International Association of Biologicals and computational Digest
iABCD|Vol 1|Issue 2|Dec 2016|69-79|

SEASONAL VARIATION AND QUANTITATIVE ANALYSIS OF PHYTOPLANKTON IN CHANDOLA LAKE, AHMEDABAD

Qureshimatva Umerfaruq M.[1], Maurya Rupesh R.[1], Gamit Sandip B. [1] Mamta K. Joshi[1] and Solanki Hitesh A.[2]

[1] Research Scholar , Department of Botany, University School of Sciences, Gujarat University, Ahmedabad-380 009.
[2] Professor, Department of Botany, University School of Sciences, Gujarat University, Ahmedabad-380 009.

Email ID: ufmqureshi@yahoo.in and husolanki@yahoo.com

ABSTRACT

The quantitative study of phytoplankton in Chandola Lake was studied during September 2013 to August 2014 by analysing samples taken each month from 9 sampling stations. Identified 29 species of the phytoplankton in 4 classes are as follows: Chlorophyceae 13 species, Bacillariophyceae 10 species, Cyanophyceae 5 species and Euglinophyceae only 1 species. Cyanophyceae was dominant during monsoon season and summer season which revile the presence of organic pollutants in the lake.

Key-words: phytoplankton, freshwater, Chandola lake, seasonal variation

Submitted Date
27 July 2016

Accepted Date
23 September 2016

Published Date
24 Decemberr 2016

INTRODUCTION

About four thousand million years ago, life initiated in an aquatic environment. Today, most of the taxonomic phyla dwell in an aquatic environment. In an aquatic environment, phytoplankton is most ubiquitous, unicellular and microscopic life form (Giripunje *et al*, 2013). Phytoplankton forms the vital source of energy as primary producers and serves as a direct source of food to the other aquatic plants and animals (Senthilkumar and Sivakumar, 2008).

Today, Indian freshwater lakes are facing tremendous ecological stress due to raising of pollution from rapid industrialization (Cecilia, 2011). Phytoplankton communities are sensitive to changes in their environment and therefore phytoplankton total biomass and many phytoplankton species are used as indicators of water quality (Qureshimatva *et al*, 2015a). However, mainly seasonal changes regulated pattern of phytoplankton growth. Phytoplankton can provide valuable insights into water quality, indicating concerns such as pollution of waterways, reduction in water flow, or a health and safety risk, as some algal species are highly toxic to humans and livestock (Qureshimatva *et al*, 2015b). The most important step to prevent degradation of lake ecosystems is to maintain its biological integrity and health (Prajapati *et al*, 2014).

MATERIALS AND METHODS

Study area:

Chandola Lake is the largest artificial lake in Ahmedabad surrounded by many industries and slums. It is divided into 2 half that are Mota chandola at Danilimda and Nano Chandola at Isanpur. The Nano chandola is surrounded by slums and the waste released in the lake whereas Mota chandola is surrounded by industrial area which are most of chemical industries, oil industries, textile industries, etc. which release all effluents in the lake. Fishing is also take place in the Chandola Lake.

Location: located near Dani Limda Road, Ahmedabad, Gujarat.

Latitude: $22^0$59’03.33” N

Longitude: 72035’24.19” E.

Area covered: 6, 18,100 m^2

Maintained by: Ahmedabad Municipal Corporation, Govt. of Gujarat (Qureshimatva *et. al*., 2016).

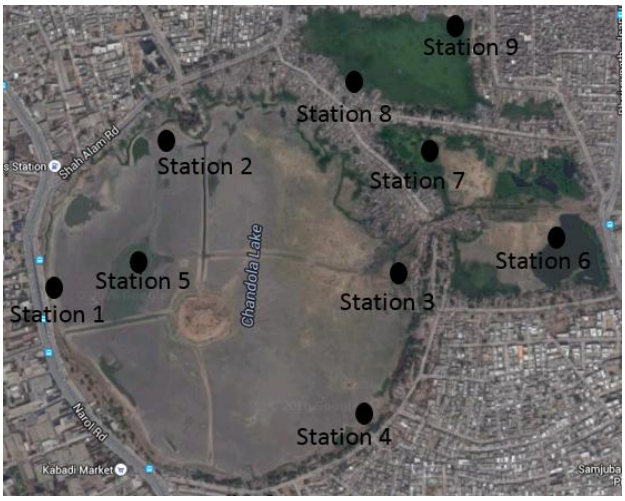


Figure 1: Map of Chandola Lake showing stations for collected samples (Source: google map)

Methods for collecting and identification of algae:

Microscopic floating algae (the phytoplankton) can be collected with a mesh net (e.g. with 25-30 µm pores) or, if in sufficient quantity (i.e. colouring the water), by simply scooping a jar through the water. 1 L of water was taken in polythene bottles and filtered through the net and concentrated in a 100 ml bottle. Samples were as close to the water surface as possible in the morning hours and preserved for further analysis.

Labelling:

The samples were labelled with date, time of sampling and volume measured and pasted on polyethylene bottles

Preservation of the sample:

For a phytoplankton sample to be analysed for an extended period, 4% Formaldehyde preservatives is used.

Quantitative analysis of Phytoplankton:

Detailed analyses of phytoplankton population are done by estimating the number in each species. The phytoplankton consisting individual cells, filaments and colonies are counted as individual cells. When colonies of species are counted, average number of cell per colony is counted, and in filamentous algae, the average length of the filament has to be determined. For this analysis Sedgwick Rafter Counting cell was used, it has approximately 50 mm long, 20 mm wide and 1mm deep. The total volume of the cell is 1 ml.

$$\text{Formula (n)} = \frac{(a \times 1000)\, c}{1}$$

Where,

n = Number of Plankton/ liter of water

a = Average no of plankton in one small counting chamber of S-R cell.

C = ml of plankton concentrate.

1 = Volume of original water filtered in liter (Verma *et al*, 2014).

Phytoplankton identification:

From the concentrated sample, the slides for the plankton were prepared. Then these slides were placed under microscope and the phytoplankton was observed in 100 X in binocular microscope. The images of the phytoplankton were captured by using digital camera. Further, the phytoplankton is identified by using the books 'The Fresh Water Alage' by Priscott; Fresh Water Diatoms of Maharashtra by Sarode and Kamat (1984) and 'Marine & Freshwater Plankton by Davis (1966).

RESULT AND DISCUSSION

Quantitative analysis of phytoplankton was done monthly and counted the number of planktons in 1 ml concentrated sample. The Quantitative analysis of phytoplankton populations is summarized in Table 1. In the present study, the abundance of phytoplankton was highest during the post-monsoon period, which could be attributed to more stable hydrographical conditions prevailing during summer months. The abundance of phytoplankton was lowered during the

winter months when the water column was remarkably stratified to a large extent because of decreased temperature and pH (Qureshimatva *et al*, 2016).

In the present study 24 genera and 29 species were reported which belong to class Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae. The highest number of species found in the class Chlorophyceae 11 genera and 13 species followed by Bacillariophyceae 8 genera and 10 species, Cyanophyceae 4 genera and 5 species and Euglinophyceae only 1 species were reported Table 1.

In class Cyanophyceae was dominant in the post-monsoon season as well as in summer season, while during winter Chlorophyceae was dominate in the lake (Figure 1). In Cyanophyceae *Spirulina* sp. was the dominant species found in the lake during post-monsoon season which form the bloom in the lake. *Spirullina* is growing in the high level of pH which enhances the growth of other plankton in the Lake. In summer the absence of blue green algae is an indication of clean water in Chandola Lake. Chandola Lake has large drainage and receives domestic sewage effluents the most conducive to luxuriant growth of phytoplankton. Blue green algae mainly contribute the nuisance blooms.

The algal unit of Cyanophyceae class recorded for Chandlodia Lake ranges from 34 to 106 ml/L the maximum numbers of Cyanophyceae found during monsoon and minimum in summer. Class Chlorophyceae ranges between 29 to 41 ml/L, the maximum number of chlorophyceae found during the winter season and minimum in summer. *Spirogyra rivularis* was the dominat species in the class Chlorophyceae. Bacillariophyceae ranges from 19 to 34 ml/L and Euglinophyceae 2 to 5 ml/L (Table 1). In class Bacillariophyceae *Nitzschia amphibian* was dominate species found throughout the year. *Pinnularia* sp. of Bacillariophycea was the rare species in Chandola Lake. Euglinophyceae only one species *Euglena acus* found throughout the year.

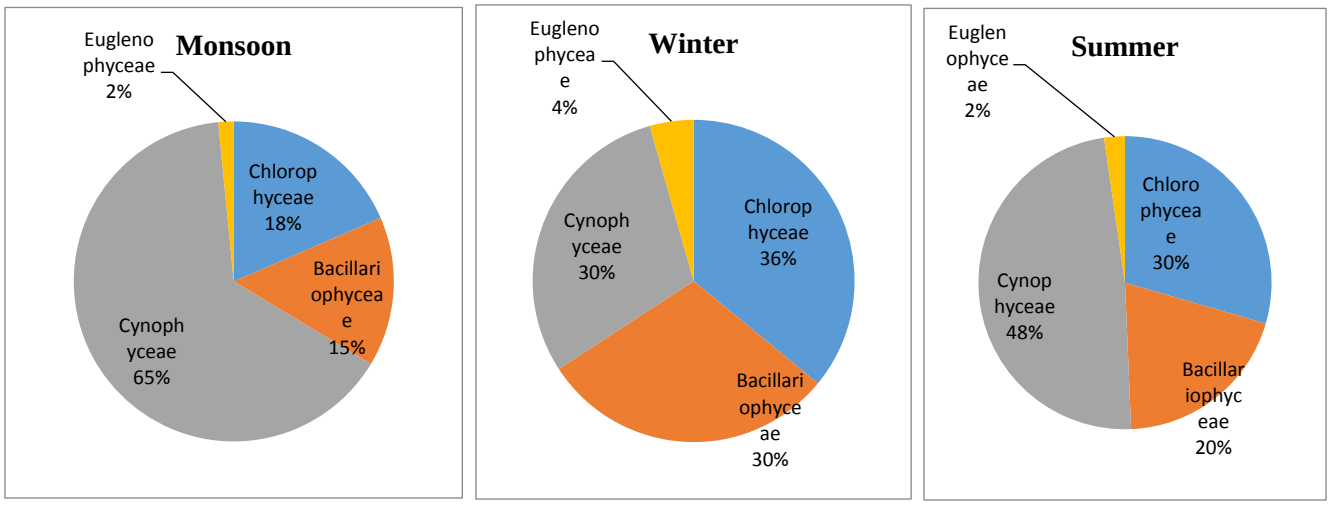
Table 1: Monthly variation and Quantitative analysis of freshwater algae in Chandola Lake (2013-14).

Monthly variation and Quantitative analysis of freshwater algae in Chandola Lake														
Sr. no	**Class**	**Botanical Name**	**Total No. of phytoplankton in 1 ml concentrated sample**											
			Sept	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**
1	CHLOROPHYCEAE	*Scenedesmus sp.*	0	0	0	0	6	0	0	3	1	0	0	0
2		*Scenedesmus quadricauda*	7	9	3	7	4	2	2	1	3	1	7	5
3		*Scenedesmus dimorphus*	2	8	8	3	0	4	2	7	2	2	1	1
4		*Actinastrum hatzschii.*	0	0	0	0	0	2	0	0	0	0	0	0
5		*Chlamydomonas sp.*	3	2	4	2	2	1	1	1	2	2	1	1
6		*Closterium sp.*	3	7	2	2	4	4	0	0	0	1	2	1
7		*Cosmerium sp.*	16	7	6	2	7	0	0	0	1	0	1	6
8		*Ulothrix sp.*	0	1	0	3	0	0	0	0	0	0	0	0
9		*Pediastrum duplex*	3	6	5	0	0	2	0	1	1	7	2	1
10		*Spirogyra rivularis*	14	20	3	8	11	8	17	19	28	13	7	7
11		*Spirogyra sp.*	0	0	0	2	1	0	0	0	0	0	0	0
12		*Eudorina sp.*	2	3	1	2	1	1	0	0	3	0	2	0
13		*Eustrum sp.*	0	0	1	1	0	0	0	0	0	0	0	0
		Total	**50**	**63**	**33**	**32**	**36**	**24**	**22**	**32**	**41**	**26**	**23**	**22**
14	BACILLARIOPHYCEAE	*Amphora sp.*	2	4	4	1	1	1	3	0	1	0	2	3
15		*Cymbella sp.*	3	2	2	4	1	1	0	0	1	1	2	3
16		*Fragillaria intermedia*	1	5	5	3	2	1	0	2	2	1	1	1
17		*Navicula sp.*	5	4	2	1	2	1	1	2	0	1	3	3

18		*Navicula subsolitaria*	1	0	0	1	2	2	1	2	1	2	2	2
19		*Nitzschia amphibian*	9	15	6	7	5	17	3	2	1	4	4	5
20		*Nitzschia sp.*	2	3	1	1	1	2	2	2	1	2	2	3
21		*Pinnularia sp.*	0	2	2	0	2	0	0	0	0	0	1	0
22		*Pleurosigma angulatum*	8	6	4	2	2	3	4	3	7	2	2	6
23		*Synedra sp.*	5	9	9	6	7	2	3	2	2	2	1	2
		Total	**36**	**50**	**35**	**26**	**25**	**30**	**17**	**15**	**16**	**15**	**20**	**28**
24	CYNOPHYCEAE	*Anabaena sp.*	2	4	3	1	4	1	1	0	0	1	1	1
25		*Microcystis aeruginosa*	12	13	24	30	20	14	7	42	35	31	41	0
26		*Oscillatoria sancta*	5	4	2	4	2	1	1	1	1	1	2	2
27		*Oscillatoria sp.*	0	0	3	0	0	0	0	1	0	0	0	0
28		*Spirulina sp.*	203	340	40	48	36	44	15	12	14	9	40	73
		Total	**222**	**361**	**72**	**83**	**62**	**60**	**24**	**56**	**50**	**42**	**84**	**76**
29	EUGLENOPHYCEAE	*Euglena acus*	2	4	4	6	6	0	2	5	2	3	3	2
		Total	**2**	**4**	**4**	**6**	**6**	**0**	**2**	**5**	**2**	**3**	**3**	**2**

Note: No. of colonies was taken for counting *Microcystis*.

Figure 1: Graphical dominance of phytoplankton class during different seasons in Chandola Lake.



CONCLUSION

The present study shows that the class Cyanophyceae was dominant during monsoon season and summer season which revile the presence of organic pollutants in the lake. *Spirulina sp.* was found dominate in the lake during monsoon seasons which indicate high level of pollutants are present. The domestic wastage and industrialization around the lake are the major resources of pollutants. To sustain the ecosystem of Chandola lake, certain measures and planning must be undertaken by the civic body (AMC: Ahmedabad Municipal Corporation) to combat the pollution rate in the lake.

ACKNOWLEDGEMENT

This research was supported by University Grant Commission under Maulana Azad National Fellowship scheme.

REFERENCES

Cecilia M (2011) Phytoplankton community and their impact on water quality: An analysis of Hollingsworth Lake, UK Journal of Applied Sciences and Environmental Management, 15(2): 347 – 350.

Davis, CC (1955) The marine and freshwater plankton. Michigan State University Press.

Giripunje MD, Fulke AB, Khairnar K, Meshram PU, Paunikar WN (2013) A review of phytoplankton ecology in freshwater lakes of India Lakes, reservoirs and ponds, 7(2): 127-141.

Prajapati SRS, Jadhav AS and Usha A (2014) Study of phytoplankton biodiversity in Panvel Lakes (Vishrale, Krishnale and Dewale Lake) At Dist. – Raigad (Maharashtra) India International Journal of Research in Applied, Natural and Social Sciences 2(7): 113-120.

Prescott, GW (1954) How to know freshwater algae. Dubuque Brown Co, Lowa.

Qureshimatva UM, Gamit SB, Maurya RR and Solanki HA (2015) Quantitative analysis and periodicity of phytoplankton from Chnadlodia lake, Ahmedabad, Gujarat, India Life Sciences Leaflets 2(65): 72-79.

Qureshimatva UM, Gamit SB, Maurya RR and Solanki HA (2015) Seasonal variation of Phytoplankton in Bibi Lake, Ahmedabad, Gujarat, India International Journal of Innovative Research in Science, Engineering and Technology 4(10) 10245-10251.

Qureshimatva UM, Gamit SB, Maurya RR, Patel RD and Solanki HA (2016) Correlation of various physico-chemical parameters and water quality index (WQI) of Chandola Lake, Ahmedabad, Gujarat, India International Research Journal of Chemistry (10) 1-12.

Sarode PT and Kamat ND (1984) Freshwater diatoms of Maharashtra Saikripa Prakashan.

Senthilkumar R and Sivakumar K (2008) Studies on phytoplankton diversity in response to abiotic factors in Veeranam lake in the Cuddalore district of Tamil Nadu, Journal of Environmental Biology 29(5) 747-752.

Verma PU, Gupta UC, Adiyecha RP and Solanki HA (2014) Seasonal variation in the phytoplankton biodiversity of Chandlodia Lake International Journal of Innovative Research in Science, Engineering and Technology (84): 66-71.