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Range of Some Heavy Metals in Flesh Tissues of *Chrysichthys auratus* of Jaja Creek, Niger Delta Zone, Nigeria

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Abstract: ***Studies on the range of heavy metal compound on the flesh tissues of Chrysichthys auratus was carried out for a period of 12 months (January – December, 2005) in Jaja Creek, Niger Delta Zone, Nigeria. The fish species were collected from the local fishers and treated before the determination of the heavy metal was carried out, using Atomic Absorption Spectrophotometer (AAS). The analysis indicated that the concentrations of Zn, Fe, Mg and Cu were higher the flesh tissues of the species. Also higher trends of metals were observed in the wet season than the dry season. However, the levels of concentration did not show a serious deterioration of the fish species as the limits were within the approved limit, but constant tissue around the vicinity.***

Keywords: Heavy metal, Flesh tissue, *Chrysichthys auratus*, Zone, Jaja Creek

1. Introduction

Chrysichthys auratus which is commonly called long fin catfish or golden Nile catfish, of the family Claroteidae is a widely distributed species ( ). It inhabits lakes and coastal waters (Risch, 1992). It lives mainly over muddy substrates with heavy layers of leafy detritus in deep, relatively calm waters (Burgess, 1999). It is a benthic feeder (Akpan, 2006), feeding mainly on mollusk and crustaceans which it digs for the substrate (Akpan, 2006).

However, the quest for technological advancement and increasing industrial activities has created unexpected damages to our environment (Salim, 2002). These damages are potential threats to the biodiversity of most aquatic systems. Man-induced environmental damages resulting from those activities have introduced various heavy metals in to the aquatic system, which mixed up in a quick version with particulates and settles in the bottom sediments (Binning and Baird, 2001).

The objective of this paper was to determine the range of some heavy metals in the flesh tissues of *Chrysichthys auratus*, which is a common species in the Jaja Creek, Niger delta Zone, Nigeria and compare data with some set standards.

2. Materials and Methods

2.1 Study Area

Jaja Creek is situated in the Niger Delta zone, Nigeria and drains into Imo River estuary (605` - 7040`E, 4025`N, Fig. 1). It is in the tropical rainforest belt with equatorial climate regime. It is characterized by moist south-westerly wind from Atlantic Ocean and hot north-easterly wind from Sahara desert (Udo, 1995). The relative humidity is over 80% due to warm wet air masses which is dominant in the area (Isangedighi, 2001).

2.2 Sample Collection and Analysis

Samples of *Chrysichthys auratus* were collected from the fishers at Jaja Creek terminal for twelve months (January – December, 2005) and were preserved in ice chests pending laboratory analysis. The flesh tissues were obtained by descaling and filleting fish samples using clean stainless instruments weighed to 5g. The tissues were ground with a mortar and homogenized with a hydrocarbon-free blender and extracted with 25.0cm^{-3} of analytical grade CCl_4 solution for 24 hours. The ground mixtures were filtered many times and the absorbance measured using UV/visible spectrophotometer (UNICAM 8700).

3. Results and Discussion

The seasonal concentrations of the studied heavy metals on the flesh tissue of *Chrysichthys auratus* is shown in table 1. The heavy metal with the highest concentration was reported for Mg, followed by Fe and Zn. The concentrations were higher in the wet season as compared to dry season, except in Mn (2.107mg/l).

Table 1: Seasonal variation in metal concentration in flesh tissue of Chrysichthys auratus

Metal (mg/l)	*Dry Season*	*Wet Season*	*t-ratio*	*Upper Allowable Detection Limit*	
				WHO 1984	*ANHMRC*
Pb	0.018	0.025	0.025	0.01	-
Zn	1.735	14.723	0.51	40.0	1000
Fe	28.625	30.095	0.77	100.0	-
Ni	0.017	0.037	0.02	100.0	-
Cr	0.074	0.066	0.04	0.05	-
Mg	246.925	391.800	2.73	-	-
Mn	2.107	0.528	0.14	50.0	-
Al	0.076	0.043	0.03	-	-
Cd	0.900	0.010	0.07	2.0	2.0
Cu	6.940	8.060	0.39	10.0	30.0

The lowest concentrations of metals was noted for Cd (0.010mg/l) in the wet season. Through the sampling period, there was no mean marked seasonal variation

amongst the heavy metal, except in Mg which had a t-ratio value of 2.73.

The trace accumulation of heavy metals in the flesh tissue of *Chrysichthys auratus* in Jaja Creek, may be attributed to wastes being discharged into the Creek from effluent sources, transportation sources, agricultural sources and domestic sources as observed during the study.

Heavy metals in aquatic systems exist either as particulate soluble form. Some heavy metals compounds are very dangerous to fish species (Akpan, 2012). They include different ionic forms of different availability to fish and are also dependent on environmental condition (Jezierska and Wifeska, 2006). The highest concentration of Mg in the Creek is probably due to runoffs from Agricultural sites and effluents from industrial treatment plants, though this was within the allowable limits. Environmental factors affect the uptake and bio-accumulation of heavy metals in fish species, Koek *et al.*,(1996) indicate that uptake rates of heavy metal in summer was higher due to a high temperature. Raymont and Shields (1994) opined that trace metals are uptaken more quickly at high temperatures by aquatic species. The mechanism whereby heavy metal toxicity increases with higher temperature was attributed by Lloyd (1965) to elevated respiratory activity. However, low rate of elimination of ingested food materials could also lead to heavy metals accumulation in tissues of fish species (Akpan, 2006). Moreso, the bioaccumulation of heavy metals in the organs of fish is manly a function of uptake and elimination rates (Jezierska and Wifeska, 2006).
Studies have indicated that water acidification is directly proportional to heavy metal accumulation rates by fish species. The comparison of data with respect to heavy metal levels in fish species from various lakes indicates that the concentrations of some metals, especially Cadmium and Lead, are considerably higher in fish species from acidified aquatic system (Haines and Brumbaugh, 1994; Wiener *et al.*, 1990; Horwitz *et al.*, 1995). The low concentration of these metals indicate the non-acidification of the aquatic system.

Lead (Pb) is a prominent toxicant and has a deleterious effect at low temperature to humans and animals, as it reduces neuro-psychological function leading to intelligence quotient deficiency and it leads to reduction in nerve physiology, especially in conduction (Waldboh, 1978).

Iron (Fe) is one the essential components of haemoglobin, which is responsible for he transportation of oxygen in the body. Studies have shown that fish concentrate metallic iron in their body organism directly or indirectly through ingested food (Kakulu *et al.*, 1980). Zinc (Zn), Copper (Cu) and Manganese (Mn) are important elements for the development and well conditioned of the fauna species. They indicate deleterious effects when they are exposed to levels of concentration higher than normally accepted (Bineg *et al.*, 1994; Akpan, 2012). However, Cadmium (Cd), Chromium (Cr) and Nickel (Ni) are not important for metabolic activities and indicate toxic characteristics.

Heavy metal bioaccumulation of the aquatic habitat usually lead to hazardous effects from localized input which may acutely or chronically toxic (Obasohan *et al.*, 2008). The hazardous effects of heavy metals to fauna species (Akpan, 2012, Oronsaye, 1989) and human (Ademorot, 1996b; Manahann, 1994) have been discussed. The upper allowable limit for heavy metal levels in fauna species and human have been documented by the World Health Organisation (WHO) ,1984, Federal Environmental Protection Agency (FEPA), 2003, Australian National Health Medical Research Council, ANHMRC, 1978 and United Nation Environmental Programme (UNEPA), 1985. The levels of all the heavy metal in the flesh tissue of fish from the aquatic system did not exceeded the upper allowable limit set up by WHO (1984), FEPA (2003) and ANHMRC (1978) in food fish.

4. Conclusions

The results of this findings showed that the flesh tissue of *Chrysichthys auratus*, a common species of economic importance in Jaja Creek, Niger Delta Zone, Nigeria is not contaminated with bioaccumulation of heavy metals, because their levels of concentration was within the approval limits of various standards. However, in view of the short time span of this research, further research for a longer time span to monitor a sudden upsurge of heavy metal in the species should be done.

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References

[1] Ademoroti, C. M. A. 1996b. Environmental Chemistry and Toxicology Toludex Press Ltd, Ibadan, pp215
[2] Akpan I. I. 2006. Limnological studies of Jaja Creek (Uta Ewa) with special emphasis on fish composition, trophic biology and Metal composition of some selected species. M.Sc. Thesis, Department of Zoology, University of Uyo, Uyo, pp126.
[3] Akpan I. I. 2012. Physico-chemical and biological studies of Imo River estuary, Nigeria. Ph.D dissertation, Department of fisheries and Aquatic Resources Management, Umudike.
[4] Australian National Health Medical Research Council (ANHMRC) 1978. Standard for Sea foods.
[5] Biney, C. A., Calamari, A. T. O., Kaba, N., Naeve, H. and Saad, M. A. 1994. Review of heavy metals in the African Aquatic Environment. *Ecotoxicol. Environ. Saf.* 28: pp 134 – 159.
[6] Binning, K. and Baird, D. 2001. Survey of heavy metals in the sediments of the swartkops River estuary, Port Elizabeth, South Africa, *Water SA* 27(4): pp 461 – 466.
[7] Burgess, W. E. 1989. An atlas of freshwater Acid marine Catfishes. A preliminary survey of the silunformes. T. F. H. publications Inc. Neptune city, New Jersey. USA, pp284 – 286.
[8] Haines, T. A. and Brumbaugh, W. G. 1994. Metal concentration in the gill, gastrointestinal tract and

carcass of white suckers (*Catostomus commersoni*) in relation to lake acidity, *Water, Air soil Pollut.* pp265 – 274.

[9] Horwotz, R. J. Ruppel, B., Wisniewski, S., Kiry, P., Hermanson, M. and Gilmour, C., 1995. Mercury concentrations in freshwater fishes in New Jersey, *Water Air Soil Pollut* 80: pp885 – 888.

[10] Isangedighi, I. A. 2001. Studies on the biology of *Pseudotolithus* species (Scianidae) in the inshore waters of southeastern, Nigeria. M.sc. Thesis, Department of Zoology, University of Uyo, Uyo. pp68.

[11] Jezierja, B. and Wifeska, M. 2006. The metal uptake and accumulation in fish living in polluted waters, soil & water pollution monitoring, protection and remediation, p3 -23.

[12] Kakulu, S. E., Osibanjo, O., Ajayi, S. O. 1980. Determination of heavy metal in aquatic food. *Environ Toxicol*. 24:pp 727 – 734.

[13] Kock, G., Triendl, M. and Hofer, R. 1996. Seasonal patterns of metal accumulation in Arctic char (*Salvelinus alpines*) from an oligotrophic alpine lake related to temperature. *Can. J. Fish. Aquat. Sci.* 53. Pp 780 – 786.

[14] Lloyd, R.1965. Factors that affect the tolerance of fish to heavy metal poisoning. Boil. Problems in water pollution, 3rd seminar, 1962. US. Dept Health, Education and Welfare, pp181.

[15] Obasohan, E. E., Oronsaye, J. A. O. and Equavoen O. I. 2008. A comparative Assessment of the Heavy metal loads in the tissues of a common catfish (*Clarias gariepinus*) from Ikpoba and Ogaba rivers in Benin city, Nigeria. *Africa Scientist* Vol. 9 vol. No. 1 March 31, 2008.

[16] Raymont, J. E. G. and Shields, J. 1994. Advances in water pollution research. Pergamon Press, London, Oxford, pp290.

[17] Risch, L. M. 1992. Bagridae. In C. Lereque, D. Paugy and G. G. Teugels (eds). Faune des poisons d'eaux douces et saumatress d'Afrique de l'ouest. Tome

[18] Salim, M. M. 2002. A review of water quality and pollution studies in Tanzania Ambio XXX pp19-10

[19] Udoh, M. T. 1995. Some aspects of the biology of the mudskipper *Periophthalmus barbarus* (Teleosti, Gobiidae) in the estuarine swamps of Imo River, Nigeria. M.Sc. Thesis, Department of Zoology, University of Uyo, Uyo. pp156.

[20] Waldboh, G. L. 1978. Health effects of environmental pollutants. In environmental studies. The earth as a living planet, edited by B. B. Daniel and A. K. Edward. Charles Maril publisher, pp359.

[21] Weiner, J. G., Marifini, R. E., Sheffy, T. B. and Glass, G. E. 1990. Factors influencing mercury concentrations in Walleyes in northern Wisconsin lakes, *Trans. Am. Fish Soc.* 119: pp862 – 870.

[22] World Health Organisation (WHO) 1984. Guidelines for drinking water quality, Health criteria and other information vol. 2 Geneva publication pp.306