ANALYSIS OF FLOURIDE LEVEL IN WATER AND FISH SAMPLES OF SANKEY, BELLANDUR AND MADIVALA LAKES OF BANGALORE, KARNATAKA.

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ABSTRACT

Fluoride concentration in water samples and bone tissue of ten species of fish harvested from Sankey Bellandur and Madivala Lake in July to October 2007was determined. The lowest and highest concentrations of fluoride 120.54 and 452.45 mg/L in Sankey Lake was found in Nandus nandus and Catla fish. In Bellandur Lake the fluoride concentration was minimum 240.24mg/kg in Nandus nandus and maximum 525.00mg/kg in Common Carp Fish and in Madivala Lake the minimum fluoride concentration 457.20 mg/kg in Mrigal and highest concentration 987.00 mg/kg in Tilapia fish. The Fluoride concentration in fish and water was Sankey lake >Bellandur lake > Madivala Lake. However the fluoride concentration in water of all the three lakes is within the permissible limits except Madiwala Lake.[1] Excessive amounts of fluoride may cause adverse health effects to humans and animals, there is a need for defluoridation of industrial, municipal and domestic wastewater.

***Keywords**: Sankey lake; Bellandur Lake; Madivala Lake ; Fluoride Concentration; Fish diversity.*

INTRODUCTION

Lakes are a dynamic inland aquatic system that supports and maintains a balanced adaptive community of organisms having diverse species composition, and the functional organization of all the organisms supports a unique biotic integrity. Lakes, the major life supporting systems, are facing ecological degradation today, due to undesirable anthropogenic activities. The undesirable activities and unscientific utilization of resources from the lakes have caused undesirable environmental problems, thus threatening the biodiversity sustained by it. It is again important to note that these species-rich aquatic ecosystems are capable of self maintaining, however the delicate equilibrium is sensitive to external stimuli such as human activities promoted by socio-economic goals. Exercising a control on the prevailing anthropogenic activities is necessary to sustain these socio-economically and bio-aesthetically important aquatic ecosystems. These aquatic ecosystems representing the highest levels of ecological integration clearly emphasizes the obligatory relationships, interdependence and interactions.[2-5] The rich biodiversity sustained by nature in these lakes is as a result of the interweaved functioning of several complex factors. Limnobiotic status of certain lakes as studied by limnologists showed that several physical, chemical and biological factors act simultaneously to influence the biotic fluctuations. One of the

most important crisis of the 21st century is the availablity of fresh drinking water, a resource basic to our survival and growth. Most of the fresh water bodies all over the world are getting polluted, thus decreasing the potability of the water. Since the beginning of civilization, Surface water bodies have been the centres of cultural development and anthropogenic activity. The causes of pollution in these water bodies are directly related to human activities. India, being essentially a rural and agrarian country, needs assured supply of water for a large rural population and even a larger agricultural area demanding assured input of water. In recent years many of the lakes are being lost in the process of various developmental activities including unplanned urbanization and expansion. Rest of the surviving lakes are reduced to cesspools due to direct discharge of industrial effluents, domestic sewage and unregulated dumping of solid wastes. Due to this many lakes particularly urban lakes are disappearing so fast that will bring far reaching consequences in the environment including changes in the micro climate of the areas. The problem of high fluoride concentration in groundwater resources has become an important health-related geo-environmental issue in some areas. Examples include the state of Rajasthan, India, where nearly 3 million people are reported to consume excess fluoride-containing water,[4,5] and the upper regions of Ghana, where 23 per cent of wells have fluoride concentrations above the WHO recommended maximum guideline limit of 1.5 mg/L.[6] In the Gdansk region, high fluoride levels (1.90 - 3.00 mg/L) were detected in Malbork drinking water supplies.[7] Since excessive amounts of fluoride may cause adverse health effects to humans and animals, there is a need for defluoridation of industrial wastewater.

Increasing water pollution causes contamination of the entire food supply chain. Chemicals accumulating in aquatic organisms, particularly fish consumed by humans in large quantities, are of special concern because a high retention of toxic substances in fish tissue may be detrimental to human health. Fluorine compounds readily accumulate in fish with a particular affinity of fluoride for their bone tissue. Analyses of fluoride in the bone tissue may thus shed light on contamination of the entire fish. The aim of this study was to determine fluoride levels in bone tissue of fish living in three different lakes of Bangalore

EXPERIMENTAL

Sampling area

Bangalore lies in the southeast of the South Indian state of Karnataka. It is in the heart of the Mysore Plateau, at an average elevation of 920 m. It is positioned at 12.97° N 77.56° E and covers an area of 741 km^2. Bangalore receives about 900 mm of rain annually, the wettest months being August, September, October Bangalore's pollution is not only affecting our health. It could actually be draining this city of its colour. Around 30 years ago, in Bangalore, there were about 262 lakes which subsequently reduced to 81. As reported, these lakes were created for drinking, bathing, agricultural, recreational and fishing purposes as there was no river which flows throughout the year.

The 'Sankey Lake,' situated in the heart of Bangalore City (Lat.:13° 00'24" - 13° 00'41"N; Long.:77° 33'53" - 77° 34'5"E; altitude: 921 m MSL, maximum water spread area 12 ha, maximum depth 23 ft, average depth 9 ft), is a 500 year old, perennial water body and supports a significant biotic community. Since the beginning of 1982, drainage of industrial effluent and other domestic sewage into the lake has been stopped and the lake is expected to be free from noticeable pollution. Long-term studies on hydrology and microbial ecology, conducted during the last decade, have indicated that Sankey Lake has high potentiality for development of inland

fisheries practices. The average annual photosynthetic profile suggests the significance of the heterotrophic food chain in sustaining the higher trophic levels. With a mean fish production of 859 metric tonnes/year, the present fish production efficiency works out to 0.41%. Since the lake is still mesotrophic and is amenable to management measures, a higher target fish production appears quite feasible.

Bellandur Lake is 130 years old and spreads across an area of 892 acres and is located near the Bellandur village towards the south of Bangalore. Sewage from residential areas near the Bangalore international airport is directly allowed into the lake through the main drain. Dense weeds have occupied a major portion of the lake, with maximum froth developed at the overflow region.

Madivala lake area is 114.3 hectare, shore line is 5.84 k.m., depth is 4.5m, breadth is 0.7km and length is 1.8 k.m. Karnataka State Forest Department carries out the routine maintenance of this lake. Children park and boating facility are available. Madiwala lake receives sewage and storm water from surroundings localities. Untreated sewerage flows in to the lake from Bommanahally CMC area kodichikkanahally side. the lake is dirty, and full of hyacinth weeds.

Owing to hydrographic, morphometric and drainage conditions of the area, the lakes are strongly predisposed to environmental degradation. Even though there are no on-site sources of contamination, its proximity to industrial locations, the presence of waste water from domestic and Municipal sewage, pose a serious threat to the ecosystem of these lakes

Materials and Methods:

Water samples were collected in polyethylene bottles from various stations of the lakes from July -October 2007. Fluoride concentrations were determined with an ion-selective electrode (Orion 210A apparatus and TISAB IV buffer). Fish samples[Catla,Silver carp , Common carp, Tilapia Mrigal Etroplus suratensis, Murrels (Channa marulius), Nandus nandus Amblypharyngodon mola Catfishes (Heteropneustes fossilis)]were purchased from the lakes once in fortnight for the months July to October. The size of the fish collected varied, depending on the species, between 12 cm and 54 cm, and their age was from 6 months to 1years. Bones were extracted from the body of the fresh and dried for 24 hr at 105 °C. Fat was removed by washing the samples in acetone. Fat-free bones were homogenized and then digested with 2 Molar perchloric acid [7,8] .The concentration of fluoride ion in the perchloric acid digest was determined potentiometrically.

RESULTS AND DISCUSSION

Fluoride analyses of the water during the study period are presented in Figure 1. The highest average fluoride concentrations occurred in July being 1.4, 1.6, and 3.2 mg/L, respectively. The overall range was 0.3 to 3.2 mg/L, depending on the sampling stations and lakes. The maximum flouride concentration in water was found to be in Madivala lake. Flouride levels were determined for Catla,Silver carp , Common carp, Tilapia Mrigal Etroplus suratensis, Murrels (Channa marulius), Nandus nandus Amblypharyngodon mola Catfishes (Heteropneustes fossilis)Table-2. The lowest and highest concentrations of fluoride 120.54 and 452.45 mg/kg in Sankey Lake was found in Nandus nandus and Catla fish. In Bellandur Lake the fluoride

concentration was minimum 240.24mg/kg in Nandus nandus and maximum 525.00mg/kg in Common Carp and in madivala Lake the minimum fluoride concentration 457.20 mg/kg in Mrigal and highest concentration 987.00 mg/kg in Tilapia fish. The flouride concentration in fish and water was Sankey lake >Bellandur lake > Madivala Lake Figure -2.
The fish community in these lakes includes the native species and the introduced species for the purpose of fish production. There are more than 30 species of fishes identified from these lakes.

Fishes belonging to genus Puntius, Labeo, Cirrhinus, Channa, Mystus are more common. Oreochromis mossambica (Tilapia), which has inadvertently entered and dominated these lakes are prolific breeder and are multiping faster. Other exotic fish species commonly found are Hypophthalmicthys molitrix (Silver carp), Cyprinus carpio (Common carp) and Ctenopharyngodon idella (Grass carp), which are mainly stocked for fish production.. Puntius filamentosus, Channa striatus and Labeo konitus were few endangered species. To conserve all endemic fish species and the total fish diversity, it is necessary to prevent drainage of pesticides and fertilizers from surrounding crop fields, heavy siltation during heavy rainfall, high density of fingerling stocking of selected culture fishes, fish diseases. Sustainable fish production by taking appropriate steps for sustaining fish diversity is necessary to conserve these vulnerable, but valuable resources[9-11].

By comparison, the fluoride content of the water in the these three lakes of Bangalore ranges from 0.3 to 3.2 mg/L. Therefore the concentration of fluoride in the Madivala lake must be regarded as high, exceeding the permissible limit (1.5 mg/L) for water quality. The Fluoride level of bone tissues of fish was maximum in Catla, Tilapia and Murrels (Channa marulius) in Madivala lake which is a need of concern.

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Table-1:Chemical parameters of water in three Lakes of Bangalore.

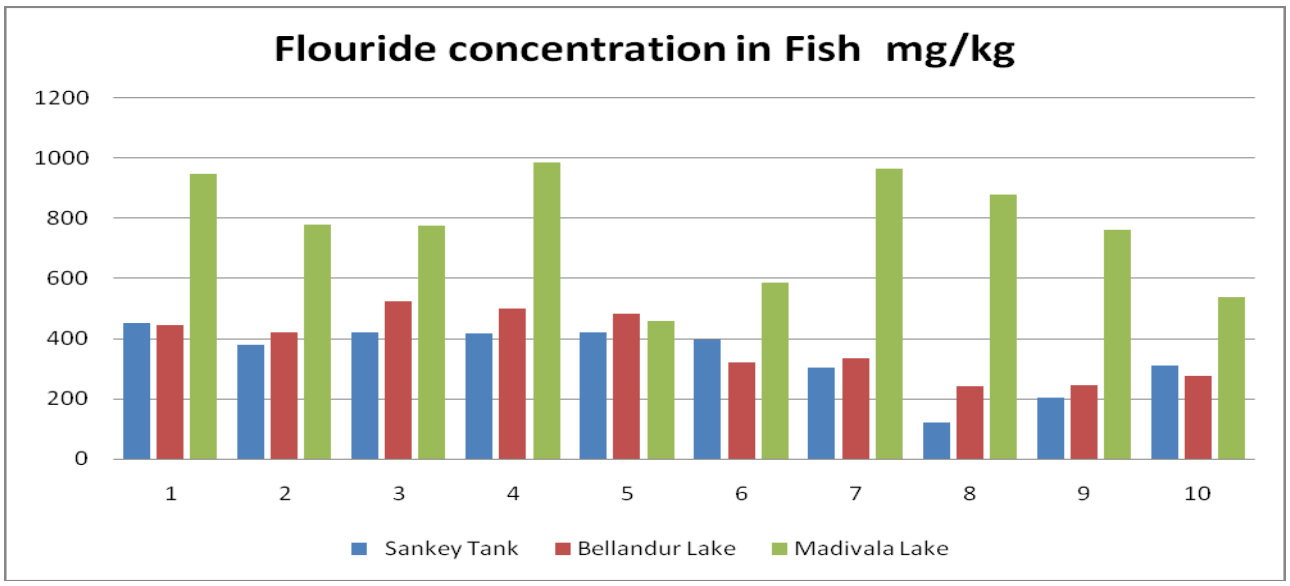
Stations	pH	TDS	Ca^{2+}	Na^{+}	HCO_3	Cl^{-}
Sankey Lake	7.45	520	34	27	92	227
Bellandur Lake	7.59	436	96	15	37	35
Madivala Lakes	8.51	1131	50	105	421	227

Table-2:Concentration of Fluoride in Fish samples of three Major Lakes on Bangalore

Fish Samples	Concentration of Flouride mg/kg		
	Sankey Tank	**Bellandur Lake**	**Madivala Lake**
Catla	452.45	446.50	946.60
silver carp	378.70	420.55	780.54
common carp	420.50	525.00	777.50
Tilapia	418.45	500.50	987.00
Mrigal	420.20	482.15	457.20
Etroplus suratensis	398.20	320.35	587.45
Murrels (Channa marulius)	302.50	333.43	965.30
Nandus nandus	120.54	240.24	879.54
Amblypharyngodon mola	203.50	245.00	762.45
Catfishes (Heteropneustes fossilis)	310.35	276.47	537.76

Table-3:Fluoride concentration in water (mg/L) in three Major Lakes of Bangalore

Water Samples	Sankey Tank	Bellandur Lake	Madivala Lake
12/7/07	1.4	1.6	3.2
12/8/07	0.3	0.8	2.2
12/9/07	0.5	1.8	1.8
12/10/07	0.4	0.7	1.5



1.Catla 2. silver carp 3. common carp 4. Tilapia Mrigal 5. Etroplus suratensis 6. Nandus nandus 7. Amblypharyngodon mola7. Catfishes (Heteropneustes fossilis)

Figure -1 :Showing Flouride levels in Fish of three Major lakes of Bangalore

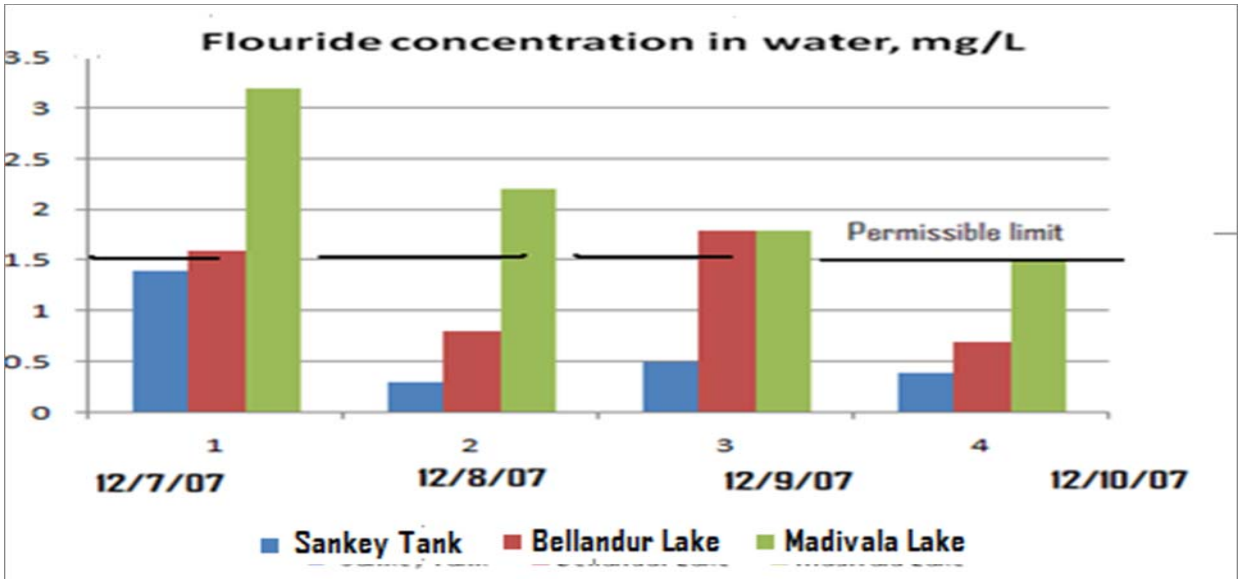


Figure-2: Showing Flouride level in water samples of three Major lakes of Bangalore

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