess the pollution status of the river. During the month of May 2014, water samples were collected from Nworie River from three sites about 50 meters apart. The water was tested physically, chemically, and biologically using LaMotte pollution test kits and Carolina bacterial pollution of water kit. Of the 12 chemical parameters tested, alkalinity, carbon dioxide, and phosphorus exceeded the Mississippi Water Quality Criteria/ Environmental Protection Agency (EPA)/ WHO water quality standards while dissolved oxygen was low. Microbial pollution was evident from the Coliform bacteria and *Escherichia coli* found. Based on the physical, chemical, and biological test results, the river was polluted and not potable. Dredging of the river that was started several years ago appears to have been abandoned and has rendered the water more polluted with the raking up of the pollutants that settled at the bottom of the river and may have caused the resurgence of water-borne disease agents. It is strongly recommended that the dredging be completed and the water quality improved in the interest of human health.

**Keywords:** River Nworie, Owerri, Nigeria, Public Health.

### 1.0 Introduction

Water is the driver of nature. It is the *summum bonum* of life but good quality water is essential for good health. Nworie River is a river that runs about 5km course across Owerri City, the capital of Imo State, Nigeria before emptying into another river, the Otamiri River. It is prone to intensive human and industrial uses, resulting in the discharge of a wide range of pollutants. It is used for various domestic applications by inhabitants of Owerri. When the public water supply fails, the river further serves as a source of direct drinking water, especially for the poorer segment of the population. A previous study (Okorie and Acholonu, 2008) clearly established that Nworie River was facing substantial organic pollution, as was obvious from the high values of carbon dioxide content and low dissolved oxygen of the river. Another study was subsequently conducted on Okitankwo River, a river that flows across the northern periphery of Owerri City along a course with relatively sparse human population,

but active agricultural activity (Okorie and Acholonu, 2013). The purpose of the present study was to reassess the pollution status of the River Nworie after a period of 7 years when this kind of study was conducted on the river (Okorie and Acholonu, *loc. cit.*).

This study was also encouraged by the statements of Renn (1970). He observed that in view of the public apprehension of the hazard of water pollution, regular water quality monitoring of inland water bodies is highly necessary. It was also carried out to include the biological profile which was not done in the previous study but recommended for subsequent investigations (Okorie and Acholonu 2008).

### 2.0 Materials and Methods

During the month of May 2014, water samples were collected from Nworie River from three sites about 50 meters apart in the vicinity of old Nekede Road. (see Figures 3-7). The water was tested physically,

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Figure 1: Map of Nigeria showing Imo State, where the study was conducted.



Figure 2: Owerri Municipal in Imo State where River Nworie is located.

chemically, and biologically. The physical parameters tested were odor, color, and turbidity, and the chemical were alkalinity, ammonia-nitrogen, calcium, carbon dioxide, hardness, iron, magnesium, phosphorus, silica, nitrate, dissolved oxygen, and salinity using LaMotte pollution test kits. The biological profile was conducted with Carolina Bacterial Pollution of Water kit. The number of bacteria in the water was determined by counting the number of coliform colonies on the Nutrient Agar plate and MacConkey Agar plate (see Figures 8A-C). This was recorded in numbers per milliliter. Lauryl tryptose broth fermentation tests for gas production from lactose were also conducted (see Figures 9A-B) to further confirm the presence of coliform bacilli in the water.



Figure 3: Dr. Acholonu pointing at the present condition of Nworie River.

The brownness of the water showed that the water turbidity was high and the River was polluted and still is polluted.



River Nworie passing

Figure 4: River Nworie showing where it passes under a bridge on Old Nekede Road.



Figure 5: A person taking water bottles to collect water samples from River Nworie.

### 3.0 Results

Of the parameters tested, alkalinity, carbon dioxide, and phosphorus exceeded the Mississippi Water Quality Criteria (MSWQC)/ Environmental Protec-



Figure 6: A person collecting water samples from River Nworie.



Figure 7: A person closing water bottles after water samples were collected.



Figure 8A: Coliform Bacterial growth from collected water samples indicative of water pollution.



Figure 8B

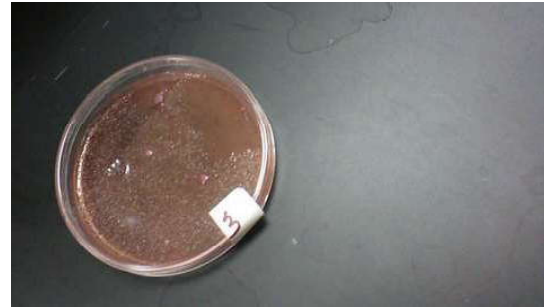


Figure 8C: Coliform Bacterial growth from collected water samples indicative of water pollution.

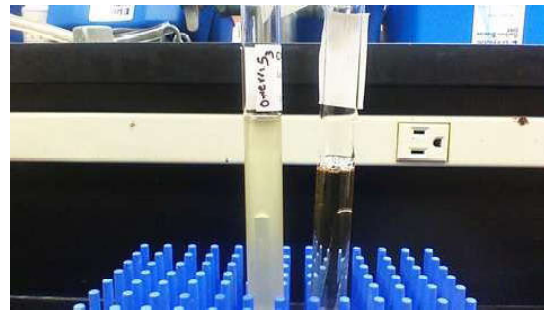


Figure 9A

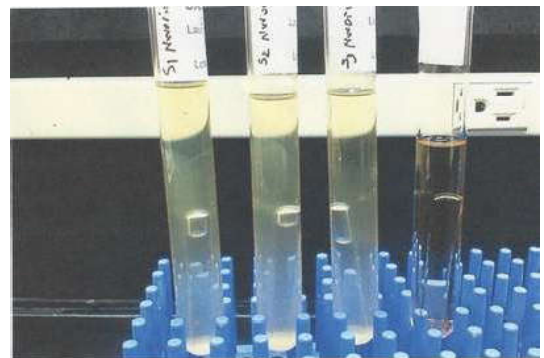


Figure 9B

tion Agency (EPA)/ WHO water quality standard while dissolved oxygen was low (see Table 1 and Figure 10). Microbial and/ or biotic pollution was evident from the Coliform bacteria and *Escherichia coli* found (see Figures 8A-C).

#### 4.0 Discussion

Based on the physical, chemical, and biological test results, the river was polluted and not potable. Dredging of the river that was started several years ago (over 7 years) appears to have been abandoned and has rendered the water more polluted with the raking up of the pollutants that settled at the bottom of the river and may have caused the resurgence of



Table 1: Parameters Tested, Average Readings for River Nworie in PPM (parts per million) and MSWQC/ EPA Standards.

Parameters	Site 1	Site2	Site 3	Average	MSWQC/EPA
<b>Chemical</b>					
Alkalinity ppm*	52.0	52.0	24.0	42.7	3.08
Ammonia-N ppm	1.0	0.25	0.1	0.45	10.0
Calcium ppm	16.0	12.0	8.0	12	200.0
Caron Dioxide ppm*	12	14.0	11.0	12.3	10.0
Chloride ppm					230.0
Copper ppm	0.0	0.0	0.0	0.0	8.85/6.28
Hardness ppm	20.0	20.0	24.0	21.3	50.0
Iron ppm	0.0	0.0	0.0	0.0	0.2
Magnesium ppm					150.0
pH	6.5	6.5	6.5	6.5	6.5-9.0
Phosphate ppm	0.5	0.0	0.5	0.5	0.1
Silica ppm					75.0
Nitrate-N ppm	2.0	10.0	6.0	5.4	10.0
Dissolved Oxygen ppm	1.0	0.6	1.6	1.07	5.0
<b>Physical</b>					
Turbidity NTU					50.0
Salinity ppm	0.1	0.1	0.1	0.1	---
Surface H <sub>2</sub> O temp °C					32.2
Lauryl Tryptose broth	Bacteria Present	Bacteria Present	Bacteria Present	Bacteria Present	400
Nutrient agar	Bacteria Present	Bacteria Present	Bacteria Present	Bacteria Present	400
MacConkey agar	Bacteria Present	Bacteria Present	Bacteria Present	Bacteria Present	400

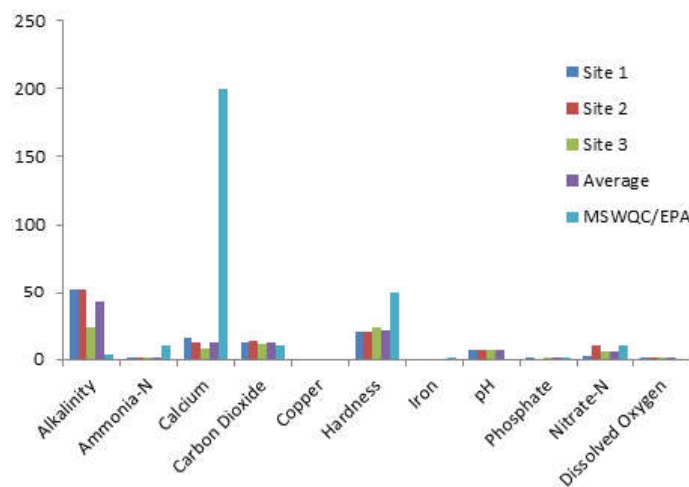


Figure 10: Graph showing results of tests as compared with the MSWQC and EPA/WHO standards.

water-borne disease agents. It is strongly recommended that the dredging be completed and the water quality improved. That the Nworie River in Owerri municipal was and is still polluted is evident from the brownish color of the water and thus the high turbidity, the chemical parameters that exceeded the water quality standards, namely, alkalinity (42.7/

3.08), Carbon Dioxide (12.2/10) and phosphate (0.5/0.5)? Coupled with the low dissolved oxygen (1.07/5.0). As observed by Wetzel and likens (2000), the measure of dissolved oxygen is one of the frequently used and the most important of all chemical methods available for the investigation of the aquatic environment. It provides valuable infor-

mation about the biological and biochemical reactions going on in waters. The pollution of the water is further evident from the biological test results. The finding of coliform bacteria and *Escherichia Coli* is an obvious indication that the water has human and/or animal fecal contamination and not good for drinking and could have water borne disease agents. The production of gas from the Lauryl tryptose broth fermentation test also confirmed the presence of coliform bacilli and water pollution.

From the esthetic point of view, the River's condition has greatly detracted from the beauty of Owerri and reduced the recognition of infrastructural developments. The sooner something is done to improve the water quality of Nworie in Owerri capital city, the better. The dredging should be completed without further delay. The river is dying!

A contrast between the study on River Nworie and Okitankwo River shows that the latter is of better quality than River Nworie in Owerri City. With respect to the Okitankwo River, none of the chemical parameters tested exceeded the WHO/EPA standards. The river was not under any serious threats from chemical pollution when the study was conducted (Okorie *et al.* 2013).

A comparison between the water quality of River Nworie in 2008 and 2014 shows that the carbon dioxide content is still above the threshold set by MSWQC and/or EPA and WHO standard. Dissolved oxygen is also still lower than the norm. But the part of the study that obviously shows that

the River Nworie is polluted is the biological (microbial) aspect. The finding of coliform bacteria and *Escherichia coli* (*E. coli*) show that the river is polluted and not drinkable; that it has human and/or animal fecal contamination, among others.

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