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CLIMATE CHANGE PARTNERSHIP ACTIONS FOR SUSTAINABLE FUTURE AND RESTORING LIFE ON EARTH

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PREFACE

There is a growing concern on the adverse impacts of climate on biodiversity. This phenomenon is greatly manifested in form of shifting weather patterns threatening global food security, health and species existence. Humanity is at the receiving end of the consequences of climate change hence there is a need to step up actions on all fronts- overtime, everywhere all at once.

This calls for collaboration, partnership and networking to strengthening synergy among relevant stakeholders in a bid to tackling climate change menace. This forms the basis for the theme of this year world Environmental conservation conference: **CLIMATE CHANGE PARTNERSHIP ACTIONS FOR SUSTAINABLE FUTURE AND RESTORING LIFE ON EARTH.** The theme is conceived with a view to create an interface for information sharing and offer opportunities for participants to refine their commitments and pledges in the quest to achieving Sustainability in the face of climate change.

This year World Environmental Conservation Conference is memorable in the sense that it received overwhelming funding from the host - West African Science Service on Climate Change and Adapted Land use). WASCAL is posed to provide information and knowledge at the local, national and regional level to cope with the adverse impacts of climate change. Thus, this conference will offer opportunities for participants to learn from good practices demonstrated and showcase by WASCAL during the course of the conference. It will also strengthen staff-student exchange and provide prospect for Doctorate Research Doctoral Research in West Africa Climate System Programme (DRP WACS) – WASCAL among others.

Special appreciation goes to the management of The Federal University of Technology, Akure the host institution, National Park Service and African Regional Center for Space Science and Technology Education-English (ARCSSTE-E) that co-host this conference. We equally acknowledge other private, individual and corporate organizations that have contributed towards the success recorded in this event.

All the submitted articles were subjected to strict double blind peer-review process by the reviewers that are experts in the area of the particular submitted manuscript. The accepted manuscripts are published in WECC 2023 proceedings and also available for download on the organization website (www.necorng.org).

The accepted manuscripts fall within the underlisted subthemes:

- Climate change adaptation strategies in Agriculture, Forestry and Other Land Use (AFOLU)
- Climate smart city and architectural landscape design
- Retrofitting and decarbonization in tourism and hospitality industry
- Indigenous knowledge and local innovation in climate change adaptation
- Climate risk management, health, safety and hygiene
- Carbon credit-offset marketing/circular economy
- ICT development in environmental conservation (image processing and acquisition, computer vision, graphics, speed, interface technology, HMD devices, GIS: Body Tracking, AI and IOT, VRT, IVE).

We commend our keynote speaker Prof. Douda Kone Director Capacity Building Department, WASCAL Headquarter, Ghana and other guest speakers Prof. Babatunde Rabiu, Director General, Chief Executive Office, African Regional Centre for Space Science and Technology Education-English (ARCSSTE-E) and Dr. Goni I. M., Conservator General National Park Service.

It is hoped that researchers, students and policy makers will find the papers in this book very useful. Even though all the papers were reviewed and edited, the content and option expressed remain essentially that of the authors and not necessarily that of Netlink Environmental Conservation Organization.

Dr. Oladeji S. O.

President Netlink Environmental Conservation Organization

Convener World Environmental Conservation Conference

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ANALYSIS OF HEAVY METALS QUALITY OF SURFACE WATER IN THE COASTAL AREAS OF MBO LGA., AKWA IBOM STATE

Essang Mfonobong Shaineze[1] and Adigun Adepoju Ibraheem[2]

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ABSTRACT

Anthropogenic activities contaminate surface water and had pose serious health risk to aquatic lives and humans due to the presence of heavy metals. The study assessed heavy metals concentration of surface water samples in the coastal areas of Mbo LGA, Akwa Ibom State. Ten sampling sites were selected randomly across Mbo LGA. Surface water was chosen randomly from streams and rivers along the different settlements. The locations coordinates was recorded using a Global Positioning System. Nine heavy metals including lead, zinc, copper, manganese, iron, cobalt, cadmium, nickel and mercury were analysed using atomic absorption spectroscopy. Results of heavy metals concentration were compared with World Health Organization (WHO) permissible level in water. Iron concentration was above 0.3mg/L WHO recommended level in eight sampling points. Seven sampling points had nickel concentration above the 0.07mg/L recommended level. Manganese, zinc and cadmium showed higher values than the recommended 3.50, 0.10 and 0.003 mg/L permissible level in water. Metals including cobalt, lead, copper and mercury showed lower concentrations in almost all sampling points than the WHO recommended levels. In conclusion, the present study showed that samples collected from coastal area of Mbo LGA had high concentration of cadmium, manganese, zinc, iron and nickel. This poses health risk to the residents who use the streams and rivers as their sole sources of water. More research should be done in the region to ascertain the state of the water quality so as to mitigate the effect of water pollution in the area.

Keywords: *Surface water, Heavy metals, anthropogenic activities, Coastal, Cadmium*

INTRODUCTION

The coastal areas of Mbo Local Government Area of Akwa Ibom State had witnessed active ports activities, oil drilling, coastal fishery and agricultural activities, tourism-related projects, industrial activities, urbanization and other socioeconomic activities over the years. These anthropogenic activities taking place within and around coastal waters depend to a large extent, on the quality of good water for land-based activities and marine life (UNEP, 2016). The effect of these activities and the expanding coastal populations is exerting pressure on the coastal waters, leading to negative impact on the coast, surface water and underground water due to the pollution of the water bodies (Bakari, 2014). Our oceans had become the dumping ground of trash and refuse which accumulate on our shores to the point of saturation and becoming an eyesore. These endanger marine life and also cause serious pollution in our water bodies (Ashiru *et. al.*, 2017).

Anthropogenic activities contaminate both surface and groundwater resources through discharge of pollutants related to the nature and degree of such activities. Where agricultural activities predominate, agro-chemical metabolites (such as pesticides, fertilizers etc.) and nutients such as nitrates etc. are the major pollutants and contaminants (Akporido and Onianwa, 2015).
In Nigeria, studies had shown that water bodies are being contaminated by anthropogenic activities such as domestic, agricultural and industrial activities. These occur both in the urban and rural areas. A wide range of human-induced factors causing changes in the surface and groundwater quality of the study area is not recorded.

It had been reported by UNICEF (2009) that 39% of world population lives without access to improved sanitation while 884 million are without improved water supplies. Also, World Health Organization (2009) reported that unsafe and insufficient water is a leading cause of all infectious diseases in the world and in Nigeria; more than 3.8 million deaths are recorded annually from pneumonia and diarrheal diseases which affect mostly children under five years of age in Nigeria.

Water pollution from anthropogenic activities are exacerbated by several natural processes such as precipitation, erosion, percolation and weathering of crustal materials which help to collect pollutants and contaminants from all sources and deposit them to surface and ground. The effects of these activities are in the least damage to the quality of drinking water, recreational and other purposes (Irfan and Shakil, 2012).The effects of these activities are most pronounced in the coastal areas where extreme conditions from the land coalesce with activities from the sea especially salt water intrusion. Several of these conditions have combined to worsen the socioeconomic conditions in the coastal areas of Nigeria destroying natural resources in all parts of Niger Delta. As Nigeria prepares to take stock of damage done to Nigeria by the over 50 years of oil exploitation and exploration in the area, it is important to ascertain the degree and spread of these problems so as to ensure a comprehensive remediation of the natural environment in the Niger Delta.Hence this work investigates the impact of anthropogenic activities on the quality of surface and underground water in coastal areas of Mbo, Akwa Ibom State, Nigeria, which is one of the oil producing LGAs in the Niger Delta.

Heavy metals are one of the major groups of toxic environmental contaminants due to their toxicity, persistence and bio accumulative properties. They originate from municipal, agricultural, and industrial wastes discharged into aquatic environments. Once the wastes enter the aquatic environment, they are transported through the water column to the sediment where they are, biomagnified and through the food chain become ecological risk to benthic organisms, fish, and humans (Fabio *et al.,* 2015).

In the coastal area, increasing population growth and pollution of the environment have resulted to overexploitation of water resources, thereby degrading the environment (Choudri *et al.,* 2015). Living organisms including aquatic lives requires heavy metals within the acceptable limit for survival. Excess amount of some of these metals like Hg, As, Pb and Cd could be detrimental and prolonged exposure can lead to illness or even death of the organisms (Azaman *et al.,* 2015). Metals are widely used in food production; industrial wastes arising from these activities are discharged without treatment into water bodies. These caused severe pollution globally (Hossain *et al*., 2018, Rahman *et al.,* 2019).

Also, these metals have instrinsic persistence, toxicities and its non-biodegradable properties and they have the tendencies to bio accumulate on the food web. Consumption of these metals in large quantities is detrimental to human beings and aquatic organisms (Bosch *et al.,* 2016, Zhong *et al*., 2018, Cameron *et al*., 2018). At even low concentration, heavy metals might be harmful if catharsis process is ineffective.
The coastal community of Mbo LGA has several on-shores and offshore oil wells as well as numerous reports of oil spillages, gas flaring, gas leak, discharge of effluent, sewage, refuse and plastics into or close to freshwater bodies. These unwholesome activities results in the degradation of the aquatic environment, reducing the quality of both surface and underground water. Surface and ground water sources are increasingly used as drinking water. The impact of these activities on the physiochemical and heavy metals quality on surface and ground water resources of the coastal areas of Mbo LGA has not been fully investigated. Lack of awareness regarding the water quality exposes people living in these regions to a variety of health-related problems. World Health Organization (2009) had reported that chemical contamination of water is associated with serious public health consequences. It is therefore; important to evaluate the heavy metal concentration and hydrocarbons in the surface and ground water resources of the coastal area of Mbo LGA in order to ascertain the potential health risks to which the population is exposed to.The aim of this study is to determine the heavy metal quality of surface water resources in Mbo LGA, Akwa Ibom State.

MATERIALS AND METHODS

Study area: The Mbo LGA of Akwa Ibom State lies approximately between latitude 4° 39′ 0″ North and longitude 8° 19′ 0″ East with an area of 365 km², and is bounded by Atlantic Ocean and Republic of Cameroon in the South, UrueOffong/Oruko Local Government Area in the North, in the West by Esit Eket and Ibeno Local Government Areas, and in the East by Udung Uko local government area of Akwa Ibom State. The area has a rich water resource where oil exploitation and exploration is taking place. The occupation is marine-based, comprising fishing, marine transportation and subsistence farming. The people of Mbo speak Oron dialect with minor differences.
The Mbo LGA has a population of 104,012 (55,395 males and 48,617 females) according to 2006 national Census figures. The local government is rich in natural resources including salt, gravel and clay deposits. It also has forest reserves rich in timber, fruits like mangoes, oranges, pears and cash crops including palm fruit. The area is witnessed a lot of oil wells for drilling purposes. There are a lot of human and vehicular traffic with heavy earth-moving, oil drilling and pumping equipment for different oil exploitation activities between Nigeria and China Government. Mbo LGA has two main seasons, the Rainy and Dry Season. The heaviest rainfall is between May and July while driest period ranges from November to February. Annual rainfall of 2000mm is experienced in the area.
Ten sampling sites were selected randomly across Mbo LGA. Surface water was chosen randomly from streams and rivers along the different settlements. The locations coordinates was recorded using a Global Positioning System (GPS).

Water samples were collected during the rainy season between April, 2021 and September, 2021 using plastic containers. These containers were cleaned by washing with non-ionic detergents, rinsed with distilled water and soaked in 10 % HNO_3 for 24 hours. At the point of sampling, sample containers was rinsed with sample water before filling. Three samples were collected randomly in a particular sampling site within a radius of 10 m and mixed together after which a representative sample was taken for analysis (Gorleku and Carboo, 2014). The sample was taken by holding the bottle at the bottom and plunging it about 15 cm below the water surface. The container was quickly capped and put in the ice berg prior to transporting to the laboratory for analysis.

Analyses of Heavy Metals

Heavy metals contents including lead, zinc, copper, manganese, iron, cobalt, cadmium, nickel and mercury were analysed in the Laboratory unit of Ministry of Science and Technology, Uyo, Akwa Ibom State by using atomic absorption spectrophotometer.Standard solutions of the respective metals were used for calibration.All chemicals used were of analytical grade and distilled water was used throughout the

study. The apparatus and the glass wares were thoroughly washed and dried in oven. Standard solutions were used to construct the calibration curve according to the procedure in the manual.Metal ions were analysed using Perkin Elmer (5100) Atomic Absorption Spectrophotometer (APHA, 2005).

Statistical analysis

Descriptive statistics was conducted using Microsoft Excel 2010.

RESULTS AND DISCUSSION

Excess iron concentration in water has been reported to pose health hazard in humans including fatigue, headaches, restless legs, liver and pregnancy complications (Nwachukwu*et al*., 2014). The present study showed increased in Fe concentration than the recommended WHO standard of 0.3mg/L as seen in figure 1. Nickel concentration (Figure 2) was above the permissible limit of 0.07mg/L in most sampling point. Nickel in water can cause irritation in the skin, it can harm the lungs and skin and its reported to be carcinogenic. Acute ingestion of manganese in water during pregnancy causes harm to new babies and children. It also hinders the cognitive development of children (Su *et al.*, 2014).

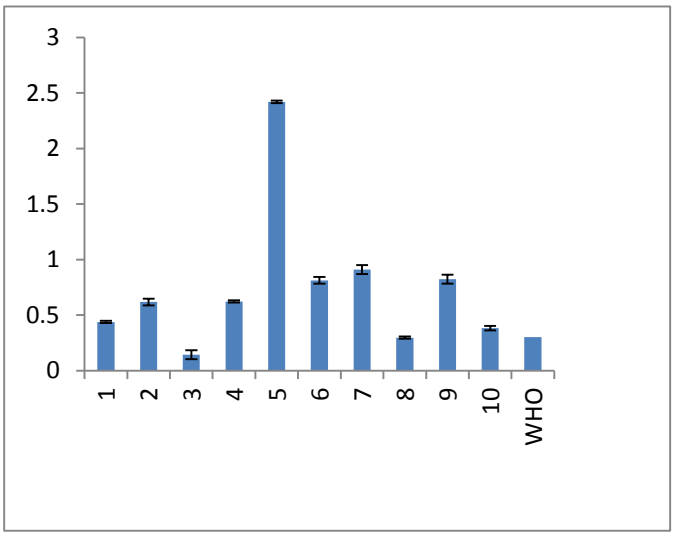

Figure 1: Concentration of Iron (Mg/L)

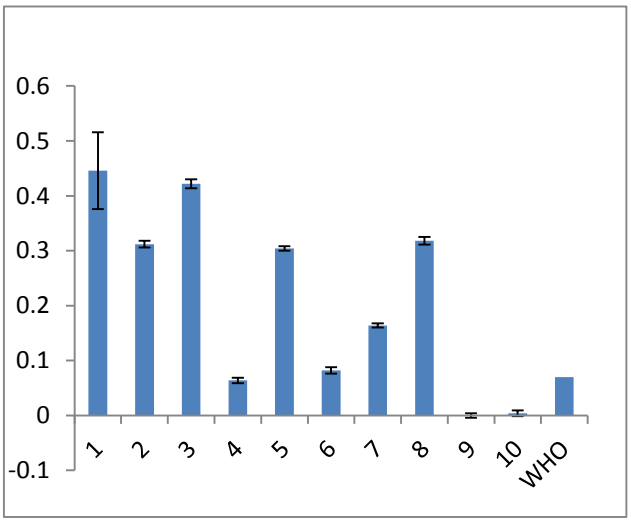

Figure 2: Concentrtatoin of Nickel (mg/L)

The oxides, silicates and carbonates of manganese minerals are common and they exist naturally in the environment as solids in soil and small particles in water. This study shows high level of manganese concentration as depicted in figure 3 than the permissible level of 0.4mg/L WHO recommended limit in water.Zinc is found abundantly in rocks ores and found naturally in water as trace constituent. It is industrially as galvanizer hence linkage into water. High quantity of zinc in water is toxic to aquatic organisms. Zinc concentration in Figure 4 was found to be higher than 0.10mg/L permissible level recommended by WHO.

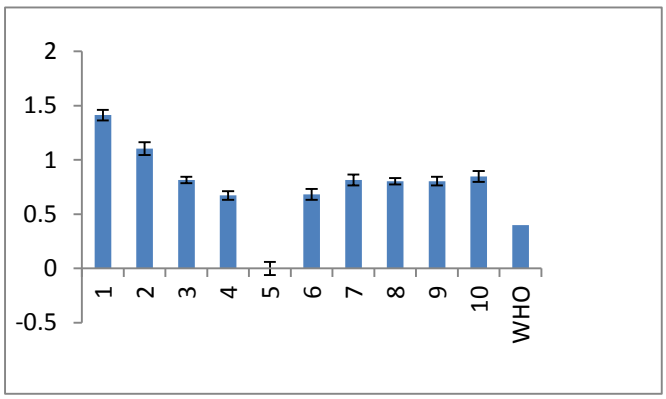

Figure 3: Concentration of Managanese (Mg/L)

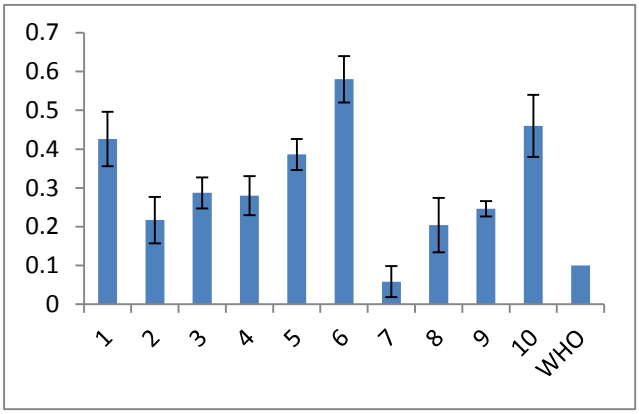

Figure 4: Concentration of Zinc (mg/L)

Cadmium is classified by International Agency for Research on Cancer (IARC) as a carcinogenic agent (Malan *et al.*, 2015). Cadmium is highly toxic in very low concentrations and its bio-accumulate in the ecosystems and organisms. Long term exposure to cadmium induces kidney failure. Its contamination shows water pollution (Ehi-Eromosele and Okei, 2012). In the present study, high level of cadmium as shown in figure 5 was found to be above the WHO permissible limit of 0.003mg/L. This could be from the industrial and shipping activities in the area of study. Ehi-Eromosele and Okei, 2012reported in a similar study that high levels of Cd are likely responsible for premature birth and cancer in humans.

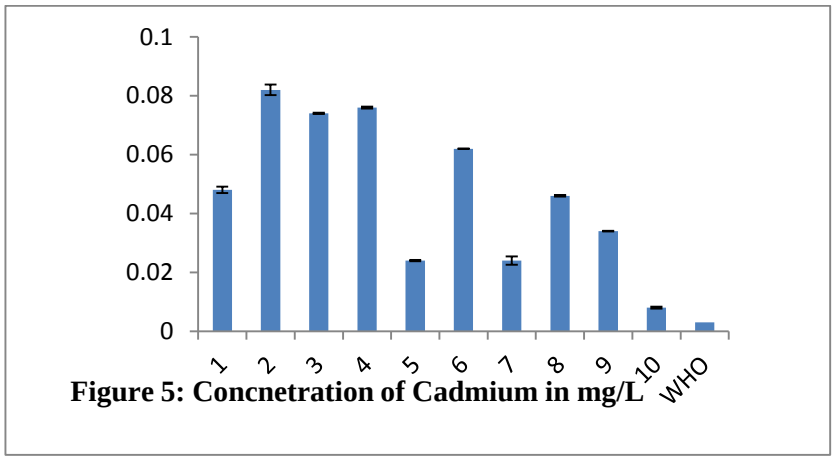

Figure 5: Concentration of Cadimum in mg/L

Copper: Copper is widely distributed trace element, because they are insoluble, so low concentrations of water is found in water. Copper is required for the function of several enzymes and including biosynthesis of chlorophyll. High levels of copper are toxic to organisms.
Lead is cumulative poison damage to the brain and deposit in bones, it is also cancer-causing, and it adversely affects reproduction, liver, and thyroid function. Figure 6, 7, 8 and 9 show lower concentrations of mercury, lead cobalt and copper respectively than the WHO permissible levels.

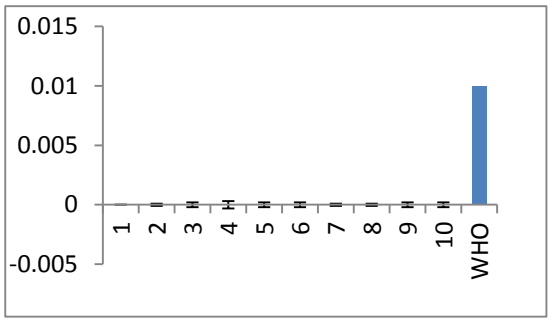

Figure 6: Concentration of Mercury (mg/L)

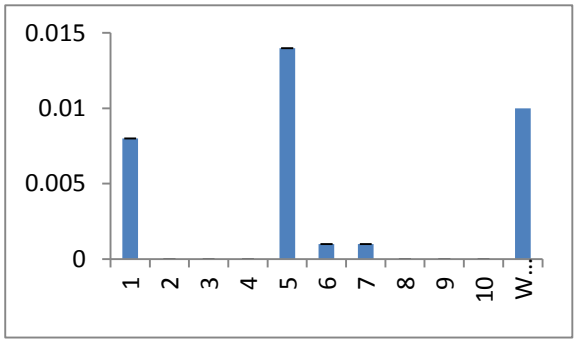

Figure 7: Concentration of Lead (mg/L)

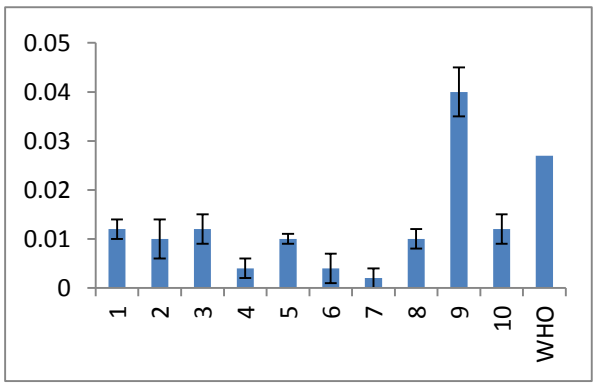

Figure 8: Concentration of Cobalt (mg/L)

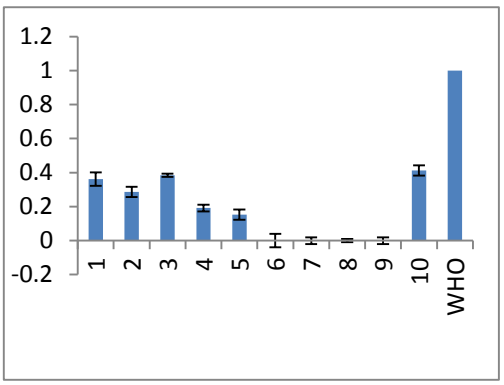

Figure 9: Concentration of Copper (mg/L)

CONCLUSION

In conclusion, the present study showed that samples collected from coastal area of Mbo LGA had high concentration of cadmium, manganese, zinc, iron and nickel. This poses health risk to the residents who used the streams and rivers as their sole sources of water. Although, lead and cobalt were found to be lower than the recommended limit, there were high levels in two sampling sites which could show tendency of bioaccumulation in the next future. More research should be done in the region to ascertain the state of the water quality so as to mitigate the effect of water pollution in the area.

Conflict of Interest

There was no conflict of interest in this study.

REFERENCES

Akporido, S. O., Onianwa, P. C., 2015, "Heavy metals and total petroleum hydrocarbons concentration in surface water of Esi River, Western Niger Delta", *Res. J. of Environ. Sci.*, 9(2), 88-100.

American Public Health Association (APHA), 2005, *Standard Methods for the Examination of Water and Wastewater,* Washington, DC, USA, 21st ed.

Ashiru, O. R., Adegbile, Moruf, O. & Ayeku, Patrick, O., 2017, "Assessment of the Effect of Anthropogenic Activities on AquaticLife in Ugbo-Aiyetoro Water-way, Southwestern Nigeria", *Int. J. Oceanogr. Marine Ecol. Sys*., 6 (2), 9–22.

Azaman, F., Juahir, H., Yunus, K., Azid, A, Kamarudin, M. K. A., &Toriman, M. E., 2015, "Heavy metal in fish: Analysis and human health-a review", *Jurnal Teknologi.*, 77(1).

Bakari, A., 2014, "Assessing the Impact of anthropogenic activities on groundwater quality in Maiduguri, Nigeria", 35–40.

Bosch, A. C., O'Neill, B., Sigge, G. O., Kerwath, S. E. & Hoffman, L. C., 2016, "Heavy metals in marine fish meat and consumer health: a review", *Journal of the Science of Food and Agriculture*, 96(1):32- 48.

Cameron, H., Mata, M. T. & Riquelme, C., 2018, "The effect of heavy metals on the viability of Tetraselmis marina AC16-MESO and an evaluation of the potential use of this microalga in bioremediation", *PeerJ*, 6, e5295.

Choidri , T. H., Chen, Y. L., Chen, C. Y., Liu, P. J., Cheng, J. O., & Ko, F. C., 2015, "Assessment of ichthyotoxicity and anthropogenic contamination in the surface waters of Kenting National Park, Taiwan", *Environmental Monitoring and Assessment*, 187, 265.

Ehi-Eromosele, C.O. and Okiei, W.O. (2012). Heavy metal assessment of ground, surface and tap water samples in Lagos Metropolis using anodic stripping voltammetry', Res. Environ. 2 82–86.

Fabio, P. A., Lourenco, A. S., Helio, B. S., Marcos, V. T. G. & Nilo B., 2015, "Bioaccumulation of mercury, cadmium, zinc, chromium and lead in muscle, liver and spleen tissues of a large commercially valuable catfish species from Brazil", *Annals of Brazilian Academy of Sciences*.

Hossain, M. B., Ahmed, A. S. S., Sarker, M. S. I., 2018. "Human health risks of Hg, As, Mn, and Cr through consumption of fish, Ticto barb (Puntius ticto) from a tropical river, Bangladesh", *Environmental Science and Pollution Research*, 25(31), 31727-36.

Irfan, R. & Shakil, A. R., 2012, "Impact of anthropogenic activities on water quality of Lidder River in Kashmir Himalayas", *Environ Monit Assess*· 184(7).

Malan, M., Müller, F., Cyster, L., Raitt, L. & Aalbers, J., 2015, "Heavy metals in the irrigation water, soils and vegetables in the Philippi horticultural area in theWestern Cape Province of South Africa", *Environ Monit Assess* 187, 4085.

Nwachukwu, A. Vitus, N. Janefrances, Health risk assessment in relation to heavy metals in water sources in rural regions of south east, Nigeria, Int. J. Phys. Sci. 9 (6) (2014) 109–116.

Rahman, M. S., Hossain, M. B., Babu, S. O. F., Rahman, M., Ahmed, A. S. & Jolly, Y., 2019, "Source of metal contamination in sediment, their ecological risk, and phytoremediation ability of the studied mangrove plants in ship breaking area, Bangladesh" *Marine Pollution Bulletin*, 141, 137-46.

Su, C., 2014, "A review on heavy metal contamination in the soilworldwide: Situation, impact and remediation techniques,"*Environmental Skeptics and Critics*, 3, 24–38.

UNEP, 2016, "The regional oceans governance to make UNEP Regional Seas Programmes, Regional Fishery Bodies and Large Marine Ecosystems Mechanisms to work better together", UNEP, Nairobi.

World Health Organization 2009, *Laboratory Analytical Work Instruction (LAWI) (2011). Determination of Total Petroleum Hydrocarbon in Soil/Sediment/Sludge in Gas Chromatography* Fugro (Nig.) Ltd. 3:9.2.

Zhong, W., Zhang, Y., Wu, Z., Yang, R., Chen, X. &Yang, J., 2018, "Health risk assessment of heavy metals in freshwater fish in the central and eastern North China", *Ecotoxicology and environmental safety*, 157, 343-9.

APPENDIX

Appendix 2: Sampling points co-ordinate

SAMPLING POINT	CO-ORDINATE
1.	N05° 01' 36.3 "
	E007° 52' 51.6 "
2.	N04° 42' 46.4 "
3.	N4° 40' 41.3 "
	E008° 13' 57.2 "
4.	N 04° 38' 07.0 "
	E008° 15' 49.7 "
5.	N04° 39' 07.4 "
	E008° 18' 46.9 "
6.	N04° 39' 09.4 "
	E008° 13' 30.5 "
7.	N 04° 39' 18.6 "
	E 008° 11' 47.1 "
8.	N 04° 39' 23.9 "
	E008° 10' 90.0 "
9.	N04° 38' 34.5 "
	E008° 11' 09.1 "
10.	N04° 43' 17.8 "
	E 008° 11' 44.3 "