Study of Phytoplankton Biodiversity in Himayatsagar Reservoir, Andhra Pradesh, India

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Abstract

The present study is carried out during the period of January 2012 to December 2014 in order to investigate the seasonal diversity of phytoplankton in Himayatsagar reservoir by analyzing seasonal variations. In the reservoir 32 genera of phytoplankton were recorded. Out of which 14 generas belong to the Chlorophyceae, 07 generas belong to Bacillariophyceae, 10 generas belong to Cyanophyceae and 01 from Euglenophyceae. Among phytoplankton Cyanophyceae were dominant over others.

KEYWORDS-Biodiversity, Seasonal Variation, Himayatsagar reservoir

INTRODUCTION

Water is one of the earth's natural resource. Three quarters of the earth's surface is covered by it. Potable water is one that is free from disease causing microorganisms (pathogens), low in concentrations of compounds that are acutely toxic or that have serious long term effects on health. Potable water should also be clear, not saline, and free from compounds that can cause color, taste and odour (Pritchard et al, 2007).

Limnology is one of the most essential components which play an important role in decision making processes for problems like dam construction, pollution control, fish and aquaculture practices. Study of Limnological parameters assume greater importance for its practical applications as it provides most accurate results and make possible an insight into the interaction between various physico-chemical factors.

Algae are used for assessing the degree of pollution or as indicator of water pollution of different water bodies (Trivedy, 1986; Sudhaker et al., 1994; Dwivedi and Pandey, 2002). Phytoplankton are the autotrophic component of the plankton community. Most phytoplankton is too small to be individually seen with the unaided eye. However, when present in high numbers, they may appear as a green discoloration of the water due to the presence of chlorophyll within their cells. Phytoplankton are the foundation of the aquatic food chain. Phytoplankton obtains energy through the process of photosynthesis and must therefore live in the well-lit surface layer of an ocean, sea, reservoir, or other body of water. Phytoplankton account for half of all photosynthetic activity on earth.

Area of study:

The Osmansagar and Himayatsagar reservoirs (Figures 1.1 &1.2) were constructed mainly for supply of drinking water and flood mitigation purpose to Hyderabad city. The main sources of surface water in Hyderabad are Osmansagar, Himayatsagar, Manjira Barrage, Singur Dam and Nagarjunasagar dam.

The Himayatsagar was constructed in 1927 across Esi river a tributary of Musi as a flood absorption tank to mitigate flood in Musi and Esi rivers and is located at latitude 17.3187° N and longitude 78.3586° E. Himayatsagar Catchment area is 505 sq. miles.
While Osmansagar was constructed across Musi river during the period 1912-1920 in Gandipet village in Ranga Reddy district and is situated at about 20 km from Hyderabad city. The reservoir is located at latitude 17.3763°N and longitude 78.2989° E. The catchment area is 285 sq.miles.

The Hyderabad Metropolitan Water Supply and Sewerage Board (HMWS & SB) is a statutory authority in-charge of providing and maintaining water supply and sewerage facilities in Greater Hyderabad including surrounding municipalities. Key role of HMWS & SB is to upkeep the supply of potable water through proper operation & maintenance and management of water supply and sewerage system.

In view of uncontrolled anthropogenic activities, the water characteristics of Himayatsagar reservoir have been deteriorated substantially. Reduced inflows coupled with organic pollution and nutrient addition result in increased algal activity and reduced dissolved oxygen levels during night time. In general, the color of the Himayatsagar reservoir water is fairly green which often turns to brown during summer season. Fish mortality has also been recorded frequently. Since this water is being used as source of drinking, water treatment plant efficiency has been reduced substantially in recent times, resulting in unacceptable levels of color and odor, in finished water. In this endeavour, improvement in the reservoirs water quality is considered a pre-requisite so as to provide potable water from these sources.

According to Ramachandraiah and Prasad (2004), growing urbanization and the related activities are posing serious threat to the survival of these two reservoirs. Experts from several research institutes voiced such concerns in a workshop on ‘Protection of Surface Water Bodies’ in Hyderabad. Based on satellite maps, an area of about 140 sq.km was recognized as a ‘dangerous zone’ in their catchment areas. It is reported that the catchment areas have shrunk to the extent of 80 per cent for Osmansagar and 70 per cent for Himayatsagar.

Therefore, an attempt is made in this research work to investigate the physico-chemical & biological variations in the Himayatsagar reservoir of Telangana state. The present study has been undertaken to assess the abundance of the planktonic communities in Himayatsagar reservoir.

MATERIAL AND METHODS

The baseline status of land environment has been assessed through reconnaissance in study area. The samples were collected seasonally from January 2012 to December 2014 for phytoplankton studies. Samples were collected from surface and bottom. In all, 12 water samples covering all the seasons’ i.e winter, summer and monsoon from the reservoir was collected with the help of a mechanized boat. Water samples from Himayatsagar were collected for biological analysis following standard limnological methods (APHA, 21sted (2005). Water samples were collected using a Niskin (depth) sampler. Samples were collected and preserved following Standard Methods and then transported to research laboratory of Sewadal Mahila Mahavidyalaya, Nagpur.

Monitoring was undertaken with special reference to plankton population, which is best indicator of water quality. Phytoplankton flora was microscopically analyzed by Lackey Drop Count Method (Lackey, 1938) while zooplankton fauna was microscopically analyzed by using Sedgwick Rafter Cell.

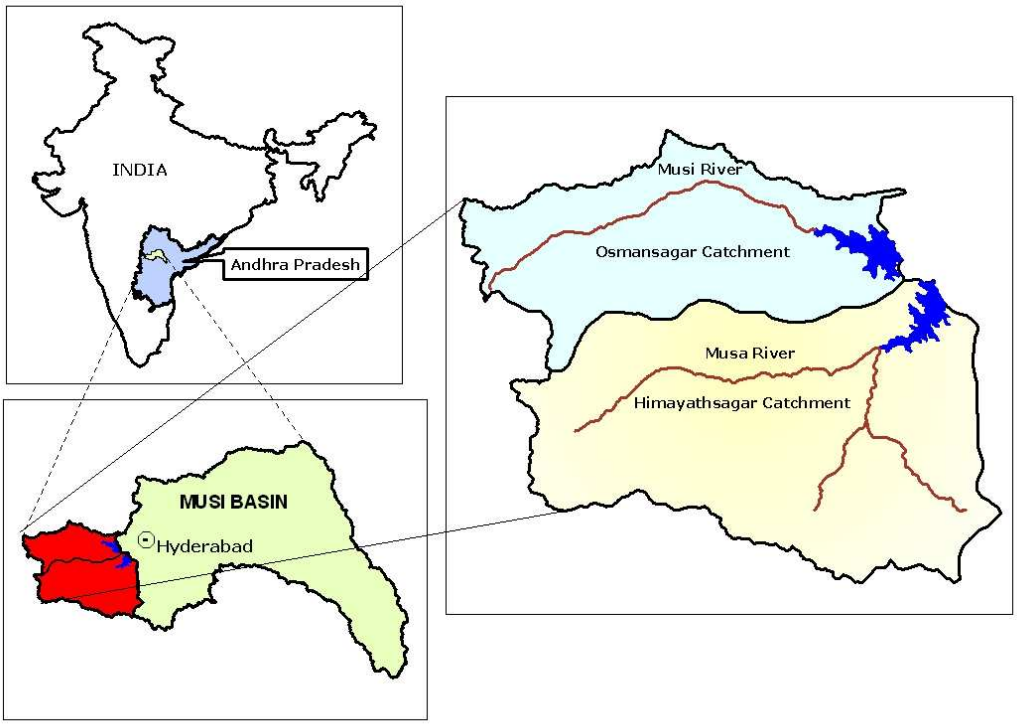

Figure 1.1: Location Map of the Study Area

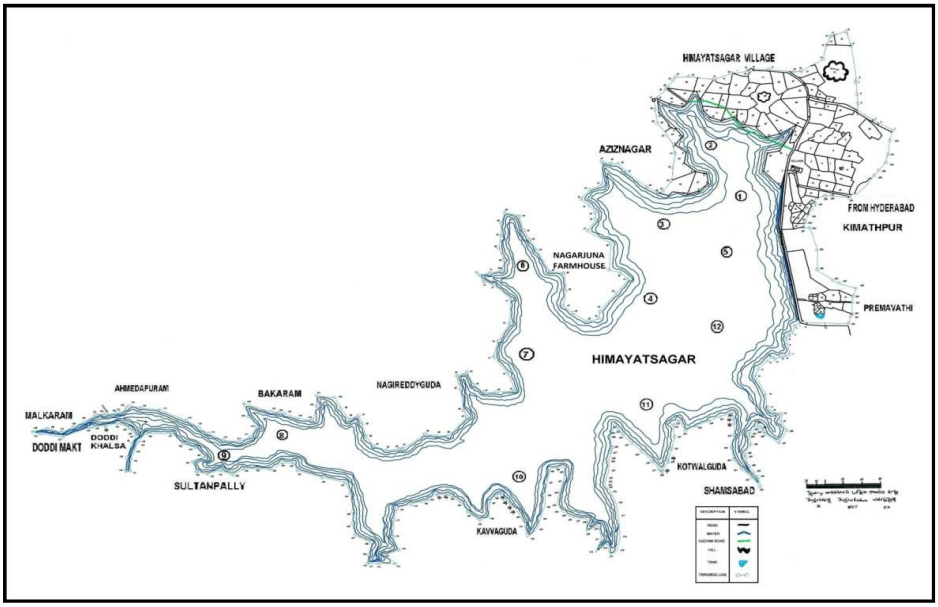

Figure 1.2: Location of Sampling Stations in Himayatsagar

RESULT AND DISCUSSION

In Himayatsagar, the maximum phytoplankton count recorded was 14560 No/ml in winter at station 3 and minimum 1250 No/ml in monsoon at station 12. In 2013 Lowest and highest count was 10652 No/ml and 1000 No/ml have been recorded in winter and monsoon at sampling stations 12 and 8. In 2014, it was maximum 10520 No/ml in winter at station 1 and minimum 1240 No/ml in monsoon at station 3. In general counts were less at bottom of the reservoirs. These might be attributed to less penetration of sunlight at lower depths.

In 2012, all four groups namely Chlorophyceae, Bacillariophycea, Cyanophyceae and Euglenophyceae were recorded, among which, Cyanophyceae dominated by Chlorophyceae. In Chlorophyceae 12 genera were recorded among which *Ankistrodesmus, Chlamydomonas, Closterium, Cosmarium, Eudorina, Scenedesmus* and *Staurastrum* were dominant. In Bacillariophyceae, 6 genera were recorded. *Fragillaria, Navicula, Synedra, Nitzschia* and *Rhoicosphenia* were dominant. In Cyanophyceae, 10 genera were recorded. *Anabaena, Aphanocapsa, Chroococcus,Microcystis, Oscillatoria, Spirulina* and *Gloeocapsa* were dominant while, *Gloeothece,Agmenellum* etc. were rare. In Euglenophyceae only *Euglena* was recorded.

In 2013, all four groups namely Chlorophyceae, Bacillariophycea, Cyanophyceae and Euglenophyceae were recorded, among which, Cyanophyceae dominated by Chlorophyceae. In Chlorophyceae 14 genera were recorded among which, *Chlamydomonas, Closterium, Cosmarium, Eudorina, Scenedesmus* and *Crucigenia* were dominant. In Bacillariophyceae, 6 genera were recorded. *Fragillaria,Navicula, Synedra* and *Nitzschia* were dominant. In Cyanophyceae, 10 genera were recorded. Anabaena, *Aphanocapsa, Chroococcus, Microcystis, Oscillatoria, Spirulina* and *Gloeothece* were dominant. In Euglenophyceae, only Euglena was recorded.

In 2014, all four groups namely Chlorophyceae, Bacillariophycea, Cyanophyceae and Euglenophyceae were recorded, among which, Cyanophyceae dominated by Chlorophyceae. In Chlorophyceae 14 genera were recorded among which *Ankistrodesmus, Chlamydomonas, Closterium, Cosmarium, Eudorina, Scenedesmus* and *Staurastrum* were dominant. In Bacillariophyceae, 7 genera were recorded. *Fragillaria, Navicula, Synedra, Nitzschia* and *Rhoicosphenia* were dominant. In Cyanophyceae, 10 genera were recorded. *Anabaena, Aphanocapsa, Chroococcus,Microcystis, Oscillatoria, Spirulina* and *Gloeocapsa* were dominant while, *Gloeothece,Agmenellum* etc. were rare. In Euglenophyceae, only *Euglena* was recorded.

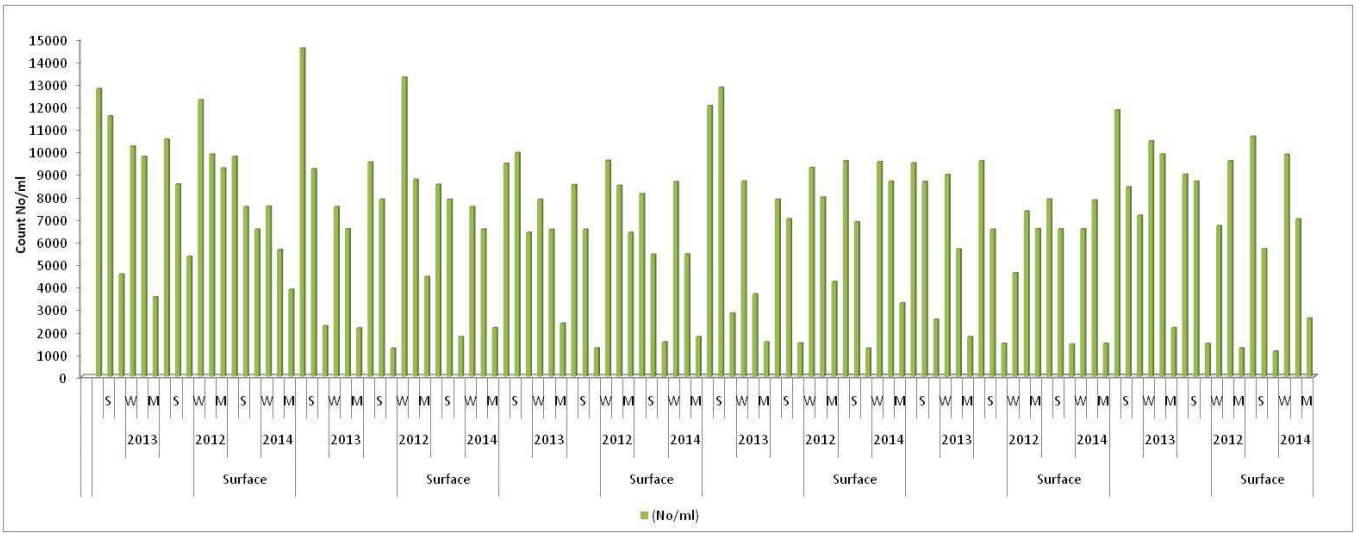

Figure 1.3: Phytoplankton Count of Surface Water in Himayatsagar (2012-2014)

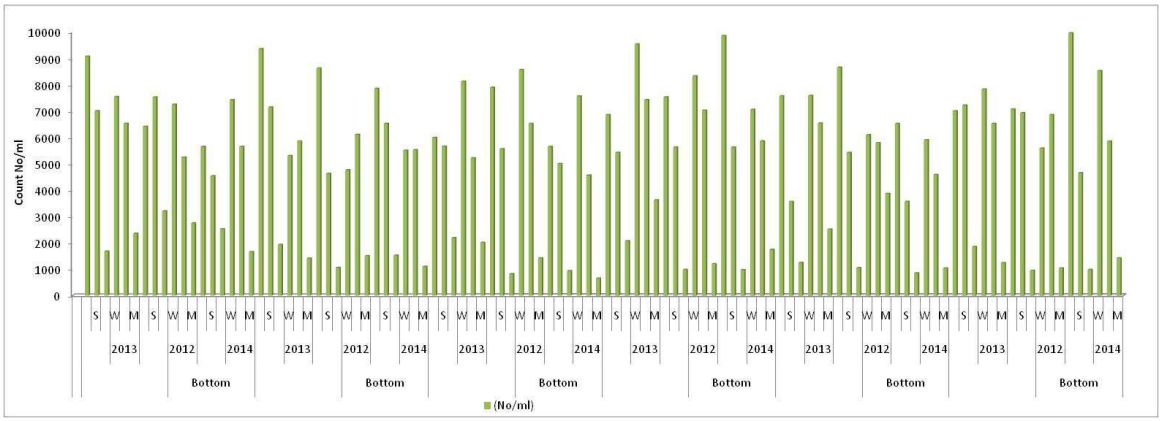

Figure 1.4: Phytoplankton Count of Bottom Samples in Himayatsagar (2012-2014)

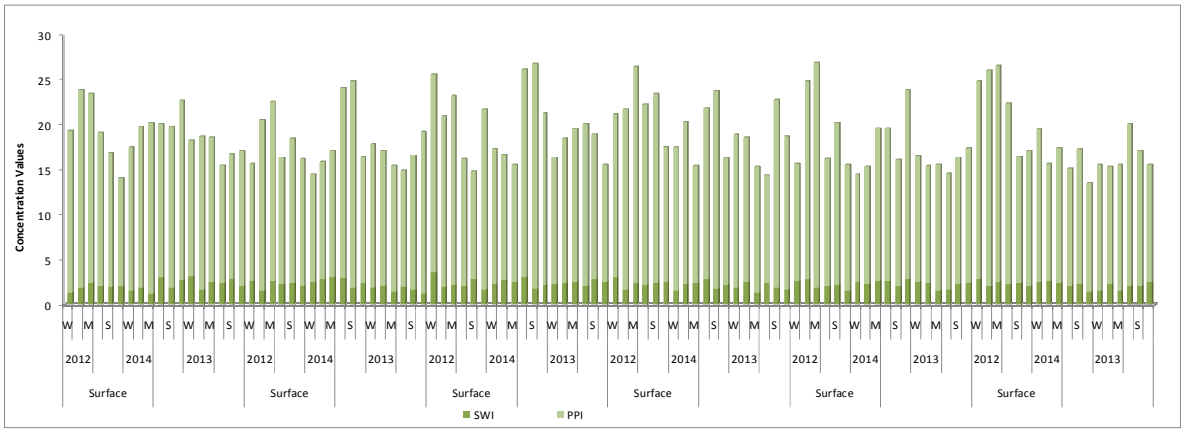

Figure 1.5: PPI and SWI Count of Surface Water in Himayatsagar (2012-2014)

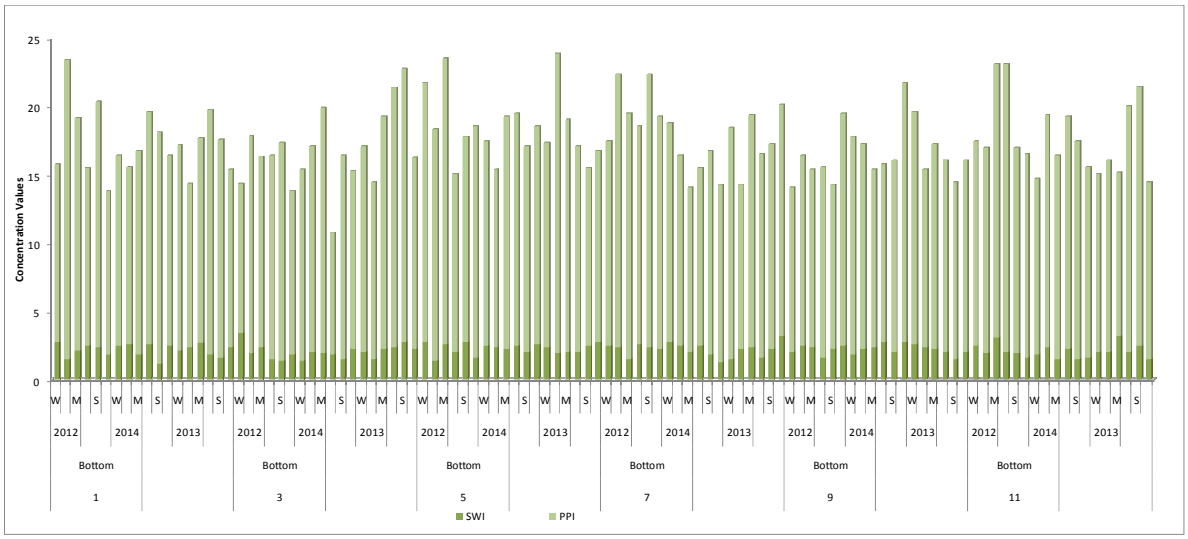

Figure 1.6: PPI and SWI Count of Bottom Water in Himayatsagar (2012-2014)

Sultana and Sharief (2004) in the Erretari lake of Chennai showed that the number of phytoplankton groups belonging to different classes are also in the order of Cyanophyceae>Chlorophyceae>Bacillariophyceae> Euglenophyceae which is similar to our present study.

During present study Cyanophyceae was found the most dominant group among all the phytoplankton. 13 species of Cyanophyceae are recorded. Similar result was observed by Shirsat *et.al*., (2004). They observed 6 species of Cynophyceae from freshwater pond in Dharmapuri in Beed District, Maharashtra. In the present investigation, the maximum amount of Cyanophyceae during in winter due to favourable sunlight, increase in domestic sewage, human generated pollution, an minimum quantity during the monsoon season is probably due to increase in water quantity. In the present investigation, total of 16 species of Chlorophyceae were observed. Similar observation was studied by Kumawat and Jawale, (2003). They reported 14 genera belonging to Chlorophyceae from a freshwater pond at Dharmapuri in Beed District, Maharashtra. In the present study 10

species of Bacillariophyceae was observed. Jayabhaye, et.al., (2007) also collected five species of Euglenophyceae in Paraola dam of Hingoli, Maharashtra. In the present investigation the Euglenophyceae were represented by Euglena sp., Banakar et.al.,(2005) collected only Euglena in Chitradurga of Karnataka.

In the present research work, the maximum population of algae was observed during winter season. Further, Singh and Srivastava (1991) studied the phytoplankton of the river Ganga between Buxer and Ballia (Bihar) and also recorded maximum phytoplankton population in winter season.

Palmer (1969) has showed that the genera like *Oscillatoria, Aphanocapsa, Scenedesmous, Chlamydomonas, Navicula, Nitzschia, Ankistrodesmus* etc. are the species found in organically polluted waters which is supported by Gunale and Balakrishnan (1976). Similar genera are recorded in the present investigation.

CONCLUSION

Higher phytoplankton density was observed during winter followed by summer in almost all the locations. Total algal population during all seasons varied between 1240 and 14560 algal cells ml^{-1}. In general counts were less at bottom of the lake.These might be attributed to less penetration of sunlight at lower depths. In general 32 genera from 4 major groups of phytoplankton were recorded from the reservoir.*Chlamydomonas, Scendesmus, Ankistrodesmus, Closterium, Pediastrum, Ulothrix, Chlorococcum, Cosmariumand, Crucigenia* were the representative of pollution tolerant genera from Chlorophyceae group. Other algal genera, like *Oscillatoria, Euglena, Navicula,* which are known to be rich in organically polluted waters, were also recorded.

The highly polluted locations are Near Krishna Oberoi farm house, Aziznagar, Nagireddyguda, Sultanpalli, Kavvaguda, Kotwalguda and raw water drawing point.

The survey surrounding the lake revealed that there are large number of possibilities of contamination from various sources viz., domestic wastewater, agriculture runoff, laboratory waste from science and engineering colleges/school, solid waste disposal, vegetation in the lake and anthropogenic activities prevalent in the lake basin.

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