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CHECKLIST OF PHYTOPLANKTON FROM UNDOCUMENTED WETLAND, WESTERN SATPURA RANGE

Patil J. V.
Associate Professor and Head
Department of Zoology, SVS's Dadasaheb Rawal College, Dondaicha
Affiliated to KBC, North Maharastra University, Jalgaon, Dist. Dhule, MS, India

Abstract

The use of phytoplankton for ecological biomonitoring of water bodies also helps in the analysis of water quality trends and judgment of adequacy of water quality for various uses. The present study gives status of phytoplankton community of Lotus Lake, located on Toranmal Plateau at 21° 53' 20'' N latitude, 74° 28' 01'' E longitude and 3201 Ft., above MSL. Lotus Lake is a shallow perennial water body. Phytoplankton communities of freshwater belong to four main taxonomic groups, the Cyanophyceae, Chlorophyceae, Bascillariophyceae and Euglenophyta, were consider for monitoring. The study site was visited at an interval of fifteen days for two year. Surface water samples were collected from three stations of Lotus Lake. Standard method was used qualitative analysis of zooplankton. At Lotus Lake, 41 species of phytoplankton were recorded that include 9 Chlorophyceae, 20 Bacillariophyceae, 7 Cyanophyceae and 4 Euglenophyta. It supports good density and diversity of phytoplankton that can maintain the balanced ecosystem. Some pollution tolerant species were recorded from Lotus Lake but with low population. Looking at the increasing tourist load in recent days good management practices are required to maintain the balanced ecosystem of Lotus Lake.

Keywords: Wetland, Lotus Lake, Phytoplankton, Diversity, Habitat Heterogeneity.

Introduction

Plankton, particularly phytoplankton, have long been used as indicators of water quality. Because of their short life span and quick responses to environmental changes their standing crops and species composition indicate the quality of water in which they are found (Mercado, 2003). Clean water supports a great diversity of organisms, whereas, very few organisms survive in polluted water with one or two dominant forms (Saladia, 1997). Phytoplankton constitutes the basis of nutrient cycle of an ecosystem hence play an important role in maintaining equilibrium between living organisms and abiotic factors (Wetzel, 2001).

Murphy et al. (2002) stated the main advantages of using phytoplankton in lake monitoring are: 1) Phytoplankton are primary producers and are directly affected by chemical and physical factors. Hence, changes in the status of phytoplankton community have direct implications on biointegrity of the wetland ecosystem as a whole. 2) reproductive rates is generally high and bear very short life cycles, making them valuable indicators for short term (impacts at scales of weeks and months). 3) Their sampling is easy, inexpensive and creates minimal impact to resident biota. 4) They are good indicators of the trophic state of lake. 5) Changes in their community composition can provide better scale assessment of changes due to ecological impact. 6) Algal assemblages are sensitive to some pollutants like herbicides which may not visibly affect other aquatic assemblages and organisms at higher concentrations One more advantage as per Netherland et al. (2009). Earlier workers have emphasized on the role of algal communities as reliable indicators of pollution (Palmer, 1969; Nandan and Patel, 1985, Patil, J. V. 2011). Hence, in recent times, instead of considering a single species, algal communities and their dynamics are taken into consideration as indicators of pollution.

Several studies on phytoplankton diversity of ponds, lakes and reservoirs have also been conducted in India (Senthilkumar and Shivkumar, 2008; Shridhar et al, 2006; Tas and Gonulol, 2007; Tiwari and Chauhan 2006;), and abroad (Sandra et al., 2007; Cleber and Giani, 2001; Round, 1985) revealing the importance of this type of study.

There are still many aquatic ecosystems that have remained unexplored. The check list generated in the study is intended to support other research in wetlands and in particular, to assure the continuity of ongoing long term ecological programs. Thus, the use of phytoplankton for ecological biomonitoring of water bodies also helps in the analysis of water quality trends and judgement of adequacy of water quality for various uses. Hence, in present study of Lotus Lake both Phytoplankton and Zooplankton are considered.

Material and Methods

Study Area

The present study describes status of Lotus Lake a shallow perennial water body, located on Toranmal Plateau. It is a quantum part of Western Satpura mountain range in Maharashtra State of India (at 21° 53´ 20´´ N latitude, 24° 28´ 01´´ E longitude) and 3201 Ft. above MSL with 1.17 Km perimeter it spreads in 3.5 hectare. Its North-South linear length is 154 m while East-West is 419 m. It receives water through streams from higher altitudes of Toranmal Plateau. It has a gravel embankment on North side which arrests the main flow of the streams. Water of the Lotus Lake is utilized by the tribal people for domestic purpose like washing,

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bathing and also for agriculture. At places it is covered with Lotus flowers the Lotus Lake is centre of attraction at Toranmal tourist spot.

Fig.1.Google Sat-Image of Lotus Lake

The study site was visited at an interval of fifteen days from December 2006 to November 2008. Surface water samples were collected from the possible euphotic zone of entire study area covering each geographical section of terrains and landscapes, from three stations of Lotus Lake (LL) namely LL-A, LL-B and LL-C as described in chapter 2 between 8 a.m. to 10 a.m. As given by (Edmonson, 1963) ten liters of water was filtered through the plankton net No. 25 of bolting silk with mesh size 64 micron. Net was washed with the water by inverting it to collect the plankton attached to the net and the final volume of sample was made to 100 ml. The samples were taken in separate vials and fixed with 1 ml of 4 % formalin and 1 ml of Lugol's Iodine at the collection sites. Qualitative study of phytoplankton and zooplankton were carried out up to the genus/species level using the standard keys given by Edmondson (1963), Philipose (1967), Sarode and Kamat (1984).

Results and Discussion

At the Lotus Lake 41 different species belonging to 4 algal groups i.e. Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyta could be identified.

During the two years (December 2006 to November 2008) study, total 41 species of phytoplankton (Table) were identified from Lotus Lake water belonging to four taxonomic assemblages: Cyanophyceae, Chlorophyceae, Bascillariophyceae and Euglenophyta.

1.Cyanophyceae (Blue Green Algae)

Blue green algae were third dominant qualitative component with total seven species.

2.Chlorophyceae (Green Algae)

Green algae were second dominant qualitative component of algal composition of Lotus Lake with nine species.

3.Bacillariophyceae (Diatoms)

Diatoms appeared to be the most dominant qualitative components among assemblage of algae at the Lotus Lake with twenty-one species.

4.Euglenophyta

The Euglenophyta appeared to be minor group qualitative with four species.

Table.1: Phytoplanktons Reordered in Lotus Lake water at Toranmal plateau in Satpura ranges during December 2006 to November 2008

A) Cyanophyceae (Blue green algae) (07)
1. Aphanocapsa TA. Montage Cramer
2. Microcystis viridis A.Br. Lemm
3. Oscillatoria limosa (Ag)
4. Phormidium ambigum (Gomont)
5. Lyngbya limnetica (Lemm)
6. Nostac spongiaeformae
7. Anabaena spiroides klebnn

B) Chlorophyceae (Green algae) (09)
8. Ulothrix aqualis Kuetz
9. Oedogonium spp
10. Bulbochaetae spp
11. Closterium microporum Nageli
12. Pediastrum simplex (Meyen)
13. Cosmerium spp
14. Staurastrum spp
15. Eudorina spp
16. Spirogyra hyalina (Cleve)

C) Bacillariophyceae (Diatoms) (21)
17. Melosira islandica (O. Muell)
18. Synedra ulna (Nitz) Her. V. biceps Kuetz.
19. Synedra acus (Kuetz)
20. Asterionella spp
21. Frustulina spp
22. Gyrosigma accuminatum Kuetz
23. Navicula cuspidata Kuetz. V. Conspicua Venkat
24. Navicula cuspidate Kuetz. V. major Meister
25. Navicula rhynchocephala Kuetz
26. Amphora ovalis. Kuetz
27. Pinnularia interrupta W. Smith
28. Pinnularia vidarbhensis Sarode Kamat
29. Rhopalodia gibba Her O. Muell
30. Nedium longiceps Grey A. Cl. V.
31. Stauroneis obtuse Lagerst. V.
32. Surirella capronii Breb.
33. Surirella robusta Ehr.
34. Cymbella ventricosa Kuetz
35. Gomphonema intricatum Kuetz
36. Fragilaria construens Ehr. Grun
37. Nitzschia obtusa W. Smith

E) **Euglenophyta (04)**
38. Euglena acus Ehr.
39. Euglena clavata
40. Phacus longicauda Her. Duj.
41. Phacus spp.

Diversity of algae is an indication of purity. The use of community structure to assess pollution is conditioned by four assumptions: 1) the natural community evolves towards greater species complexity, 2) this eventually stabilizes and increases the functional complexity of the system 3) complex communities are more stable than simple communities, and 4) pollution stress simplifies a complex community by eliminating the more sensitive species (Cairns, 1974). At the Lotus Lake 41 different species belonging to 4 algal groups i.e., Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyta could be identified. Practically, environmental instability with temporal and spatial changes determines the community present in a lake (Levandowsky, 1972). In addition, not only the physical environment (i.e., Light intensity and temperature) influences the distribution of algal populations

(Bormans and Condie, 1998) but nutrients along with chemical compounds like CO_2 and composition and abundance of biotic component like Zooplankton also influence the phytoplankton assemblages in an aquatic ecosystem (Mortensen et al., 1992; 1993; Shapiro, 1997). This all is reflected at Lotus Lake with maximum density of total phytoplankton recorded in summer.

Different groups of phytoplankton contributed to total plankton density during different seasons i.e., Chlorophyceae with Bacillariophyceae in winter, mainly Bacillariophyceae in summer and monsoon while almost all the groups together during postmonsoon. This indicates that various climatic factors influence phytoplankton groups in various ways over the seasons. This is reflected with difference in correlation of physicochemical parameters with different groups of phytoplankton (Patil, J.V.2011).

Further, Palmer (1980) has also reported that majority of algae grow best in water at or near neutral pH but some Blue greens grow best at high pH. Slightly alkaline pH observed in Lotus Lake water is therefore suitable for community structure dominated by Diatoms and Chlorophyceae as is revealed in the present study (Patil, J.V.2013). Besides the temperature, higher pH during summer can be another factor for summer maxima of total phytoplankton density (Hujare, 2005; Patil, J.V.2013; Ekhande,2013). The Lotus Lake fall in semiarid zone of Maharashtra that receives maximum photoperiod during summer favoring growth of the aquatic autotrophs.

At Lotus Lake, a high-altitude lake in tropics, 41 species of phytoplankton that include 9 Chlorophyceae, 20 Bacillariophyceae, 7 Cyanophyceae and 4 Euglenophyta did showed oscillations. Among these, Bacillariophyceae appeared to be the dominant group. The nutrient increase in a lake due to human activities in the catchments, leads to change of Lake Flora from Diatom assemblage to those of greens and blue greens (Hutchinson, 1967). The nutrient enrichment at Lotus Lake is reflected as increase and decrease in these three groups quantitatively as well as qualitatitively over major part of the year in accordance to nutritional changes.

Dominance of Microcystis adversely affect the growth of other taxonomic groups of phytoplankton especially Chlorophyceae group in lakes (Kearns and Hunter, 2001). However, in the present study the Cyanophyceae and Chlorophyceae are positively significantly correlated indicating that the members of Cyanophyceae are not dominating the system.

The green algae of Lotus Lake include genera Ulothrix, Oedogonium, Bulbochaetae, Pediastrum, Eudorina, Spirogyra, Closterium, Staurastrum and Cosmarium. Of these Closterium, Staurastrum and Cosmerium are considered as desmids which indicate good quality of water and absence of desmids is an indication of heavy pollution of water (Hosmani et al., 2002). Detailed study of Desmid flora would be useful in managing the pristine quality of the Lotus Lake. According to Hutchinson (1967) desmids (e.g., Cosmarium) are associated with oligotrophic freshwater and in these, they may form an important food source for herbivore fish. However, rare occurrence of tolerant species such as Spirogyra, Ulothrix, Oedogonium at some parts of the Lake requires to be monitored intensively.

Diatoms appeared to be the most dominant qualitative components among assemblage of algae at the Lotus Lake with twenty-one species. The dominance of Bacillariophyceaen members amongst phytoplankton substantiates the previous work of Zutshi (1991). According to Telford et al. (2006) lentic Bacillariophyceae communities that show spatial variation in diversity and species composition cannot be solely driven by local environmental conditions but also determined by habitat availability. However, according to Fabricus et al. (2003) Diatom community distribution in a Lake is also determined by the combination of physical, chemical and biological factors. Palmer (1969) has listed diatom taxa in decreasing order of emphasis with reference to pollution index. With reference to this, in the Lotus Lake water the tolerant species in decreasing order of emphasis were Nitzschia, Navicula, Synedra, Melosira, Gomphonema, Fragilaria, Surirella, Cymbella and Pinnularia. Nitzschia species is characteristics of organically rich waters (Richardson, 1968). Though many studies have investigated autecological status of indicator species (Taylor et al., 2007), few studies contribute to species optima of Nitzschia species and Gomphonema sp. However, the clean water diatom species Amphora ovalis, Cymbella species and Pinnullaria species were also recorded in Lotus Lake.

Euglenophyta is the free swimming micro-algal group of wide geographical distribution found worldwide, occurring predominantly in small freshwater bodies with high organic content (Round, 1985; Wetzel, 2001) several species are known as indicators of organically polluted environment (Hafsa and Gupta, 2009). In the Lotus Lake only four species of Euglenophyta belonging to two genera representing just 7.78 % of the total diversity of phytoplankton species were observed Euglena gaumei and Euglena viridis were most common in the monsoon and post monsoon. Presence of Euglena sp and Phacus sp, are a direct indication of beginning of pollution load because both these species in general, are considered to be dominant and tolerant genera of polluted ponds (Alam and Khan, 1996).

Conclusion

At Lotus Lake, a high-altitude lake in tropics, 41 species of phytoplankton were recorded that include 9 chlorophyceae, 20 Bacillariophyceae, 7 cyanophyceae and 4 Euglenophyta. It supports good density and diversity of phytoplankton that can maintain the balanced ecosystem. Some pollution tolerant species were recorded from Lotus Lake but with low population. Lotus lake supports good diversity of phytoplankton with Bacillariophyceae as most common group while Euglenophyta the least. The Lotus Lake is not yet polluted. But, in today's modern world, ecotourism is fast growing field and Toranmal area is one of the most favoured centre. If care is not taken Lotus Lake can soon undergo deterioration and develop into a deteriorated habitat.

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