

Reviving Kachapur Lake: Analyzing Heavy Metal Pollution Impact on Fish and Water Quality

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Abstract- The research project presented herein is an endeavor to address the growing concern of pollution in Kachapur Lake, situated in the Kamareddy district. The elevated pollution levels have taken a toll on the aquatic ecosystem, particularly affecting the fish population. This study outlines its core objectives, which encompass the evaluation of nonessential heavy metal concentrations in fish, assessment of seasonal variations, and an extensive analysis of key physical and chemical parameters, including temperature, electrical conductivity, turbidity, and more.

To accomplish these objectives, the project will undertake a multi-faceted approach. This includes the quantification of heavy metal concentrations in fish samples and the exploration of potential correlations between these levels and the laboratory analysis of metals in stock and working standard solutions. Furthermore, the research will involve rigorous calibration of instruments, the digestion of water samples for metal analysis, and the processing and digestion of sediments to determine their metal content.

This comprehensive investigation aims to shed light on the intricate relationship between pollution levels and aquatic health in Kachapur Lake. By unraveling the impact of heavy metals and seasonal variations on both fish and water quality, this research project aspires to provide valuable insights and recommendations for mitigating pollution and revitalizing the lake's ecosystem.

Keywords: Kachapur lake, Bioaccumulation of heavy metals, Calibration of Instrument , catla-catla, labeo rohita, cirrhinus, mrigala, thilapia, kombu fish, flat fish, plain fish, channa punctata , channa striatus, clarius magur (snake fish), murrel fish , tortoise , prawns , crabs, moll scans , wallagoattu,

INTRODUCTION:

Freshwater reservoirs play an important role in the livelihood of human populations. They are used as a source of domestic water supply, irrigation, fishery development, hydropower generation and flood control. The present proposed study is to make study at kachapur lake present in the district of Kamareddy in Telangana state. Historically this lake was dug by one of the feudatory of Nizam's of Hyderabad and it is a tourist site. Temples of various deities like Ayyappa swamy, Pochamma, Srikrishna temple and Hanuman Temple are present in the vicinity. The lake's capacity is around one TMC and is spread over 522 acres and is also located near Kamareddy town. The other villages in its surrounding are Sarampally, Devunapally and Lingapur. Rain water is the main source and much of the inflow The lake mainly depends upon Santaipet Canal & Tadwai hills and also seasonal rainfall occurring from June to September and in addition there are numerous seasonal streams which drain Into the lake .This lake provide direct and indirect employment to over 1000 people. The reservoir provides irrigation Water for agriculture and commercial fishing. Water of this lake is mainly used for drinking, irrigation and other development activities along with aquatic culture. Fishermen folk of surrounding villages of around thousand families depend on this lake for their livelihood. (Fisherman cooperative society of Kamareddy Reg: 406 , 3/12/1963).

This lake is suitable for the culture of various fish species, like *catla-catla*, *labeo rohita*, *cirrhinus*, *mrigala*, *thilapia*, *kombu fish*, *flat fish*, *plain fish*, *channa punctata* , *channa striatus*, *clarius magur* (snake fish), *murrel fish* , *tortoise* , *prawns* , *crabs*, *moll scans* , *wallagoattu*, etc. Many species of this are today at the verge of extinction and that are present in the lake today are getting affected with the dissolve of heavy metal. Heavy metals are causing different types of diseases among fish species in this lake. One of the main reasons of inflow of heavy metals is due to the sewages waters that are flowing into the lake and this water is contaminating. Other cause of chemical contamination and cause of environmental pollution is use of pesticide by farmers that is also getting flowed into lake during rainy season.

Hence this lake is completely in the claws of contamination and because of this aquatic flora and fauna in undergoing both physical and chemical change. The bio cycles, reproduction, ecosystem, nervous system, immunity, respiratory, excretory and likewise other many things related to flora and fauna in the lake are getting affected. Some of the species are experiencing stunted growth but the main focus of the present proposed research topic is around the impact of heavy metals on bio-accumulation in *Catla Catla* & *Labeio rohita* fish species. Today we find the process of above said change among the above said species.

THE PROBLEM STATEMENT AND JUSTIFICATION:

Increase in pollution of water bodies is directly or indirectly related to increasing Urbanization and in discriminate disposal of agro chemical and sewage effluents into Aquatic systems .In developing countries ,trace metal analysis in fresh water is very Important because these ecosystems provide drinking water and are habitats for flora And fauna. Kachapur Lake, which is located in urban ecosystem of Kamareddy District Telangana , polluted with agricultural effluents and sewage wastes. So the Present study was undertaken to assess the enrichment of heavy metal in Kachapur Lake and its used for the irrigation and fish culture .This lake home ground of different Species such as Kachapuri's a fresh water lake most important species in the catches were *Labeo Rohita* , *Catla catla*,*Cirrhinus reba* *Cyprinus carpio*,*Channa striatus*, *Mastacembelusarmatus* *Anguillabengalensis*, *Etioplussuratense*, *Parambassislala* and *Xenentodoncancila*. This reservoir is under urban ecosystem which is near to Kamareddy District, Telangana ,India ,which is being polluted from urbanization ,domestic sewage effluents and Agriculture pesticides and automobiles service centers waste products. We assumed that the metal concentrations were found to be slightly increased in year by year. Therefore, it is important to assess and monitor heavy metal in aquatic environments.

SCOPE OF THE STUDY AND AREA OF STUDY:

The present area of study is in and around KachapurLake (*Pedda Chervu*) which is located in the urban vicinity of Kamareddy town situated 100 km away from Hyderabad. The storage capacity is about one TMC and extends in and around 522 hectares and has good catchment area of about 500 hectares (see Figure). The area of study is on aquatic species in this lake with special reference to *Catla Catla* & *Labeo rohita* and Bioaccumulation of heavy metals in them in the above said lake.

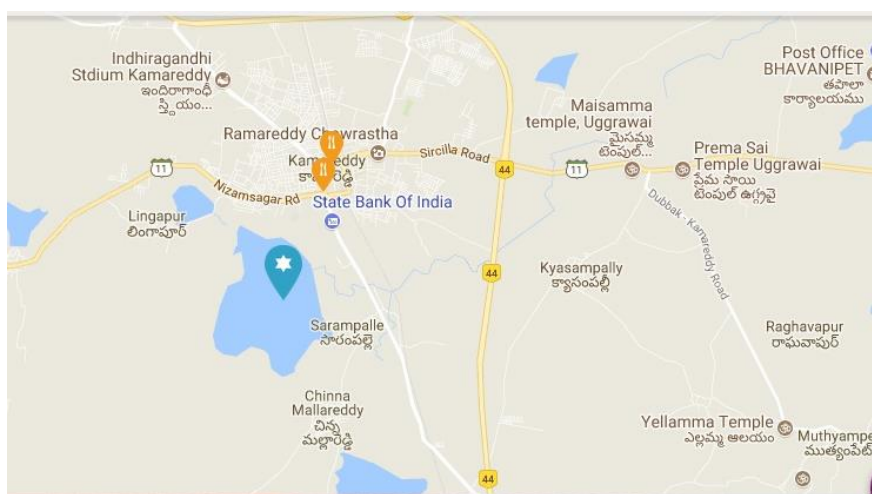


Figure 1: Map showing the location of KachapurLake at Kamareddy District, Telangana State, India.

OBJECTIVES

1. The objectives of this study is to determine concentration of nonessential heavy metals in fish it issues and assess the seasonal variations of these heavy metals(rainy and non rainy periods)in the ecosystem.
2. To determine the physical parameters (pH, electrical conductivity, dissolved Oxygen, temperature and turbidity) of water in KachapurLake.
3. To determine the concentrations of heavy metals like lead (Pb), cadmium (Cd),zinc (Zn),copper(Cu),chromium (Cr) and manganese (Mn) in surface water, sediments and in two selected fish species, *Catlacatla* and *Labeorohita*.
4. To determine the relationship between the levels of heavy metals in surface water, sediments and in the muscle tissues of the two select fish species.

HYPOTHESIS:

1. This study makes a comprehensive study on the aquatic life existing in this lake and the interrelated aspects in the lakes ecosystem. The level of heavy metals seems to be higher than recommended levels in the KachapurLake.
2. Due to the inflow of toxic and heavy metals through different means like seepage of sewage, industrial effluents, inflow of chemicals like pesticides form nearby cultivating lands and thus changing the biotic characteristics of the aquatic life.
3. Change in the seasonal wise among the aquatic life has also experienced change and it has been affected by the external changes.
4. Damage in reproductive, circulatory and respiratory system along with nervous system among the aquatic life that is showing effect on the growth rate of these animals.

METHODOLOGY OF RESEARCH:

Sampling and Storage of Fish: During field study three sites for sampling will be chosen to represent areas of Lake and Water will be collected in three stations thrice in each season from tank, in cleaned polythene Bottles and tightly stopped and used for heavy metal analysis . The common freshwater Fishes namely *Labeo Rohita* and *Catla catla* will be collected thrice in each season in three Stations of the lake for a period of two years using gillnet. Adult individuals of similar size will used for the study for each experiment. The liver, kidney and gill will be examined through dissecting out the species, washed with cold distilled ice

water and process immediately or frozen in Liquid nitrogen till further use. From sampling sites water is also collected at a depth of about 0.3m below upper water surface in 500 ml plastic bottles. Prior to sampling, the bottles will be cleaned with 10% nitric acid and rinsed with distilled water. The bottles were rinsed three times with the dam water at the time of sampling. Samples will be collected by direct immersion of the sampling bottle into the lake. Immediately after sample collection, 2 ml nitric acid (AR grade) shall be added to the water sample and stored to reduce absorption of metals onto the walls of the plastic bottles. Sample bottles were then labeled to indicate date of sampling and the sampling site. Samples will be transported in sampling box to the laboratory and stored at 40 C for analysis. In the laboratory, total length (cm) and weight (grams) will be recorded. The samples will then be kept in a deeper freezer until muscle tissues are extracted for analysis.

FIELD MEASUREMENTS:

The physical parameters will be measured in the field at the time of collecting samples between 7am and 10 am.

Physical Parameters:

1. Water Temperature: Surface water temperature will be determined on site using a thermometer with different depths. The pH of the water will be measured on site using a portable pH meter. The pH probe is lowered to a depth of about 0.3 m to allow it to stabilize and the pH value will be read.

Chemical parameters:

The chemical parameters such as Electrical Conductivity (APHA 2008), Turbidity (APHA 2008) and Dissolved Oxygen (Winkler's reagent, Winkler's reagent) will be used for analysis.

Laboratory Analysis:

1. Stock and Working Standard Solutions: Stock standard solutions containing 1000 mg/L of Cu, Zn, Cd, Pb, Cr and Mn are prepared from metal salts (Analytical Grade) using nitric acid. Working standards for all the metals were prepared from the stock solutions by serial dilutions in distilled water sample preparation.

2. Calibration of Instrument: To determine the instrument signal response to changes in concentration, calibration using working standard solutions of known and increasing concentrations for each analytical element of interest. By measuring the signals of the working standards, the AS constructs a suitable calibration curve of response/absorbance versus concentration. The AS is a suitable graph to determine concentration so far known analytically. In this study, the actual concentration of each heavy metal in the samples was calculated using the formula: Actual concentration (mg/kg) = Digested concentration (mg/L) × Volume digested (L) / Weight of dried sample (kg).

3. Digestion of Water Samples for Metal Analysis: Digestion of the water samples was done in triplicates using concentrated nitric acid (Analytical Grade) according to the method described by. Concentrated acid (5ml) was added to 50 ml of sample water in a 100ml beaker, and then heated on a hot plate to boil until its volume reduced to 20ml. Another 5ml of concentrated HNO₃ was added and then heated for 10 minutes and allowed to cool. About 5ml of nitric acid was used to rinse the sides of the beaker and the solution filtered using Whatman 0.42µm filter paper into a 50ml volumetric flask and topped up to the mark with distilled water. A blank solution was similarly prepared. Heavy metal analysis was done using Varian Atomic Absorption Spectrometer (model Spectra AA-10) the blanks were aspirated along with the analytical samples in order to correct background adsorption. The operating conditions of the instrument (AAS) were set according to manufacturer's specifications.

4. Processing and Digestion of Sediments for Metal Analysis: Each sediment sample was thawed at room temperature (25C–28C) and put into pre acid cleaned evaporating beakers. These sediments were then dried at a temperature of 500C in an oven until a constant weight was obtained. The dried sediment samples were ground using a porcelain mortar and pestle and sieved through a 2mm mesh plastic sieve. For each sediment sample, 2g will be weighed using Shimadzu electronic weighing balance (Model ATX 224) into 100ml acid cleaned beakers. Digestion was done using concentrated nitric acid (Analytical grade) and hydrogen peroxide. All the digested samples are filtered using Whatman 0.42µm filter paper into a 50ml volumetric flask and topped up to the mark with distilled water (Plate 3.3). The filtrate is analyzed for heavy metal analysis using AAS. A blank solution was similarly prepared. Water samples (500ml) were filtered through Whatman (0.45µm pore size) filter paper followed by addition of 2ml concentrated HNO₃ to prevent growth of algae. The filtrate is concentrated 10 times in a water bath and subjected to HNO₃ digestion with a microwave assisted technique (30bar, 700W) as per standard methods (American Public Health Association 2000). 2g of the fish liver, kidney and gill were oven dried at 100±1°C for 3h. 2g of the dried tissues were subjected to acid digestion with 15ml of HNO₃:HClO₄ (4:1) followed by dissolving them in 10ml of dilute HNO₃ and filtered for analysis of heavy metals Cd and Hg.

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