ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

Concentration of Heavy Metal substances in Sardinella Longiceps in Threspuram Area,Tuticorin.

M.Muthukani
Head of the Dept of Zoology, APC Mahalaxmi Arts and Science College for Women, Tuticorin, Tamilnadu, India

Abstract:-- **Thoothukudi. popularly called as 'Pearl city' has lost its charm due to industrialization. Thoothukudi. sea water has become contaminated due to the effluent discharges from several industries. The Thoothukudi. sea water is contaminated and polluted due to the untreated sewage drained into the sea from Industries and factories. The outcome is that there is higher concentration of toxic heavy metals which affect the marines species especially Sardinella Longiceps. This paper is a report of research work carried out in the Threspuram Area of Thoothukudi. which is a part of Gulf of Mannar. An Investigation was carried out to assess the heavy metal substances(Cu, Ni, Fe, Co, Mn, Cr and Zn) in the commercially important fish species Sardinella Longiceps. The accumulation was found in tissues of muscles, liver, kidney and gills. Concentration of heavy metal substances were studied in sea water, sediment and the fish Sardinella Longiceps and the results showed that the concentration of heavy metals was found in the order of Fe>Mn>Cu>Pb>and Zn.**

Keywords:-- **Sardinella Longiceps, Heavy metals, Thirespuram, Gulf of Mannar.**

1. INTRODUCTION

The detrimental effects of pollutants affect the inhabitant of fishes widely [1](Olaifa et al., 2004).Of all the pollutants heavy metal contaminations has drastic undesirable effect on the ecological balance of the recipient environment and a diversity of aquatic organisms [2] (Ashraj, 2005; Vosyliene and Jankaite, 2006). Physiological activities and biochemical parameters of fishes are highly disturbed due to these pollutant especially in tissues and blood [3](Basa and Rani, 2003). Several researchers have worked on bioaccumulation of heavy metals [4] [5] (Rani U, 2000; Waqar, 2006). It is learnt that metals accumulate on sediment surface in benthic living things, planktonic organisms and other living organisms and other living matter. Metals accumulate on sediment surface in benthic living things, planktonic organisms and other living matter and is enhanced through food chain. Fishes is one of the main aquatic organisms in the food chain often accumulating large amounts of certain metals. Fishes assimilate these heavy metals through ingestion of suspended particulars, food materials and by constant ion exchange process of dissolved metals across lipophilic membranes [6] (Reddy et al., 2007). Bioaccumulation of heavy metals by absorption occurs across the entire body surface of the fish [7](Benson et al., 2007). Fish accumulate xenobiotic chemicals, especially those with poor water soluble occurs because of the very intimate contact with the medium that carries the chemicals in solution or suspension and also because fish have to extract oxygen from the medium by passing the enormous volumes of water over gills. For fish, the gills, skin and digestive tract are potential sites of absorption of water borne chemicals. self-transported by the liver it may be stored there, excreted in bile, or passed back into the blood for possible excretion by kidney or gills or stored in extra hepatic tissues such as fat. It is known that heavy metals have toxic effects even at places away from the source of pollution as they have the ability of biological accumulation [8](Barlas, 1997). Toxic substances may knock down immune, reproductive, nervous and endocrine systems in animals and these effects can be at organ, tissue and cell level [9](Geeraerts and Belpaire, 2009). Environmental changes trigger the stress response of fishes. Stress influences plasma glucocorticoids and catecholamines. Environmental changes cause hypoxia, metabolic acidosis and alkalosis, hypotention and hypoglycemia [10] (Fabbri et al., 1998). Gill tissue is an organ having a large surface and separates blood from water in fish and is very susceptible to changes in concentrations of the variables (heavy metals, temperature, pH etc.) in the environment. These variables affect the structural integrity of the gill and cause morphological changes. For this reason gills are good indicators of water pollution [11] [12](Bhagwant and Elahee, 2002; Koca et al., 2005, 2008). Liver plays an important role in protecting inner homeostasis in vertebrates. The highly dynamic nature of liver and its regulation in many metabolic and physiological processes make this organ a valuable model for study [13](Segner, 1998). Muscle tissue forms a

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

major part of the body weight of fish when compared to other vertebrates [14](Fabbri et al., 1998) and is also economically valuable. The heavy metals, being conservative in nature have the maximum probability of biomagnification, when they are transferred to the human beings through the various members of different trophic levels in the food chain. This heavy metal accumulation has adverse effect on the health of human beings.. With this research inputs, the researcher collected samples of Sardinella Longiceps and evaluated the degree of heavy metal accumulation.

2. MATERIALS AND METHODS

Fish Sampling

Three Fish Samples were taken from Threspuram area (Lattitude 8o 51' N, 78o10' E Longitude) in Tuticorin which is a part of Gulf of Mannar.

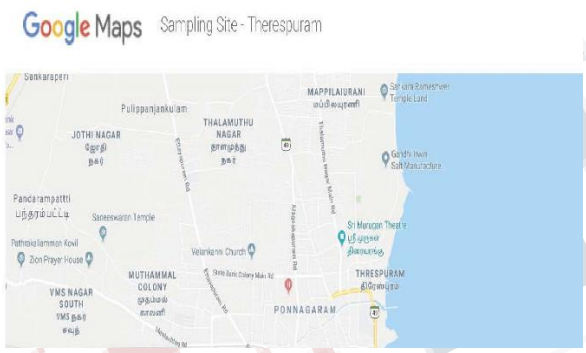

Fig 1 – Map Showing Sampling site Therespuram

Samples were stored in poly ethylene bags and brought to the laboratory, packed with ice (at 4oC) and proper labelling was done on the same day. Water, sediment and fish samples for heavy metal analysis were collected for a year from October 2016 to October 2017. Temperature was recorded using thermometer. Hydrological parameters namely salinity, dissolved oxygen, B.O.D, pH were estimated following standard procedures [15](Strickland and Parson, 1968). The collected Sardinella Longiceps were washed and kept in filtered sea water to empty the gut. Whole body tissue of animals were removed and washed in distilled water. The sediment and tissue samples were dried in an oven at 80 ± 2oC. The metals Cu, Hg, Fe, Cd, Pb and Zn were extracted and dried and finely ground tissue and sediment samples in duplicate (5g each) by following acid digestion procedure [16](Dalziel and Baker, 1984) and were detected on a Perkin Elmer AAS (Model 2380) in an air acetylene flame. Surface water samples from 2 m depth were collected from the same locality. The heavy metals Cu, Hg, Fe, Cd, Pb and Zn in sea water were analysed using Stripping Voltametry in a 757 VA Computrace attached to 765 Dosimat (Metrohm, Switzerland) following the method outlined by Anoop et al. [17] (2007). The mean values of each metal were analyzed using Microsoft Excel 2013.

3. RESULTS AND DISCUSSION

Heavy metal Concentration in Sardinella Longiceps The mean values of heavy metal concentration in the Gills, Liver, Kidneys and muscles.

Table 1: Heavy metal concentration in different organs of Sardinella Longiceps

Sample	Cu (ppm)	Hg (ppm)	Fe (ppm)	Cd (ppm)	Pb (ppm)	Zn (ppm)
Gills	15	0.04	4214	1.12	13	76.17
Liver	8	0.04	2410	1.60	26	46.68
Kidney	4	0.03	6241	2.04	46	69.78
Muscles	3	0.12	2585	0.15	5	19.27

Table 1 mentioned above shows the range of heavy metal concentration in different organs of Sardinella Longiceps and values are Mean values.

The results as it is read from Table 1 the concentration of cuvaries from 3 ppm to 15 ppm. The highest accumulation of copper is Gills and muscles have the lowest concentration as 3ppm. Hg is highest in muscles and in all other organs of Sardinella Longiceps it is well below the desired level. Kidney is highest in Fe (6241 ppm) and Liver accumulates the lowest concentration of Fe (2410 ppm). As regards Cd, Kidney has the highest concentration whereas muscles has the low concentration. Pb has highest concentration in Kidney and lowest concentration in muscles. Gills accumulate highest concentration of Zn 76.17 (ppm) and muscles have lower concentration of 19.27 (ppm)

Table 2 Hydographical parameters – Values are (mean ± SD, n=3)

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

Parameters	Therespuram Station (Mean ± SD)
pH	7.91±0.14
Salinity (ppt)	35.8±0.5
D.O ($ml.l^{-1}$)	1.8±0.8
Total Suspended Solids (TSS) ($mg.ml^{-1}$)	0.35±0.035
Biochemical Oxygen Demand (B.O.D) ($mg.ml^{-1}$)	2.51±0.03

From Table 2 it is inferred the hydrographical condition of Therespuram sea water. At Therespuram the pH of water is 7.91±0.14, Salinity is 35.8±0.5, Dissolved Oxygen is 0.35±0.035 and B.O.D recorded was 2.51 ± 0.03.

Table 3 Heavy metal concentration (mean ± SD) in sea water (µg g-1), Sediment (µg g-1)

Sample	Cu	Hg	Fe	Cd	Pb	Zn
Water	4.29	0.03	4524	0.26	0.60	27.53
Sediment	1.31	<0.01	692	<0.01	0.29	0.82

The Cu concentration in water is 4.29 as against the sediment 1.31. Hg recorded in water high as compared to Sediment. The Therespuram sea water contained Fe of 4524 ppm as against 692 in sediment. The Cd concentration in water is 0.26 ppm which is slightly compared to the sediment. Water has 0.60 ppm whereas the sediment at Therespuram records 0.29. Zn has the concentration of 27.53 ppm in water as against 0.82 ppm in sediment at Therespuram.

In the present study, levels of heavy metals in the organs of Sardinella Longiceps in the landing station Therespuram is determined. It is aimed to evaluate the current environmental status of this region is determined. The metal content in Gills, Liver, Kidney and muscles of Sardinella Longiceps were compared to the maximum permissible limit (MPL) to assess the quality of fish for human consumption.

Table 4 Permissible metal levels in marine organisms used for food purposes from different countries

Organization/country	Metals (ppm)							
	Cd	Cu	Mn	Ni	Pb	Cr	Zn	Reference
EC (European Community)	0.05	-	-	-	0.2	-	-	
FAO (Food and Agricultural Organization)	-	10	-	-	0.5	-	30	
Turkish guidelines	0.1	20	20	-	1	-	50	
FAO/WHO limits	0.5	30	-	-	0.5	-	40	
EU (European Union) limits	0.1	10	-	-	0.1	-	-	
Saudi Arabia	0.5	-	-	-	2	-	-	
MPEDA (Marine Product Export Developmental Authority), India	3	-	-	80	1.5	12	-	

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 12, December 2017

4. CONCLUSION

Heavy metal analysis of Sardinella Longiceps showed lower concentration in Cu, Fe, Cd, Pb and Zn except Hg in the muscles. Health risk analysis of heavy metals in the edible parts of fish indicated safe levels for human consumption and concentrations in the muscles are generally accepted by the international legislation limits. But Sardinella sp. accumulated high concentrations of Cu, Zn, Cd, Fe and Mn in the muscles when compared to other species [18](Moselhy et al). Health risk analysis of heavy metals in the edible parts of the fish indicated safe levels of human consumption and concentrations of muscles are generally accepted by the international limits.

ACKNOWLEDGEMENT

The author places on record the encouragement and support rendered by the Management of APC Mahalakshmi College, Tuticorin. The author wish to thank the Principal of the College and the faculty members of various departments in doing the actual research, Data Analysis and also anonymous persons in proof reading.