International Journal of ChemTech Research
CODEN(USA): IJCRGG ISSN : 0974-4290
Vol.2, No.1, pp 620-623, Jan-Mar 2010

Concentration of (Fe, Mn, Mg, Ni) in five Species of Fishes Caught in Parangipettai Coastal Waters

R. Lakshmanan*., K. Kesavan, K. Sakkaravarthi and S. Rajagopal

**Centre of Advanced Study in Marine Biology,
Annamalai University, Parangipettai – 608502, India**

***Corres.author: k7til@yahoo.co.in,
Tel/Fax: +91{4144}243223***

Abstract: The objective of the present study is to determine the accumulation of heavy metals in five of the most commercially important fishes caught in the Parangipettai coastal waters and analyzed for the (Fe, Mn, Mg, Ni) concentrations in the muscles. The results revealed that the Mn and Fe concentrations were the highest; followed by Mg and Ni being the lowest in the all five species of fish tissue. The muscle concentrations of Mn<Fe<Mg<Ni ranged from 0.274±0.03-53.39±14.3, 0.132±0.11-10.52±1.51, 0.628±0.12-28.61±1.56, 0.023±0.01-0.261±0.14ppm respectively. A significant species-specific difference was not found. The *Pomadasys maculates* contained higher muscle concentrations of Fe, Mn and Mg than the other species of fishes. However, the *Ambassis commersoni* contained the highest concentrations of Mn and medium concentration of most of the metals. The accumulation of most of the metals followed the ratio as *Pomadasys maculates* < *Anchoviella commersonii* < *Ambassis commersoni* < *Upeneus vittatus* <*Lutjanus adetii.* As these fishes are extensively used for human consumption, this finding shows that these metals are all within the limits and therefore no public health problem would be raised in the consumption of the fishes.
Key words: Trace metals, fishes, muscle, parangipettai

1. Introduction

The seas and oceans, which cover 70% of the world's surface, are one of the man's great hopes for future food supplies. As human populations multiply and industrialization increases, the problems of environmental pollution become more critical (Jerome & Williams, 1979). The concentrations of heavy metals in aquatic environment and marine organisms have been of considerable interest because of their toxic effects which are important in human beings (Ipinmoroti *et al.,* 1997). Heavy metals have the tendency to accumulate in various organs of marine organisms, especially fish, which in turn may enter into the human metabolism through consumption causing serious health hazards (Puel *et al*.,1987).All around the world a lot of research work have been documented on trace metal concentration in marine and fresh water fishes (Asaolu, 2002). Over the last few decades, there has been growing interest in determining heavy metal levels in the marine environment and attention was drawn to the measurement of contamination levels in public food supplies, particularly fish (Tariq *et.al*., 1993). Toxicological and environmental studies have prompted interest in the determination of toxic elements in food. The ingestion of food is an obvious means of exposure to metals, not only because many metals are natural components of foodstuffs but also because of environmental contamination and contamination during processing (Steve Hall ,1995).With the exception of occupational exposure, fish are acknowledged to be the single largest source for man. In some instances, fish catches were banned for human consumption because their total metal content exceeded the maximum limits recommended by the FAO & WHO(1972). The present work was undertaken to study the concentration levels of selected metals in commercially important fish species of parangipettai coast.

Fig. 1. Showing the Study area

2. Description of the Study Area

Parangipettai a coastal town was the study area (Lat 11^0 30'N; Long. 79^0 46' E): situated at the mouth of the Vellar estuary in the marine zone, near Annankoil fishing hamlet. The Vellar Estuary is a highly productive estuary located at Parangipettai, originated at Servarayan hills in Salem Dist, Tamil Nadu and flows over a distance of 480km, forming an excellent estuarine system at Porto novo before it drains into the Bay of Bengal **(Fig. 1)**.

3. Material and Methods

Five fish species were purchased from local fishermen at the Annancoil landing centre at Parangipettai in April, 2009. In the present study accumulation of metals such as Iron, Magnesium, Manganese and Nickel were estimated in the tissue of *Upeneus vittatus* (Yellow striped goat fish) *Anchovilla commersonii* (White bait) *Pomadasys maculates* (Spotted grunter) *Lutjanus adetii* (Yellow banded sanpper) *Ambassis commersoni*(Glassy perchlet).After identifying the species, samples were immediately kept in pre cleaned polythene bags, which were sealed and kept in an ice box until further analysis in the laboratory. The soft tissue was removed and dried at 60ºC. The dried tissue was reduced into fine powder in a pestle and mortar and the resulting powder was selected, using a plastic sieve with 0.2mm opening size and was stored in dessicator for further analysis. To estimate the trace metal content (Fe, Mn, Mg, Ni) samples were digested (1g) with conc. HNO_3 and conc. $HClO_4$ (4:1) and analysed in optical emission spectrophotometer (optima 2100DV) (Topping, 1973). .The values were expressed in ppm.

4. Results and Discussion

Increasing industrialization, along with the violation of effluent disposal norms, has caused heavy contamination of water bodies. Fish and other aquatic biota in the vicinity of industrial areas is a good indicator for gauging the level of pollution. Metals like Iron, Manganese, Magnesium and Nickel have proven to be persistent pollutants. Though present in traces and being lipophilic, heavy metals tend to bioaccumulate and biomagnify. Their accumulation in biotic tissues causes toxic effects. The present study is undertaken to gauge the accumulation of Iron, Manganese, Magnesium and Nickel in fish tissue, Heavy metals have the tendency to accumulate in various organs of marine organisms, especially fish, which in turn may enter into the human metabolism through consumption causing serious health hazards (Puel, et.al., 1987).

Hence the present study was undertaken to evaluate the metal concentrations in the fish samples. The analysis of the selected metals in the present study revealed an order of Mn<Fe<Mg<Ni in almost all the species. Accumulation of metal in different species is the function of their respective membrane permeability and enzyme system, which is highly species specifics and because of this fact different metals accumulated in different orders in different fish samples **{Plate.1}.**

Iron in the fish samples accumulated in the order *Pomadasys maculates* < *Ambassis commersoni*< *Anchoviella commersonii* <*Upeneus vittatus* < *Lutjanus adetii.* In contrast to earlier reports showing Iron (Fe) to be normally highest. The present study showed Fe concentrations in tissue were below quid line limit. The concentrations of Iron in the five

species of fishes varied from 10.52 ± 1.513 to 0.132 ± 0.110 ppm.

Manganese accumulated in the order *Ambassis commersonii* < *Pomadasys maculates* <*Anchoviella commersonii* < *Lutjanus adetii* < *Upeneus vittatus*. Mn tends to reside in the tissue in all the fish samples studied, Hence, Mn concentrations in the entire species of fish were higher than all other metals. This does not constitute any threat upon the consumption of these species of fish.

The high values of in the samples indicate that the environment is stressed with respect to Mn and Fe. On the other hand, the concentrations of Mg and Fe were highest which indicates that other variables may affect the accumulation of metals, such as the rate of uptake and excretion, chemical form of the metal and species (Murphy *et al.,* 1978). Worth mentioning that the examination of the results of the present work showed no clear trends of increasing or decreasing of metal concentrations in the fish tissue.

The concentration of metals in the muscle tissues were generally low and within the ranges expected for metals in muscle of fish from relatively uncontaminated locations. Moreover, the values of these metals found in the examined fish species fall below the acceptable levels for human consumption recommended by FAO (1989) and (WHO, 1989) which means that they do not pose a significant threat to the health of human consumers

Magnesium accumulation showed the order as *Upeneus vittatus* <*Pomadasys maculates*<*Anchoviella commersonii* < *Ambassis commersoni*< *Lutjanus adetii.* Taking into account that Mg is not potentially harmful to fish and wildlife (Swann,2000) and that little is known concerning whether or not elevated levels of Mg in fish tissue are harmful to the organism itself and to human and other wildlife species which consume the organism (Irwin,1991). The present Mg levels might not be a major concern.

Nickel accumulated in the order of *Anchoviella commersonii* < *Upeneus vittatus* < *Ambassis commersoni*< *Pomadasys maculates* < *Lutjanus adetii.* Nickel concentrations of 2.3Mg g-1 or greater, may cause reproductive impairment and lack of recruitment in fishes (Baumann and May, 1984). None of the samples in this study approached these levels of concern. Hence nickel (0.023±0.01-0.261±0.14) concentrations in the entire species of fish do not constitute any threat upon its consumption.

Plate 1. Level of metal concentrations {Mg, Fe, Mn, Ni}

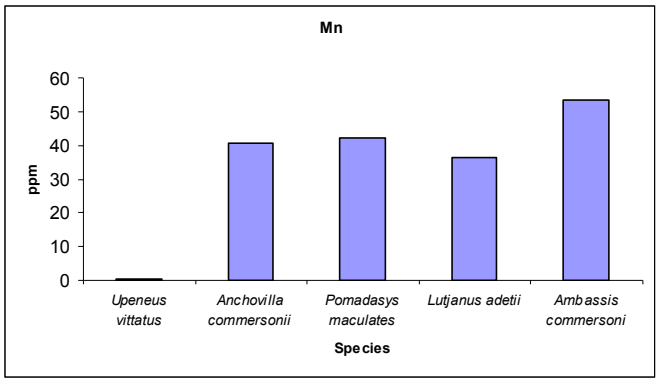

Fig. A

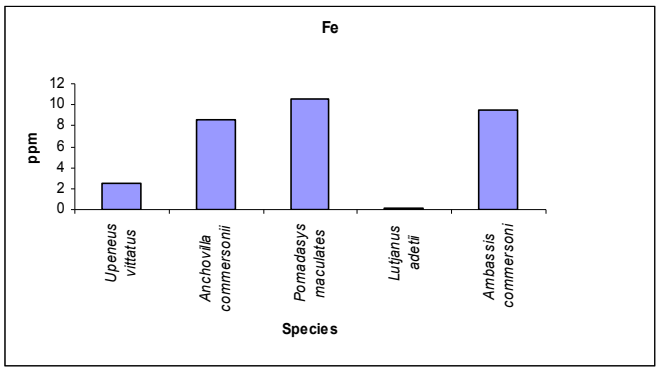

Fig. B

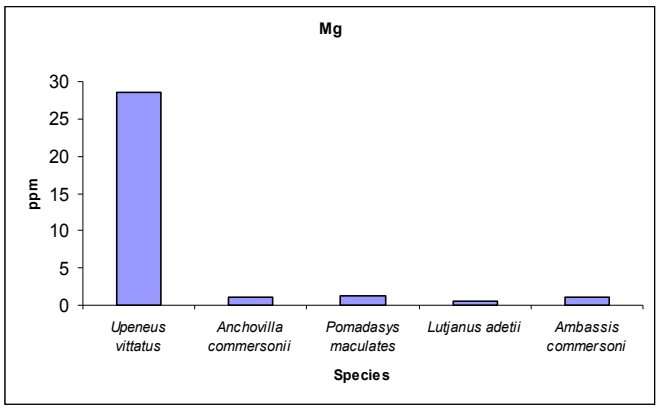

Fig. C

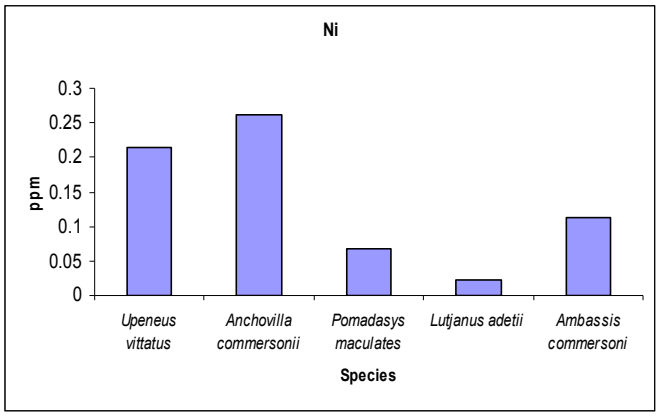

Fig. D

5. Conclusion

Fish absorb metals through ingestion of water or contaminated food. Heavy metals have been shown to undergo bioaccumulation in the tissue of aquatic organisms. On consumption of fish and other aquatic organisms these metals become transferred to man. However, it is not yet known whether the fishes in the have been severely affected by heavy metals based on the results obtained from this study. Although the results do not explicitly indicate a manifestation of toxic effects, the possibility that deleterious effects could manifest after a long period of consumption of fish caught in parangipettai coast with trace metal contamination cannot be ruled out.

6. Acknowledgement

Authors are thankful to the Director, CAS in Marine Biology and authorities of Annamalai University for providing with necessary facilities.

7. References

Asaolu, S.S., 2002. Determination of some heavy metals in Oreochromis Niloticus, Clarias Gariepinus and Synodontis Spp from the coastal water of Ondo State, Nigeria. *Pakistan J. Sci. Ind. Res.,* 45: 17–9.

Baumann, P. C. and T. W. May, 1984. Nickel residues in fish from inland waters of the United States. Pages 1-16 in Workshop proceedings, the effects of trace elements on aquatic ecosystems. Vo1.7. Electric Power Research Institute, Palo Alto, CA.

FAO, 1989. National Research Council. Recommended dietary allowances.10th ed. National Academy Press. Washington, D.C., U.S.A.

Food and Agriculture/World Health Organization (FAO/WHO) 1972. "Evaluation of Certain Food Additives and theContaminants Mercury, Cadmium and Lead", WHO Technical Report Series No. 505, Geneva.

Ipinmoroti, K.O., S.S. Asaolu, C.E Adeeyinwo and O. Olaofe, 1997.Distribution of some heavy metals in coastal water of Ondo State,Nigeria. *J. Techno-Sci.,* 1: 46.

Irwin, R.J., 1991. Prototype Contaminants Encyclopedia. U.S. Fish Wild. Serv, Arlington, Texas, pp: 1094.

Jerome and Williams, 1979.Introduction to marine pollution control, pp 1–50. John Wiley-Inter Science Publication.

Murphy B.R, Atchinson GJ, McIntosh AW & Kolar DJ. 1978. Cadmium and zinc content of fish from an industrial contaminated lake. J. Fish. Res. Boar. Can. 13:327-332.

Puel, D., N. Zsuerger, J.P. Breittmayer, 1987. Statistical assessment of a sampling pattern for evaluation of changes in Hg and Zn concentration in Patella coerulea. *Bull. Environ. Contam. Toxicol.,*38: 700–6.

Steve Hall, 1995. "Fish:It's Usually the Last Meat People Give Up, Maybe it Should be the First" New England Journal of Medicine 33(2), pp. 977.

Swann, LaDon, 2000. A fish farmer's guide to understanding water quality. IIlinois-Indiana sea grant program, Purdue University; URL: http://ag.ansc.purdue.edu/aquanic/publicat/state/il-in/as-503.htm

Tariq. J., M. Jaffar, and M. Ashraf, 1993. "Heavy Metal Concentrations in Fish, Shrimp, Seaweed, Sediment and Water from Arabian Sea, Pakistan", Marine Pollution Bulletin, 26 (11), pp. 644–647.

Topping, G. 1973. Heavy metals in shell fish from Scottish waters. Aquaculture. 1: 379 – 384.

WHO, 1989. Environmental health criteria 108: Nickel. International programme on chemicalsafety.World healthOrganization.http:\\www.inchem.org/documents/ehc.

*****