



## An Approach to Evaluate Fish Diversity and Limnological Status of Sewage Fed Urban Lake (Shahpura), Bhopal, India

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**ABSTRACT :** The Capital city of Madhya Pradesh, "Bhopal" is also known as City of Lakes, in which more than fifteen wetlands are present in and around the city and most of the wetlands are eutrophicated due to multiple anthropogenic activities. This poor water quality has led to the reduction of native fish species in their own natural habitat.

The Shahpura Lake, which is also known as the third lake of Bhopal, is a man made impoundment in the outskirts of the town ship in the southeast having the catchment area 8. 29 sq.km. The township has expanded and developmental activities are concentrated around the lake which has Negative impact on water quality of lake. The lake receives untreated domestic sewage water from measure sewage inlets near Mata Mandir slums and at Chunabhatti area.

The present paper deals with study of water quality monitoring and fish fauna in reservoir for its conservation and management point of view. On the basis of different physico-chemical and biological parameters, the status of reservoir is eutrophic in nature and during period under study 6 fish species, 14 phytoplankton and 10 zooplankton genera have been recorded.

**Keywords :** Fish fauna, eutrophication, limnology, plankton.

### I. INTRODUCTION

Madhya Pradesh is rich with different aquatic ecosystem and has 3.0 lakh hectare water area in the form of reservoir and ponds. All these aquatic ecosystems support diversified flora and fauna. In "Lake City Bhopal" large number of lakes and reservoirs are present, which are polluted due to multiple anthropogenic factors in catchment area of wetlands.

Shahpura Lake was formed in 1974–75 under the Betwa river irrigation project scheme which envisaged the creation of lake near Chunabhatti village in south portion of Bhopal city, the water is not used for irrigation purpose. From 1975 onwards the lake water is being used by fisheries department for fisheries activities. The Shahpura Lake was formed by putting an earthen dam across the natural drainage of the area about last four decades back. Factors responsible for eutrophication of Shahpura Lake are: untreated sewage inflow, siltation, excessive growth of aquatic weeds, encroachment, washing and bathing activities, deforestation, soil erosion, and removal of oxygenated surface water through waste weir.

Today it is well known fact that the environment degradation has caused damage to biodiversity including plants & animals. The damage to biodiversity can range from loss of genetic diversity, population and even consequences leading to extinction of species. The environmental threats could be manmade, natural or in combination with cascading and interlinked impacts. Such

threats are wide ranging including over exploitation of resources, habitat alterations, reduction in natural habitat area, construction of dams, diversion or reclamation of river beds for urbanization that reduce water discharge in the lakes, introduction of non-native fishes etc. Poor water quality has also led to the reduction in number of native fishes in wetlands. Anthropogenic interventions resulting in loss of biodiversity, decline in fish catch and depletion of natural resources.

Various limnological studies have been carried out in important wetland of the state and most of the wetlands are polluted due to multiple anthropogenic factors. The work on fish fauna of Madhya Pradesh was initiated with the first survey of fish fauna of rivers of central India by Hora (1941-1949). Thereafter as per available literature, different ichthyologists have made limited efforts related with the fish biodiversity. Tamot and Bhatnagar (1989) studied the raw water quality of Upper Lake and its change during the various states of treatment. Johri (1990) studied the limnological and water quality status of two lakes of Bhopal. Saxena (1990) assessed the limnological and water quality status of Lower Lake of Bhopal, Shrivastava (2003) studied the limnology of Kerwan for conservation and management of Mahseer fish. Zoological Survey of India (2000) reported 172 fish species in Madhya Pradesh. Qureshi (2003) recorded 53 species of fishes from Bhoj Wetland, Bhopal. Some work has been done on game fishes by Menon in year 1988.

Tamot & Awasthi (2010) studied biodiversity and conservation of indigenous fish species of Upper Lake.

It is evident from above that the limnology and biodiversity of the small lakes, reservoirs and ponds have been neglected from study point of view and no action regarding the proper management of these wetlands have been taken and the same is the situation with ichthyo-fauna present within them. However the limnology and fish diversity of this wetland has been subject of interesting studies.

## II. MATERIAL AND METHODS

Samples were collected from April' 2010 to March' 2011 and analyzed as per "Standard Methods for Examination of Water and Waste Water" 19th edition, AWWA-APHA-WPCF (1995) and "Laboratory Manual on Water Analysis" NEERI (1986). Fish samples were collected with the help of meshes of different mesh sizes ranging from 10-100 mm and also from fishermen. These fishermen use to catch fishes with the help of caste nets. After collection, preserved in 5% formalin and then identified on the basis of morphometric measurement, fin formula and the classification given by Jayaram, Jhingaran, Francis Day, Shrivastava, Qureshi & Qureshi.

### Morphometric Features of Shahpura Lake

m	Formation:	1974-1975
m	Type of Dam:	Earthen dam
m	Longitude:	77025'30"N
m	Latitude:	23012'00"E
m	Catchment Area:	8.29 Sq. Km.
m	Submergence Area:	0.96 Sq. Km.
m	Gross Storage:	2.2 m.cum
m	Live Storage:	2.07 m.cum
m	Dead Storage:	0.22 m. cum
m	Lowest Still Level:	483.71 m
m	Full Reservoir Level:	488.30 m
m	Maximum Water Level:	489.00 m



## III. RESULTS AND DISCUSSION

During the period under study the range of variation in different physico-chemical parameters is as:

Sl. No.	Parameter	Shahpura lake
1.	pH	7.4 – 9.4
2.	Water temperature	12 – 26°C
3.	Transparency	20 – 60.0 cm
4.	Dissolved oxygen	2.2 – 11.6 mg/l
5.	Free carbon dioxide	Nil – 18.0 mg/l
6.	Alkalinity	120 – 270 mg/l
7.	Total hardness	100 – 220 mg/l
8.	Chloride	28 – 90.4 mg/l
9.	B.O.D.	8.0 – 26.3 mg/l
10.	Nitrate	0.6 – 2.2 mg/l

On the basis of the observations that Shahpura Lake are eutrophic in nature

## IV. PLANKTONOLOGICAL STUDY

The biota in an aquatic system positively reflects the condition existing in the environment & information can be utilized for biological monitoring of water pollution level. Planktonic study is a very useful tool for the assessment of water quality in any type of water body and also contributes to an understanding of the basic nature and general economy of the lake.

**Phytoplankton:** In the present study 14 genera of phytoplankton belonging to three major groups were recorded:

**Cyanophyceae:** *Anabaena, Anacystis, Spirulina, Nostoc, Aphanizomenon.*

**Chlorophyceae:** *Chlorella, Cosmarium, Oedogonium, Pediastrum, Scenedesmus.*

**Bacillariophyceae:** *Fragilaria, Melosira, Navicula, Nitzschia.*

**Zooplankton:** In the present study 10 genera of phytoplankton belonging to three major groups were recorded:

**Rotifera:** *Brachionus*, *Keratella*, *Trichocera*.

**Crustacea:** *Cyclops*, *Daphnia*, *Eubrachiounus*, *Moina*, *Nauplius*.

**Protozoa:** *Ceratium*, *Euglena*.

## V. FISH DIVERSITY

Six fish species belonging to two families are found in the Shahpura Lake. Out of all these species, *Tilapia mossambica* is flourishing well because it breeds in every three months, grows well in the sewage polluted waters and is the most dominant species in this lake as is predatory in nature. *Cirrhinus mrigala* (Naren) is found less in number comparison to the other species.

Sl. No.	Scientific name	Shahpura lake	Feeding habit	Economic importance	CAFF 2006
<b>A F-CYPRINIDAE</b>					
1.	<i>Labeo rohita</i> (Rohu)	++	HF	MFF	LR-1c
2.	<i>Cirrhinus mrigala</i> (Naren)	++	OF	MFF	LR-nt
3.	<i>Catla catla</i> (Catla)	++	NP,WF	MFF	LR-nt
4.	<i>Hypophthalmichthys molitrix</i> (S. carp)	++	HF	MFF	DD
5.	<i>Cyprinus carpio communis</i> (C. carp)	++	OF,NP	MFF	DD
<b>O F-CHICHLIDAE</b>					
6.	<i>Tilapia mossambica</i>	+++	PD	MFF	DD

+= Rare, ++= Average, +++= Abundant, HF = Herbivorous Fish, OF = Omnivorous Fish, CF = Carnivorous Fish, PD = Predatory Fish, PF = Plankton Feeder, LV = Larivorous, MV = Medicinal Value, AF = Aquarium Fish, Bait Fish, GTF = Good Table Fish, EFF = Esteemed Food Fish, SF = Sport Fish, FF = Food Fish, MFF = Major Food Fish, NP = Non Predatory, EN = Endangered, VU = Vulnerable, LR-nt = Low Risk Near Threatened, LR-1c = Lower risk least Concern, DD = Data Deficient, CAFF = Conservation Assessment of Freshwater Fish Diversity.

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