Phytoplankton enumeration with respect to water parameters of Kurul lake-Alibagh, dist. Raigad, Maharashtra.

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Abstract: The growth of phytoplankton is governed by many environmental factors like sunlight, chlorides, phosphates and nitrate content, etc. The present study deals with the investigation of phytoplankton population at Kurul Lake with respect to physicochemical parameters. The water sample was collected in all the three seasons and analysed for various limnological parameters. Phytoplankton analysis was done by Sedgwick Rafter Counting Cell and number of phytoplankton per liter was estimated.

Present study reveals high density of phytoplankton during monsoon season with increasing concentration of nitrate. pH of the water was found to be about neutral but phosphates were always present beyond the permissible limit. Though total solids were higher during monsoon, maximum phytoplankton density was observed. It necessitates studying the diversity of phytoplankton to identify the phytoplankton species as a bio-indicator.

Key words: Physicochemical parameters, Sedgwick Rafter Counting, Seasonal variation.

Introduction:

Lake water study is extremely important to interpret the fresh water ecosystem. Alibaug is a small town in Raigad district of Maharashtra undergoing tremendous urbanization. The ecosystem in and around is undergoing rapid changes. Peculiarity of Alibaug and nearby villages is the temples and lakes next to it. The present study is carried out in Kurul lake (18° 41' 38.42" N and 72° 57' 19.83" E) located in Raigad District of Maharashtra situated at a distance of about 100 kms from Mumbai. The lake also called as Lotus Point Lake is divided into two parts by a mud barrier of approximately 3 m width. There is a temple near the eastern end of the lake which justifies the human interference in the lake ecosystem as it is used for holistic purposes. The western part of the lake has undergone complete eutrophication and is completely covered by *Eichornia* spp.

The eastern end has however been cleaned and is partially covered with *Lotus* and *Hydrilla* spp. The water in this western end is used for washing linen, bathing and cleaning cattle.

Washing activities tend to release large amount of organic matter and macronutrients like phosphorus in the aquifer (CEEP). The release of these nutrients and organic matter facilitate the growth of algae and phytoplankton in presence of ample sunlight (Kauppila, 2007). Phytoplankton are microscopic organisms that play a crucial role in the food chain as they are a source of carbon (Kathi et *al*). Phytoplankton help maintain a healthy food chain in the aquatic ecosystem however they may create an imbalance if they exceed in number and some phytoplankton have a toxic effect as well (ref). However, phytoplankton serve as good pollution indicators (Kauppila, 2007) and should be monitored to assess the levels of pollution in the aquifer.

Phytoplanktons are not only important as a basic link of food chain but also ecologically significant as pollution indicators helping assessing environmental condition of the ecosystem (Dalal *et.al,* 2012).

Materials And Methods:

The study was carried out from November 2012 to October 2013. 1000ml of surface water sample was collected on a monthly basis separately in glass jars from Kurul Lake for studying the seasonal variations in physicochemical parameters of water and diversity of phytoplankton. The collected sample was analyzed immediately for physicochemical parameters on a portable bench photometer for Environmental Testing - Hanna HI 83206 instruments.

For preservation of phytoplankton the sample water was instantly fixed using 4% formaldehyde in Lugol's Iodine solution. The sample was left undisturbed for 24 hours to allow the settling of phytoplankton and then the settled part of the solution was transferred in other capped glass jar.

The subsample was then observed under high power microscope, quantitative analysis of phytoplankton species was done by Sedgwick Rafter Counting Cell. The number of phyto-planktons per liter was estimated.

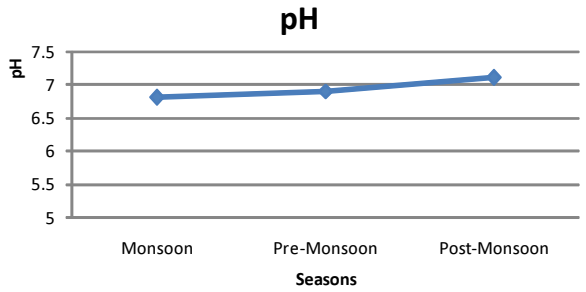
Results And Discussion:

Table1. Seasonal Variation in Water Parameters of Kurul Lake

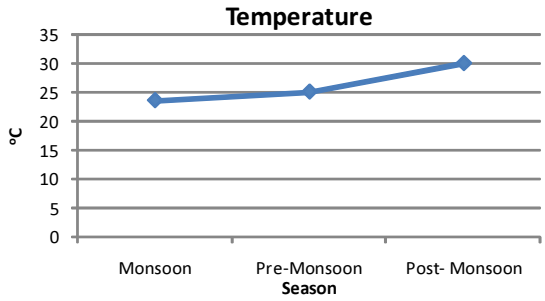
Seasons	Post-Monsoon	Pre-Monsoon	Monsoon
Parameters			
pH	7.1	6.9	6.8
Temperature ° C	30	25	23.5
D.O. (mg/l)	3.25	1.6	5.8
Chlorides (mg/l)	20.2	59.55	19.88
Phosphates (mg/l)	1.3	2.15	1.65
Nitrates (mg/l)	6.2	4.2	8.6
Nitrites (mg/l)	0.1	0.8	0.2
Ammonia (mg/l)	0.385	3	1.3
Total Solids (mg/l)	380	160	385
LP (cms)	52	63	42
Phtyoplankton Density (ind/l)	4,49,000	5,16,267	7,26,000

The limnological characters of the water body are mentioned in Table 1. The water quality was monitored on a monthly basis and pooled season wise. The pooled data was then interpreted for results and discussions.

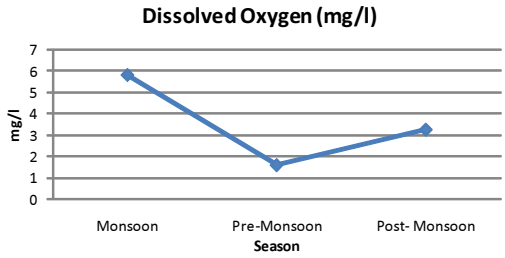
pH: The pH of an ideal fresh water ecosystem should be in the range of 6.5 for the sustenance of life (Muralidhar *et al*). The pH of the water body under study was in the range 6.8 to 7.1. In the present investigation the pH of the water body was near neutral throughout the study period. The highest pH was recorded during the post monsoon period while slight change in pH is due to the increased photosynthetic activity of the planktons and aquatic plants (Bhandarkar *et al,* 2013).



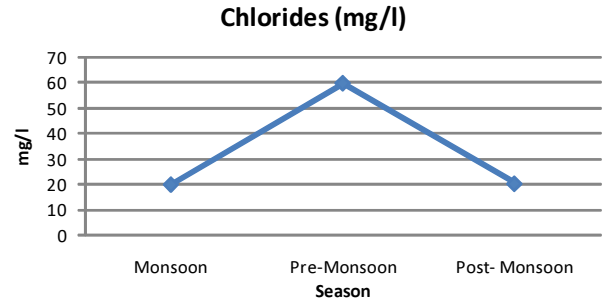
Temperature: The temperature variation was between 23.5 to 30°C with the highest temperature in the post-monsoon period and minimum in the monsoon season. The temperatures increased during the post monsoon period owing to increased atmospheric temperatures in the post monsoon month of October.



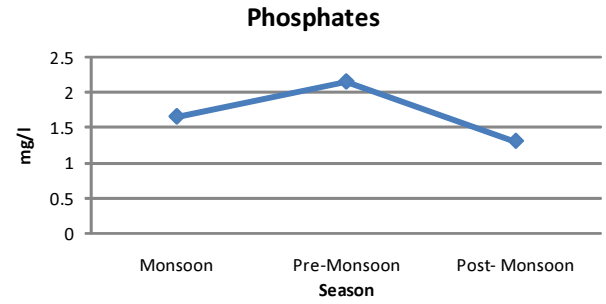
Dissolved Oxygen: The dissolved oxygen levels were in the range of 1.6 to 5.8 mg/l. The maximum dissolved oxygen levels were observed during monsoon owing to the maximum turbulence in the water caused by precipitation as rainfall. The oxygen levels in water required to sustain life is 3.0 mg/l as per WHO standards. Accordingly the oxygen levels in water were reduced below this limit only during the pre-monsoon period due to the reduced exchange of gases (Verma and Singh, 2010).



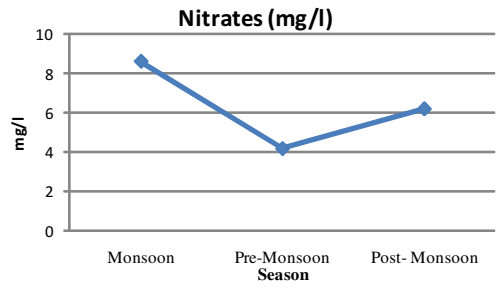
Chlorides: The chlorides ranged from 59.6 to 19.88 mg/l with the highest concentration in post monsoon period and the minimum was seen during the monsoon period owing to the constant dilution by rainwater. The concentration of chlorides was always under the permissible limit of 250 mg/l.



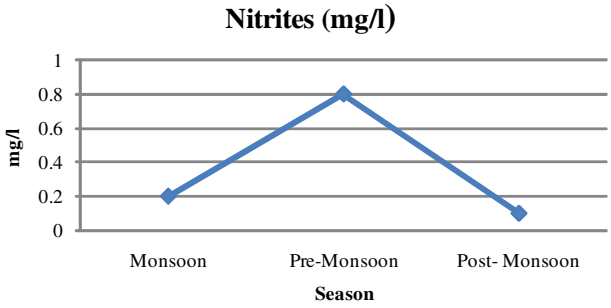
Phosphates: Phosphates were in the range of 1.4 to 2.15 mg/l. Maximum concentration of phosphates was seen during the pre- monsoon periods when the evaporation rates are high causing saturation of salts in the water body. The levels of phosphates were always above the permissible limits of 0.1 mg/l (WHO) for drinking water however, the phosphate levels were below the permissible limit if 5mg/l as per the Pollution Discharge Standards.



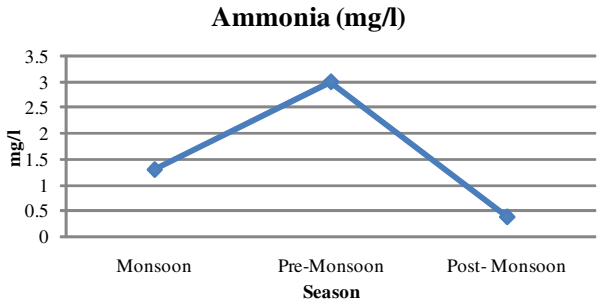
Nitrates: The nitrates were in the range of 2.5 to 8.6 mg/l. The levels of nitrates were high during monsoon. The nitrate levels were however within the permissible levels of 50 mg/l as prescribed by ISO and WHO. The high levels of nitrates during the monsoon due to the wastes of the animals washed in the pond and surface run off from the nearby areas



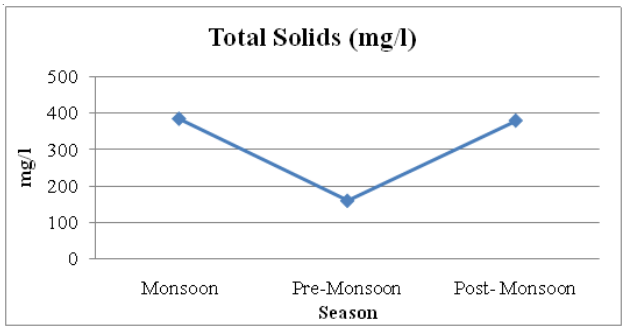
Nitrites: The nitrite levels during the study period were in the range of 0.2 to 0.8 mg/l. The nitrites levels were fluctuating around the permissible limits of 0.3 mg/l (USEPA). But the mean values were above the permissible limit of 0.3 mg/l. Highest concentration of nitrites were seen during the pre-monsoon period due to the concentration of salts by increased levels of evaporation. Also, as the lake is used for holistic purposes; organic matter is emitted into it.



Ammonia: The ammonia levels were in the range of 0.3 to 3 mg/l. The maximum concentration of ammonia was seen during pre-monsoon period when the evaporation rate is high and ammonia exceeded the permissible limit of 1.5mg/l (WHO). The levels of ammonia were below the permissible limit during monsoon and post monsoon periods.

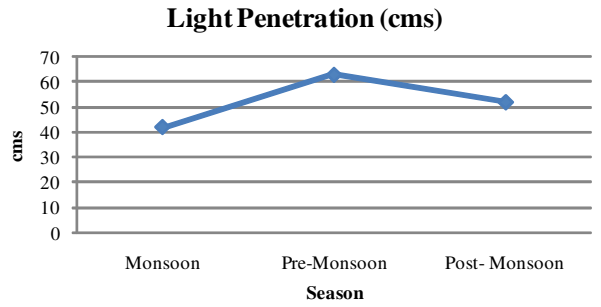


Total Solids: The total solids in the water varied from 160 mg/l to 385 mg/l. The maximum levels of total solids were seen during the monsoon due to the extreme turbulence caused by the rainfall and also due to the flow of sediments with the rain water.

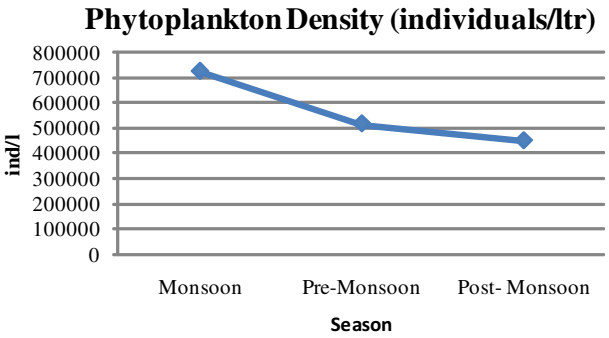


ISBN : 978-81-923628-1-6

Light Penetration: The light penetration varied with the seasons from 42 cm to 63 cm and maximum light penetration was seen during the pre monsoon period owing to the reduced presence of total solids in the water. Also, the light penetration was low during monsoon owing to the high total solid content.



Biological Analysis: The phytoplankton enumeration showed results ranging from 4, 49,000 to 7,26,000 ind/l. The maximum density of phytoplankton was seen during the monsoon period due to the animal wastes liberated in to the waters. These animal wastes and anthropogenic activities like holistic rituals and offerings, etc carried out on the periphery of the lake result in release of nitrates in the lake water. Nitrates being a macro-nutrient help in increasing the population density of the phytoplankton. The post-monsoon season showed minimal phytoplankton density as the lake water was completely covered by *Lotus* and *Eichornia* spp. Phytoplankton require stable water for propagation and require sunlight to flourish but *Lotus* and *Eichornia* spp. block sunlight thereby reducing phytoplankton growth. The number of phytoplankton was found to be higher during pre-monsoon period than post monsoon as availability of sunlight was maximum.



Conclusion:

The analysis indicated that the water though not extremely polluted shows impact of anthropogenic interference in the lake ecosystem which is further indicated by presence of highest amount of nitrates during the monsoon season when the water should be most diluted. Also, in depth analysis of the phytoplankton diversity needs to be carried out to identify bio-indicator phytoplankton if any.

Acknowledgement:

Authors are grateful to Principal Dr. Mrs. M. K. Pejaver for her constant support and encouragement. We also wish to thank Dr. Nirmalkumar Kurve for the help and support whenever needed. We are thankful to Dr Ketan Thatte and colleagues for their valuable suggestions during the study.

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