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Research Paper

Microbial Load and Heavy Metal Levels in Some Sea Foods from Ekerekana and Buguma Creek Niger Delta

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ABSTRACT: *Variations in microbial load (total heterotrophic bacteria count, total vibro count; and total oliform count) and heavy metals (Iron-Fe; Copper - Cu; Cadmium- Cd; Nickel-Ni and Lead –Pb) in Periwinkle (Tympanotonus fuscatus);)and Mudskipper (Periophthalmus papilio)) were carried out in Ekerekana and Buguma Creeks, Niger Delta, Nigeria. The sea foods were sampled monthly in both creeks from July 2012 to February, 2013 for a period of eight months. Standard methods were employed in the evaluation of microbial and heavy metals in each species. The results obtained indicated that the microorganisms isolated: total heterotrophic bacteria count, total vibro count; and total coliform count were more predominant in the wet season (July to October), when compared to dry season months (November to February). While, total coliform count bacteria exhibited some measure of elevation in the dry season months, an indication that they can be prevalent in both seasons. Generally, the following trend in decreasing order of the heavy metals in all the sea foods occurred: Fe>Cu>Cd>Ni>Pb. An overall elevated concentration of these metals was recorded during the wet season, particularly in periwinkle (T. fuscatus) in Ekerekana creek. Conversely, higher levels (P>0.05) of these metals were observed in sea foods sampled from Ekerekana creek when compared to Buguma creek, This study has shown that industrial and domestic wastes discharged into Ekerekana and Buguma creek resulted in high concentrations of pollutants in the water body, which promotes the growth of microorganisms heavy metals in the water column and sea foods, this may pose a health hazard to humans as a final consumer of these organisms There is therefore the need to formulate appropriate policies and regulations for safeguarding the ecosystem from anthropogenic pollution.*

KEYWORDS: *Microbial load, Heavy metals, Sea foods, Creeks, Rivers State*

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I. NTRODUCTION

Coastal waters are of economic importance in Niger Delta, it is use for different human activities such as fishing, and other domestic purposes. It is a shallow expanse of water with restricted circulation in a micro tidal environment (Lawson, 2011)**.** This aquatic resource of multiple usages receives input of domestic and industrial waste waters saw dust and particulate wood waste, petroleum by hydrocarbons, cooling water from a thermal power static and emission from automobile exhaust (Orhibabor and Ogbeibu, 2009). Survey on the microbiological quality of sea food has shown that they harbour pathogens which have been implicated in out breaks of food – borne diseases in many parts of the world, these illnesses include typhoid fever, hepatitis and similar disorder of the digestive system (Adebayo -Tayo *et al.,* 2006). These microorganisms are found on the skin, in the muscle and internal organs of freshly caught sea food, also, the skin and alimentary tract carry substantial number of bacteria, with counts on the skin ranging from 10^3 to 10^9 CFU/ml (Pinto *et al.,* 2008). These are mainly gram negative bacteria of the genera *Pseudomonas, Shewanella, Psychrobacter, Vibrio, Flavobacterium* and *Cytoplage* despite this, some Gram positive bacteria such as *Staphylococcus aureus* are also found (Hayat *et al.,* 2002).

Heavy metals generated from domestic and industrial wastes discharge into the aquatic environment quickly associates with particulates and ultimately settles in bottom sediments of water bodies either through direct discharge or surface run offs from erosion (Burgman, 2003). The accumulation of metals from the overlying water to the sediment is dependent on a number of external environmental factors such as pH, electrical conductivity and the available surface area for adsorption caused by the variation in size distribution. Diagenetic processes in the sediments can change and redistribute these contaminants between the solid and the dissolved phases, but most of the elemental contaminants are immobilized through sedimentation (Ni *et al.,*

2005). Moreover, heavy metals are inorganic elements, essential for plant growth in traces or very minute quantities. They are toxic and poisonous in relatively higher concentration (Ikem *et al.,* 2006). Two factors contribute to the deleterious effect of heavy metals as environmental pollutants. Firstly, they cannot be destroyed through biological degradation as is the case with most organic pollutants. Secondly, they are easily assimilated and can be bioaccumulated in the protoplasm of aquatic organisms (Egborge, 1994). Well known example of heavy metals include: Iron, lead and copper. Others include: arsenic, mercury cadmium, chromium, nickel, zinc, cobalt and vanadium (Anyakoha and Coker, 2007).

There is growing need to understand the transfer of contaminants such as microbial pathogens and heavy metals through the food web in the aquatic environment (Asonye *et al*., 2007). Analyzing pollutants in living organisms is more attractive and promising than analyzing pollutants of the abiotic environment, as living organisms provided precise information about the microbiological quality, bio-availability of pollutants, biomagnification and bio-transference of pollutants (Azim *et al.,* 2006). This may assists in predicting pollutants transfer, exposure and its possible health consequences to humans. In addition such information is crucial in making accurate risk assessment for sea food safety purposes (Caeiro, 2005). Several aquatic organisms have the ability to bio-accumulate heavy metals to a very toxic level (Chindah *et al.,* 2003). The impacts of these metals have not only limited the productivity and reproduction capabilities of these organisms, but affect human population due to the food chain relationship. Heavy metal toxicity and excessive microbial load is frequently the result of long term exposure to pollutants common in environment or air, water, food and numerous products (Chindah *et al*., 2008).

The suitability of periwinkle and mudskipper is universally recognized, being included in most of the national environmental monitoring programmes of marine and brackish water pollution (Chindah *et al.,* 2009).Increased metal pollution concentrations in the environments as an effect of urbanization have also been shown in many studies in Niger Delta (Dambo 2000; Davies *et al.,* 2006; Howard *et al.,* 2009). It is because of concern regarding such increased risks of heavy metal enrichment in the environment from neighboring anthropogenic sources that this study was planned to asses and monitor metal concentration levels in sea food in two creeks in Niger Delta. Given the historical anthropogenic impacts that is common in Niger Delta, this study therefore focus on microbial and heavy metal analysis of sea food, especially periwinkle and mudskipper in Ekerekana and Buguma Creek of Niger Delta which hitherto has not been reported.

II. MATERIALS AND METHODS

Study Area

The study was carried out in Ekerekana and Buguma creeks, Niger delta, Nigeria. Ekerekana creek is located in Okrika local Government Area or Rivers State, Nigeria and lies between longitude 700 and 601E and latitude 400 and 501N. While Buguma creek is located in Asari Toru local Government area of the state. It is situated between longitude 60471E and latitude 400 591N (Figure 1).

Sampling period

The sampling was carried out bimonthly between July 2012 and February 2013; consisting of four wet season months (July-October) and four dry season months (November February).

Collection of samples

The different species used in the study were sampled from the creeks based on their life cycle, feeding and behavioural pattern. These species were chosen based on their availability all year round. Ten samples of each specimen were collected in each of the sampling months. The periwinkles *(T. fuscatus*) were handpicked from the sediment in the creeks at low tide. Specially designed traps were used in the collection of mudskipper (*P.papilio*), They were kept in a sterile isothermal container and transported to the laboratory for microbiological analysis. At the laboratory, these samples were extensively washed and rinsed with normal saline solution to remove dirt, debris and surface contaminants. The edible parts of periwinkle was removed with the aid of a specially fabricated sterile needle.These samples were transferred separately one at a time to a sterile blender for homogenization and serial dilution. Water samples were collected monthly with sterile plastic containers from both creeks, in all sampling months. The containers were rinsed three times with the water samples to be collected at the site before the collection was made. The water and the sea foods were later transferred to the laboratory for heavy metal and microbiological analysis.

Microbiological analysis

Total hetorotrophic bacteria count; Total vibrio count; Total Salmonella/ Shegella count and Total Coliform count were analyzed in water and periwinkle and mudskipper and mullets. Samples of the seafood (the fleshy edible part) were hygienically transferred to a sterile stomacher (Model BA 6021, Seward Medical, UK) according to the method described by Chouliora *et al.* (2006). This was later homogenized, using 225ml sterile

0.1% peptone water for a period of two minutes. Serially, tenfold dilution up to 105 of the homogenates were made by transferring 1ml of fresh sterile dilutors to plates of surface-dried Nutrient Agar for total bacteria count and Salmonella-Shigellae Agar for salmonella count. All plates were incubated at 370C for 48 hours. In analysis of total coliform, the 5-tube MPN (Most Probable Numbers) methods described by Gerhardt *et al.* (1996), was employed. The tubes for total coliforms were incubated at 370 C for 24 hours. Evaluation of bacterial number was done by plant count following the methods described by APHA (1998).Enumeration of vibrio spp. was done by using the medium Thiosulphate citrate bile salt agar (TCBS). Aliquot (0.1ml) each of water sample and each of the seafood was pipette aseptically into TCBS plates in triplicates and spread with a sterile glass rod. The vibrio spp. was later enumerated using standard microbiological techniques (BAM, 1998).

Heavy Metal Analysis

The tissues of *T.fuscatus* and the flesh of *P.papilio* were rinsed with distilled water to remove debris, plankton and other external adherents. They were then dried in an oven at 105^0c. They were later homogenized using mortar and pestle. 10g of the homogenate was digested as described by APHA (1998). The sample was digested using 1:5:1 mixture of 70% perchloric acid, concentrated nitric acid and sulphuric acid at 80^0c in a fume chamber until a colourless liquid was obtained. The metal concentrations were determined by Atomic Absorption spectro photometry buck scientific 200A model. Levels of heavy metals were expressed in mg/L dry weight.

III. RESULTS

Population Densities of Microorganisms Found In Wet Season In Ekerekana And Buguma Creek

The results of population densities of microorganisms found in wet season month of July to September are presented in Table 1. The results obtained indicated that in Total Heterotrophic bacteria count, Total Salmonella/Shigella count, Total Vibrio count and Total Coliform count, in Ekerekana were more than that of Buguma creek in all the months of study Variations in microbial counts in wet season months (July to October) revealed that the highest number in colony forming units per millimeter of Total Heterotrophic Bacteria Count (THC), (cfu/ml), were observed in fish (mudskipper) in Ekerekana creek. While the lowest range (1.1×10^2 – 1.6×10^2) in Total Salmonella Count in periwinkle in Buguma creek (Table 1).In the dry season months, the highest range (5.3×10^4 – 7.2×10^5) was recorded in THC in periwinkle in Ekerekana creek, while the lowest (0) was recorded in Total Vibro Count of fish (periwinkle) in Buguma creek (Table 1).

Heavy Metal Concentrations in Water, Periwinkle and Mudskipper from Ekerekana And Buguma Creek

The results of heavy metal concentrations in water samples obtained from Ekerekana and Buguma creek are presented in Table 2. The results obtained revealed that heavy metals namely copper (Cu), Cadmium (Cd), Lead (Pb), and Nickel (Ni) in Ekerekana creek were higher than that of Buguma creek, except in Iron (Fe) concentration (Table 2). The results of heavy metals in sampled periwinkle from Ekerekana and Buguma creek as shown in Table 3, indicated that concentrations of heavy metals Cu, Fe, Cd and Ni in periwinkle from Ekerekana creek were consistently higher than that of Buguma creek, except in Pb, where the samples obtained from the two creeks were in the same range (Table 3). The results of heavy metals in mudskipper collected from both Ekerekana and Buguma creek are presented in Table 4. The results showed that heavy metals, such as Cu, Fe, and Cd were higher in mudskipper obtained from Ekerekana creek, than that of Buguma, whereas, Pb and Ni, were in the same range for both Creeks

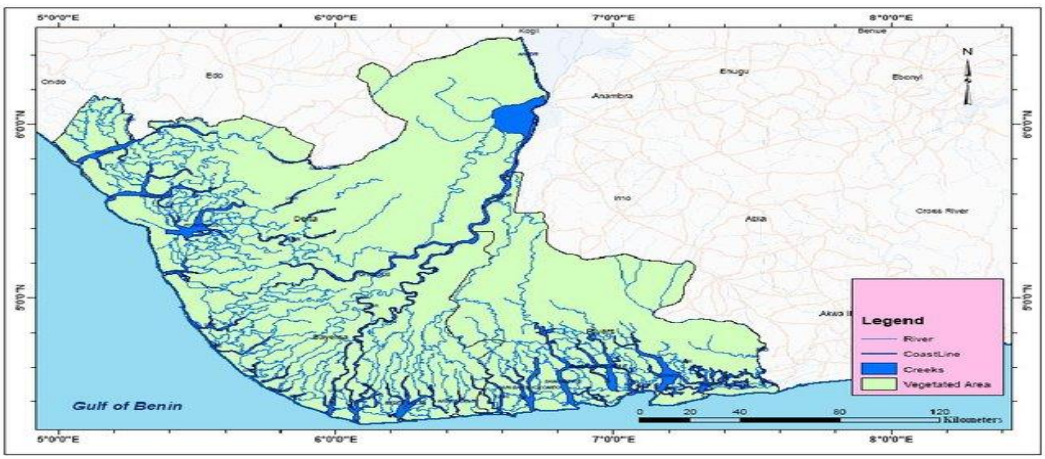

Figure 1: Map of Niger Delta

Source:

Table 1: Population Densities Of Microorganisms Found In Ekerekana And Buguma Creek

Months	Sample	Total Heterotrophic bacteria count (cfu/m)		Total *Vibro* count (cfu/m)		*Total Salmonela/Shigella* (cfu/m)		Total Coliform count (cfu/m)	
		Eke	Buguma	Eke	Buguma	Eke	Buguma	Eke	Buguma
July	Water	6.3×10^5	4.2×10^5	3.0×10^2	1.8×10^2	9.0×10^2	4.0×10^2	1.0×10^2	1.0×10^2
	Fish	7.1×10^4	5.2×10^4	4.0×10^3	2.4×10^3	2.0×10^2	1.1×10^2	2.4×10^2	1.4×10^2
	Periwinkle	7.6×10^3	4.8×10^3	5.4×10^3	3.1×10^3	2.4×10^2	1.4×10^2	3.6×10^3	1.6×10^2
August	Water	6.0×10^5	4.0×10^5	3.2×10^2	1.6×10^2	8.2×10^2	3.2×10^3	1.0×10^2	1.0×10^2
	Fish	7.4×10^4	5.1×10^4	4.8×10^3	2.1×10^3	2.0×10^2	1.0×10^2	2.6×10^3	1.6×10^2
	Periwinkle	7.8×10^3	4.2×10^5	3.6×10^4	1.6×10^2	2.2×10^2	1.1×10^2	3.8×10^3	1.8×10^2
September	Water	5.8×10^5	4.1×10^6	3.0×10^2	1.4×10^2	8.5×10^2	4.5×10^2	1.1×10^2	1.0×10^2
	Fish	7.0×10^5	3.2×10^5	4.2×10^3	1.6×10^2	2.0×10^2	1.0×10^2	2.3×10^3	1.2×10^3
	Periwinkle	6.2×10^6	3.0×10^4	3.9×10^4	1.9×10^4	2.4×10^2	1.2×10^2	3.6×10^2	1.6×10^2
October	Water	7.1×10^5	5.1×10^5	3.8×10^2	7.8×10^2	9.1×10^2	6.2×10^2	2.1×10^2	1.1×10^2
	Fish	7.6×10^5	4.6×10^5	4.9×10^2	2.1×10^2	3.4×10^2	1.4×10^2	3.8×10^2	1.6×10^2
	Periwinkle	6.8×10^5	3.6×10^3	4.1×10^2	2.7×10^2	3.1×10^2	1.6×10^2	4.2×10^2	1.8×10^2
November	Water	3.9×10^5	1.9×10^5	1.8×10^2	1.4×10^2	6.8×10^2	4.8×10^2	2.9×10^2	Nil
	Fish	5.8×10^5	3.1×10^5	1.9×10^2	Nil	1.2×10^2	1.1×10^2	2.1×10^2	Nil
	Periwinkle	6.9×10^5	2.7×10^5	2.3×10^4	1.2×10^4	4.8×10^2	2.4×10^2	2.4×10^2	Nil
December	Water	4.1×10^5	2.1×10^5	1.9×10^2	1.0×10^2	6.7×10^2	3.6×10^2	2.7×10^2	1.7×10^2
	Fish	5.1×10^5	3.2×10^5	Nil	Nil	1.2×10^2	1.9×10^2	1.1×10^2	1.0×10^2
	Periwinkle	7.2×10^5	3.6×10^5	2.5×10^2	Nil	4.7×10^2	3.2×10^2	2.8×10^3	1.6×10^2
January	Water	5.6×10^5	3.6×10^5	2.4×10^2	1.1×10^2	1.8×10^2	1.9×10^3	2.4×10^2	1.4×10^2
	Fish	4.2×10^4	2.8×10^4	1.7×10^2	Nil	Nil	2.8×10^2	1.7×10^1	1.5×10^1
	Periwinkle	5.3×10^4	2.3×10^4	2.5×10^2	1.1×10^2	2.1×10^2	3.4×10^2	1.8×10^2	3.8×10^1
February	Water	4.3×10^5	3.2×10^5	2.0×10^2	1.1×10^2	4.7×10^3	1.9×10^2	1.0×10^2	Nil
	Fish	5.2×10^3	3.1×10^3	1.8×10^2	Nil	2.3×10^2	3.4×10^2	3.6×10^3	Nil
	Periwinkle	5.7×10^4	3.1×10^4	3.2×10^2	1.1×10^2	2.4×10^2	3.4×10^2	1.7×10^2	Nil

Table 2: Heavy Metal Concentrations in Water From Ekerekana And Buguma Creek

Sampling Months	Ekerekana Creek					Bugumma Creek				
	Cu	Fe	Cd	Pb	Ni	Cu	Fe	Cd	Pb	Ni
July	0.41 ± 0.01	0.71 ± 0.01	0.11 ± 0.01	0.28 ± 0.02	0.91 ± 0.01	0.24 ± 0.01	0.42 ± 0.01	0. 09 ± 0.01	0. 12 ± 0.01	0. 61 ± 0.01
August	0.32 ± 0.01	1.79 ± 0.01	0. 11 ± 0.01	0.51 ± 0.01	0.81 ± 0.01	0.21 ± 0.01	1.01 ± 0.11	0. 08 ± 0.01	0. 22 ± 0.01	0. 41 ± 0.01
September	0.91 ± 0.01	0.98 ± 0.01	0.12 ± 0.01	0.11 ± 0.01	0.72 ± 0.01	0.14 ± 0.01	1.21 ± 0.12	0. 02 ± 0.01	0. 02 ± 0.01	0. 06 ± 0.01
October	0.11 ± 0.01	0.52 ± 0.01	0.11 ± 0.01	0.12 ± 0.01	0.06 ± 0.01	0.11 ± 0.01	1.20 ± 0.11	0. 04 ± 0.01	0. 21 ± 0.01	0. 17 ± 0.01
November	0.09 ± 0.01	0.48 ± 0.01	0.09 ± 0.01	0.21 ± 0.01	0.28 ± 0.02	0.11 ± 0.01	1.96 ± 0.13	0. 04 ± 0.01	0. 37 ± 0.02	0. 29 ± 0.02
December	0.32 ± 0.01	0.31 ± 0.01	0.09 ± 0.01	0.22 ± 0.01	0.09 ± 0.01	0.08 ± 0.01	1.91 ± 0.13	0. 04 ± 0.01	0. 36 ± 0.02	0. 09 ± 0.01
January	0.11 ± 0.01	0.31 ± 0.01	0.08 ± 0.01	0.11 ± 0.01	0.09 ± 0.01	0.11 ± 0.01	0.12 ± 0.01	0. 01 ± 0.00	0. 11 ± 0.01	0. 13 ± 0.01
February	0.11 ± 0.01	0.28 ± 0.02	0.06 ± 0.01	0.09 ± 0.01	0.08 ± 0.01	0.11 ± 0.01	0. 09 ± 0.01	0. 01 ± 0.00	0. 01 ± 0.01	0. 11 ± 0.01

Table 3: Heavy Metal Concentration In Periwinkle (*Tympanotorus fuscatus*) From Ekerekana And Buguma Creek

Sampling Months	Ekerekana Creek					Bugumma Creek				
	Cu	Fe	Cd	Pb	Ni	Cu	Fe	Cd	Pb	Ni
July	4.01 ± 0.12	3.98 ± 0.14	1.01 ± 0.01	0.71 ± 0.01	2.22 ± 0.11	2.06 ± 0.81	2.02 ± 0.11	0. 99 ± 0.12	0. 42 ± 0.01	1. 81 ± 0.10
August	3.86 ± 0.11	2.81 ± 0.12	0. 99 ± 0.01	0.61 ± 0.01	1.21 ± 0.12	0.99 ± 0.01	1.68 ± 0.11	0. 92 ± 0.11	0. 41 ± 0.01	1. 26 ± 0.11
September	1.02 ± 0.12	2.14 ± 0.14	1.18 ± 0.10	0.72 ± 0.01	1.21 ± 0.11	0.93 ± 0.01	1.76 ± 0.12	0. 91 ± 0.11	0. 62 ± 0.01	0. 08 ± 0.12
October	1.19 ± 0.11	2.41 ± 0.22	0.74 ± 0.01	0.88 ± 0.01	1. 6 ± 0.11	0.71 ± 0.02	1.21 ± 0.13	1. 11 ± 0.12	0. 99 ± 0.01	0. 72 ± 0.01
November	1.29 ± 0.09	2.61 ± 0.21	0.91 ± 0.01	0.96 ± 0.01	0.91 ± 0.12	0.69 ± 0.02	0.52 ± 0.02	0. 61 ± 0.01	0. 51 ± 0.01	0. 72 ± 0.01
December	1.41 ± 0.11	2.61 ± 0.22	0.92 ± 0.01	0.96 ± 0.01	0.61 ± 0.01	0.68 ± 0.01	0.61 ± 0.2	0. 62 ± 0.01	0. 52 ± 0.01	0. 69 ± 0.01
January	1.52 ± 0.12	2.82 ± 0.32	1.00 ± 0.01	0.96 ± 0.01	0.63 ± 0.01	0.92 ± 0.01	0.91 ± 0.02	0. 68 ± 0.01	0. 07 ± 0.01	0. 76 ± 0.01
February	1.13 ± 0.11	1.13 ± 0.11	0.84 ± 0.02	0.02 ± 0.02	0.61 ± 0.01	0.61 ± 0.01	0. 92 ± 0.02	0. 51 ± 0.02	0. 02 ± 0.01	0. 61 ± 0.01

Table 4: Heavy Metal Concentration In Mudskipper From Ekerekana And Buguma Creek

Sampling Months	Ekerekana Creek					Bugumma Creek				
	Cu	Fe	Cd	Pb	Ni	Cu	Fe	Cd	Pb	Ni
July	3.68 ± 0.12	2.61 ± 0.11	1.71 ± 0.18	0.61 ± 0.01	2.48 ± 0.01	2.01 ± 0.01	1.18 ± 0.02	0. 09 ± 0.01	0. 98 ± 0.01	2. 18 ± 0.01
August	2.41 ± 0.21	1.61 ± 0.02	1. 76 ± 0.12	0.72 ± 0.01	2.02 ± 0.12	2.11 ± 0.31	1.01 ± 0.11	1. 21 ± 0.02	1. 66 ± 0.12	1. 18 ± 0.01
September	2.91 ± 0.31	2.04 ± 0.02	1.78 ± 0.12	0.65 ± 0.01	2.11 ± 0.11	1.81 ± 0.12	1.21 ± 0.12	1. 22 ± 0.04	1. 61 ± 0.11	0. 01 ± 0.01
October	2.81 ± 0.22	1.91 ± 0.01	0.99 ± 0.01	0.63 ± 0.01	1.91 ± 0.11	1.61 ± 0.12	1.20 ± 0.11	1. 21 ± 0.06	0. 81 ± 0.01	0. 99 ± 0.01
November	2.01 ± 0.11	1.73 ± 0.04	0.81 ± 0.02	0.41 ± 0.01	1.01 ± 0.12	1.12 ± 0.13	1.96 ± 0.13	1. 01 ± 0.01	0. 82 ± 0.01	0. 58 ± 0.02
December	2.11 ± 0.11	1.98 1 ± 0.01	0.88 ± 0.02	0.49 ± 0.01	1.31 ± 0.11	1.98 ± 0.11	1.91 ± 0.13	1. 12 ± 0.01	0. 94 ± 0.01	0. 81 ± 0.01
January	1.91 ± 0.12	1.92 ± 0.01	0.98 ± 0.02	0.31 ± 0.01	1.01 ± 0.01	1.88 ± 0.11	0.12 ± 0.01	0. 12 ± 0.01	0. 34 ± 0.01	0. 38 ± 0.01
February	1.93 ± 0.14	0.99 ± 0.02	0.92 ± 0.02	0.30 ± 0.01	0.89 ± 0.01	1.81 ± 0.12	0. 09 ± 0.01	0. 34 ± 0.01	0. 31 ± 0.01	0. 21 ± 0.01

IV. DISCUSSION

Sea foods are prone to bacterial contamination and could cause health risk to consumers (Wafaa *et al.*, 2011). The food poisoning associated with consumption of periwinkle and mudskipper either raw or slightly cooked that is contaminated with varying degree of bacteria can cause intestinal infection, characterized by diarrhea, abdominal cramps, vomiting, fever and severe headache (Espireira *et al.*, 2010; Merwad *et al.*, 2011).

Microbial analysis of the effluents discharged into Ekerekana creek, produced five bacterial groups, *Bacillus spp, E. coli, and Salmonella sp, Micrococcus sp, Pseudomonas sp* . This result is in agreement with earlier report by Ogbuagu *et al.* (2011), in the same creek, but contradicts that of Okoh *et al.* (1996) who observed a high bacteria population density. The difference observed may be due to environmental influence, which is a crucial factor affecting microbial population density. Samples of periwinkle and mudskipper analyzed microbiologically in this study showed varying degree of bacterial contamination. The study revealed that a total of nine different species of bacteria were isolated, with *Salmonella and E. coli* being more predominant throughout the months of study. This result is in line with the report of Ji *et al.* (2011) in sea foods from two coastal areas of China, but contradicts that of Ana *et al*. (2009), the difference may be due to differences in type of seafood analyzed. As different seafood, contains different flora micro organisms.

In both creek studied in this work, the seafood analyzed contains more bacteria species in the wet months (July – October) than the dry months (November – February). This may be due to increase in concentration of bacterial flora in the surrounding water, as fish and shell fishes have a tremendous ability to concentrate bacteria from their immediate surrounding waters (Adams and Moss, 2005). In the present study, *Vibrio spp* isolated in the sea foods, is more predominant in Ekerekana creek compared to Buguma creek in the study months. This is similar to the results of Thompson *et al*. (2008) when comparing two coastal areas of Eastern China. This result is also comparable with that reported by Tamura *et al.* (2011) in the Gulf of Mexico waters. *Vibiro* species were also isolated from Buguma, but at a lower concentrations, this support the finding of Omenwa *et al.* (2011) in the same creek. This may be due to human activities that bring about pollution, such as bathing, defecation by the local populace, coupled with waste from cottage industries, which are common phenomenon in the area. *Salmonella spp* one of the most important food-borne pathogens are indicators of sewage contamination and it is found to be associated with a number of non-human hosts example reptiles (Winfiled and Groisman, 2013). It has been reported to survive and persist in the aquatic environment and has been detected, in seafood in different creeks of Niger Delta (Adebayo-Tayo *et al.,* 2006) and causes new born meningitis and infantile diarrhea (Odu *et al.,* 2010). In addition, *Staphylococcus aureus* was isolated in sea food sampled from Ekerekana creek, this is in agreement that with reported by Okonko *et al.* (2008) while comparing to microbial quality of sea foods from two different areas.

The results of this work indicated that the water samples from both Ekerekana and Buguma creek showed variations in bacterial composition between the sampling months. This may have been influenced by anthropogenic activities such as defecation, recreation and presence of both small and large scale industries sited in these areas that discharges their effluents into the creek. Hence these findings confirms the report of other workers (Benka – Coker and Ohiman, 1995; Efiuvwevwere and Ezeama, 2004; Edun and Efiuvwevwere, 2012), who observed that high bacterial counts in rivers and creeks were associated with manure-run offs from farms, discharge from industries and most importantly human activities. The Gram-negative bacterial flora from the water samples accounted for more than 60% of the microbial composition. This may be due to the presence of high human wastes and industrial waste in the aquatic environment. This corroborated the observation of other workers that Gram-negative bacteria predominate where there is abundance of effluents and human waste (Craig *et al.,* 2002; Desmaraz *et al*., 2004).

Heavy metal concentration analysis in water samples from Ekerekana and Buguma indicated that heavy metal were higher in concentrations in rainy season then the dry season months. This result corroborates the findings of Uzoekwe and Oghosane (2011) in Ubeji creek Warri, Southern Nigeria, but contradicts that of Al-Sulami *et al.* (2002) in Arabian gulf along the Easter coast, who observed no seasonal change in the heavy metal analysis in the gulf region. This reason may be due to environmental factors, such as length of rainfall and sunshine hours which differ in the two regions. The high concentrations of heavy metals recorded in the wet season. In both creeks, may be due high intensity of rainfall which results in flooding, thereby washing a lot of debris into the creeks. The higher metal contents (Cu, Cd, Pb, and Ni) in water samples observed in Ekerekana creek is similar to those reported by Chindah *et al.* (2008) in the same creek. These high concentrations of heavy metals may be due to influx of effluents which is constantly discharged into the creeks. As Igbinosa and Oko (2009) reported that continuous discharge of refinery effluents into the water body overtime can lead to higher concentrations of metal in the water body. In the study higher concentrations of Iron (Fe) where observed in Buguma creek, than that of Ekerekana creek. This result is similar to the one obtained by Oribhabor and Ogbeibu (2009) in the same creek this increase may be traceable to sources such as waste dump, and other relevant occupational fields (steel making, wielding, cutting, glass and ceramic production which are common phenomenon in the area.

The average levels of the metals in the seafood under consideration shows that the level of Copper (Cu) was highest in both periwinkle and mudskipper in Ekerekana creek, while Iron (Fe) was the highest in Buguma. These observed differences may be due to variations in pollutants discharged into these creeks. (Anyakoha and Coker, 2007), in the case of Ekerekana, it is majorly effluents from the refinery while that of Buguma, is from small scale cottage industries. The pattern of heavy metal accumulation in the tissues of mudskipper and

periwinkle in both creeks was Cu > Fe > Ni > Cd > Pb, at deferent levels. The results of the study indicated that trace metals bioaccumulates at different levels in the tissues of the periwinkle (*T. Fuscatus)* and mudskipper (*P. Papillio)* examined from the two creeks. These differences in accumulation may be due to their specific finding habits and elimination processes in addition to the bioavailability of the metals (Chindah *et al.*, 2004). This phenomenon may also be attributed to the fact that Periwinkle are sedentary animal, this may have been enhanced by their constant contact with sediments, that is known to act as receptors to pollutants (Chindah 2004). However, the values of metals observed in Ekerekana creek was higher than that of Buguma . This is because these heavy metals are closely associated with crude oil and its processed products and to some extent municipal waste discharges (Gobo *et al.*, 2008).

V. CONCLUSION

Data obtained from this work revealed that the activities of a refinery can cause a serious contamination of the receiving creek of its host community, resulting in potential, chronic detrimental health effects. The observed spatial variation in heavy metal concentrations indicates proximal inputs. Seasonal variations were observed in the concentrations of various water quality parameters, most of these parameters evaluated showed higher concentrations during the rainy season when water volume is increased to its maximum. This study has shown that industry effluents discharged into Ekerekana creek resulted in the presence of high concentrations of pollutants in the water body. The toxicants have been shown to be present in concentrations which may be toxic individually to different aquatic organisms and sea foods such as periwinkle and mudskippers which poses a health hazard to humans' final consumers.

VI. RECOMMENDATIONS

Based on the findings in this study is therefore recommend that:

1. Discharge of untreated effluents from the refinery effluets into Ekerekana creek, should be discouraged.
2. Sea foods consumed should not be collected from the point of discharge of these effluents
3. Awareness should be created of the hazards involved in consumption of these sea food collected from polluted water.
4. More research should be carried out on appropriate processing methods that will reduce the incidence of these bacterial infection in periwinkle and mudskippers
5. Waters from Ekerekana creek should not be consumed directly without adequate processing.

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