

# Phytoplanktonic Biodiversity in Upper Lake of Bhopal, India

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**Abstract:** *Phytoplankton is an important organism that sustains majority of aquatic life with its primary productivity. The phytoplankton diversity and composition are an expression of the environmental health and quality of the existing water body. A study was carried out to examine the diversity, composition and distribution of phytoplankton and were used to study the Upper Lake, Bhopal. Four sampling stations { Khanugaon (U1), Boat Club (U2), Medical College (U3), Reference station (Ur) } were selected from the Upper Lake. Sampling were carried out from May to Oct.2014. Phytoplankton samples were collected by plankton sampler net with mesh size of 25µm. Result obtained showed that a total of 90 phytoplankton species (belonging to Chlorophyceae, Bacillariophyceae, Cyanophyceae, Euglenophyceae and Dinophyceae) were recorded. During the sampling, 82, 89, 77, and 90 species of phytoplankton were recorded in station U1, U2, U3 and Ur respectively. Species composition was almost uniform in all the selected stations, where as species diversity varies across stations.*

**Keywords:** Algal classes, phytoplankton, diversity, Upper Lake.

## 1. Introduction

Biological diversity or biodiversity is the total variability of all living organism in the ecological complexes (Bajpai,1994). Biological monitoring of a wetland is a integral part for the management of the total ecological health of the water body and is becoming increasingly important in water quality monitoring and assess (Bajpai et.al.,2001). Phytoplankton is the base of most lake food webs and fish production is linked to phytoplankton primary production (Ryder et.al.,1974). Phytoplankton have a critical role in primary production, nutrient cycling, and food webs and make up a significant proportion of the primary production in aquatic system (Dawes,1998). Phytoplankton adapt quickly to the environmental changes because of their short life cycles. Their standing crop and species composition indicate water quality. Phytoplankton are one of the most rapid detectors of environmental changes due to their quick response to toxic and other chemicals, pollution stress reduces the number of algal species but increase the number of individuals. A marked change in algal community severely affects the species diversity (Biligrani,1988). Phytoplankton studies and monitoring are useful for control of the physico-chemical and biological conditions of the water bodies. Phytoplankton are involved in water pollution in number of significant ways. Certain species of phytoplankton grew luxuriantly in eutrophic waters while some species cannot tolerate waters that are contaminated with organic or chemical wastes, some of the species that indicate clean waters are *Melosira islandica*, *Cyclotella occlata* and *Dinobryan*. The pollution indicating phytoplankton includes *Nitzschia palea*, *Microcystis aeruginosa* and *Aphanizomenon flosaquae*. The latter two species have been found to produce toxic blooms and anoxic conditions. Phytoplankton have been successfully employed to detect the degree of trophic level of water and to fresh water quality. In recent years, increasing anthropogenic interventions influence in and around aquatic systems and their catchment areas have contributed to a larger extent towards deterioration of water quality leading to accelerated eutrophication. As a consequence water eutrophication can

bring about economic losses in the form of decreased property values, high cost of drinking water, illness, depressed recreation industries, and ultimately need to built new reservoirs. Thus the investigation on phytoplankton population in fresh water is one of the most important steps in the complex analysis of aquatic ecosystem, because phytoplankton being the primary producers constitute the basic food source of any water body which supports the aquatic animals, thus for any kind of utilization of water from a natural source the study of phytoplankton are of primary interest. In the present work an attempt has been made to assess the seasonal distribution pattern of phytoplankton and water quality of Upper Lake Bhopal.

Upper lake Bhopal is arguably the oldest man-made lake in India, and was created by Raja Bhoj in the 11th century by constructing an earthen dam across the Kolans River. The upper lake is a major source of portable water for the city of Bhopal, Madhya Pradesh, India. Latitude 23° 12' (23.2000) and Longitude 77° 18' (77.3000). The basin has a maximum depth of 11.7m and storage capacity 101.5m, cm and the surface area is 32.29 sq. km.

## 2. Materials and Methods

The present study was conducted in Upper Lake, Bhopal, India during May 2014 to Oct.2014. For this four sampling stations were selected along with their reference to compare the status of phytoplanktonic species in the lake. The selected sampling stations were { Khanugaon (U1), Boat Club (U2), Medical College (U3), Reference station (Ur) }. Reference station was selected at a place, which is away from influence of urban and rural impact of pollution.

The Biological samples (phytoplankton) were collected by plankton net of standard bolting silk cloth no-25 (mesh size 0.03-0.04 mm) from all selected stations from 100 liter water sample on use of a plastic bucket of 15 liter capacity. Finally the planktons were collected from the plankton net tube and were preserved by adding 5 ml of 4% formalin and the identification of phytoplankton was done with the help

of standard works viz Edmondson WT (1959), Needham and Needham (1966).

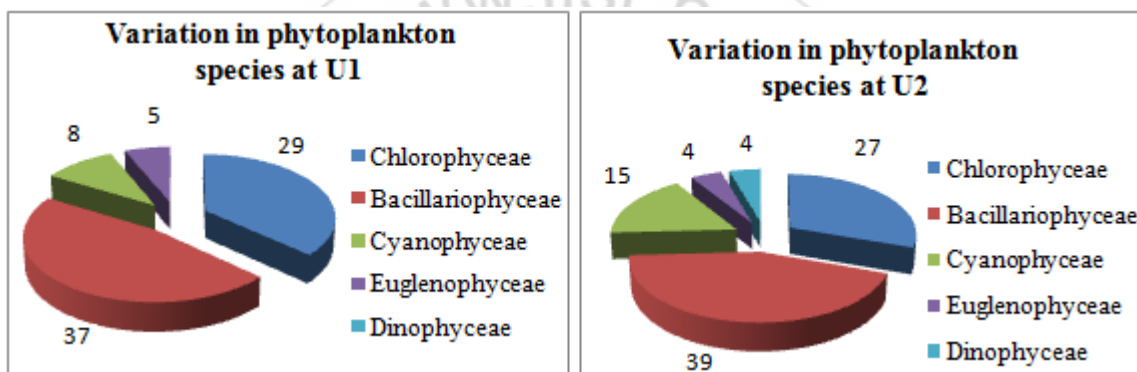
### 3. Result and Discussion

Biodiversity contributes both directly and indirectly to many constituents of human well being but the losses in biodiversity and changes in ecosystem services have adversely affected the well being. Phytoplankton ecology is an indicator for the evaluation of impacts of influencing factors. These factors provide a suitable management plan for lakes. Phytoplankton are ecologically significant as they form the primary link in food chain for all aquatic animals (Misra et al.,2001).Diversity, distribution, abundance and variation in the biotic factors provide information of energy turnover in the aquatic systems. This study found that phytoplankton composition was higher than a previous study in Upper Lake, by (Verma et.al.,2009) which only identified 90 species. The increase we observed could be due to increasing community, anthropogenic activity and agricultural areas with the corresponding land use changes.

On the basis of findings, distribution of planktons in Upper Lake Bhopal,(M.P.) at selected sampling stations { Khanugaon (U1), Boat Club (U2), Medical College (U3), Reference station (Ur) } during the study period is shown in Fig.1.1. and Fig.1.2.

In Khanugaon (U1) during 2014, total 82 species of phytoplankton were recorded of which 29 sp belong to *Chlorophyceae* , 37 sp *Bacillariophyceae*, 8 sp *Cyanophyceae*, 5 sp *Euglenophyceae* and 3 sp *Dinophyceae* was found.

In Boat Club (U2) station during study period (2014) total 89 species of phytoplankton population was recorded of which *Chlorophyceae* contributed 27 species , *Bacillariophyceae* contributed 39 species, while *Cyanophyceae* was represented by 15 species, *Euglenophyceae* by 4 species, and *Dinophyceae* by 4 species.



**Figure 1.1:** Phytoplankton species in U1 and U2 station of Upper lake during year 2014.

In Medical College (U3) during 2014, total 77 species of phytoplankton population were recorded of which of which *Chlorophyceae* contributed 38 species , *Bacillariophyceae* contributed 22 species, while *Cyanophyceae* was represented by 12 species, *Euglenophyceae* by 5 species, and *Dinophyceae* by 4 species. In Reference station (Ur) during 2014, total 94 species of phytoplankton were recorded of which 25 sp belong to *Chlorophyceae* , 45 sp *Bacillariophyceae*, 16 sp *Cyanophyceae*, 5 sp *Euglenophyceae* and 6 sp *Dinophyceae* was found.

The Cyanophyceae group is characteristic of eutrophic environments which have high concentrations of nutrients. Cyanophyceae could bloom and cell division occurs rapidly due to the enriched nutrients (Wetzel, 2001).The Bacillariophyceae also had an increase number of individuals since they adapt better to more stable environments, 4 species of Dinophyceae were recorded at Medical college and Reference stations as same findings by (Verma et.al.,2009). Euglenophyceae, algal species belonging to this group show higher tolerance to organically polluted areas. (Palmer,1969) thus can be used as biological indicator of organic pollution. (Verma et.al., 2009) reported 90 phytoplankton species in Upper Lake Bhopal, India.

Chlorophyceae dominance has been shown that the lake is of eutropic nature. (Mishra and Saksena,1993) have also reported these genera as the bioindicator of organic pollution. (Misra et. al.,2001) reported 94 phytoplankton species of above mention group in Upper lake.

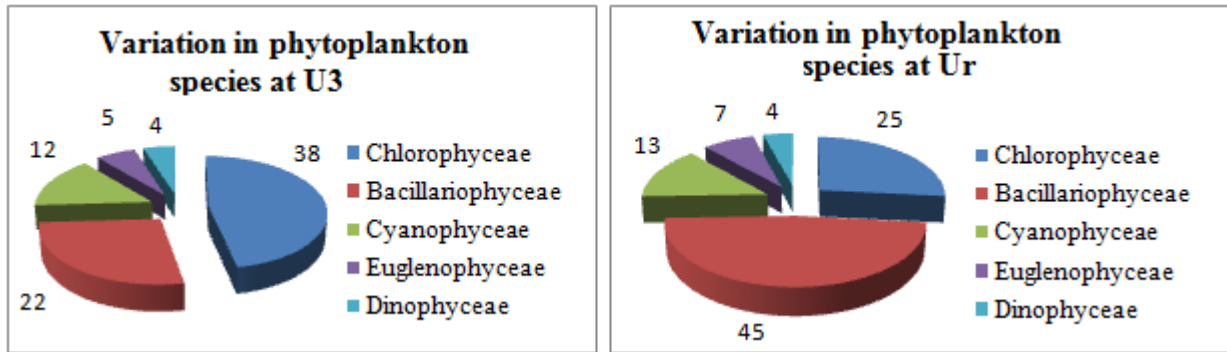


Figure 1.2: Phytoplankton species in U3 and Ur station of Upper Lake during year 2014.

#### 4. Conclusion

Biodiversity is our life. Biodiversity got lost at a rate then in near future, the survival of human being will be threatened. So, it is our moral duty to conserve biodiversity as well as our environment. Biodiversity is integral to our health and economy. Biodiversity is the basis of most rural livelihoods and is the foundation of major new economic sectors. Over the last century, a great deal of damage has been done to the biodiversity existing on the earth. Increasing human population, increasing consumption levels, and decreasing efficiency of use of our resources are some of the causes that have led to over exploitation and manipulation of ecosystems. The aim of present investigation was to investigate species diversity and composition of phytoplankton in four selected stations which represents the whole lake. The present study reveals that Upper lake is rich in micro as well as macro flora and fauna. The distribution of aquatic plankton in Upper Lake explains that the lake is rich in planktonic biodiversity

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