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OCCURRENCE OF TRACE METALS IN *PENAEUS NOTIALIS* (DECAPODA: PENAEIDAE) FROM THE BRASS RIVER SYSTEMS OF THE NIGER DELTA, NIGERIA

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ABSTRACT

The presence of trace metals (Zn, Hg, Fe and Pb) in different tissues of *Penaeus notialis* collected from the Brass River System were studied. Results showed inter tissue difference; exoskeleton (492.266 □g/g having highest concentrations of all metals studied, followed by muscles (363.39 □g/g) and viscera (274.09 □g/g) which were significant at $P \leq 0.05$

Smaller sizes of *P. notialis* (7 - 10.9 cm) accumulated higher concentrations of Fe and Zn than the longer sizes (12 - 17.8cm). Lead and Mercury levels in all sizes of specimen studied were higher than the recommended World Health Organisation limits for food.

Key words: Trace metals, shrimps, Niger Delta.

INTRODUCTION

Shrimps of different species are caught in commercial quantities throughout the year in the Niger Delta. These shrimps spawn in the sea but uses the tidal and coastal lagoon systems for growth and development into post larvae. It is also in these systems that some species grow to a length of 100 - 210mm and sometimes to maturity before they emigrate for another round of reproductive process e.g. spawning (Edwards, 1972).

Due to population growth, urbanisation and industrialisation, Nigerian waters as well as similar water bodies in Africa (Calamari and Naeve, 1994) are exposed to pollution. These coastal waters are rich in fisheries resources including the shrimps (Scotts, 1966). These facts probably guided West and Biney (1991) to assert that fisheries development is dependent on a healthy aquatic environment. Major sources of pollutants often identified in coastal waters are of urban and industrial origin. Several authorities have studied the various aspects of urban and industrial pollution in relation to aquatic resources (Camalari; 1985; Okoye, 1989; 1991; Okoye *et al*; 1991).

Literature information on the effects of trace metals on Nigerian fisheries resources are scarce (Kakulu and Osibanjo, 1986; 1987; 1988 and 1992). Information on bioaccumulation of heavy/trace metals in the tissues of aquatic organisms is very useful especially in the identification of liable organs and in environmental monitoring (Szefer *et al*, 1990, Paez-Osuna and Ruiz Fernandez 1995). This study is aimed at closing the gap of information on the presence of trace metal within the Niger Delta water channels and their effects on the fisheries resources of the region to complement existing literature and aid fisheries managers in their activities.

MATERIALS AND METHODS

This study was conducted along the Brass River system which is one of the nineteen river systems that empties into the Atlantic Ocean through the Niger Delta. The river is located between longitude 4° 25'E and 4° 30'E and latitude 4° 25'N and 4° 30'N. The Nembe creek flow station and the Agip Oil terminal together with some other oil service industries are located along the river system and are continually discharging their effluents into it. Shrimps specimen were collected from two stations (Fig 1) from local fishermen who used the traditional beach seine known as "ikõ" for fishing. These fishing sites are located around Nembe Creek Flow Station (Station I) and Agip Oil Terminal (Station II). They were chosen because they are catchment areas for industrial wastes and also good fishing grounds. The total lengths of all specimen obtained were measured.

Total length was considered as the distance of the long axis from rostrum to the tip of the telson. Specimen were identified using the identification key of Schneider

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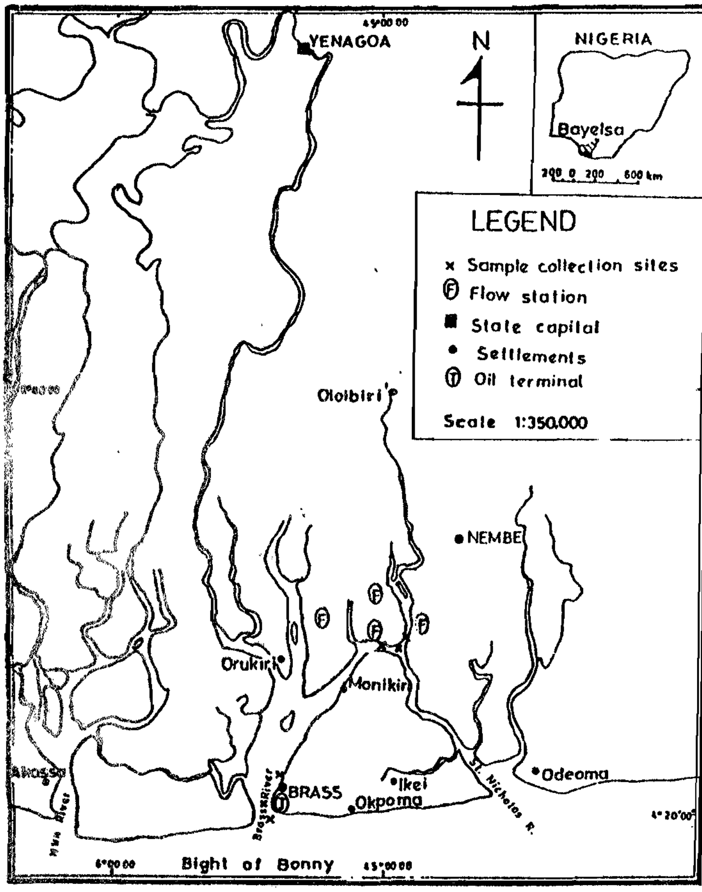

Fig 1: Sampling sites for *P. notialis* on the Brass River system

(1990). Shrimps were sorted and arranged according to their sizes into two groups ranging between 7cm - 10.8cm for small sizes and 10.9cm and above for large sizes. Each group consisted of 40 individuals per station making a total of 80 individuals from the two stations. They were packed in labelled plastic bags and transported in ice chest to the laboratory where they were preserved at -20°C.

In the laboratory, shrimps were thawed and dissected to separate the exoskeleton from muscles and viscera. The wet weights of each tissue sample was taken. Pulverisation and homogenization were achieved using standard procedures. Samples for analyses were digested with a concentrated mixture of nitric/percloric acids; and later diluted at a ratio of 1:10 with distille water.

Trace metal concentrations were determined using tl flame atomic absorption spectrophotometer (Pae: Osuna *et. al.*, 1993) and the emerging data wei subjected to the student t-test to determine differences i concentration of trace metals from the two samplin stations. All statistical analysis were at 5% significanc level.

RESULTS AND DISCUSSION

The mean concentration of the heavy metals observed i the various tissues of *P. notialis* during the study ai given in Table I. These results indicate the presence c Zn, Hg, Fe and Pb in *P. notialis* caught within the Bras river system. The most abundant metals are zinc (Zn) and Iron (Fe). Lowe: mean concentration were observed in Mercury (Hg 0.358 □g/g and 0.371 □g/g) in stations I and I respectively. In a similar study Kakulu and Osibanj (1988, 1992) noted the presence of Pb, Cr, N and V i water, sediment and fish around Port Harcourt in River State. These authors attributed the presence of the trac metals to pollution originating from effluents discharge from industries within Port Harcourt metropolis.

Similarly, Okoye (1991) observed the presence of th same trace metals in Lagos lagoon and attributed thei origin to land-based urban and industrial waste. Als Kakulu *et. al.*, (1987) attributed the presence of heav metals in water sediments and fishers from Nigeriai coastal areas to rapid industrialisation and imprope disposal of industrial waste. They however noted that th present levels of heavy metals in these water bodies and fishes are lower than FAO standard limits a: reported by Etim and Akpan (1991).

In this study, we observed that the levels of leac (4.33□g/g; 4.71□g/g) and mercury (0.358□g/g; o.37□g/g in both Nembe Creek and Brass terminal station were slightly higher than the World Healtl Organization established standards. Although the sourc of the metal pollution could not be ascertained we

Table I: Mean concentration of trace metals in the various tissues of *Peneaus notialis*

Large *P. notialis*							Small *P. notialis*					
Matals	Viscera		Exoskeleton		Muscle		Viscera		Exoskeleton		Muscle	
	I	II	I	II	I	II	I	II	I	II	I	II
Zn	50.78	43.7	60.00	53.85	60.1	47.9	60.1	60.0	71.3	70.0	86.1	77.60
Hg	0.38	0.48	0.53	0.56	0.61	0.50	0.03	0.042	0.51	0.52	0.53	0.55
Fe	33.8	48.05	55.18	51.52	104.2	62.3	224.1	199.2	432.9	396.8	250.6	301.5
Pb	4.91	4.61	5.65	5.43	6.1	5.34	1.80	2.92	6.1	6.4	5.1	4.80
Total	89.87	96.84	121.36	111.36	171.01	115.9	286.03	262.16	510.81	473.72	342.33	384.45

I Nembe Creek Sampling Stations
II Brass Terminal Sampling Stations

suspect that they probably may have originated from oil exploration and exploitation, and from the oil installation facilities within the sampling sites alongside with those from migratory oil servicing outfits abounding in the Brass river system.

The Nembe Creek station accumulated more trace metals than the Brass Terminal station. This observation suggests that more industrial waste loaded with trace metals are discharged into the waterways in station I than station II. This probably have to do with frequent maintenance crew facilities operating at the numerous oil wells of SPDC in the Nembe Creek area. In general, results of this study (Table 1) show that more trace metals were accumulated in the exoskeleton than in the viscera and muscles of the shrimp. However shrimps in station I accumulated more trace metals in the viscera and exoskeleton than those from station II but the muscles of the small specimens from station II had more accumulated iron than those of station I.

CONCLUSION

Small individuals accumulated higher concentrations of iron (Fe) and zinc (Zn) than the large specimen and vice versa for lead (Pb) and mercury (Hg) in larger individuals. This findings may be related to the metabolic rates of these organisms. In general smaller animals showed higher metabolic rates than larger ones. Udo and Taege (1991) showed that smaller (younger) shrimps exhibited higher rates of metabolism than older (larger) individuals. This difference in metabolic requirements between larger and smaller sizes of specimen may be related to the uptake of metals in the animal. This is further demonstrated by the so called "size, dependent" metal accumulation by aquatic species. Rainbow and Moore (1986), Rainbow (1990) found that concentrations of copper (Cu), iron (Fe), lead (Pb) and zinc (Zn) in amphipods was significantly affected by their body sizes while small sizes had higher concentrations of these substances. For the three organ groups (viscera, exoskeleton and muscles), the pattern of trace metal concentration in the three studied organs can be described as follows:

$$Fe > Zn > Pb > Hg$$

From the results of this study it can be indirectly inferred that there seems to be great relationship between the body sizes of the specimen with the quantity of metal accumulated in the organs; and may serve as a clue to the short term interpretation of metal contamination of aquatics.

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