STUDIES ON TRACE METAL CONCENTRATION *PSEUDOTOLITHUS ELONGATUS* FROM MARINE COASTAL WATERS AT MBO, SOUTH-EASTERN NIGERIA

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ABSTRACT

A study was conducted to assess the trace metal (i.e. Cu, Cd, Pb and Zn) concentration in *Pseudotolithus elongatus* species from Mbo Marine Coastal waters. Fish samples were randomly sampled from the six sampling stations using hooks and fishing nets and the muscles tissue were later analysed on Perkin Elmer Absorption Spectrophotometer mode, UNICAMP 919, after adequate sample treatment. The result reveals that lead (Pb) had the overall mean metal concentration of $7.47 ugg^{-1}$ in fishes indicating high level of pollution when compared with the National Health and Medical Research Council (NHMRC) standard of $2.0 ugg^{-1}$ for lead (Pb) in seafood. The concentration of Cu, Cd, and Zn metals were within the NHMRC recommended limit. It is therefore concluded that Mbo Coastal waters is heavily polluted with Lead (Pb), perhaps from anthropogenic input like sewage discharge. The ecological and human health implications of Lead (Pb) pollution are discussed.

KEY WORDS: Trace metals, Lead Pollution, *Pseudotolithus elongatus*, Mbo coastal waters, Nigeria.

INTRODUCTION

Anthropogenic activities which have taken place for the past two decades have greatly impacted on the marine ecosystem and its components. Although chemical and biological processes are common to all estuaries, the distribution of trace metals and their rates of reactivity vary greatly between estuaries, depending on environmental factors such as hydrodynamic resident times, mixing patterns and transport processes. As such, there is no universal pattern of trace metal behaviour in estuaries (Hatje *et al*., 2003).

High levels of metals in coastal and estuarine areas frequently result from anthropogenic activities both along estuarine shorelines and in upland watersheds. Because of this, estuaries are prone to receive significant metal inputs from marinas, boat hull maintenance, whole sale fish markets, shipping activities, as well as industrial and urban discharge. Once in the water column, metals are quickly adsorbed onto particulates and eventually removed from sediments (Blake *et al*., 2004).

Trace elements, especially the so-called heavy metals, are a serious pollutant in the natural environment due to their toxicity, persistence and bioaccumulation problems (Pekey *et al.,* 2004). Their occurrence in waters and biota indicates the presence of natural or anthropogenic sources (Klavins *et al*., 2000; Tam and Wong, 2000)

Many studies have shown that trace metal partitioning between dissolved and particulate phase depends on a number of factors including pH, salinity, temperature, redox-conditions, dissolved organic carbon and composition of the suspended particulate matter (SPM) (Hatje *et al*., 2003). A considerable amount of research has been carried out on trace metals concentration in Nigerian freshwaters and estuaries; however none has been conducted in Mbo marine coastal waters which serve as a breeding ground for some commercially important fish species like *Ethmalosa fimbriata* (Bonga), which also serves as a staple food for the coastal dwellers. *Pseudotolithus elongatus* is a bony fish that inhabits the marine and estuarine waters. It belongs to the Sciaenidae family. It is an important fish in the diet of the coastal dwellers of Mbo local government and its environ. It is one of the cheapest sources of protein which is also exploited in commercial quantity and sold for income.

The aim of the study assess the concentration level of some trace metal like copper (Cu), cadmium (Cd), lead (Pb) and zinc (Zn), in fish species from mbo marine coastal waters. This will provide the basis for appropriate recommendation.

MATERIALS AND METHODS
The Study Area

Six sampling stations (Ibaka beach, Ibuot Utan, Utan Effiong, Utan Brama, Mbendoro beach, and Utan Iyata fishing port) located on (Lat: $4^0 36^0$N and Long: $8^0 22^0$E) within Mbo L.G.A. were considered for the study. The sampling stations mentioned above represented station 1 to station 6 respectively.

Ibaka beach, in particular, is a commercial centre where trading, bunkering, fishing, smuggling, boating, firewood cutting, raffia palm cutting activities as well as repairs workshops for outboard engines are being carried out. Situated along Ibaka beach also is the Nigerian Naval Base for Akwa Ibom State. Associated with sampling area are waste of different categories such as land-based wastes, vessel (ship)

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generated wastes, operational discharge, accidental discharge, dumping at sea and atmospheric fall-out associated with incineration process and co-precipitation etc. Mbo Local Government Area of Akwa Ibom State, Nigeria is located in the rain forest belt of Nigeria and the coastline harbours lush green mangrove vegetation. However, this has been burnt brown by incessant gas flaring activities of Exxon Mobil and Eco-Drill Oil Company operating in the area. Some of the vegetation even dies off due to increase acidity of the soil by oil spillage.

Field Sampling Techniques

Fish samples were randomly sampled from the sampling sites using hooks and fishing nets. The fish collected were properly tagged according to the collected site and put in a cold portable aquarium. They were later identified and stored in a freezer until analysis.

Laboratory Analysis Techniques

The fish samples (*Pseudotolithus elongatus*) were taken to the laboratory and the muscle tissue prepared by filleting the fish on both sides. 5.0g of the muscles representing the two fillet from each fish was weighed from each fish, homogenized and digested with a mixture of nitric and perchloric acids in the ratio of 2:1.

The resultant solution was evaporated to dryness on a hot plate and the white residue formed was dissolve in 10ml of 2% nitric acid.

The sample solution was diluted to $30cm^3$ with deionized water and analysed on Perkin Elmer Absorption spectrophotometer model UNICAMP 919 for copper (Cu), Cadmium (Cd), Lead (Pb), and Zinc (Zn) respectively.

RESULTS AND DISCUSSION

The result of the present study shows that all the four (4) metals were present in the sampling sites at the time of sampling. Among the fours (4) metals, Zinc (Zn) with a mean concentration of $129.91ugg^{-1}$ was the highest. It was followed by Copper (Cu) with a mean concentration of $9.87ugg^{-1}$, before Lead (Pb) with a mean concentration of $7.47ugg^{-1}$. Cadmium (Cd) with mean concentration of $0.52ugg^{-1}$ was the least. However all the metals were within the National Health and Medical Research Council (NHMRC) standard, except for Lead (Pb) whose concentration exceeded the NHMRC standard of $2.0ugg^{-1}$ in seafood. Detail of the recorded concentrations obtained for each element is shown in Table 1 below, and their mean concentrations is compared with that of NHMRC standard for seafood in Table 2.

TABLE 1: CONCENTRATION OF EACH ELEMENT IN EACH OF THE STATIONS

PARAMETERS	ST. 1	ST. 2	ST. 3	ST. 4	ST. 5	ST. 6
Copper (Cu)	10.21	10.21	11.02	8.55	8.92	10.3
Cadmium (Cd)	1.14	0.38	0.53	0.38	0.37	0.36
Lead (Pb)	9.16	7.45	7.33	7.63	6.27	7.00
Zinc (Zn)	175.00	131.84	103.82	123.92	109.13	135.76

Table 2: Mean Concentration of Elements Compared With NHMRC Standard

Location	Copper (Cu)	Cadmium (Cd)	Lead (Pb)	Zinc (Zn)
NHMRC STANDARD	30.00	2.00	2.00	1000.00
MBO L.G.A. WATERS	9.87	0.52	7.47	129.91

An element like copper (Cu) is likely to generate from industrial wastewater (Yarsar *et al*., 2001). Most atimes, Cu generates from sewage (Ating *et al.,* 2000; Ruiz, 2001). The Cu level in the present study might have been contributed by sewage discharge into Mbo Marine Coastal waters. Copper is as essential element for which the body has a narrow tolerance. It is frequently found in surface waters and when it is found in excess, it affects aquatic life (WHO, 1984). Copper plays important roles in human metabolism such as erythrocyte formation, release of tissue iron and bone development. It also helps in building the connective tissue and proper functioning of the nervous system. The concentrations recorded for copper in samples from all sites were within the NHMRC limit for Cu (30.0ugg^{-1}) See table 2. Therefore fishes from Mbo coastal environment are not likely to cause adverse effects in humans.

Cadmium, Lead and Zinc are used as markers or tracers of motor vehicles (Huang *et al*., 1994; Qu and Kelderman, 2001), eventhough Lead may also originate from industrial wastewater (Lin *et al*, 2002) or sewage (Feng *et al*., 2002; Liu *et al*., 2003). Unlike most of the other heavy metals, Cadmium can be taken up by many aquatic plants because at low P^H and high temperature, it exists in its stable state (Cd^{2+}). Cd^{2+} is a relatively soluble metal ion that behaves some what like Ca^{2+}. Here lies the danger of indiscriminate discharge of Cd laden waste into the Mbo coastal environment. Moreover, the uptake of cadmium is irreversible and it excretion occurs very slowly (Udosen, 1991). Fishes are very sensitive to cadmium and retain about 1% of ingested cadmium (Young and Blevins, 1980) and could be transferred to human through bioaccumulation and biomagnification. Autopsy study has shown that cadmium can accumulate in liver and kidney. This situation could lead to severe kidney and liver damage as well as pulmonary disease and death. Other effects of acute cadmium poisoning include bronchitis, hypertension, destruction of testicular tissue, anaemia and emphysema.

The recorded mean concentration of lead (Pb) (i.e. 7.47ugg^{-1}) was above the NHMRC recommended limit of 2.0ugg^{-1} in seafood. Even at individual stations, it was still higher than the NHMRC recommended limit. The high lead levels in all the sampling stations must have resulted from indiscriminate discharge of Pb-laden waste at Ibaka coastal environment. The high level of lead from samples obtained from the Mbo coastal waters implies that the fish species present in these waters are heavily polluted with lead (Pb). It is therefore advisable to guard against indiscriminate discharge of Pb-laden waste into Mbo coastal environment. Lead is easily attracted to biological tissues and once absorbed; it acts as an accumulated toxin and is capable of deadening nerve receptors in man.

Zinc is an abundant and nutritionally significant element for man and animals. Zinc pollution in the sampling stations may be due to the anthropogenic input from garbage, solid waste dumps, sewage dumps particularly at station 1 (Ibaka Beach) that flows downstream to other stations. This not withstanding, the monthly mean concentration of zinc (Zn) in all the stations were within the NHMRC standards of 1000ugg^{-}
^{1}. Hence the fishes in the area were not polluted with zinc. According to WHO (1994), Zinc poisoning is very rare since the metal is a metabolite antagonist of metals like Cu, Fe, and Cd, while high zinc intake may also be expected to afford some protection against the toxic effects of cadmium.

CONCLUSION

The present study has revealed that out of the four (4) trace metals concentrations assessed in *Pseudotolithus elongatus*, Lead (Pb) was found to be exceptionally high above the NHMRC recommended level in this fish species. This is attributed to anthropogenic input of land based and industrial waste which may have adverse effects on human through consumption of contaminated seafood. To this end, there is an urgent need of promoting controls over anthropogenic inputs of domestic sewage that enters coastal water.

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