OBSERVATIONS ON PHYTOPLANKTON DIVERSITY OF FRESH WATER PONDS AT NAVI MUMBAI, MAHARASHTRA

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Abstract: The present study is based on diversity of phytoplankton from four freshwater ponds at Navi Mumbai during summer season of 2014. These ponds showed presence of twenty five genera representing six algal groups. Chlorophyceae and Bacillariophyceae were recorded as the dominant groups. Nageshwar pond showed 80% contribution by Chlorophyceae members with marked bloom of *Chlorogonium sp*. Digha pond exhibited occurrence of twelve genera considered as tolerant species.

Key words – *phytoplankton, Navi Mumbai, Chlorogonium sp, pollution*

INTRODUCTION

Observations about phytoplankton community are important to understand the productivity potential and extent of pollution in urban ponds. This provides a simple way to study the dynamics of the biological community, competition and success of various algal members. In urban ponds, anthropogenic activities influence the phytoplankton community members and can alter the community composition. Four fresh water ponds in Navi Mumbai were selected for this study.

Study area - Navi Mumbai city (19°01′ N 73°01′ E) in Maharashtra is known for planned development. The city is dotted with more than twenty five fresh water ponds. These ponds are influenced by washing, bathing and sewage disposal up to certain extent. Cleaning and beautification programs are taken up for some of these water bodies. These ponds offer opportunity for recreation in the city and also support aquatic biodiversity. These are influenced by high evaporation rate during summer months and the water appears green indicating higher abundance of phytoplankton.

Nageshwar pond is located in Seawoods - Darave area. There is a temple present near the pond. The water always appeared green in colour indicating prominent presence of phytoplankton. Wadale pond in Old Panvel showed growth of aquatic macrophtytes. The pond supported population of local aquatic birds. Khandeshwar pond is located in Khanda Colony. This pond also has a temple and garden in the adjoining area. Dighe pond is located close to Thane Belapur road, showing heavy vehicular traffic. Disposal of religious refuse, dried flowers, washing and solid waste disposal were common for all these water bodies.

MATERIAL AND METHODS

Surface water samples for phytoplankton were collected from the ponds during periodic visits in summer season 2014. The samples were collected in early morning hours. Fixed volume of water sample was immediately fixed with Lugol's iodine solution and later 4% formaldehyde was used for long term preservation. The phytoplankton samples were concentrated and identified up to genera level using standard keys (Bellinger, 1992). Density count was done by Haemocytometer method (Trivedy and Goel, 1984). The diversity indices were calculated using Microsoft Excel (2010). ABC grouping was carried out based on cumulative percentage abundance of phytoplankton of each pond, to determine the most important species as members of Group A. Relatively less important species formed next group B and so on.

RESULT AND DISCUSSION

The temperature varied from 27^0C to 33^0C during the study period. During summer, the temperature increases causing higher evaporation and reduction in water at shallow ponds. This further leads to nutrient concentration creating favorable conditions for growth of phytoplankton. The few opportunistic algal members outnumber others in the available set of conditions. The abundance of phytoplankton and their dominance in summer is related to period of sunshine, nutrients and grazing pressure.

During this study, twenty five genera belonging to six groups of phytoplankton were recorded from the four fresh water ponds (Table 1). Highest phytoplankton abundance was recorded at Nageshwar pond whereas lower values were recorded at Khandeshwar pond. Digha pond showed coexistence of seventeen genera, highest diversity among the four ponds.

The phytoplankton community of Nagehshwar, Wadale and Digha ponds showed higher density of green algal members. Percentage contribution of Chlorophyceae was higher in Nageshwar pond (Fig.1) as compared to other ponds. Among green algae, *Chlorogonium sp* was recorded as dominant species in Nageshwar pond. Bamane *et al.,* (2013) reported presence of this genus from Upavan lake. Jafari and Gunale, (2005) recorded it in polluted stretch of Mutha river, Pune. This genus exhibited highest contribution, 53.48% among the phytoplankton community of this pond. Its significant position (group A) was reflected in the ABC curve for this pond (Fig.5). This genus was not recorded at other ponds.

Dominance of green algae was recorded by Sabita Kumari *et al.,* (2018) in Bangalore lakes and Raghavendra *et al.,* (2015) in Anchepalya Lake. However, it is interesting to note that the three ponds with dominance of green algae had varied dominance of specific genera. In Wadale pond, *Scendesmus sp* was recorded with higher abundance and constituting 52% of total phytoplankton abundance. This genus is pollution tolerant genera among fresh water phytoplankton (Palmer, 1969). Whereas, *Monoraphidium sp* was dominant in Digha pond. It contributed 31% of total phytoplankton. This genus was recorded at Nageshwar pond with 23% contribution. The prominent presence of the genus is reported from Navi Mumbai region (Vidhate and Somani, 2016). According to Hutchinson (1967), both these species are dominant organisms in eutrophic waters. The significant presence of this phytoplankton indicates higher trophic status of these ponds during summer season.

Diatoms showed higher percentage contribution in Khandeshwar pond (Fig.2). *Navicula sp* was prominent here with 26% contribution. Forming Group A on ABC curve. *Phacus* and *Scenedesmus* were next in terms of abundance in this pond, forming Group B on the curve (Fig.6). Diatoms were at lower density in Nageshwar and Wadale ponds, with *Surirella* as prominent genus.

In Wadale pond, *Scenedesmus* exhibited significant position as sole member of Group A on ABC curve followed by *Phacus, Surirella sp, pediastrum sp and Peridinium sp* formed B group on ABC curve of this pond (Fig.7). *Monoraphidium sp* in Dighe pond (Fig. 8) formed group A on ABC curve where as *Scenedesmus* and *Nitzschia* were placed in next group B.

Nageshwar and Khandeshwar pond showed higher similarity with respect to presence of phytoplankton reflected in Jaccard's index (0.41) and lowest similarity value in between Khandeshwar and Digha (0.29) (Table 2). Simpson index with reference to phytoplankton exhibited highest average value at Khandeshwar pond (0.86) whereas Shannon's diversity index was higher at Digha pond (2.34).
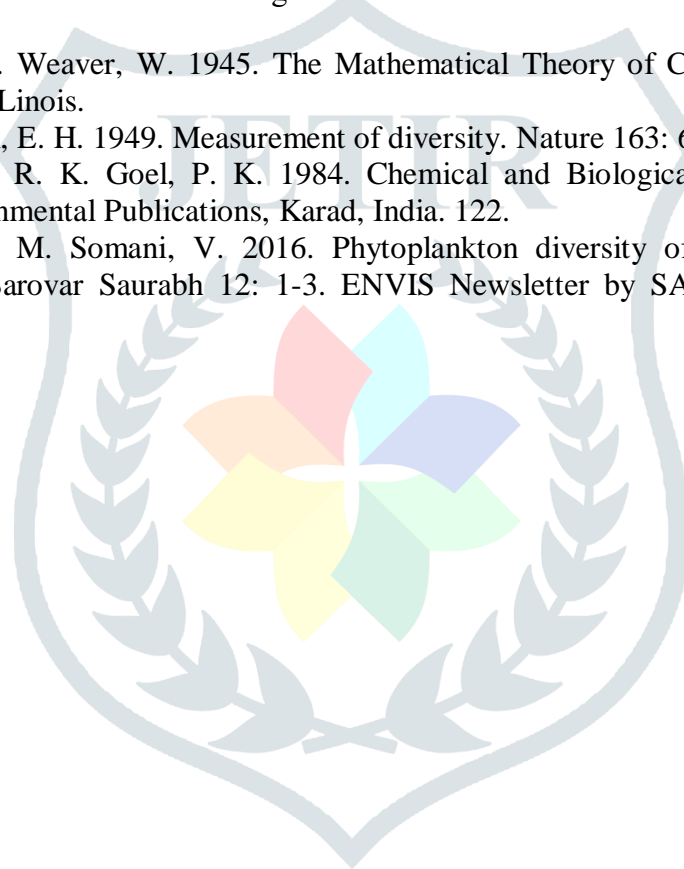
Among phytoplankton members, *Chlorogonium, Monoraphidium* and *Scenedesmus* were mainly responsible for blooms in these ponds. *Chlorogonium* bloom was recorded in Nageshwar pond. *Monoraphidium* bloom was recorded in two water bodies i.e. Nageshwar and Dighe pond. *Scenedesmus sp.* reached blooming densities in Wadale pond. Digha pond exhibited highest number of pollution tolerant genera. The algal blooms were probably associated with nutrient rich bottom and higher temperature. There is an urgent need of careful biological monitoring of these blooms especially at Nageshwar pond to plan conservation measures.

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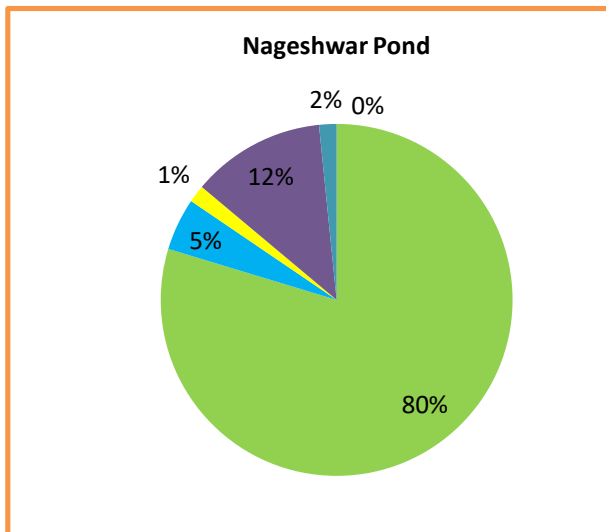
■ Chlorophyta (Green algae)   ■ Cyanophyta (Blue-green)   ■ Xanthophyta (Yellow-Green)
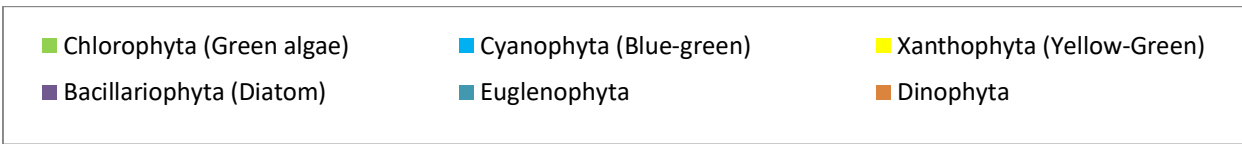■ Bacillariophyta (Diatom)   ■ Euglenophyta   ■ Dinophyta
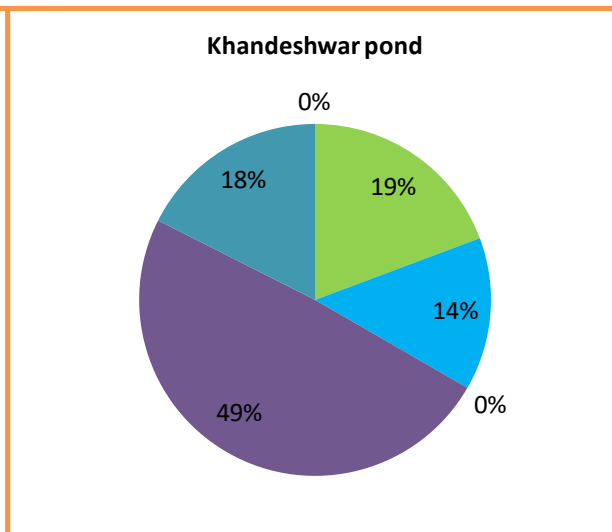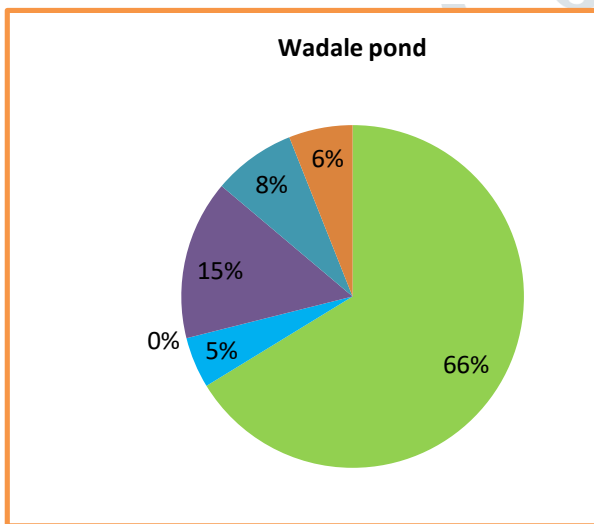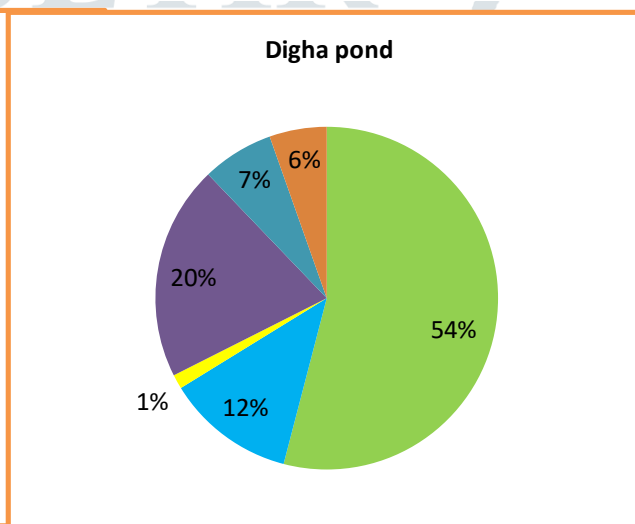

Fig. 1

Fig. 2

Fig. 3

Fig. 4

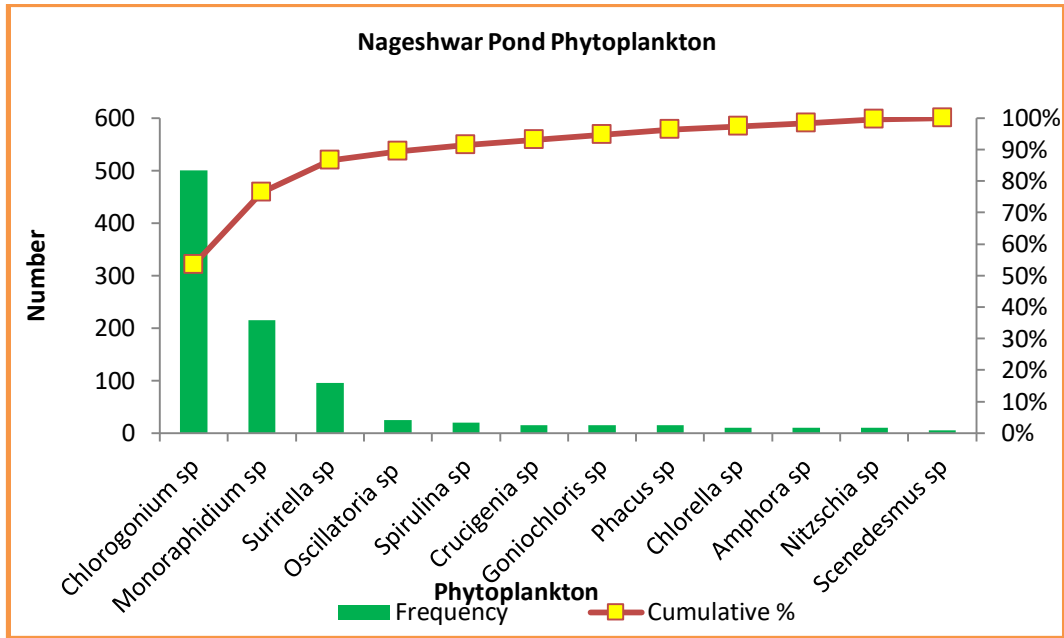Fig. 1 to Fig. 4 Phytoplankton distribution in Fresh water ponds at Navi Mumbai

Fig. 5
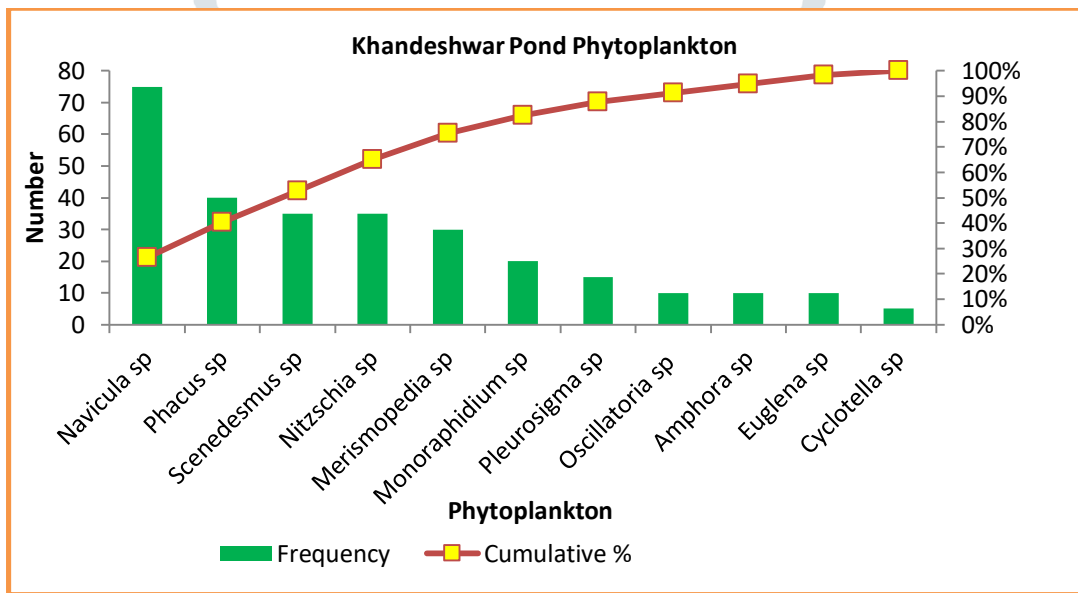

Fig. 6
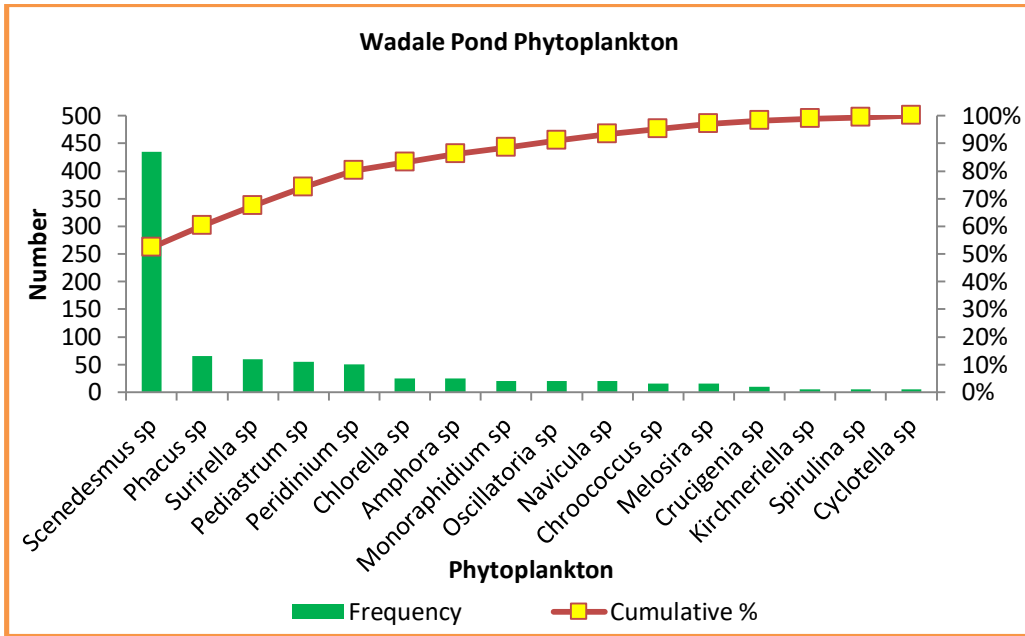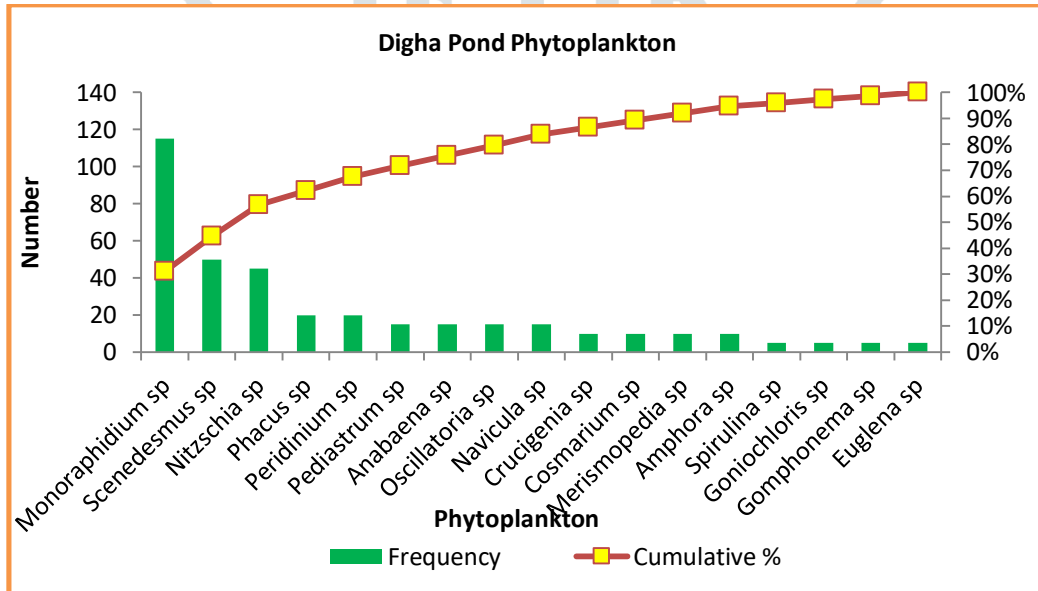
Fig. 7

Fig. 8

Fig. 5 to Fig. 8 ABC Curve of Phytoplankton

Table 1 - Average Phytoplankton Density = Unit x 10^3 / L

Sr. No	Name of the fresh water pond	Summer 2014 (February to May)			
		Nageshwar	Khandeshwar	Wadale	Digha
	Chlorophyta (Green algae)				
1	*Chlorogonium sp*	500	0	0	0
2	*Chlorella sp*	10	0	25	0
3	*Crucigenia sp*	15	0	10	10
4	*Kirchneriella sp*	0	0	5	0
5	*Monoraphidium sp*	215	20	20	115
6	*Pediastrum sp*	0	0	55	15
7	*Scenedesmus sp*	5	35	435	50
8	*Cosmarium sp*	0	0	0	10
	Cyanophyta (Blue-green)				
9	*Chroococcus sp*	0	0	15	0
10	*Merismopedia sp*	0	30	0	10
11	*Anabaena sp*	0	0	0	15
12	*Oscillatoria sp*	25	10	20	15
13	*Spirulina sp*	20	0	5	5
	Xanthophyta (Yellow-Green)				
14	*Goniochloris sp*	15	0	0	5
	Bacillariophyta (Diatom)				
15	*Cyclotella sp*	0	5	5	0
16	*Melosira sp*	0	0	15	0
17	*Amphora sp*	10	10	25	10
18	*Gomphonema sp*	0	0	0	5
19	*Navicula sp*	0	75	20	15
20	*Nitzschia sp*	10	35	0	45
21	*Pleurosigma sp*	0	15	0	0
22	*Surirella sp*	95	0	60	0
	Euglenophyta				
23	*Euglena sp*	0	10	0	5
24	*Phacus sp*	15	40	65	20
	Dinophyta				
25	*Peridinium sp*	0	0	50	20
	No. of pollution tolerant genera (Palmer, 1969)	9	7	11	12
	Simpson's index (Simpson, 1949)	0.64	0.86	0.70	0.85
	Shannon index (Shannon, 1945)	1.45	2.14	1.84	2.34

Table 2 - Similarity in phytoplankton community of the ponds

Jaccards index (Jaccard, 1908)	Value
Nageshwar and Khandeshwar	0.41
Wadale and Digha	0.37
Nageshwar and wadale	0.32
Nageshwar and Digha	0.31
Khandeshwar and Wadale	0.32
Khandeshwar and Digha	0.29

Image 1 - Location of Ponds