Preliminary Study of Phytoplankton Diversity to Assess Pollution Status of Lotus Point Lake, Kurul, Alibaug, M.S, India.

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Abstract: The water quality and abundance of phytoplankton communities in a lentic ecosystem of Kurul Lake, Alibaug was assessed from September 2013 to December 2014. The study revealed the dominance of phytoplankton belonging to classes Chlorophyceae and Bacillariophyceae. Observations indicated a deteriorating ecosystem due to eutrophication caused by anthropogenic interference. During the study the need for conservation of such fragile ecosystems through constant monitoring was observed to be essential.

Key words: Phytoplankton, Pollution

Introduction:

Phytoplankton play a key role in aquatic ecosystems. These are some of the most prominent primary producers found in marine and freshwater ecosystems which are generally low in primary trophic level biomass. Phytoplankton diversity is highly influenced by hydrological parameters affecting not only its biota but also the productivity in water body. Phytoplankton communities determine the health and sustainability status of the aquatic ecosystem. Salim et al (1985) compared the relationship between abiotic factors and variance in phytoplankton densities whereas, few other studies have elaborated phytoplankton dynamics and productivity fluctuations in aquatic ecosystems (Rao *et.al* 1990). Environmental changes due to pollution, anthropogenic activities and climatic changes affect micro flora and fauna of lentic and lotic ecosystems drastically (Komala et. al 2013; Gayatri *et.al*, 2011). Phytoplankton communities are considered as pollution indicator species (Kampill, 2007) and thus indicate the ecological status of any aquifer (Dalal *et.al* 2012). regular monitoring of such ecosystems is therefore of utmost importance.

The present study deals with phytoplankton diversity in Lotus Point lake, Kurul, Alibaug and its co-relation to anthropogenic activities.

Materials and methods:

Study Area

Kurul Lake (18°41' 38.42" N and 72°57' 19.83" E) also known as Lotus Point Lake is located in Raigad district of Maharashtra at a distance of about 100 km. from Mumbai. The lake is situated near Alibaug a coastal town which has been undergoing urbanization in leaps and bounds. Indian culture generally associates the presence of lentic water bodies with a temple or a shrine which was once meant to maintain the purity and sanctity of the water body but commercialization and urbanization are having adverse effects on such cultural associations protecting various ecosystems. A temple flanks the eastern end of the lake causing addition of floral and other wastes directly into the lake waters. This lake experiences heavy anthropogenic hindrance in the form of bathing, washing clothes, utensils and cattle, immersion of Ganesh idols during Ganesh Chathurthi festival, land run offs etc., consequently, causing tremendous turbulence and changes in the dynamics of lake ecosystem.

Fig 1: Lotus Point Lake, Kurul, Alibaug, Dist. Raigad

Material and Methods:

The study was undertaken from September 2013 to December 2014. Water samples were randomly collected on a monthly basis from surface in separate 1000ml sterile glass bottles from different locations of the lake and Lugol's iodine was added for instant preservation of phytoplankton. Samples were kept undisturbed for 24 hours allowing them to settle at the bottom. The sub samples of the settled material were again separated in polyethylene bottles. Counting of phytoplankton was done using Sedgewick rafter counting cell under high power microscope (Saxena *et.al* 1987) and identification was done using standard references. Sanet Janse *et.al*, 2006.

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Hyrdological parameters such as pH, dissolved oxygen, nitrates and phosphates were checked using a portable bench photometer (Hanna instruments HI 83206) on field. Surface temperatures were measured using alcohol thermometer and Salinity by Argentometric-Mohr's method. The data collected was pooled to study seasonal variations (four seasons viz. pre monsoon, monsoon, early post monsoon and late post monsoon) and was interpreted accordingly.

Result and discussion:

Table 1: Seasonal variations in physicochemical parameters of water in Kurul lake.

	Early-Post Monsoon	Late-postMonsoon	Pre-Monsoon	Monsoon	Mean
pH	7.1	7.27	7.5	6.9	7.1925
Temp (%C)	26	27	28.2	26.5	26.925
DO (mg/l)	3.25	3.8	3.2	4.8	3.7625
Chlorides(mg/l)	20.1	52.4	59.64	19.88	38.005
					1.455
PO_4-P (mg/l)	1.3	1.32	1.4	1.8	
NO_3-N (mg/l)	4.2	2.02	1.5	5	3.18
Total Solids (mg/l)	1300	721	360	5001	1845.5

Physico chemical parameters:

The pH of the lake water was almost neutral throughout the study period while the water temperature was season dependent. The dissolved oxygen content was enough to sustain life forms in the ecosystem (OATA, 2008). The chloride content was well within the permissible limits of 250 mg/l (BIS, 1991) while the nitrates and phosphates were also within the limits prescribed by BIS. The total dissolved solids exceeded the prescribed limits only during monsoon.

The study showed presence of 31 species belonging to class, Chlorophyceae (13 genera). Bacillariophyceae (11 genera), Cyanophyceae (05 genera), and Euglenophyceae (2 genera). Chlorophyceae (42) remained dominant throughout the study period followed by Bacilariophyceae (36%).

Table 2: Seasonal variations in the diversity and density of phytoplankton in Kurul Lake

Sr.No.	Genera	Monsoon	Early Post Monsoon	Late Post Monsoon	Pre Monsoon
			Cyanophyceae		
1	*Merismopedia spp.*	+++	-	++++	+++++
2	*Anabaena spp.*	+	+++	++++	+++
3	*Oscillatoria spp.*	+	-	++	-
4	*Spirulina spp.*	-	-	++	-
5	*Chroococcus spp.*	-	+	++	++++
			Chlorophyceae		
6	*Koliella spp.*	++	-	++	-
7	*Scenedesmus spp.*	++	+++++	+++	++++
8	*Crucigenia spp.*	+++	+++++	++	++++
9	*Monoraphidium spp.*	++	+++	++	-
10	*Pediastrum spp.*	+	+++	+++	++
11	*Oocystis spp.*	+	-	++	-
12	*Crucigeniella spp.*	-	+++	++	-
13	*Cosmarium spp.*	-	-	+++	+++
14	*Chlorella spp.*	-	-	+++	++++
15	*Kirchineriella spp.*	-	-	++	-
16	*Chlorogonium spp.*	-	-	-	+++
17	*Actinastrum spp.*	+	-	-	-
18	*Closterium spp.*	-	-	++	++

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		Bacillariophyceae			
19	*Synedra spp.*	++	-	++	+++++
20	*Nitzschia spp.*	+	+++	+++	++++
21	*Amphipleura spp.*	+	-	++	+++
22	*Pinnularia spp.*	+	-	++	++
23	*Coconeis spp.*	++	-	+++	+++
24	*Triceratium spp.*	-	+++	+	+++
25	*Navicula spp.*	-	+++	++++	-
26	*Cyclotella spp.*	-	-	++	+++
27	*Melosira spp.*	-	-	++	-
28	*Gomphonema spp.*	-	-	++	-
29	*Stephanodiscus spp.*	-	-	++	-
		Euglenophyceae			
30	*Phacus spp.*	++	+++	++	+++
31	*Euglena spp.*	+	-	++	+++
+++++ = Abundant, ++++ = < abundant, +++ = Average, ++ = meager, + = Rare, - = Absent					

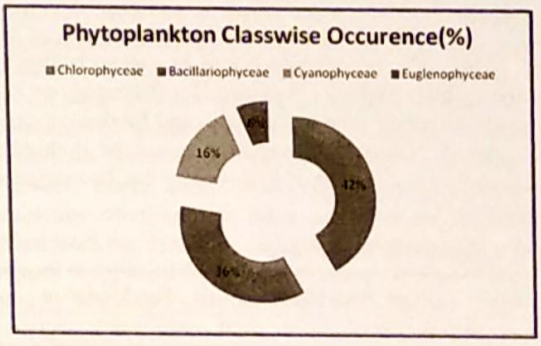

Fig 2: Pie chart showing class-wise abundance of phytoplankton

Chlorophyceae: Chlorophyceae formed the major group of phytoplankton in the lake except for pre monsoon. Total 13 genera from this class were recorded and contributed around 42% of the total phytoplankton in the lake. Palmer (1959) stated that enormous number of *Scenedesmus* are indicators of degrading water quality while adequate number of Chlorophytes also indicates food for fish population in the water body. Species like *Crucigenia spp. and Scenedesmus spp.* dominated the microflora during the entire period of study.

Bacilariophyceae: 11 genera in class Bacillariophyceae were found during the study period. These showed dominance next to Chlorophycae during late post-monson and pre-monsoons periods. It formed around 36% of the total phytoplankton genera in the lake. *Nitzchia spp.* which indicates presence of high nitrate and phosphates (Pearsall, 1932) was seen throughout the sampling period. Mohan, (1987) stated that the presence of species like *Cyclotella, Navicula, Nitzschia, Melosira, Gomphonema* indicates the deterioration of water quality of lakes (Mohan *et.al.* 1987). Thus, presence of such species in the current study shows deteriorating quality of lake water.

Cyanophyceae: 5 genera in Cyanophyceae were onserved during the study period. This class contributed to around 6% of total phytoplankton population in the lake. The abundance of members of class Cyanophyceae is supposed to be better when the temperature and alkalinity of the aquatic ecosystem are high (Ganpati *et al,* 1953). *Anabaena spp.* and *Merismopaedia spp.* dominated the Cyanophycae population. Ganpati (1953) also suggested that density of Cyanophytes depends on phosphates and silicates while some species lead to eutrophication and pollution (Pennak, 1955).

Euglenophyceae: Class Euglenophyceae was respresented by minimal number of genera during the study. Euglenophyceae contributed to around 6% of total phytoplankton population in lake. Presence of Euglenophytes indicates higher availability of nitrogen compounds, carbon dioxide, chlorides and organic content (Rao, 1977; Hegde *et.al* 1985).

Discussion

The changes in physicochemical parameters of the lake have a profound influence on the occurrence of phytoplankton communities. higher temperatures were also found to be directly proportional to phytoplankton density. The water quality in Kurul Lake was constantly under pressure due to constant anthropgenic interference in the form of washing of utensils, clothes, bathing cattle and other such activities in the lake. This caused a rise in the nitrates and phosphate contents of the lake ecosystem thereby impacting the phytoplankton communities. Abrupt removal of hydrophyes and lotus seeding into the lake were also responsible for inducing distress to the biota of water body.

Dominance of Chlorophyceae and Bacilariophyceae indicates organic pollution (Kumari *et.al*, 2008) which further emphasizes the previously made physical observation of existing natural and anthropogenic sources of organic pollution.

Conclusion:

The study of physico-chemical parameters and phytoplankton diversity of Lotus point lake clearly shows an increase in nutrient concentration in the lake ecosystem under scrutiny, having direct relation to human interference. These changes in the water quality influence the type of phytoplankton communities growing in the lake ecosystem indicating the rising pollution levels and deteriorating ecosystems. Regular monitoring, community awareness and sensitization of locals are of prime importance for sustainability and maintenance of existing lentic ecosystems.

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