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Heavy Metal Content in Dominant Fish Catch (Rohu, Mrigal and Tilapia) of Hebbal Lake, Bengaluru

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Abstract The concentrations of heavy metals (Cu, Pb, Zn, Cd, Cr, Fe and Hg) in the organs (muscle, gills and viscera) of the dominant fish catch (rohu, mrigal and tilapia) of Hebbal Lake, Bengaluru were analyzed. Accumulation of heavy metals in the organs of 3 fishes (rohu, mrigal and tilapia) was found in the order viscera>gills>muscle. The concentration of heavy metals accumulated in gills and muscles was found in the order Zn>Fe> Pb>Cu>Cd>Hg and in the viscera, it was found in the order Fe>Zn>Cu>Cd>Pb>Hg. The heavy metal concentration for various parameters was sediment >water>fishes. The geoaccumulation indices of the heavy metals revealed that the tank is moderately polluted.

Keywords Hebbal Lake, Heavy metals, Water, Sediment, Fish organs.

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Introduction

Fish play an important role in human nutrition and therefore need to be carefully and routinely screened to ensure that there are no high levels of heavy metals being transferred to man through consumption. It is worth while noting too that other organs including the muscles, liver and kidney have also been studied for heavy metal accumulation [1—5]. The gill tissues play an important role in ion regulation , gas exchange, acid balance, nitrogenous wastes and excretion which signifies the key role it play at the interface with the environment. The intestine is the main organ for food digestion and storage while spleen is attached to it. The spleen acts as an organ of detoxification of metal contaminants since it produces metallothionein. The intestine is potentially

Fig. 1. Map showing the Hebbal Lake.

the most important organ for metal absorption. As heavy metals cannot be degraded, they are continuously being deposited and incorporated in water, sediment and aquatic organisms thus causing heavy metal pollution in water bodies. The present research work aimed to analyse the accumulation of heavy metals (Cu, Pb, Zn, Cd, Cr, Fe and Hg) in the organs (muscle, gills and viscera) of the dominant fish catch (rohu, mrigal and tilapia) of Hebbal Lake, Bengaluru.

Materials and Methods

Study area

The Hebbal Lake is lies between 13°02′ 47.57″ N latitude and 77°35′ 13.66″ E longitudes.The study will be conducted over a period of 1 year (January 2013 to December 2013) (Fig.1). The sampling will be done at Hebbal Lake. The dominant fish catch collected were namely, rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*) and tilapia (*Tilapia mossambica*) were collected quarterly and the fishes were transported to the laboratory immediately. The heavy metals (Mercury, Iron, Lead, Zinc, Cadmium and Copper) in different parts fishes (rohu, mrigal and tilapia) like muscle, gills and digestive tract were estimated by analytical methodology following standard procedures (American Public Health Association) by using Thermo Scientific iCE 3000 Series Atomic Absorption Spectrophotometer. Approximately 5g muscle on the dorsal surface, the entire digestive tract and two gill rakers separated from each fish were washed with distilled water and kept in muffle furnace at 550^{0}C (for about 4 h) for ash , weighted and packed in polyethylene bags for further analysis for heavy metals. The results were given as mg/1 dry weight.

Results and Discussion

Heavy metals are taken up through different organs of the fish because of their affinity for them. During the present study the heavy metal content in different organs (meat, gills and digestive tract) of 3 commercially important fish species namely rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*) and tilapia (*Tilapia mossambica*) was assessed from Hebbal Lake (Table 1).

Rohu (*Lebeo rohita*)

In the fish meat mercury and cadmium concentrations are not detectable level, where as the Iron, Lead, Zinc and Copper values ranges from 0.0673, 0.0482,

Table 1. Distribution of heavy metals (mg/g) in 3 different fish species in Hebbal Lake during the study period.

Fish sp. and heavy meta	Rohu			Mrigal			Tilapia		
	Meat	Gills	Digestive track	Meat	Gills	Digestive track	Meat	Gills	Digestive track
Iron	0.0673	0.0499	0.5721	0.0785	0.0578	2.6174	0.0403	0.0830	1.9517
Lead	0.0482	0.0368	0.0569	0.0708	0.0507	Nd	nd	0.1072	0.0667
Mercury	nd	nd	nd	nd	nd	nd	nd	nd	nd
Zinc	0.1037	0.1724	1.0902	0.1310	0.5436	0.2006	0.1389	0.1319	0.2574
Cadmium	nd	Nd	nd	nd	nd	Nd	nd	nd	nd
Copper	0.0014	0.0085	0.0144	0.0107	0.0100	0.0050	0.0058	0.0087	0.0326

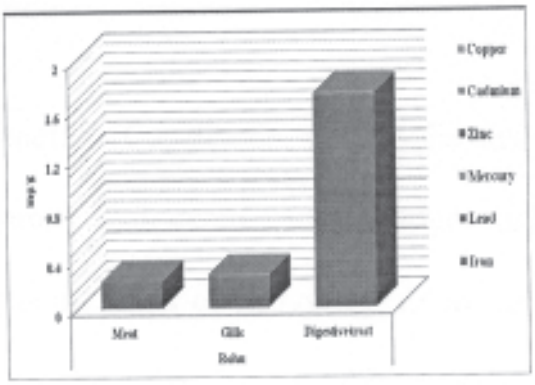

Fig. 2. Distribution of heavy metals (mg/g) in different organs of rohu (*Labeo rohita*) in Hebbal Lake.

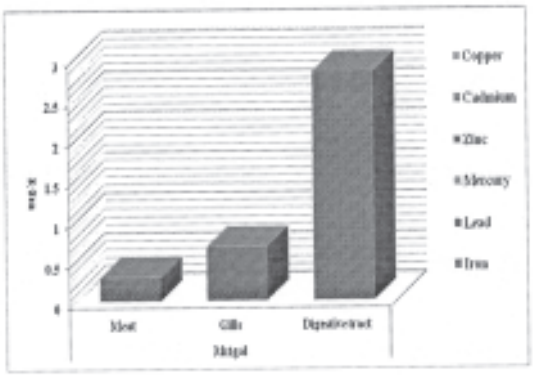

Fig. 3. Distribution of heavy metals (mg/g) in different organs of mrigal (*Cirrhinus mrigal*) in Hebbal Lake.

0.1037 and 0.0014 mg/g respectively. The Zinc concentrations were more when compared to other metal in meat of the rohu. Similar observations made by [1—5]. Similarly in the gills mercury and cadmium concentrations are not detectable level, where as the Iron, Lead, Zinc and Copper values were 0.0499, 0.0368, 0.1724 and 0.0085 mg/g respectively. The higher concentrations of Zinc were more when compared to other metal in gills of the fish. Where as in digestive tract the Iron, Lead, Zinc and Copper values were 0.5721, 0.0569, 1.0902 and 0.0144 mg/g respectively, the mercury and cadmium concentrations are not detectable level (Fig.2). During the present study the heavy metals concentration in rohu follows the sequence of Zn>Fe>Pb>Cu in all the organs of muscle, gills and digestive tract. It has been observed that the Zinc concentrations were more in all the organs of fish when compared to other metals.

Mrigal (*Cirrhinus mrigala*)

In the fish meat mercury and cadmium concentrations are not detectable level, where as the Iron, Lead, Zinc and Copper values ranges from 0.0785, 0.0708, 0.1310 and 0.0107 mg/g respectively. The Zinc concentrations were more when compared to other metal in meat of the Mrigal. Similarly in the gills mercury and cadmium concentrations are not detectable level, where as the Iron, Lead, Zinc and Copper values were 0.0578, 0.0507, 0.5436 and 0.010 mg/g respectively. Where as in digestive tract the Iron, Zinc and Copper values were 2.6174, 0.2006 and 0.005 mg/g respectively, the lead, mercury and cadmium concentrations were not detectable level (Fig. 3).

Tilapia (*Tilapia mossambica*)

In the fish meat lead, mercury and cadmium concentrations are not detectable level, where as the Iron, Zinc and Copper values ranges from 0.0403, 0.1389 and 0.0058 mg/g respectively. The Zinc concentrations were more when compared to other metal in

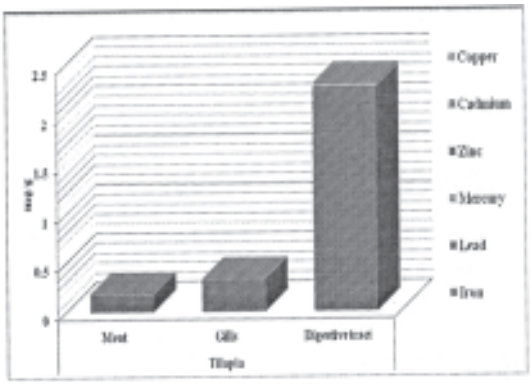

Fig. 4. Distribution of heavy metals (mg/g) in different organs of *Tilapia mossabicus* in Hebbal Lake.

meat of the tilapia. Similar observations made by [1—5]. Similarly in the gills mercury and cadmium concentrations are not detectable level, where as the Iron, Lead, Zinc and Copper values were 0.083, 0.1072, 0.1319 and 0.0087 mg/g respectively. Where as in digestive tract the Iron, Lead, Zinc and Copper values were 1.9517, 0.0667, 0.2574 and 0.0326 mg/g respectively, the mercury and cadmium concentrations were not detectable level (Fig.4).

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