

## STUDIES ON MICROBIOLOGICAL AND SOME PHYSIOCHEMICAL PROPERTIES OF IKWO RIVER, IVO L. G. A., EBONYI STATE.

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### ABSTRACT

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This study examined the microbiological impact of Ikwo River in Ivo Local Government Area of Ebonyi State. Three sample stations were used (Amaonye, Ihie, and Amagu). Water samples were collected between May and September 2016 and analyzed in the Laboratory the result showed that Amaonye had the least pH value of 6.40 (slightly acidic) Ihie recording the highest 8.59. The temperature was least at Ihie 28.0°C with Amaonye the highest 28.9°C. The total bacteria count were least at Amagu but highest at Amaonye even in coliform count. This implies that Amaonye received much input than any other stations. In Morphological characterization, *Escherichia coli*, *Streptococcus sp.*, *Enterobacter sp.*, *Pseudomonas sp.*, *Staphylococcus sp.*, *flavobacterium sp.*, *Pseudomonas sp.*, *Proteus sp.*, *Klebsiella sp.* and *Bacillus sp.* were identified. This work showed that the Ikwo river is highly contaminated, therefore appropriate measure should be taken to purify the water and make it fit for human use. Again Government should enforce existing law to regulate the generation and disposal of waste into the river.

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Key words: Ikwo River, Assessment, Physiochemical, Contaminants, Microbiological.

### INTRODUCTION

Water is one of the most abundant resources on which life on earth depends. In some places, availability of water is critical, limited and renewable.

Shortage of water could lead to disease outbreak and economic loss, hence water is a necessity. It is a unique liquid and without it, life is impossible. The world populations

as a whole, lack sufficient water supply and sanitation (Mara, 2003).

Water plays a vital role in the proper functioning of the earth's ecosystem. Man uses water for various purposes which include drinking, transportation, industrial and domestic use, irrigation in agriculture, and recreation, fisheries and waste disposal among others.

Water that is of a good drinking quality is important to human physiology, and man's continued existence depends so much on its availability (FAO, 1997).

The quality of water for drinking deteriorates due to inadequacy of treatment plants, direct discharge of untreated sewage into rivers and stream, and inefficient management of piped water distribution system (UNEP 2001).

The contaminated water therefore has critical impact on all biotic components of the ecosystem and this could affect its uses for other purposes. Water receives its bacteria spores from air, sewage, organic waste, dead plants and animal, at times almost all micro – organisms may be found in water, but bacteria appeared to be the major water pollutants. Majority of the bacteria found in nature live on dead decaying organic matter as saprophytes (Peter and George 1989).

There are many ways in which water is tested in the developed world to ensure its safety for consumption. One such way is through the presence and absence of fecal coliform bacterial. Fecal coliforms include species in the general *Enterobacter*, *Escherichia*, *Hafnia*, *Klebsiella*, *Citrobacter*, *Yersinia*, and *Serratia* (Mara, 2003).

Microbial food webs are crucial to many aspects of aquaculture specifically pond aquaculture. The main reason for the

necessity of bacterial in pond and intensive aquaculture is that bacteria along with algae have direct influence on the oxygen content of the water (Moriarty, 1997). While algae produce oxygen with photosynthesis during the daylight, bacteria are predominant oxygen consumers and respirator's. Bacterias also help to fix the nitrogen in the form of toxic unionized ammonia from fish waste that has been excreted, and process it to a less toxic compound. This means that bacteria are beneficial biological filters for the water. Bacteria can also directly influence the productivity of a pond food web. They serve a role as both decomposers and help to recycle nitrogen and phosphorus crucial to primary production (Mariaty and David, 1997)

Ailments have been documented (CDC, 2001; Fleming *et al* 2001; Backer *et al* 2003). Symptoms occur generally as a consequence of consumption of contaminated seafood and direct human exposure to Ciguatera fish poisoning is the most common marine toxin disease worldwide. The primary toxin, involved appears to be ciguatoxin. Ciguatera poisoning is usually diagnosed on clinical grounds Toxin may be detected in serum plasma, and urine of patients, ciguatera poisoning can also affect fish population as the larval survivability in finfish is affected (Edmunds 1999).

Seafood species can adapt to tolerate high levels of certain algal toxins. For example softshell clams (*Mya arenaria*) from areas exposed to red tides are more resistant to PSP toxins and accumulate toxins at greater rates than sensitive clams from unexposed areas (Bricelj *et al* 2005).

*E. coli* in water- ways can originate from the intestinal tracts of both humans and other warm-blooded animals such as dogs, cats, livestock and wildlife. Human sources include failing septic tanks, leaking sewage lines, wastewater treatment plants, sewage over flows, land application of bio solids, boat discharges and urban storm water runoff in urban or rural water sheds. Possible animal sources of fecal coliform bacteria include cattle in streams, land application of animal waste, dairy operations, poultry operations, hobby horse farms, dog and cat waste from parks, lawns, streets and wildlife such as geese, pigeons, ducks, deer and vaccoons.

Fecal material as well as other pollutant can be transported to waterways through runoff from rain events. How quickly pollutants are transported partially depends on the type of land use. Grasses and vegetated land tend to soak up rainfall, thereby increasing infiltration into the ground and reducing runoff to waterways. Developed lands such as streets, rooftops, sidewalks, parking lots and driveways create more impervious surfaces thereby increasing runoff. Lands

that support animals such as cattle, dogs or horses can also be a source of bacteria particularly if animals enter the water for drinking or if heavy rains wash manure from the land into receiving waters.

The primary source of microbial pollution in agricultural watersheds is fecal matter generated from livestock production. The microbial loading potential from point sources, such as storage facilities and feedlots, and from non-point sources, such as grazed pastures and rangelands, is substantial. Non – agricultural sources of microbial pollution in rural watershed include failing septic systems and wildlife.

Non – point sources of microbial pollution are inherently more difficult to identify and characterize than point sources. Walker *et al* (2005) state that source areas can be divided into four categories: (i) areas where manure is surface applied (ii) areas where manure is incorporated into the soil, (iii) areas where manure is directly deposited by livestock and (iv) non- manured areas. The transport of potential pathogens from non- point source areas to streams is linked to temporally and spatially variable factors, which affect runoff. The number of organism which will be available for transport will also depend on the timing manure application and a combination of physical, chemical and biological factors which influence survival (Edwards *et al* 2004).

## MATERIALS AND METHODS

Ikwo River in Ishiagu lies on longitude of  $7^{\circ}34'60\text{E}$  and latitude  $5^{\circ}55'60\text{N}$  and elevation of 43 meters above the sea level in the south eastern part of Nigeria. The river takes its source from a marshland in Lokpa village in Abia State and joins other river's inlets which empty into Ivo River. The different villages in Ishiagu/Amata Ihietutu, Amony, Ihie, Amagu, Ogor and Okwe. The experimental samples of water used in the research project were collected from three different points of Ikwo river in Ishiagu town, Ivo L.G.A Ebonyi State of Nigeria.

Ikwo in Ebonyi State is located within the South East Zone of Nigeria with annual mean temperature of  $27^{\circ}\text{C}$  (minimum) and  $32^{\circ}\text{C}$  (maximum) and an average relative humidity of 88%, with annual rainfall of 1600mm.

The Laboratory assessment of micro-organisms was carried out in pathology microbiology Laboratories of Federal College of Agriculture, Ishiagu, Ebonyi State. The samples were taken to the Laboratory within 12hrs of collection and assessment done in earnest.

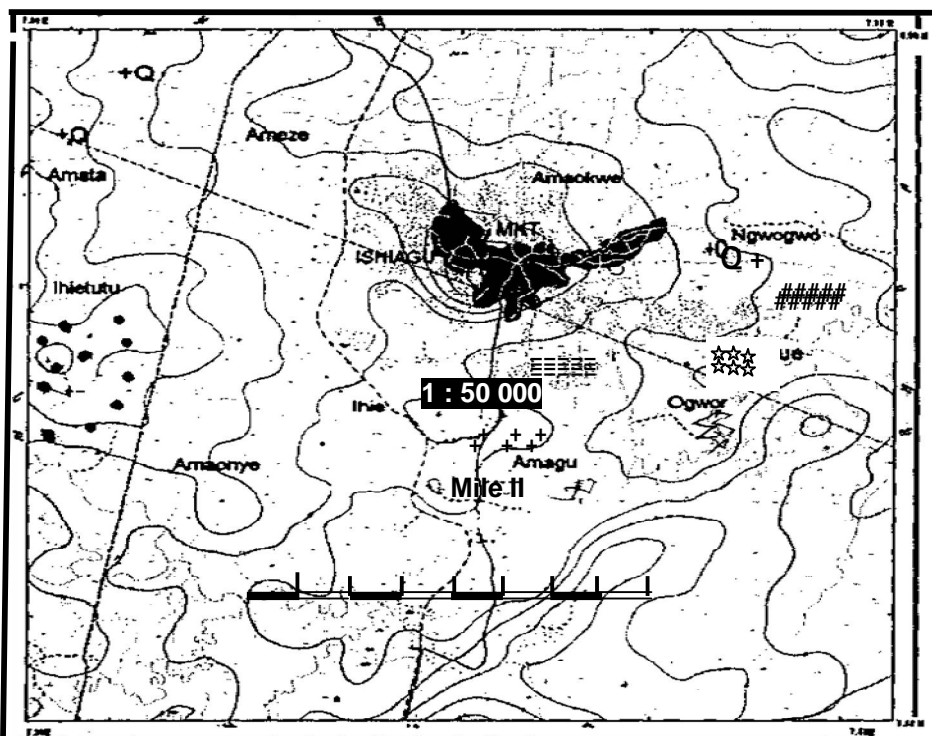


Fig. 1 Map of Ishiagu, the study area showing the seven sampling stations.

## Assessment of physic-chemical parameters

pH of the sampled water were assessed using the fisher accrument pH meter model 600 fisher scientific company, USA. While thermometer was used to determine the water temperature in situ.

## Quantitative Examination of Water

Nutrient agar medium and Macconkey agar medium were used in sterilized glass-wares to culture and identification of microorganisms according to Baron *et al.*(1990).

The isolates were grouped according to their colonial morphology and cell characteristics. The colonies were counted and re-isolated in pure culture using the

medium on which they had grown as described by Bitton *et al* (1994). The isolates were thereafter subjected to biochemical test as described by Benson (1990).

Morphological and biochemical characteristics of the microbial isolates were used for the identification of the isolates according to Baron *et al.*. 1990. Benson (1990) and Bitton (1994). The Bergey's Manual of determinative bacteriology was used to compare the characteristics with the results obtained.

**Statistical analysis:** The obtained results were analyzed statistically using factorial arrangement. The test was used to evaluate the mean differences among different treatments at the 0.05 significance level.

## RESULTS AND DISCUSSION

**Table 1: Shows the result of the water quality of the three sampling stations**

SAMPLE SOURCE	pH	TEMPERATURE( <sup>0</sup> C)	ODOR	COLOUR
Amaoye	6.40	28.9	Odourless	sand colour
Amagu	7.56	28.5	Odourless	sand colour
Ihie	8.59	28.0	Odourless	sand colour

**Table 2: Shows the bacteria and coliform count of the three locations and control**

Sample source	TOTAL BACTERIA COUNT		COLIFORM COUNT	
	Cfux10 <sup>-3</sup> m1 <sup>-1</sup>	cfux10 <sup>-5</sup> m1 <sup>-1</sup>	cfux10 <sup>0</sup> m1 <sup>-1</sup>	cfux10 <sup>2</sup> m1 <sup>-1</sup>
Amaoye	70	20	70	35
Amagu	45	12		49
	10			
Ihie	62	17	71	34
Control	0	0	0	0

**Table 3: Morphological Characterisations of Isolated on Solid Media**

MORPHOLOGICAL CHARACTERISATIONS OF ISOLATED ON SOLID MEDIA	GRAM STAINING	CELL MORPHOLOGY	CATALASE	MOTILITY	INDOLE	STARCHY HYDROLYSIS	SUGAR FERMENTATION					IDENTIFICATION
							GLUCOSE	LACTOSE	FRUCTOSE	GALACTOS	MANNITOL	
Circular creamy flat Entire moderate smooth	-	Short Rod	+	+					-			Escherichia coli
Irregular white flat Entire moderate smooth	-	Cocci in chains	-	-								Streptococcus sp.
Circular creamy low convex smooth moderate smooth	-	Rod	+	+	-	+	AG	+	-	+	+	Enterobacter sp
Circular creamy hit raised rhizoid moderate dull	-	Motile rod	-	+	-	+	AG	AG	+	-	-	Pseudomonas sp
Irregular pale white	+	Cocci in										Staphylococcus

flat smooth moderate smooth	clusters	+	-	-	+	+	-	-	-	+	ccus sp	
Circular yellow flat undulated moderate dull	- Rod		-	-	-	-	AG	AG	A G	+	+	flavobacter ium sp
Circular creamy hite raised rhizoid moderate dull	- Rod	+	+	-	-	AG	-	-	-	+	+	Pseudomon as sp
Irregular creamy flat undulated moderate rough	+ motileod		-	+	A G	+	-	AG	-			Proteus sp
Cir cular opaque raised Entire moderate smooth	- Rod		-	-	-	-	AG	AG	-	+	+	Klebsiella sp
Wio-circular white flat entire moderate smooth	+ Rod		+	-	+	+	AG	-	+	+	+	Bacillus sp

MA = Macconkey. Agar; NA=Nutrient agar. (Baron et al, 1990)

### RESULT DISCUSSION:

The quality of water in any ecosystem provides significant information about the available resources for supporting life in that ecosystem. Good quality of water resources depends on a large number of physic-chemical parameters and biological characteristics. To assess that monitoring of these parameters is essential to identify magnitude and source of any pollution load. These characteristics can identify certain

condition for the ecology of living organisms and suggest appropriate conservation and management strategies.

Bacterial growth is the main cause of water contamination; therefore it use bacterial number as an index of water quality. Amaoye stream had the highest number of coliform. Various groups of micro-organisms were isolated and identified during the study. They include *Escherichia*

*coli*, *streptococcus sp.*, *Enterobacter sp.*, *pseudomonas sp.*, *staphylococcus sp.*, *Flavobacterium sp.*, *pseudomonas sp.*, *proteus sp.*, *Klebsiella sp.*, and *Bacillus sp.*, as shown in table 3 The presence of some of these organisms are indicators of water contamination.

Bacteriological test are extremely sensitive and specifically designed to reveal the evidence of water pollution. A great majority of quality problem with community drinking water are related to fecal contamination. Although, a significant number of serious probes may occur as a result of chemical contamination from variety of natural and man-made sources. Water from streams and rivers may look clean and have no undesirable odour or taste. However, it is unfortunate that the pathogens found in these water sources can be harmful by causing serious illnesses. In this study, Amagu had the lowest bacteria count which may be due to its depth. In some cases, improper construction or nearness to toilet facilities and various human activities around the river /stream could contaminate the water. Other water could also be contaminated due to shallowness, animal water, closeness of refuse dump sites, proximity to toilet facilities (closeness to latrines), improper placement of bucket and bowls direct from the soil into the stream/river as well as human activities around it (Bitton 1994).

The total coliform for samples examined during this study were exceedingly high as against the EPA maximum contamination level (MCL) for coliform bacteria in drinking water (EPA 2002).

The high coliform count obtained in the samples may be an indication that the water sources were faecally contaminated (EPA 2002, Osunide and Eneuzie 1999). None of the water sources in this study complied with the EPA standard for coliforms in water. The micro-organisms generally isolated in this study include *Escherichia coli*, *streptococcus sp.*, *proteus sp.*, *Flavobacterium sp.*, *pseudomonas sp.*, *proteus sp.*, *Klebsiella sp.* and *Bacillus sp.* (table 3). The presence of some of these organisms signifies contamination of water from some domestic sources.

The *staphylococcus species* is known to produce enterotoxin (Okonko et al, 2008). *Proteus species* is an intestinal flora, but also widely distributed in soil and water (Schlegel, 2002).

*Pseudomonas aeruginosa* is an example of nonfaecal coliforms, while *E. coli* are a faecal coliform. Other organisms encountered include *pseudomonas species*, *streptococcus species* and *Bacillus species*.

## CONCLUSION AND RECOMMENDATION

The result obtained from this study revealed that the three stations are undergoing some



levels of environmental stress that could even affect the flora and fauna of the River. The first station, Amaonye had the highest amount of input from both agricultural and domestic wastes which in turn contributes to the amount of bacteria found in the River. The stakeholders should minimize the amount and quality of waste that should be discharged into the River. Again, they should treat their waste water before discharging or releasing them into the River. The study therefore, recommends continuous monitoring by the relevant Governmental agencies that are charged with maintaining quality of life, especially the use of water.

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