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Phytoplankton Community Dynamics as Bioindicator of Ecological condition in two urban ponds of Kalyan City, Thane, Maharashtra

Dr. Tushar Anant Pawar

Associate Professor
Department of Environmental Studies
MES Mahatma Night Degree College of Arts and Commerce, Chembur, Mumbai

Abstract

The current study uses Phytoplanton diversity to evaluate the water quality of Chinchpada and Vitthalwadi Ponds in Kalyan City.
Ponds and other reservoirs are examples of freshwater environments that have enormous potential for use as irrigation and drinking water supplies, as well as for fish farming and aquaculture. Sustainable use of these aquatic bodies is becoming more difficult, though, as these habitats are expanding across the entire nation in recent years. Such freshwater environments' ecological data is important for their preservation and long-term use for human welfare.
A considerable number of chlorophyceae members, such as closterium, cosmerium, and spirogyra, indicates that the water body is contaminated.Presence of *chlorophyceae* member like *closterium*, *cosmerium*, *spirogyra* in large number indicating these water bodies are polluted may be because of some anthropogenic activities, discharge of organic material from surrounded area.

Key Words: Ecology, Fresh water bodies, Phytoplankton, Biological indicator

1. Introduction

Environment is not just sector of our society or separate compartment of our existence but an integral part of everyday life. Hence in an urban environment, for orderly growth, a long-term plan, not only for industrial and agricultural development but also for the entire environment, utilization of water resources, transport, power and town planning for cities is of paramount importance.
While planning a city, the planner such as Town Planning Board, invariably keep aside certain areas for putting up parks. Parks are usually referred as lungs of the city. There are areas where people are live in crowded flats and work in equally crowded offices, can breathe in deep gulps of air and relax. Similarly, water bodies are the kidneys of an area or city. They are important as park, for number of reasons.
Water is a basic need of all living organism on the earth. Most of the water on this planet is stored in ocean and ice caps, which is difficult to recover for our diverse needs. Most of our demand for water is fulfilled by rain water, which gets deposited in surface an ground water resources. More than 73% of the

earth's surface is covered by water to an average depth of 3,800 m.In India, there are several large reservoirs exist besides large natural lakes and innumerable small tanks and ponds.

Phytoplankton contributes in different ways to aquatic ecosystem. Along with their contribution to the primary productivity, they strongly influence the air sea exchange of carbon dioxide and sulfur compounds, and the albedo of surface ocean water (Holligan, 1992). They play an important role in determining the material flux within the food chains from the euphotic zone to the deep sea (Longhurst, 1991).

Phytoplankton represents the first link in primary food chain from inorganic to organic substances. They are the major primary producers in the sea (Takahashi and Bienfang, 1983) besides seasweeds, sea grass and photosynthetic bacteria. This is due to their ability to synthesize their own food through the process of photosynthesis, wherein the available light energy is used to synthesize energy rich organic material from inorganic material in the presence of chlorophyll *a*. The rate of formation of energy-rich organic compounds from inorganic materials is termed as primary productivity. This in turn determines the actual productivity of the area.

Study Area:

The two ponds are selected for the present investigation. The first one is known as Chinchpada pond and second one is known as Vitthalwadi pond.

Chinchpada pond is situated in Kalyan, about one kilometer away from Kalyan station. This pond is large shallow water body almost spherical in shape. Diameter of this pond is 18 meter and area of pond is about 250 sq.mt. The water depth of this pond is 20 to 25 ft. the bottom of the pond is muddy mixed with clay and sand. This pond receives water through rain from the catchment areas during the monsoon months, also receive some residential sewage.

Vitthalwadi pond situated in Kalyan near Vitthalwadi station hence it is named as Vitthalwadi pond. This pond is nearby Vitthalwadi railway station and 1 kilometer away from Kalyan station. This pond is shallow water body almost rectangular in shape with area about 150 sq. mt. It is subjected to pollution due to discharge of domestic sewage.

By observing both ponds I felt that both ponds are highly polluted with organic pollutant. May be because of phytoplankton due to which water show green colour. From this I thought that to study the algal biodiversity & correlated algal biodiversity to represent pollution of freshwater body.

Plate:- 1 Chinchpada Pond

Plate:- 2 Vitthalwadi Pond

Material and Methods:

Phytoplankton samples were collected during winter season of the year 2023 using wide mouth container, 1000 ml sample was collected from the boundary of pond and was preserved for phytoplankton in different container. For immediate fixation, Lugol's Iodine solution made in formaline was used in the field and later 4% formaline was used for long term preservation.

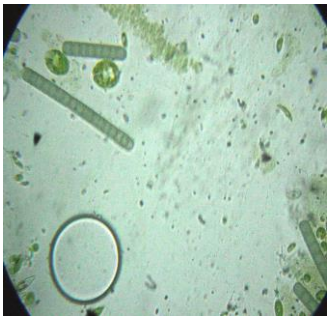
The phytoplankton was concentrated by allowing them to settle for 24 hours and then upper water was decanted by using rubber tube. The phytoplankton were identified by using the standard identification keys under compound microscope (Fritsch, 1946; Botes, 2001; Bellinger and Sigee (2010); Prescott, 1962).

RESULT AND DISCUSSION:

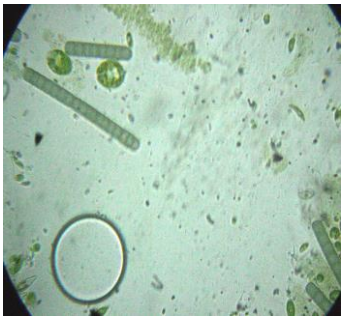
Table:-1 Phytoplankton of Chinchpada and Vitthalwadi Pond

Phytoplankton	Chinchpada pond	Vitthalwadi pond
Chlorophyta		
Closterium	+	+
Cosmerium	+	+
Oedogonium	+	--
Cladophora	+	--
Pithophora	+	--
Mougestia	+	--
Spirogyra	+	--
Chlorella	+	+
Pleurococcurs	+	--
Bacillariophyta		
Pinullaria viridis	+	+
Plurosigma spneeri	+	+
Navicula	+	+
Pennales	--	+
Cyanophyta		
Oscillatoria	+	+
Rivularia	+	--
Gloeocapsa decorticans	+	+
Scytonema	+	+

Plate No. :- 3 (Phytoplankton recorded in Chinchpada Pond)



Pennales sps.

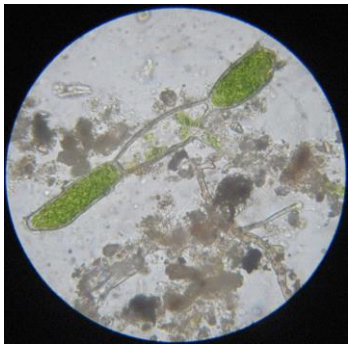


Cosmerium sps.

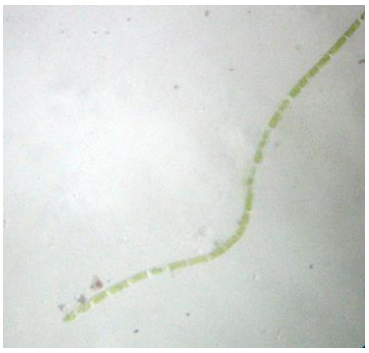
Oedogonium sps.

Closterium sps.

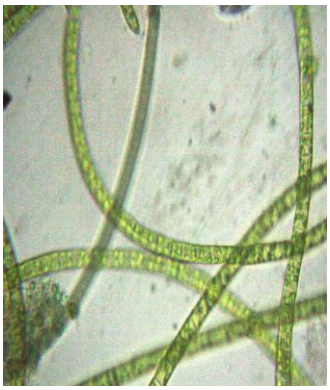
Cladophora sps.



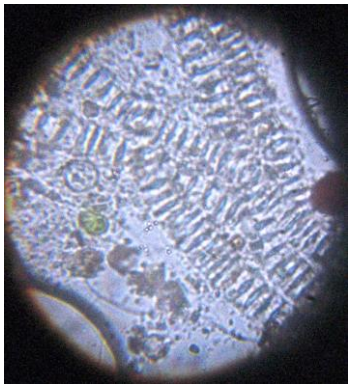
Pithophora sps.



Mougestia sps.



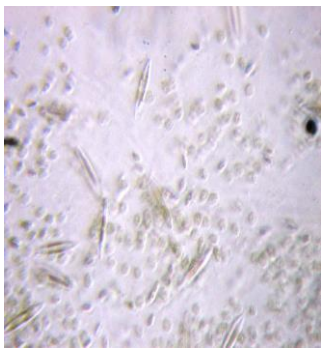
Spirogyra sps.



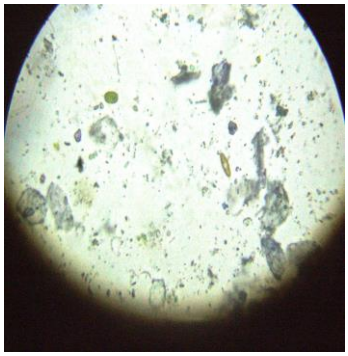
Chlorella sps.

Plerococcurs sps.

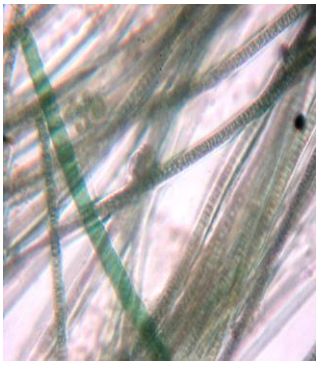
Pinullaria viridis sps.



Plurosigma spnceri sps.

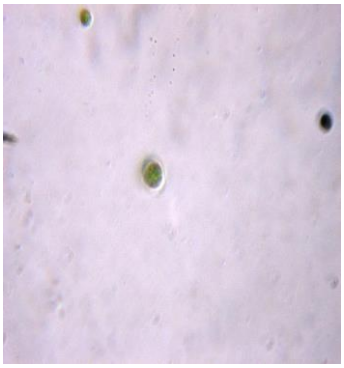


Nivicula sps.



Oscillatoria sps.

Rivularia sps.

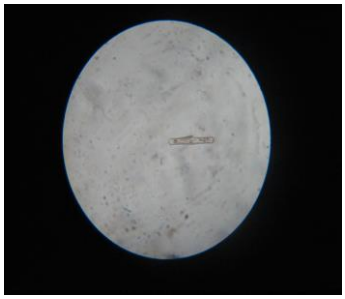


Gloecapsa decorticans sps.

Plate No. :- 4 (Phytoplankton Recorded in Vitthalwadi Pond)

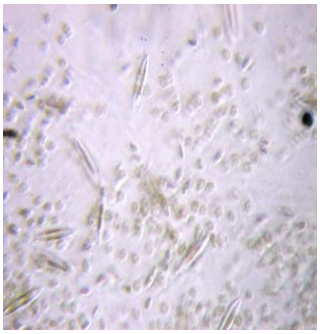
Spirogyra sps.

Pennales sps.



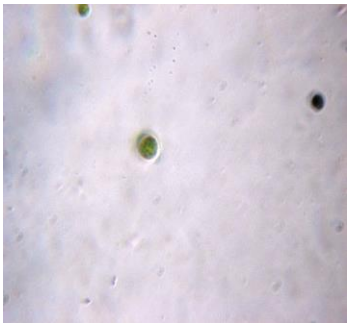
Pinullaria viridis sps.

Oscillatoria sps.



Plurosigma spnceri sps.

Pennales sps.



Gloeocapsa decorticans sps.

Navicula sps.

Cosmerium sps.

Chlorella sps.

In both the ponds nutrient level was may be high as per the overall observation of ponds however, in Vitthalwadi pond there were only few forms of algae present indicating low diversity.

This low diversity can be connected to the physico-chemical chataracters of the water. Similar result was reported earlier by Tiwari in 2004 (algae of lentic and lotic habitats of some temporary water bodies of Kanpur.

The presence of cyanophyceae member and the appearance of the pond water is suggestive of load of domestic sewage being dumped into the pond. Chlorella alga is well documented pollution tolerant forms with reported dominance in sewage contaminated water. High temperature, high organic mater and low dissolve oxygen influence the periodicity of cyanophyceae (Venkateshwarlu ,1970). Philipose (1960) opined that species of Navicula, oscillatoria, closterium, plurosigma and some volvocales occur abundantly in sewage fed water. The presence of these forms in these ponds avers his findings. It seems that alkalinity and nutrient favored the algal growth in this water body.

Conclusion

Living organism maintain a dynamic relationship between physical and biotic system. They exchange material and carry out delicately controlled manipulation within the environmental framework. Water is one of the most essential commodities which has exploited than any other resources for the sustenance of life. Modern civilization with its rapidly growing population had led to unaccelerated degradation of the freshwater resources.

Freshwater bodies are being increasingly used as natural dustbin for the discharge of all sort of agricultural and industrial wastes. Such unwise exploitation disturbs the natural harmony of aquatic ecosystem.

Considering the present problem the present investigation had been undertaken. These ponds are infested with vegetation only on littoral zone and are filled with rain water during monsoon. Both ponds have their adjoining area crowded with residential buildings and chawls, therefore highly polluted.

Moreover, within a distance of 100 meter behind the concrete buildings are agricultural fields. The pond is subjected to pollution due to discharge of domestic sewage and by the defection of local people. The sewage passing through the residential area is discharged into the pond by large open drains.

From the results obtained during the investigations it can be concluded that

- ✓ Presence of *chlorophyceae* member like *closterium, cosmerium, spirogyra* in large number indicate the water body to be polluted. As they are pollution tolerant genera.
- ✓ Similarly, the presence of *Basillariophyceae* members like *pinullaria, navicula* and the *cyanophyceae* member namely *oscillatoria* are adopted to polluted water. They are indicator of pollution.

Thus, from above data it can be concluded that both the fresh water bodies studied. Chinchpada pond and Vitthalwadi pond are polluted, but when compared it is the vitthalwadi pond heavily polluted.

Though it is too early to confirm our findings and it requires further studies on following aspects

- Seasonal variations
- Algal population studies
- Nygard index
- Zooplankton studies
- Few elements and heavy metal estimation

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