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Bioaccumulation of some heavy metals in different tissues of commercial fish *Lethrinus lentjan* from Chinnamuttom Coastal area, Kanyakumari, Tamil Nadu

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ABSTRACT

Concentration of zinc (Zn), iron (Fe) and copper (Cu) were determined in muscles, liver and gills of the marine fish species Lethrinus lentjan from Chinnamuttom coast, southern tip of Kanyakumari during February 2010- January 2011 to understand the toxicity of heavy metals. The results were expressed as µg/gm dry weight of tissue. The concentration of zinc varied from 3.71 – 8.35, 26.18 – 27.38 and 9.03 to 10.78, iron content fluctuated from 25.62 – 27.68, 26.13 – 27.63 and 10.65 – 12.95 and the copper content varied from 1.63– 2.97, 4.1 – 7.25 and 2.16 – 2.97µg/gm dry weight of tissue in muscles, liver and gills respectively. A positive correlation were observed between the selected metals in muscles and gills whereas negative correlation were observed between zinc and copper (r = -0.476) and iron and copper (r = - 0.144) in liver of Lethrinus lentjan. Heavy metals in the different tissues of Lethrinus lentjan were in the permissible safety levels for human uses.

Key words: *Lethrinus lentjan*, Heavy metals, Chinnamuttom.

INTRODUCTION

In natural system, many trace elements, even in low concentrations, may exert harmful or beneficial effects on aquatic biota. These elements have been introduced to the environment both through natural process and as a consequence of human activities such as industrialization or fuel combustion [1, 2, 3]. Heavy metal contaminations have devastating effects on the ecological balance of the recipient environment and a diversity of aquatic organism [4, 5]. Among animal species, fishes are the inhabitants that cannot escape from the detrimental effects of these pollutions [6]. It is known that metals accumulate on sediment surface in benthic living things, planktonic organisms and other living matter and it enhance through food chain. Fish accumulate xenobiotic chemicals especially those with poor water solubility. Because of the very intimate content with the medium that carries the chemicals in solution or suspension and also fish have to extract oxygen from the medium by passing the enormous volume of water over gills [7, 8]. Toxic substances may knock down immune, reproductive, nervous and endocrine system in animals and these effects can be at organ, tissue and cell level [9].

India's extensive coastline of about 7515km is potentially unique fishery resource that currently contributes to about 90% of total annual marine fish landings of the country. The aquatic system is extensively contaminated with the different types of pollutants released from domestic, industrial and other man made activities [1]. Metal is one of the contaminants discharge into the marine environment can damage both animals and humans [10].

Zinc, iron and copper are the trace metals. These essential elements play important role in biological metabolism at very low concentration [11] and either on excess or deficit can disturb biochemical function in aquatic animals and humans. These metals participate in different reactions of biotransformation and have specific functions indispensable for life such as normal skeletal growth and development, glucose utilization, lipid synthesis and lipid metabolism, prevention of sterility, pancreases function and development, protein and nucleic acid metabolism and activation of enzyme functions [12].

This fish species *Lethrinus lentjan* is commonly found near reefs and over rocky bottom in the Chinnamuttom Coastal area, and has a significant commercial and social value to the local people for their good quality, unique meat texture and their taste. This fish is normally utilized as fresh, preserved, dried or salted. These are marketed all over the country and transported from one landing centre to another with the assistance of cooler. The trace metal concentration of *Lethrinus lentjan* is not yet determined in Chinnamuttom. Therefore, the present study was undertaken to elucidate the distribution of trace metal composition in different tissues of *Lethrinus lentjan*.

MATERIALS AND METHODS

Specimens of *Lethrinus lentjan* used for this study were brought from Chinnamuttom harbor, Kanyakumari, Tamilnadu. The fish samples were dissected out and the tissues such as muscles, liver and gills were taken. 1 gm of these tissues were weighed and used for heavy metal analysis. All the samples were dried at 110^0C, powdered with pestle and mortar and stored in dessicator until chemical analysis. To estimate the metal concentration (Zn, Fe and Cu), samples were digested (1gm) with a mixture of concentrated nitric (HNO_3) and conc. perchloric acid ($Hclo_4$) [13] and analyzed by Flame Atomic spectro metry method (*FAAS, thermo, UK*).

The pearson correlation coefficient was used to measure the strength of the association between heavy metal concentration in the tissues and presented in the correlation matrix.

RESULTS AND DISCUSSION

The concentration of trace metals in selected organs, viz muscles, liver and gills of the *Lethrinus lentjan* are presented in table no. 1, 2 and 3 and the data has also been given in the form of chart fig. no. 1. The results were expressed in µg/gm dry weight of tissues. The distribution of trace elements in the selected organ was in the order of magnitude as liver > gills > muscles. The distribution of trace metals in fish organs analyzed were in the order of Fe > Zn > Cu. Among the metals analyzed, the highest concentration of iron (27.06±0.12 µg/gm of dry weight of tissue) was observed in the liver tissue while the lowest concentration of iron (26.57±0.19) was found in the muscles. The highest level of iron in all the tissues of *Lethrinus lentjan* may be due to they forms hydrated ionic condition and may form a variety of complexes with inorganic and organic ligands. In water they may occur as complex and diverse mixture of soluble and insoluble forms such as inorganic and organic complex and or associated with colloids and suspended particulate matter. From this it enters into the organ of fishes through some vulnerable sites such as gills and skins. The fishes also get this iron from their prey item and biomagnified in the different parts of the body. Iron is not considered hazardous to health. In fact, it is essential for good health to transport oxygen in blood. Similar finding was observed by Bamishaiye *et al.,* [14] on the determination of some trace elements in water samples within Kano meteropolis. The above findings were supported by Farkas *et al.*, [15] and Olssen [16].

Table No. 1 Monthly variations of heavy metal concentration in different tissues of *Lethrinus lentjan* during 2010 - 2011

Months	Muscles µg/gm			Liver µg/gm			Gills µg/gm		
	Zinc	Iron	Copper	Zinc	Iron	Copper	Zinc	Iron	Copper
Feb-10	7.04	25.62	1.96	26.18	26.13	4.32	9.65	10.78	2.16
Mar-10	3.71	25.73	1.81	26.22	26.6	4.28	9.69	10.95	2.32
Apr-10	5.19	25.79	1.63	26.28	26.78	4.1	9.03	10.65	2.54
May-10	6.73	27.18	1.75	27.09	27.05	6.08	10.08	10.72	2.63
Jun-10	6.78	27.68	2.89	27.18	27.35	6.63	10.72	12.11	2.5
Jul-10	6.82	27.5	2.73	26.68	27.63	6.95	10.68	12.63	2.62
Aug-10	7.35	27.13	2.97	26.9	27.6	7.08	10.75	12.95	2.97
Sep-10	8.01	26.32	2.36	26.98	27.18	7.16	10.69	12.05	2.36
Oct-10	8.35	26.37	2.1	27.23	27.39	7.18	10.58	12.62	2.51
Nov-10	7.82	26.63	2.15	27.26	27.43	7.25	10.63	12.26	2.27
Dec-10	5.62	26.78	2.08	27.38	26.83	6.2	10.78	12.35	2.46
Jan-11	5.71	26.1	2.2	26.68	26.78	6.11	9.92	11.62	2.4

Zinc is also an essential element that plays an important role in biological metabolism at very low concentrations and either an excess or deficit can disturb biochemical function in both animals and humans.

Table No. 2 Mean values of heavy metals concentration in *Lethrinus lentjan* during 2010-2011

Parameters	Muscles µg/gm M±S.E	Liver µg/gm M±S.E	Gills µg/gm M±S.E
Zinc	6.59 ± 0.38**	11.81 ± 0.24**	10.27±0.17**
Iron	26.57 ± 0.19**	27.06 ± 0.12**	26.84 ± 0.15**
Copper	2.22 ± 0.13*	6.11 ± 0.35*	2.48 ± 0.08*

(*) Significant at P>0.05% level and (**) Highly Significant at P>0.05% level
M±S.E = Mean ±Standard Error, n=12

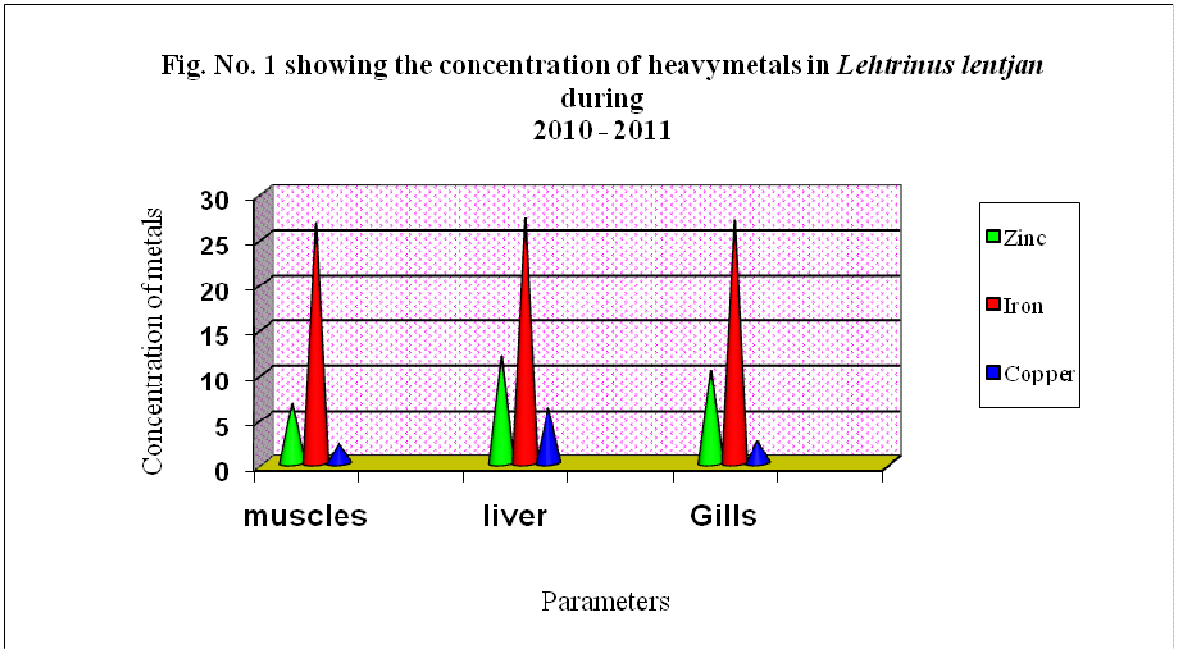
Table No. 3: Correlation intermatrix between Heavy metals in different tissues of Lethrinus lentjan during 2010 – 2011

Parameters	Muscles	Liver	Gills
Zinc Vs Iron	0.35	0.58	0.64
Zinc Vs Copper	0.42	-0.48	0.85
Iron Vs Copper	0.69	-0.15	0.82

The high (11.81±0.24 µg/gm dry weight of tissue) concentration of zinc was observed in the liver and the low (6.59±0.38) concentration was recorded in the muscles. The high (6.11± 0.35) concentration of copper was observed in the liver and low (2.22±0.13) concentration was observed in the muscles.

Highly significant difference (P>0.05%) was observed for zinc in muscles, liver and gills of *Lethrinus lentjan*. The concentration of zinc in the selected organs of *Lethrinus lentjan* was due to the presence of the large number of agricultural activities that ultimately finds its way into the ambient media through leaching and also major source of zinc is the antifouling paints which are used in marine vessels and fishing travlers in order to protect them from biofloulers. From this it is transported in to the aquatic environment and it is readily incorporated with biogenic materials especially phytoplankton and thus may get transferred to the fishes through the different trophic levels of aquatic food chain. Similar observations were made by Abijit mitra *et al.*, [17] on heavy metal concentrations in Indian Coastal fishes and Ambedhkar *et al.*, [18] on bioaccumulation of some heavy metals in the fresh water fish from Kollidam river.

Higher concentration of copper was observed in the liver which may be due to the presence of domestic waste, agricultural and industrial waste which is discharged into the environment. The extensive coal tar used in the travlers and also local aquacultural farms which use copper sulphate as an algicide also be regarded as pollution. This is toxic to the aquatic life at low concentrations and it may be accumulated from water to higher level in fish tissue. The same has been reported by Bamishaiye *et al.*, [14] on determination of some trace elements in water samples within Kano metropolis.



The present study showed that high concentration of trace metals (Zn, Fe and Cu) was observed in liver when compared to that of gills and muscles. The high level of metals in the liver may be due to the role of metals in

physiological activities of organs. The metals involved in the enzyme activities in liver, consequently higher quantities of these elements are accumulated in liver. The liver being an organ for storage and detoxification of metals as well as an organ where the specific metabolic process takes place and enzyme catalysed reactions are related to the metals as well as an organ where the specific metabolic processes and enzyme catalysed reactions and liver has also an important role in redistribution transformation of contaminants and also act as an active site of pathological effects induced by contaminants. The results are in accordance with the findings of Evans *et al.,* [19] and Shanker *et al.,* [20] on the trace element concentration in some fishes of fresh water ecosystem.

Lower concentration of metals in muscles were observed during this study may be due to the fact that the absence of metals binding protein and also muscles was less active as compared with other tissues. Similar results were observed by Al Yousuf *et al.,* [21] in the *Lethrinus lentjan.* The above observation was also supported by Romeo *et al.,* [22].

The results of this study revealed that consuming the *Lethrinus lentjan* from the Chinnamutom Coastal area may not have harmful effects, because the levels of heavy metals are below the permissible limits as prescribed by WHO [23] and FAO [24].

CONCLUSION

The present study revealed that changes in the metal concentration in the different tissues are associated with metal concentration in eco system, time of exposure, ecological needs, metabolic processes, feeding habits, salinity, temperature and interacting agents. Form the present study, it can be concluded that the metal concentration in the different tissue of *Lehtrinus lentjan* are below the prescribed level. Therefore the selected species for this study are fit for human consumption in this region.

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REFERENCES

[1] Velez D. and Montoro R, *Journal of food Protect*, **1998**, 9(61): 1240-1245.
[2] C. O. B, Okoye C, Ibeto N. and Ihedioha J. N, *Advances in Applied Science Research*, **2011**, 2 (3), 63-68.
[3] Yadav S.S. and Kumar Rajesh, *Advances in Applied Science Research*, **2011**, 2 (2), 197-201.
[4] Ashraj W, *Environmental Monitoring Assessment*, **2005**, 1-3(103), 311- 316.
[5] Vosyliene M. Z. and Jankaite A, *Ekologija*, **2006**, 14:12 -17.
[6] Olaifa F.E, Olaifa A.K, Adelaja A.A, Owolabi A.G, *African Journal of Biomedical Research*, **2004**, 7, 65-70.
[7] Barlas N, *Environm.Toxicol*, **1997**, 14, 367 – 373.
[8] Koranteng E, Addo J.1,Owusu , Ansah E, Boamponsem L. K, Bentum J. K. and Arthur S, *Advances in Applied Science Research*, **2011**, 2 (1), 280-288.
[9] Geeraerts C. and Belpaire C, *Ecotoxicology*, **2009**, 19, 239- 266.
[10] Edward J.W, Edyvane K.S, Boxalls A, Hamann M. and Soole K.L, *Pollution Bulletin*, **2010**, 42(5): 389-396.
[11] Le Q.D, Shirai K, Nguyen D.C, Miyazaki N. and Arai T, *Water Air Soil Pollut.*, **2009**, 204:69-78.
[12] FAO. National research council Recommended Dietary Allowances. 10th Edn. National Academy press. Washington, Dc.USA. **1989**.
[13] Kumar B, Senthilkumar K, Priya M, Mukhopadhyaya D.P. and Saha R, *Toxicology and Environmental chemistry*, **2010**, 92 (3): 243-260.
[14] Ogbonna O, Jimoh W.L, Amagn E, Bamishaiye E. I, *Advances in Applied Science Research*, **2011**, 2(2), 62 – 68.
[15] Farkas, Salanki A. and Varanka J, *Lake and Reservoirs Research and management*, **2000**, Vol. 5, 271-279.
[16] Olsson P.E, Disorders associated with heavy metal pollution. In: Neatherland J. F. and P. T. K. Woo (eds), Fish Diseases and disorders, *CABI publishing, Newyork, USA.*, **1998**, 105-131.
[17] Abhijit Mitra, Shreya Mitra, Sumit Hazra and Anish Chaudhuri, *African Journal of Biomedical Research*, **2000**,7, 145 – 148.
[18] Ambedkar G. and Muniyan, *Advances in Applied Science Research*, **2011**, 2(1), 221- 225.
[19] Evans D.W, Doo Do D.K. and Hanson P, *Mar. Pollut. Bull.*, **1993**, 26, 329-354.
[20] Marichamy G, Shanker S, Saradha A, Nazar A.R. and Badhul Haq M.A, *European Journal of Experimental Biology*, **2011**, 1(2),47-55.

[21] Al-Yousuf M. H, El-Shahawi M. S. and Al-Ghais S. M, *The Science of the Total Environment*, **2000**, 256, 87-94.
[22] Romeo M, Siau Y, Sidoumou Z. and Gnassia Barelli M, *The Science of the Total Environment*, **1999**, 232, 169 -175.
[23] WHO, National Research Council, recommended dietary Allowancs. 10th Edn. National Academic press. Washigton, DC.USA, **1989**.
[24] FAO, Compilation of legal limits for hazardous substances in fish and fishery products.FAO Fishery Circular, **1983**, 464: 5-100.