Journal of Medicine & Biomedical Research

HEAVY METALS IMPACT IN WATER AND SEDIMENT OF A RURAL STREAM IN BENIN CITY, NIGERIA: IMPLICATIONS TO AQUATIC AND HUMAN HEALTH

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ABSTRACT

Heavy metals are known to have a deleterious effect on organs and tissues of both aquatic and human lives. This study was to assess the impact of heavy metals in water and sediment of Obueniyomo river and its implications to aquatic and human health. Water and sediment samples were collected using a pre-washed plastic container and Eckman Grab for analysis with an Atomic Spectrophotometer (AAS).The heavy metalsassessed included Cadmium, Cobalt, Copper, Iron, Lead, Manganese and Zinc respectively.The world health organization (WHO), United States environmental protection agency (USEPA) and Federal ministry of environment (FMEv) standards wereapplied to assess the pollution load of the surface water, while World Surface Rock Average (WSRA) and World Health Organization (WHO) standards were applied for Sediment. Data were analysed using SPSS version 23.0;Microsoft Excel (2016) and MATLAB (2015a). The results revealed varying heavy metal contamination in water and sediment with Manganese recording 18.25±88.13mg/L in the surface water of station 2 and Iron levels of 253.96±52.71, 289.63±126.65 and 242.20±57.66 in the sediment at the sampled stations. Iron,manganese and lead revealed high pollution with copper above WHO and USEPA standards in water while Cadmium was above the set standard of WSRA (0.3) in sediment. Iron, manganese and lead impact the river greatly thereby increasing the pollution load of the water body,which could accumulate and destroy vital organs thereby affecting human and aquatic health.

***Keywords**: Anthropogenic Influence, Heavy metals, Obueniyomo River and Water Pollution.*

INTRODUCTION

Trace metals occurs naturally as components possessing higher atomic weight and a density that areat-most 5 times greater than water, as these elements can hardly be destroyed or degraded. (Ubiogoro and Adeyemo, 2017). Some of which are essential to living organisms as basic requirements for their metabolic activities. Elements like copper, iron, zinc, manganese and cobalt are necessary but some are toxic (chromium, lead, mercury, arsenic and cadmium) even at minimal concentrations (Ubiogoro and Adeyemo, 2017). The contamination of water bodies by pollutants of heavy metals through increased anthropogenic activities can unfavorably influence the quality of water and sediment of water bodies, thereby impacting life forms in the aquatic ecosystem. In addition, heavy metals contaminants in form of floating particles are foraged from the water column by benthic macroinvertebrates and also accumulates in the fine sediments of freshwater, thus, increasing the contamination load (Carlos*et al.* 2017).

Heavy metals pollution of freshwater is a serious environmental issue due to its bioaccumulating factor in organs and tissues of organisms, which are consumed by both invertebrates and humans, and often result to adverse health implications. These, however, could lead to carcinogenesis or apoptosis due to damages of DNA molecules and nuclear proteins (Beyersmann and Hartwig, 2008). Researchers have studied the deleterious effects of heavy metals in the water and sediments of various aquatic ecosystems to be acquainted with the level of pollution of these metals and to determine its relations to each specific aquatic ecosystem. Some of such studies includes, Dapam*et al*., (2018); Khalid *et al*., (2018); Khan *et al*., (2018); Mgbemena*et al*., (2017); Nwankwoala and Angaya, (2017) and Rama *et al*., (2017). Obueniyomo River is a rural stream which serve as the significant wellspring of water supply for the local community. This

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however, subjects freshwater body to high level of anthropogenic and agricultural activities thereby degrading it at a very large scale (Odigie, 2014). The main goal of this study was to assess heavy metal impact on water and sediment of a rural stream in southern Nigeria and relating it's effects to aquatic and human health.

MATERIALS & METHODS

Study Area

Obueniyomo River, Latitudes 05°34.445' E, 05°34.444' E and Longitudes 006° 37.477' N, 006° 37.476' N is the major river in Agemokopa community of Edo state, Southern Nigeria . The Stream is about 13km long, taking its source from Odighi hills and empties into Benin River. This rural community is mainly dependent on agriculture, livestock farming, timber logging and hunting as means of survival. This river serves as the vital source of water for drinking and other domestic and agricultural activities. The increased anthropogenic activities in this freshwater body adversely affect the aquatic biota and reduces the water quality.

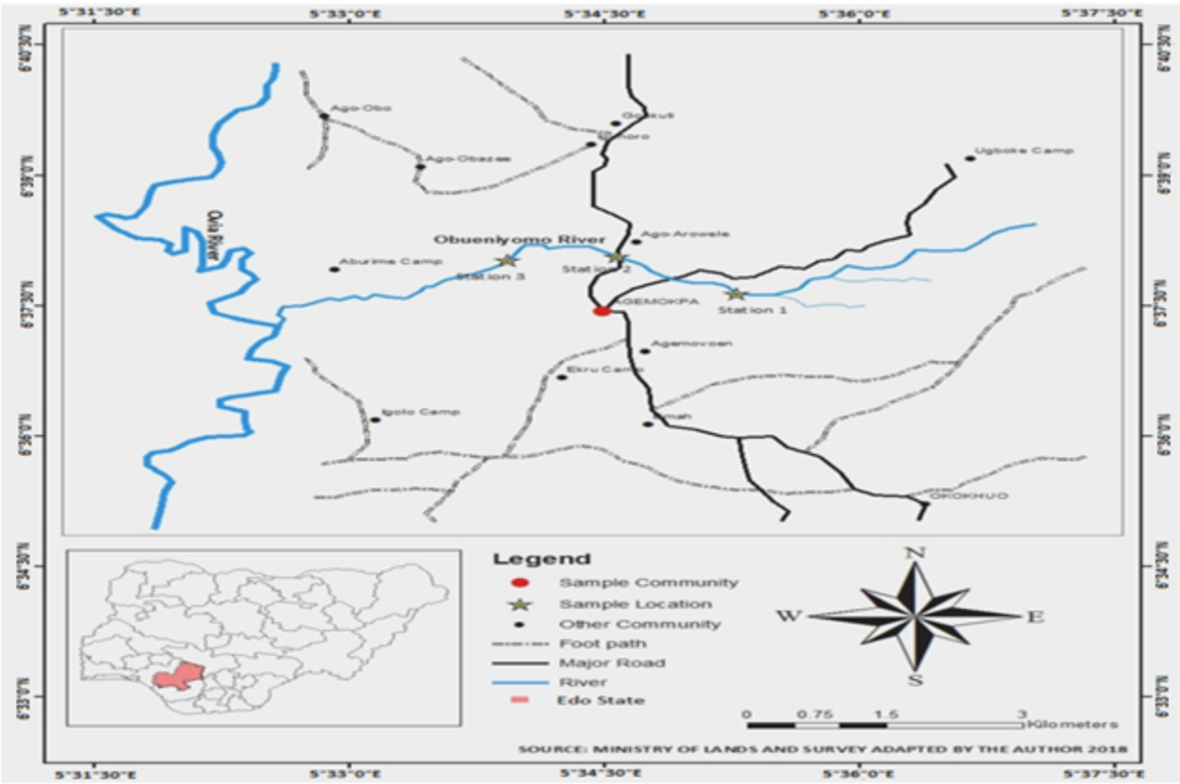

Figure 1: Map of study area showing the sampling stations.

Sampling Stations

Three stations that were highly impacted were selected and tagged stations 1 (upstream-close to the source), 2 (mid-Stream) and 3 (down-stream) were designated for this study. Also, some characteristics such as flow velocity, depth of overlying water as well as substrate type and size were also considered.

Sampling techniques

Heavy metals samples of surface water was collected in 50cl pre-washed plastic containers and fixed with few drops of Nitric acid. Also, sediment samples was also collected with the aid of an Eckman Grab and stored in well labelled foil paper for further analysis in the laboratory.

Laboratory Analysis

Heavy metalsfor surface water and sediment samples was analysed using Atomic Absorption Spectrometer (AAS), Solar 969 Unicam series (APHA, 2005). The AAS method was applied for the rapid determination of Lead, Cobalt, Zinc, Copper, Nickel, Cadmium, Iron and Manganese in sediment samples after digestion and double acid extraction in the laboratory.

Statistical Analysis

Data obtained for heavy metals in water and sediment was subjected to paired t-test using SPSS version 23.0, Microsoft Excel (2016) and MATLAB (2015a).

RESULTS

Water

The results of the analysis of seven (7) trace metals and comparison with the standards of World Health Organization, United States Environmental Protection Agency and Federal Ministry of Environment in surface water are presented in tables 1, 2 and 3 respectively. Cadmium showed significant difference ($p < 0.05$) between the three stations but Lead, Manganese and Zinc were significant ($p < 0.05$) only in between stations 1 and 3 when compared respectively. In addition, the levels of Iron recorded highest concentrations across the three stations which was closely followed with Copper and Zinc while Cadmium recorded the least respectively. Furthermore, the mean values of heavy metals in surface water from the three station when compared with WHO, USEPA and FMEv standards showed that Lead was above the acceptable range limit of the three regulating bodies. However only the levels of Cadmium and Zinc in the surface water were within the acceptable range limit. Iron levels in surface water was above WHO and USEPA standards but within FMEv limits. Cobalt levels was not compared as there was no set standards by the three regulatory bodies. Copper levels in surface water was within USEPA range but above WHO and FMEv standards. Manganese level was within USEPA standard but above FMEv limits of surface water also there are no set standard for WHO.

Cadmium (Cd) recorded mean values of 0.00±0.01mg/L, 0.00±0.00mg/L and 0.00±0.01mg/L in the study stations. The monthly variations of Cd across the three study stations revealedpeak Cd values in December 2017. The Cd levels remained constant in the three stations in the months of March 2016-November 2017 and January-February 2018 respectively (Figure 2).

The heavy metal Iron (Fe) concentration level ranged between 0.70±0.46mg/L, 0.90±0.78mg/L and 0.78±0.57mg/L at the study stations respectively. The highest mean concentration of 3.26mg/L was recorded in station 2, while the lowest Iron concentration of 0.03mg/L was recorded in Station 3. The monthly trends in Fe levels recorded peak values across the study stations in the months of March 2016, October 2016, March 2017, August 2017, October 2017 and December 2017. Also, low levels of Fe was also recorded in stations 1, 2 and 3 in the months of June 2016, April-July 2017, September 2017, November 2017 and January 2018 (Figure 3).

The mean concentration of Lead (Pb) ranged between 0.03±0.09mg/L in station 1, 0.03±0.06mg/L in station 2 and 0.04±0.10 respectively. Maximum Pb levels was recorded in station 3(0.51mg/L) with low Pb values of (0.00mg/L) recorded across the study stations. The monthly trends of Pb levels were observed across the three study stations. In the month of March 2016 high Pb levels was recorded, with low levels of Pb recorded from April 2016-February 2018 respectively across the study stations (Figure 4).

Cobalt (Co) mean values recorded a slightly high concentration of 0.11±0.20mg/L in station 1, with stations 2 and 3 recording constant mean concentration of 0.10±0.18mg/L respectively. The maximum Co concentration of 0.84mg/L was recorded in station 1 with minimum values of 0.00mg/L recorded across the three study months seasonally monthly variations in Co level experienced fluctuations in some study months and stations. Peak levels of Co were recorded in station 1 in December 2017, while high Co values were recorded in station 3 in April 2016. At the three study stations, peak levels of Co were recorded in May-June 2017 and October 2017. Low levels were recorded in stations 1and 2 in April 2016. Stations 1 and 3 experienced low Co levels in November 2017, while individual stations like station 2 and 3 recorded minimum Co levels in August 2017 and December 2017. All stations recorded low Co levels in March 2016, May 2016- April 2017, July 2017 and January- February 2018 (Figure 5).

The concentration level of Copper (Cu) varied between 0.27±0.31mg/L in station 1, 0.25±0.27mg/L in station 2 and 0.25±0.26mg/L in station 3. The maximum and minimum mean concentration of Cu was recorded in station 1 of between 1.25mg/L and 0.00mg/L seasonally. Monthly trends of Cu levels observed peak values in the study months of April 2016, December 2016, February 2017, June 2017, August 2017, December 2017 and February 2018 across the three study stations. Low levels of Cu were observed in the months of March 2016, May 2016- January 2017, March-April 2017, July 2017, September 2017, November 2017 and January 2018 (Figure 6).

Maximum Mn concentration was recorded at station 2 (0.4320mg/L) with the least (0.00mg/L) recorded at stations 1 and 2. The monthly variations in Mn levels observed peak values in the months of April 2016, June 2016, January 2017 and June 2017. In addition, stations 2 and 3 recorded peak values of Mn in the months of August 2017 and December 2017. However, low levels of Mn were recorded across the three study stations in the months of March 2016, May 2016, July-October 2016, April-May 2017, October 2017 and February 2018. More so, station 1 also recorded low Mn levels in the months of August- September 2017 and December 2017 respectively (Figure 7).

Station 1 recorded maximum Zn mean value of 0.93mg/L while stations 2 and 3 recorded a constant low value of 0.00mg/L respectively. Station 1 recorded peak Zn levels in the month of September 2017, while stations 1 and 2 recorded peak levels in November 2017. Also, stations 1 and 3 recorded peak Zn levels in the months of January 2018, while stations 2 and 3 recorded high Zn levels in the month of June 2017. In addition, station 2 recorded peak Zn levels in the month of February 2018. Minimum levels of Zn were also recorded across the three study stations in the months of March 2016, May 2016, August- September 2016, February 2017, April 2017, October 2017 and December 2017. However, at the individual stations, low Zn levels was observed in station 1 in the month of August 2017, while station 2 recorded low levels of Zn in the months of January 2018. In addition, station 3 recorded low Zn levels in the months of September 2017, November 2017 and February 2018 respectively (Figure 8).

Table 1: Comparisons of heavy metals levels in surface water between the stations of Obueniyomo River using paired t-test analysis.

	STATION 1	STATION 2	STATION 3	*p*-VALUE		
Parameters	Mean±SD	Mean±SD	Mean±SD	STN1 vs STN 2	STN1 vs STN 3	STN 2 vs STN 3
Cadmium (mg/L)	0.00±0.01	0.00±0.00	0.00±0.01	.000*	.000*	.000*
Iron (mg/L)	0.70±0.46	0.90±0.78	0.78±0.57	0.113	0.31	0.25
Lead (mg/L)	0.03±0.09	0.03±0.06	0.04±0.10	0.721	.036*	0.328
Cobalt (mg/L)	0.11±0.20	0.10±0.18	0.10±0.18	0.787	0.796	0.999
Copper (mg/L)	0.27±0.31	0.25±0.27	0.25±0.26	0.721	0.753	0.995
Manganese (mg/L)	0.13±0.12	18.25±88.13	0.22±0.20	0.324	.023*	0.326
Zinc (mg/L)	0.24±0.26	0.17±0.19	0.13±0.16	0.197	.041*	0.239

* - Significant at $p < 0.05$

Table 2: Comparisons of heavy metals concentrations of surface water at three study stations of Obueniyomo River in with WHO, USEPA and FMEv standards.

					RECOMMENDED AGENCIES		
		STATION 1	STATION 2	STATION 3	WHO (2017)	USEPA (2018)	FMEv (2016)
	Parameters	Mean±SD	Mean±SD	Mean±SD	Std (Sn)	Std (Sn)	Std (Sn)
1.	Cadmium (mg/L)	0.00±0.01	0.00±0.00	0.00±0.01	0.005	0.005	0.01
2.	Iron (mg/L)	0.70±0.46	0.90±0.78	0.78±0.57	0.3	0.3	1
3.	Lead (mg/L)	0.03±0.09	0.03±0.06	0.04±0.10	0.01	0.01	0.005
4.	Cobalt (mg/L)	0.11±0.20	0.10±0.18	0.10±0.18	-	-	-
5.	Copper (mg/L)	0.27±0.31	0.25±0.27	0.25±0.26	0.01-0.15	1	0.1
6.	Manganese (mg/L)	0.13±0.12	18.25±88.13	0.22±0.20	-	0.05	0.05-0.5
7.	Zinc (mg/L)	0.24±0.26	0.17±0.19	0.13±0.16	3	0.5	5

Table 3: Summary of heavy metals mean values in surface water from the study stations of Obueniyomo River.

	STATION 1			STATION 2			STATION 3		
Parameters	Mean±SD	Min	Max	Mean±SD	Min	Max	Mean±SD	Min	Max
Cadmium (mg/L)	0.00±0.01	0	0	0.00±0.00	0	0	0.00±0.01	0	0
Iron (mg/L)	0.70±0.46	0.08	1.64	0.90±0.78	0.09	3.26	0.78±0.57	0.03	2.27
Lead (mg/L)	0.03±0.09	0	0.47	0.03±0.06	0	0.32	0.04±0.10	0	0.51
Cobalt (mg/L)	0.11±0.20	0	0.84	0.10±0.18	0	0.75	0.10±0.18	0	0.7
Copper (mg/L)	0.27±0.31	0	1.25	0.25±0.27	0.01	0.92	0.25±0.26	0.01	0.89
Manganese (mg/L)	0.13±0.12	0	0.54	18.25±88.13	0	0.432.00	0.22±0.20	0.02	0.72
Zinc (mg/L)	0.24±0.26	0.02	0.93	0.17±0.19	0	0.55	0.13±0.16	0	0.54

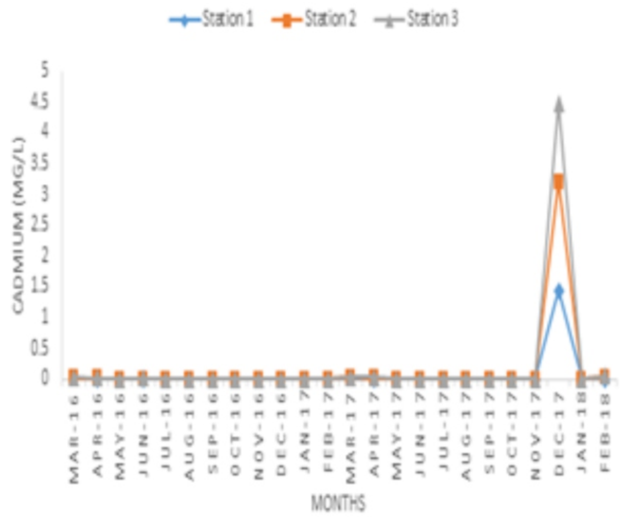

Figure 2: Spatial and monthly variation of Cadmium (mg/L) in surface water at the study stations.

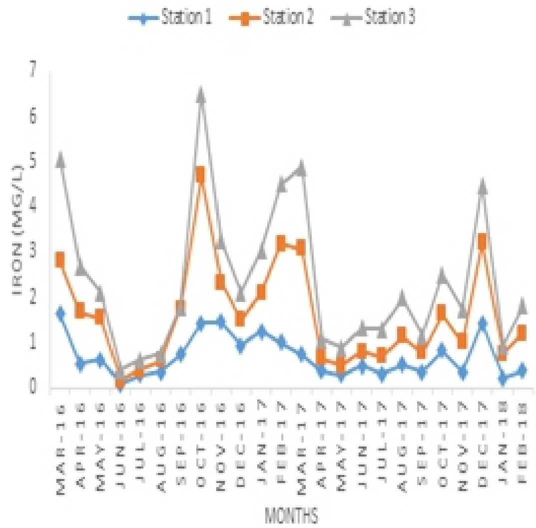

Figure 3: Spatial and monthly variation of Iron (mg/L) in surface water at the study Stations.

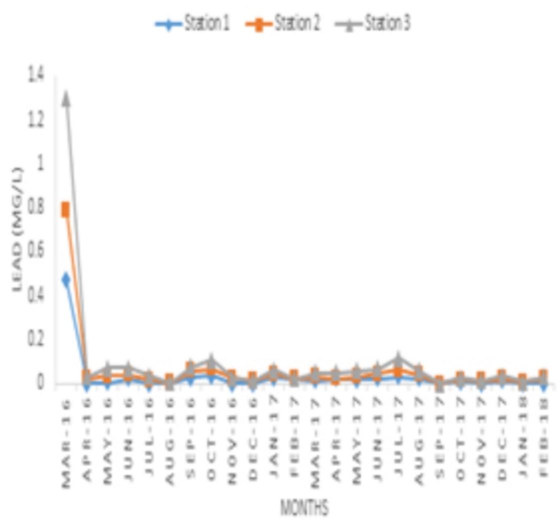

Figure 4: Spatial and monthly variation of Lead (mg/L) in surface water at the study stations.

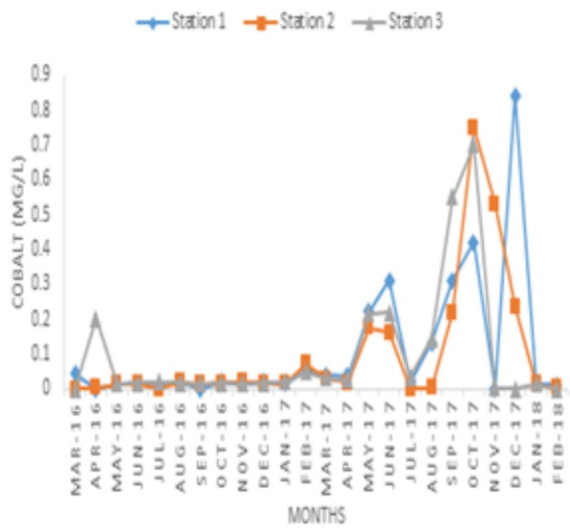

Figure 5: Spatial and monthly variation of Cobalt (mg/L) in surface water at the study stations.

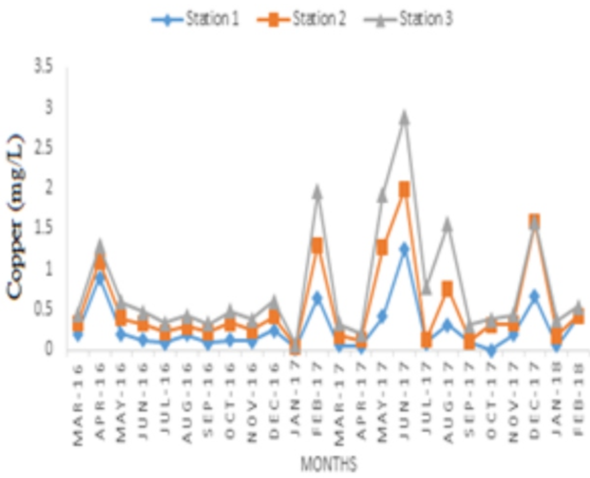

Figure 6: Spatial and monthly variation of Copper (mg/L) in surface water at the study

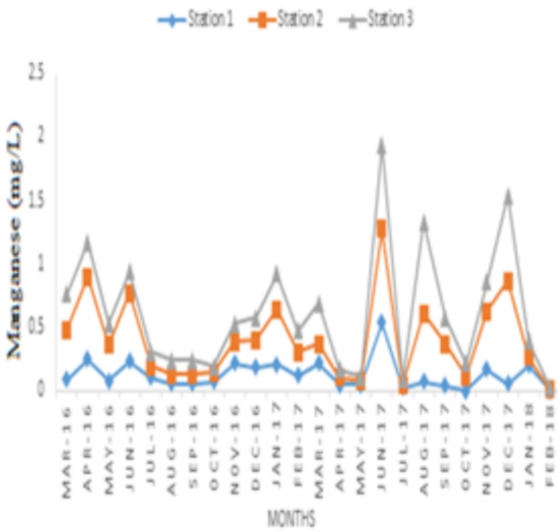

Figure 7: Spatial and monthly variation of Manganese (mg/L) in surface water at the study stations.

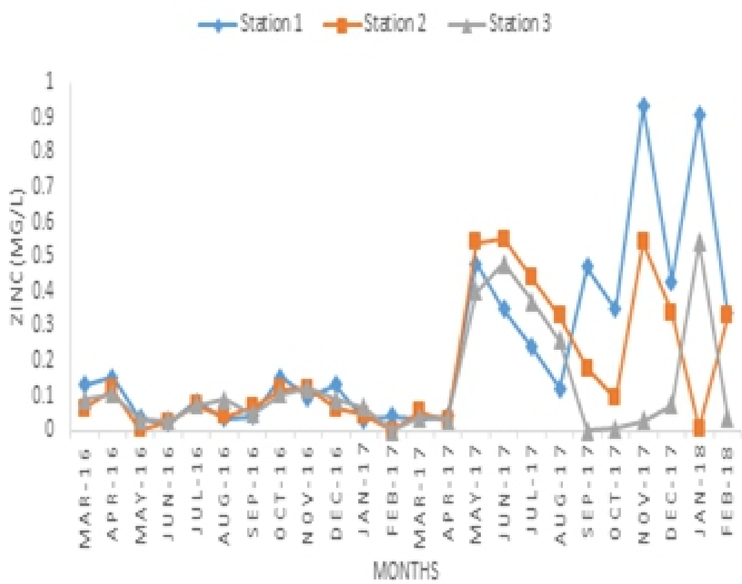

Figure 8: Spatial and monthly variation of Zinc (mg/L) in surface water at the study stations.

Sediment

The summary of trace metals concentration in sediment of the three study stations of Obueniyomo River is shown in tables 4, 5 and 6. The only trace metal that showed significant difference ($p< 0.05$) between stations 1 and 2 was Cadmium in the study months. However, the various heavy metals concentrations when compared with World Surface Rock Average (WSRA) and World Health Organization (WHO) showed that only Cadmium was above the set standard of WSRA (0.3).

High concentration of Iron (Fe) 581.20mg/kg was recorded in station 2, while the lowest concentration of 123.80mg/kg was recorded in Station 3. The monthly variations of Fe in the sediments observed peak values in stations 2 and 3 in the months of March 2016, September 2016, January 2017, March 2017, August 2017, December 2017 and February 2018 but in October 2016 low concentrations of Fe was recorded across the three stations. (Figure 9).

The concentration level of Zinc (Zn) in the sediment of the three study stations of Obueniyomo River varied between 21.39±21.10mg/kg in station 1, 45.84±82.85mg/kg in station 2 and 26.92±32.82mg/kg in station 3. The maximum mean concentration of Zn was recorded in station 2 (260.30mg/L), with the minimum Zn concentration recorded in station 3 (7.20mg/kg). Monthly variations of Zn levels in the sediment across the three study stations revealed peak values in the month of March 2016. Low Zn levels were also recorded across the three study stations in the months of April-October 2016, December 2016- June 2017 and September 2017- February 2018 (Figure 10).

Maximum Mn concentration in sediments was observed at station 1 (90.45mg/kg) with the least concentration of 5.44mg/kg recorded also at the same station respectively. The monthly variations of Manganese concentration levels in the sediments at the three study stations recorded peak values in March 2016, July 2016, November 2016, February- March 2017, October 2017 and January 2018 respectively. However, low Manganese levels in the sediments were recorded at the threes stations in the months of April 2016, October 2016, December 2016, January 2017, April 2017, September 2017 and November-December 2017 (Figure 11).

Maximum and minimum Cd mean concentration in sediments recorded 3.09mg/kg in station 2 and 0.01mg/kg in station3 respectively in the study periods. Monthly trends recorded peak values of Cd in sediments of the three study stations in the months of March 2016, July 2016, March 2017, August 2017, and November 2017. Low Cd levels occurred across the three study stations in the months of April 2016, December 2016, July 2017, September-October 2017, and January 2018 (Figure 12). These varying concentrations observed across the study stations was as a result of increased anthropogenic activities with impacted the sediment quantity of the study sites.

Table 4: Summary of heavy metals analysis of Sediment at the stations of Obueniyomo River

	STATION 1			STATION 2			STATION 3		
Parameters	Mean±SD	Min	Max	Mean±SD	Min	Max	Mean±SD	Min	Max
Iron(mg/kg)	253.96±52.71	164.49	311.95	289.63±126.65	184.32	581.2	242.20±57.66	123.8	310.48
Zinc(mg/kg)	21.39±21.10	10.56	118.32	45.84±82.85	8.63	260.3	26.92±32.82	7.2	116
Manganese(mg/kg)	23.91±27.16	5.44	90.45	23.91±21.95	11.73	80.58	16.51±4.93	10.17	29.6
Cadmium(mg/kg)	0.70±0.62	0.02	1.91	1.00±0.61	0.11	3.09	0.71±0.83	0.01	2.66

Table 5: Comparisons of heavy metals levels in Sedimen t between the stations of Obueniyomo River using paired t-test analysis.

	STATION 1	STATION 2	STATION 3	P-VALUE		
Parameters	Mean±SD	Mean±SD	Mean±SD	STN1 vs STN 2	STN1 vs STN 3	STN 2 vs STN 3
Iron(mg/kg)	253.96±52.71	289.63±126.65	242.20±57.66	0.281	0.256	0.184
Zinc(mg/kg)	21.39±21.10	45.84±82.85	26.92±32.82	0.118	0.374	0.081
Manganese(mg/kg)	23.91±27.16	23.91±21.95	16.51±4.93	0.988	0.146	0.128
Cadmium(mg/kg)	0.70±0.62	1.00±0.61	0.71±0.83	015*	0.897	0.063

* - Significant at $p< 0.05$

Table 6: Comparisons of heavy metals concentrations in Sediment at three study stations of Obueniyomo River with WHO and WSRA standards.

	STATION 1	STATION 2	STATION 3	WHO	WSRA
Parameters	Mean±SD	Mean±SD	Mean±SD	Std (Sn)	Std (Sn)
Iron(mg/kg)	253.96±52.71	289.63±126.65	242.20±57.66	5000	300
Zinc(mg/kg)	21.39±21.10	45.84±82.85	26.92±32.82	300	127
Manganese(mg/kg)	23.91±27.16	23.91±21.95	16.51±4.93	2000	750
Cadmium(mg/kg)	0.70±0.62	1.00±0.61	0.71±0.83	3	0.3

Note: Referenced values of World Surface Rock Average (WSRA) and World Health Organization (WHO) from Emmanuel *et al.* (2018).

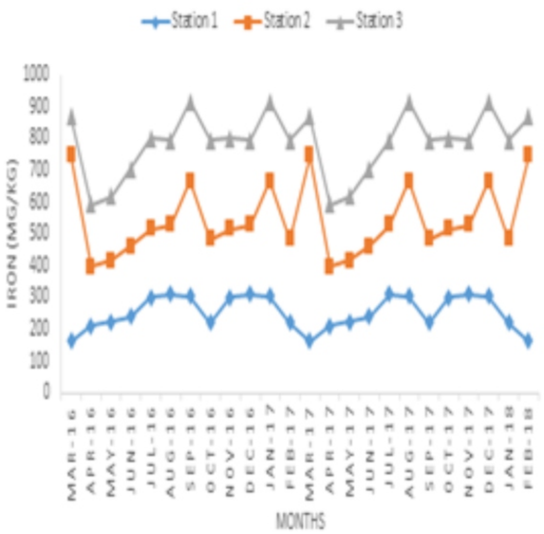

Figure 9: Spatial and monthly variation of Iron (mg/kg) in sediment the three stations.

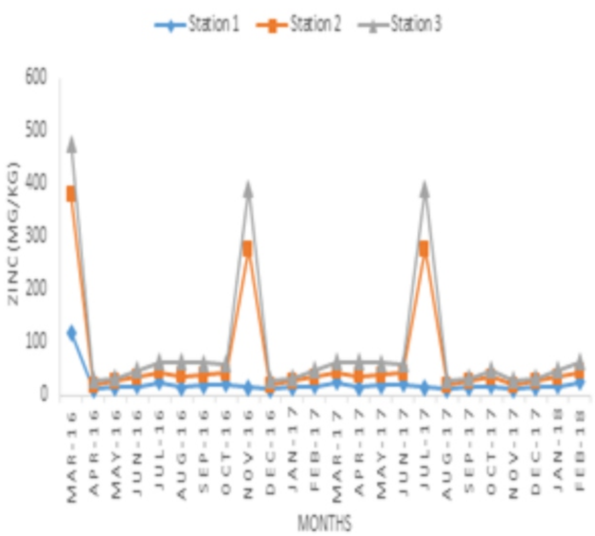

Figure 10: Spatial and monthly variation of Zinc (mg/kg) in sediment the three stations.

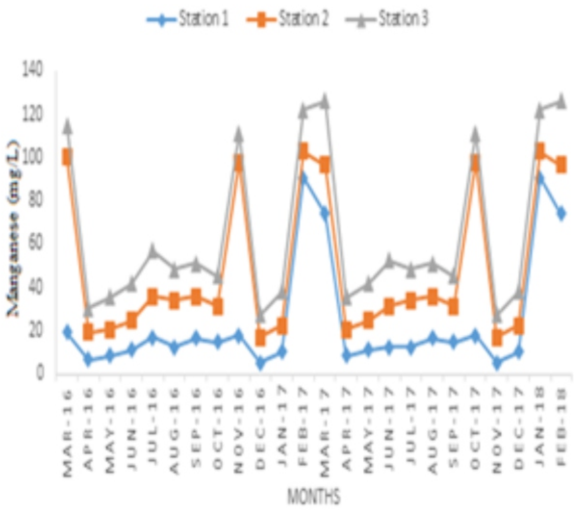

Figure 11: Spatial and monthly variation of Manganese (mg/kg)in sediment the three stations.

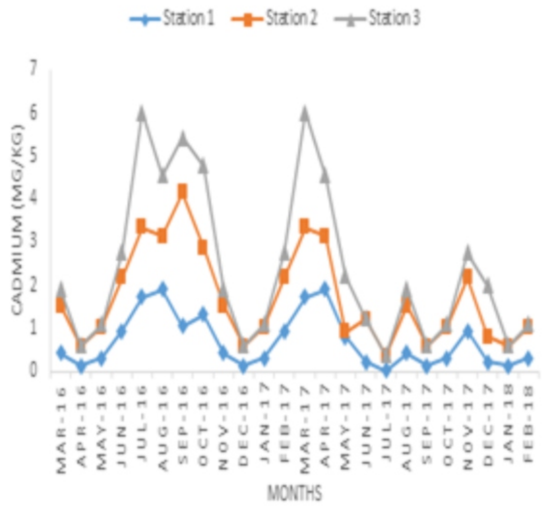

Figure 12: Spatial and monthly variation of Cadmium (mg/kg) in sediment the three stations.

DISCUSSION

Heavy metals are released into the environment by many different activities such as agriculture, mining, industries, and even nuclear processes (Aazami and Taban, 2018). Very small amount of some heavy metals such as Cu, Zn, Fe, and Mg are essential for all living organisms, however, excessive amounts can result in fatal poisoning of aquatic organism and even humans**.** However, some plant species posses bioremediative properties as they are able to absorb high quantities of heavy metals from soil and water (Aazami and Taban, 2018). In this study, the Ascending order of heavy metals occurrence the surface water of Obueniyomo River were; Fe > Cu> Zn> Mn> Co> Pb> Cd with values within and above WHO, USEPA and FMEv standards of water. The elevated levels of these heavy metals especially manganese may be attributed to the effect of surface run-off into the waterbody during the period of water sampling (peak of rainy season in the study area). This finding was similar to the studies of Wogu and Okaka, (2011) in Warri River, Babunath and John (2017) in River Noyyal, Ubiogoro and Adeyemo (2017) in Rivers such as Egbokodo, Ethiope, Urie, Asaba-Ase creek, Aragba and Uzere Creek. Also, similar findings were reported by Onyekuru *et al.,* (2017) in **Otamiri River,** Dapam *et al.,* (2018) in Wujam River, Khalid *et al.,* (2018) in River Kabul. From these studies and the results obtained from the water samples analysed , it is important to state that the levels of heavy metals contamination of the water of Obueniyomo River does not pose any health risk to the inhabitants of the community and aquatic life.

In the sediment, the concentration of the heavy metals followed the trend Fe>Zn>Mn>Ni>Cd with Cadmium above WSRA, while others were within the acceptable limits of WHO and WRSA. Cadmium (Cd) has high soil mobility than any other metal to plant system. In human, only about 5% - 50% of the inhaled element ever enters the lungs. Also, only 1% - 10% Cd gets into the digestive system via ingestion of food and water intake. Chronic exposures to Cd result in renal tubular damage, bone deformities, and heart related diseases (Manju, 2015). However, the variable concentrations (Fe, Zn, Mn and Cd) may be attributed to the dilution factor from rainfall which effects the kinesis and influence of trace metals in sediment of Obueniyomo River. All the metals investigated in the sediment samples from stations 1, 2 and 3 revealed that the concentrations of all the metals where high with Fe recorded the highest concentrations. This observation could be attributed to high anthropogenic and agricultural activities, increase surface area seasonally, content of humic substances released into the water by movements of aquatic organisms and difference in environmental factors (Khan *et al.,* 2018). This result is in agreement with Omoigberale *et al.,* (2014), Omoregie *et al.,* (2016), Babunath and John (2017), Lawal *et al.,* (2017), Nwankwoala and Angaya (2017), Ayandirana *et al.,* (2018), Dapam *et al.,* (2018), Khan *et al.,* (2018) and Sabbir *et al.,* (2018). These studies observed high concentrations of heavy metals in the sediments in the various study sites due to anthropogenic influence, dilution by rainwater which influences concentration and heavy metal mobility, inputs from urban and industrial wastes and agricultural wastes. However, Emmanuel *et al.* (2018) studied the heavy metals concentrations in shore sediments from the Bank of Benue River and recorded high metals concentrations in the study stations. The highest value was that of Fe and the lowest one was that of Cd.

All over the globe, contaminants are washed into rivers, lakes, coastal regions and estuaries from industrial, agricultural and anthropogenic activities. The drainage feature of any aquatic ecosystem be it marine, coastal or fresh water affects the sediment characteristics including the species composition and abundance (Nikulina and Dullo, 2009). Sediment contamination by heavy metals serves as a big threat to the health status of aquatic organisms and humans who consume aquatic organisms especially fishes, crabs and shrimps etc. As such, the assessment of sediment quality is very essential to environmentalist especially in the complexity in which heavy metals pollution adversely effects marine, estuarine and freshwater environments (Adesuyi *et al.,* 2016). Their multiple industrial, domestic, agricultural, medical and technological applications have led to their wide distribution in the environment; raising concerns over their potential effects on human health and the environment (Tchounwou *et al.,* 2012).

CONCLUSION

From this study, it can be concluded that the increased levels of iron, lead and manganese concentrations in surface water and sediment of Obueniyomo River is attributed to the impact of anthropogenic activities, surface water runoffs from rainfall and increased agricultural activities along the banks of the water body**.** Although, the level of trace metals poses low risks to the inhabitants of the community dependent of this water but they can bioaccumulate in the tissues and organs of aquatic invertebrates and humans, which leads to life-threatening conditions such as cancer, liver disease and heart problems. It is therefore recommended that regular biomonitoring be carried out on this freshwater ecosystem to avert future potential health risks.

ACKNOWLEDGEMENTS

The Author wishes to appreciate Mr Festus Arijode for his assistance in the field during the course of this Research. I whole heartedly appreciate the department of Animal and Environmental Biology, University of Benin, Benin City, Edo State, Nigeria for providing the enabling environment for the prompt completion of this Research studies.

REFERENCES

1. Aazami, J and Taban, P 2018. Monitoring of heavy metals in water, sediment and *Phragmites australis* of Aras River along the Iranian-Armenian Border. *Iranian Journal of Toxicology* 12(2): 1-6.
2. Adesuyi, AA, Ngwoke, MO, Akinola, MO, Njoku, KL and Jolaoso, AO (2016). Assessment of physicochemical characteristics of sediment from Nwaja Creek, Niger Delta, Nigeria. *Geoscience and Environment Protection* 4:16-27.
3. Ayandirana, TA, Fawolea, OO and Dahunsib, SO 2018. Water quality assessment of bitumen polluted Oluwa River, South-Western Nigeria. *Water Resources and Industry*

19:13–24.
4. Babunath, R and John, G 2017. A study on physicochemical and heavy metals characteristics of River Noyyal, Tamilnadu, India. *Environmental Science: An Indian Journal Research* 13(1):130.
5. Beyersmann, D and Hartwig, A 2008. Carcinogenic metal compounds: recent insight into molecular and cellular mechanisms. *Archives of Toxicology* 82(8):493512.
6. Carlos, AES, Estefan, MDF, Beatriz, WG, Flavo, ESDS and José ABN 2017. Potentially mobile of heavy metals on the surface sediments in tropical hyper-saline and positive estuaries. *Anais da Academia Brasileira de Ciências* 89(4): 2597-2607.
7. Dapam, IL, Ibrahim, EG and Dodo, JD 2018. Heavy metal speciation study of water and bottom sediments from River Wujam in Chip District of Pankshin local government area, Plateau State, Nigeria. *Journal of Environmental Science and Pollution Research* 4(1):242–245.
8. Emmanuel, E, Sombo, T and Ugwanyi, J 2018. Assessment of heavy metals concentration in shore sediments from the bank of River Benue, North-Central Nigeria. *Journal of Geoscience and Environment Protection* 6:35-48.
9. Khalid, U, Hameed, URR, Sehrish, K, Pervaiz, SZ, Abideen, U, Ali, MJ, Maqsood, SM, Jawad, AD and Yasir, I 2018. Investigation of heavy metals in River Kabul at Jehangira Lower Khyber Pakhtunkhwa Pakistan. *Journal of Entomology and Zoology Studies* 6(1):100-102.
10. Khan, MI, Muhammad, K, Ajmal, K, Naila, G, Muhammad, S, Farrah Z, Ahmadullah, A, Syeda, HF, Shumaila, N, Hamidullah, ZAS and Fazli, Q 2018. Bioaccumulation of heavy metals in water, sediments, and tissues and their histopathological effects on *Anodonta Cygnea* (Linea, 1876) in Kabul River, Khyber Pakhtunkhwa, Pakistan. *Hindawi Biomed Research International* Volume 2018, Article Id 1910274, 10pp.
11. Lawal, RA, Lohdip, YN and Egila, JN 2017. Evaluation of pollution status of sediment from Kampani-Zurak River, Plateau State, Nigeria. *Ewemen Journal of Analytical and Environmental Chemistry* 3(2):151-156.
12. Manju, M 2015. Effect of heavy metals on human health. *International Journal of Research-Granthaalayah* 31:1-7.
13. Mgbemena, NM, Ilechukwu, I, Ubadi, JO and Ndukwe, GI 2017. Status of heavy metals pollution in the sediments of the New Calabar River in Rivers State, Nigeria. *Journal of Chemical Society of Nigeria* 42(2):84-87.
14. Nikulina, A and Dullo, WC (2009). Eutrophication and heavy metal pollution in the Flensburg Fjord: a reassessment after 30 years. *Marine Pollution Bulletin* 58(4):905-915.
15. Nwankwoala, HO and Angaya, YB 2017. An evaluation of heavy metals concentration in the Choba Section of the New Calabar River, Eastern Niger Delta. *Biodiversity International Journal* 1(5):00030.
16. Nwankwoala, HO, Angaya, YB 2017. An evaluation of heavy metals concentration in the Choba Section of the New Calabar River, Eastern Niger Delta. *Biodiversity International Journal* 1(5):00030
17. Odigie JO 2014. Harmful effects of wastewater disposal into waterbodies: a case review of Ikpoba River, Benin city, Nigeria. *Journal of Tropical Freshwater Biology.* 23:87-101.
18. Omoigberale, MO, Oboh, IP and Erhunmwunse, NO, Ezenwa, IM and Omoruyi, SO 2014. An assessment of the trace metal contents of Owan River, Edo State, Nigeria. *European International Journal of Science and*

Technology. 3(5):88-98

19. Omoregie, IP, Freeman, OE and Idowu, JI 2016. Analysis of heavy metals and total hydrocarbons in water and sediment of Ovia River, in Ovia North East Local Government of Edo State, Nigeria. *International Research Journal of Public and Environmental Health* 3(10):234-243.
20. Onyekuru SO, Nwankwoala HO, Uzor I 2017. Heavy metal analysis of Otamiri River in Imo State, South-Eastern Nigeria. *Biodiversity International Journal* 1(4):00024.
21. Rama Pal, RK, Dubey, SK Dubey and Singh, AK 2017. Assessment of heavy metal pollution through index analysis for Yamuna Water in Agra Region. *International Journal of Current Microbiology and Applied Sciences* 6(12):1491-1498.
22. Sabbir, W, Rahman, MZ, Hasan, MM, Khan, MN And Ray. S 2018. Assessment of heavy metals in river water, sediment and fish mussel in Rupsha River under Khulna District, Bangladesh. *International Journal of Experimental Agriculture* 8(1): 1-5.
23. Tchounwou, PB, Yedjou, CG, Patlolla, AK, Sutton, DJ 2012. Heavy metal toxicity and the environment. In: Luch A. (Eds) molecular, clinical and environmental toxicology. *Experientia Supplementum* 101:133-164.
24. U.S. Environmental Protection Agency 2018. The drinking water standards and health advisories tables. Epa 822-F-18-001, Washington, DC.
25. Ubiogoro, OE and Adeyemo, OK 2017. Heavy metal pollution of aquatic systems in oil producing communities of delta state, Nigeria. *Journal of Applied Biosciences* 120:11993-11998.
26. Wogu, MD and Okaka, CE 2011. Pollution studies on Nigerian Rivers: heavy metals in surface water of Warri River, Delta State. *Journal of Biodiversity and Environmental Sciences*, 1(3):7-12.
27. World Health Organization 2017. Guidelines for drinking-water quality, 4th Edition, Incorporating the 1st Addendum 631pp.