Study of phytoplankton diversity and physico-chemical parameters of Upvan-lake, Thane, Maharashtra, India

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Introduction

Thane is known as 'City of lakes'as there are around 35 lakes of which Upvan Lake is well known for its recreational activities. Upvan Lake (19°13'21''N 72°57'22''E) is located at foothills of Yeoor, in Thane, Maharashtra. It extends over an area of about 6 hectares.

Thane Municipal Corporation (TMC) had undertaken conservation of 13 lakes including Upvan Lake in 2002. In their study it was observed that water in all these lakes was highly polluted, turbid, greenish black in colour. The lakes were also infested with dense growth of aquatic plants water hyacinth, salvinia and algae. Considering the need for recreation and improving the aesthetics of region, de-weeding, clearing of garbage and bioremediation of lakes were undertaken by TMC with support from NLCP (National Lake Conservation Plan).

The Upvan lake is getting polluted by the sewage entering from the surrounding settlements, religious practices and human activities like washing, bathing, etc. The restored lakes have to be kept free from pollution to maintain their ecosystem.

Material and Methods

In the present study the phytoplankton diversity and the physico-chemical properties of the lake water were studied for monsoon and postmonsoon season. The physico-chemical parameters such as temperature, pH, Dissolved oxygen, chlorinity, salinity, nitrates, nitrites, phosphates, were studied. pH, temperature and DO were estimated onsite and DO was estimated using a portable DO kit. Chlorinity and Salinity was done by Argentometric method, Nitrates and Nitrites by colorimetric and Phosphates by spectrophotometric method.

The collection of sample for phytoplankton

The samples were collected from the surface using one litre glass jar and fixed immediately using 4% formaldehyde in Lugol's Iodine solution. The sample was left undisturbed for 24 hours to allow the settling of phytoplanktons and then the settled part of the solution was transferred in other capped glass jar.

The subsamples were observed under high power of microscope. The checklist of the phytoplankton species was prepared. The identification key given by Caljon (1983) and Sanet Janse van Vuuren et al (2006) were used.

Results and Discussion

Physico-chemical properties of water

Sr no.	Water parameters	August	September	Average
1	pH	7-7.5	7.5	7.5
2	Dissolved Oxygen	5.85	5.85	5.85
3	Chlorinity	0.021gm/l	0.042gm/l	0.031gm/l
4	Salinity	0.038gm/l	0.076gm/l	0.057gm/l
5	Nitrates	0.3mg/l	0.01mg/l	0.15mg/l
6	Nitrites	0.21mg/l	0.21mg/l	0.21mg/l
7	Phosphates	0.3mg/l	0.8mg/l	0.55mg/l
8	Hardness	90mg/l	80mg/l	85mg/l

pH: The pH of the sample was found to be near neutral. The pH was neither highly acidic nor alkaline. It was within the range described by IS0 2003 which is 6.5-8.5. It can be said to be suitable for the life.

Dissolved Oxygen: The dissolved oxygen in the water was found to be 5.85 mg/l. According to WHO standards, the dissolved oxygen required to sustain life is 3mg/l. The DO was found to be in the range described by WHO.

Chlorinity: The chlorinity was found to be 31.5 mg/l. The chlorinity was within the limits of 200mg/l given by WHO(1971)

Nitrates: The nitrates were found to be 0.155 mg/l. The discharge standards described by WHO for nitrates is 50 mg/l. The nitrates were found to be within the given limits.

Nitrites: The concentration of Nitrites was found to be 0.21mg/l which was within the permissible limits of 0.3 mg/l described by USEPA.

Phosphates: The concentration of Phosphates was found to be 0.55 mg/l. This level was above the permissible limit of 0.1mg/l given by WHO.

Hardness: The total hardness of water was found to be 85 mg/l. It is within the permissible limit of 200 mg/l given by WHO (1984).

After comparing water parameters with study by Raut N. S., (2006), the difference was not significant except phosphates which were found to be greatly reduced due to the dilution by rain water. As this study was conducted during the monsoon season, there is a possibility of dilution in nutrient concentrations and thus phytoplankton diversity.

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Phytoplankton Diversity

20 genera of phytoplankton belonging to three divisions were observed. The checklist of the Species from each division has been given in the Table No.:2

Table No. 2 : List of Phytoplankton

Sr. No.	Chlorophyta	Bacillariophyta	Cyanophyta
1	*Tetrastrum* Spp	*Synedra* Spp	*Microcystis* Spp
2	*Cosmarium* Spp	*Nitzschia* Spp	*Merismopedia* Spp
3	*Crucigenia* Spp	*Gomphonema* Spp	-
4	*Pediastrum simplex*	*Aulacoseira granulate*	-
5	*Pandorina* Spp	*Pinnularia* Spp	-
6	*Koliella* Spp	-	-
7	*Monoraphidium* Spp	-	-
8	*Tetraedron mediocris*	-	-
9	*Tetraedron minimum*	-	-
10	*Tetraedron trigonum*	-	-
11	*Scenedesmus* Spp	-	-
12	*Oocystis* spp	-	-
13	*Chlorogonium euchlorum*	-	-

In the previous study, by Raut N. S. (2006), had studied the phytoplankton diversity of Upvan lake. Table no. 2 shows a comparison between (Raut N. S., 2006) and present study.

Table No 3: Comparison between the studies of 2006 and 2013

Sr. No.	Divisions	No. of Species	
		Studies in 2002-03 (Raut N., 2006)	Present study 2013
1	Chlorophyta	13	13
2	Bacillariophyta	11	5
3	Cyanophyta	6	2
4	Euglenophyta	2	-
5	Cryptophyta	1	-
6	Dinophyta	2	-
	Total	**35**	**20**

Studies in 2006 revealed 35 species from 6 different divisions. While in the present study 20 species were found from 3 divisions. Division Chlorophyta was represented by 13 species, division Bacillariophyta by 5 species and division Cyanophyta by 2. The study also shows that the diversity of species from Bacillariophyta has reduced by 54% and that of Cyanophyta by almost 67%. Species from divisions Euglenophyta, Cryptophyta and Dinophyta were not found in present study.

The present study was carried out during monsoon. Decrease in the number of species in 2013 can be attributed to dilution by rain water.

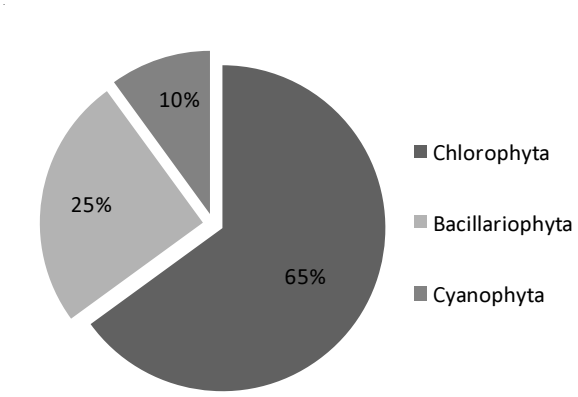
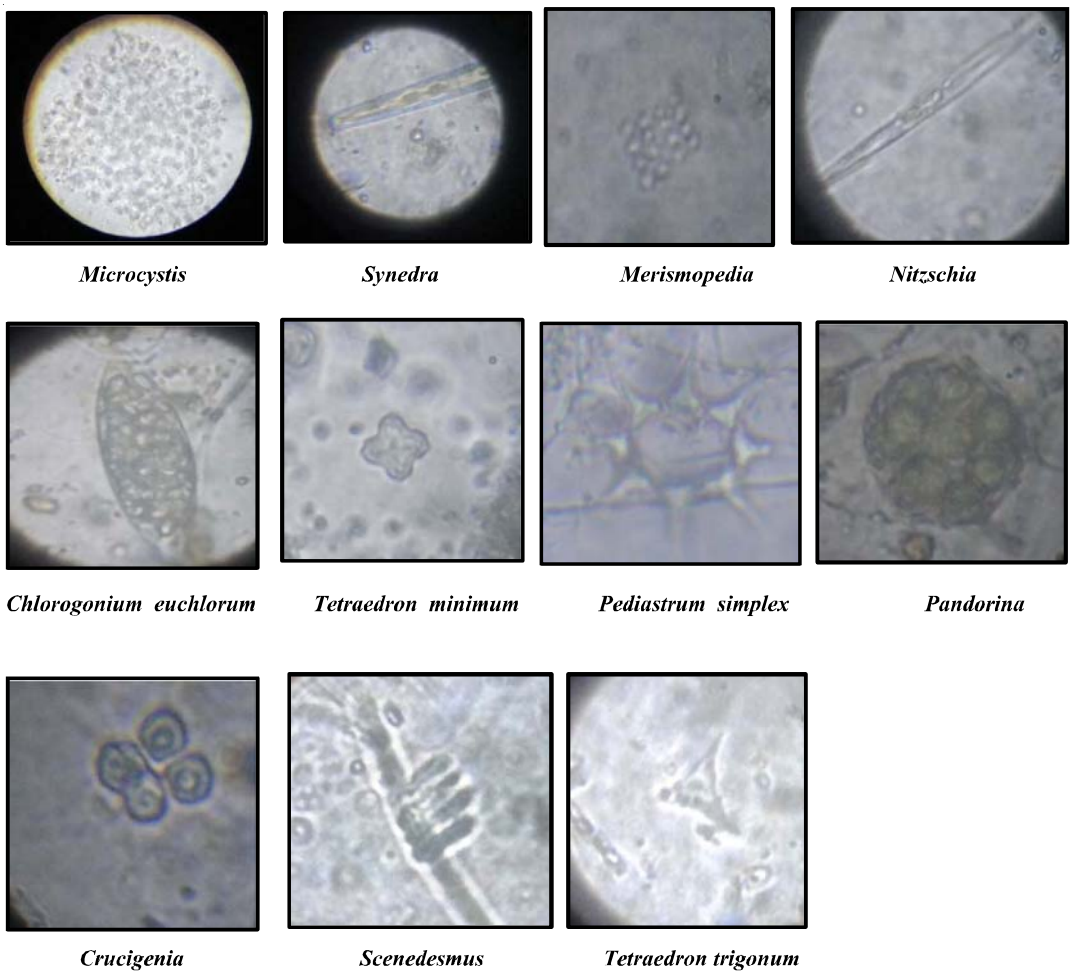


Fig.1 Division wise distribution of Phytoplankton

Images of Phytoplankton species



Conclusion:

The present study shows that anthropogenic activities have a profound impact on Lake ecosystem. A detailed study of limnological characters and phytoplanktonic activities in the lake should be carried out to get an elaborate estimate of the quality of the lake ecosystem.

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