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SEASONAL VARIATION IN THE PHYTOPLANKTON BIODIVERSITY OF CHANDLODIA LAKE

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Abstract: Extensive and rapid growth of planktonic algae, caused by an increased input of nutrients is a common problem in lakes. Eutrophication and excessive algal growth reduces water clarity, inhibits growth of aquatic plants, extensive oxygen depletion, accumulation of unsightly, decaying of organic matter, unpleasant odours, and killing of fishes. Chandlodia lake is also facing the similar problem. The study of phytoplankton biodiversity in Chandlodia lake was carried out seasonally during March 2012 to February 2013. The phytoplanktons were collected and were identified by using Sedgwick Rafter counting cell. In Chandlodia lake the phytoplankton's recorded with huge amount were *Cylinderospermum sp. Microcystis sp., Phormidium sp., Oscillatoria sp., Chlorella sp., Pediastrum sp., Navicula sp., and Synedra sp.* The presence of this phytoplankton in huge amount indicates that the water of Chandlodia lake is polluted, as they are good indicator of pollution. And it was also found that phytoplankton growths of cyanophyceae group were dominated over chlorophyceae, bacillariophyceae and euglenophyceae group.

Keywords: Algae, Biodiversity, Chandlodia, Freshwater, Lake, Phytoplankton and Pollution

I. INTRODUCTION

Phytoplankton (microscopic algae) usually occurs as unicellular, colonial or filamentous forms and is mostly photosynthetic. Plankton, particularly phytoplankton, has long been used as indicators of water quality. Because of their short life spans, planktons respond quickly to environmental changes. Some species have also been associated with noxious blooms sometimes creating offensive tastes and odours or toxic conditions. Primary production and limnology of tropical lake has been studied by [1]. Many other limnologist such as [2] [3] [4] [5] [6] made similar type of studies in different lakes of India .

Chandlodia lake is an artificial lake, constructed by AUDA. Chandlodia lake is also located in the western part of Ahmedabad city. The half portions of the lake become dry during the summer season. The people in the surrounding region use to throw waste into the lake and the cattle also take bath in the lake. The lake covers an area of 22,940 m^2. And its exact geographical location is $23^0$05'00.05" N Latitude and $72^0$33'09.43" E Longitude.

II. MATERIAL AND METHODS

The study was carried for a period of 1 year (March 2012 to February 2013). Monthly data was collected, but results were represented season wise. Four month make one season [March to June summer season, July to October monsoon season, and November to February winter season]. In Chandlodia lake the botanical methods used for assessing water quality include collection, counting and identification of phytoplankton. Plankton net number 25 of mesh size 20 µm was used for collecting samples. 100 liters of water was measured in a graduated bucket and filtered through the net

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and concentrated in a 100 ml bottle. The collected sample were preserved by adding Lugol solution or by adding 4 % formaline. Finally the sample was concentrated to 30 ml by decanating, and 1 ml of concentrated sample was added to Sedgwick Rafter counting cell and were counted. The phytoplanktons were identified by using the key given in the book "The Fresh Water Algae" by [7].

III. RESULT AND DISCUSSION

It also demonstrated that algal assemblages could be used as indicators of clean water or polluted water. Clean water would support a great diversity of organisms, whereas polluted water would yield just a few organisms, with one or few dominant forms [8]. In this context, the micro algae have great potential for monitoring and evolving the water quality of the water bodies [9].

CYANOPHYCEAE: This is distinctive group of algae in which the pigment are localized in the peripheral portion of protoplast and include chlorophyll a, carotene, xanthophyll, c – phycocyanin and c – phycoerythrin. Another unique feature of cyanophyceae is the primitive type of nucleus, which lack nucleolus and nuclear membrane.These algae can tolerate very high range of temperature and form the dominant group. In the present study in Chandlodia lake 11 genera of cyanophycea algae were recorded [Table –1]. The algal unit of cyanophyceae class recorded for Chandlodia lake ranges from 64 ± 2.58 unit/ml to 99 ± 2.08 unit/ml [Table –2]. In Chandlodia lake the maximum unit of cyanophyceae was recorded during summer season followed by monsoon and winter [Graph – 1.].

[10] concluded that absence of large number of blue green algae is an indication of clean water. In Chandlodia lake it was found that Blue green algal growth is dominated over Chlorophyceae, Bacillariophyceae and Euglenophyceae. [11] reported that the polluted water zone constituted a heavy blue green algal growth and are dominated over Chlorophyceae and Bacillariophyceae. [12] stated that water bodies with large drainage area or which receive domestic sewage effluents are the most conducive to luxuriant growth of phytoplankton. Blue green algae mainly contribute the nuisance blooms.

CHLOROPHYCEAE: The chlorophyceae is a group of algae having their photosynthetic pigments localized in chromatophores which are grass-green because of the predominance of chlorophyll – a and b over the carotene and xanthophylls. In the present study in Chandlodia lake 14 genera of chlorophyceae class were recorded throughout the year [Table – 1]. The algal unit of chlorophyceae class in Chandlodia lake ranges from 69 ± 3.87 unit/ ml to 87 ± 3.14 unit/ml. [Table – 2]. The minimum unit of algae of chlorophyceae class were recorded during summer season and maximum units were recorded during winter season (Graph – 1).

Chlorophyceae was widespread among the plankton. The dominance of chlorophyceae might be due to high dissolved contents. [13] had also observed that the green algae prefer water with higher concentration of dissolve oxygen. Monthly variation of chlorophyceae shows himodel distributions with one peak during monsoon and other peak during winter. According to [14] [15] decrease in the amount of water during summer season and high turbidity has adverse effect on phytoplankton abundance by absorbing solar energy in the surface layer on water and thus impairing photosynthesis which cause a sharp fall in phytoplankton density.

BACILLARIOPHYCEAE: This group includes a large number of unicellular and colonial genera which differ from other algae in the shape of their cells. In the present study in Chandlodia lake total 6 genera of bacillariophyceae class were recorded throughout the study [Table – 1]. The diatoms unit recorded in Chandlodia lake of bacillariophyceae class ranges from 41 ± 4.65 unit/ml to 48 ± 2.58 unit/ml [Table – 2]. The minimum units were recorded during monsoon season and maximum unit were recorded during summer season (Graph – 1).

[16] also registered maximum diatoms in summer and minimum during winter and monsoon, which has been further supported by[17] [18] A number of factors influenced the distribution of diatoms in water body, such as change in water temperature light and irradiance of water [19] [20] [21]. [22] also suggested that high temperature favours the growth of diatoms, but [23] observed an inverse relationship between diatoms and temperature.

EUGLENOPHYCEAE: Euglenophytes are free-swimming algal flagellates found in a variety of freshwater and marine environments. Despite the fact that they are of common occurrence, its taxonomy still is problematic. In Chandlodia lake 2 genera of eugleophyceae class were recorded throughout the study [Table -1]. The euglenoid recorded ranges from 6 ± 0.82 unit/ml and 9 ± 1.08 unit/ml [Table – 2]. The minimum unit of euglenod were recorded during monsoon and maximum during summer (Graph – 1)

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The ecological distribution of euglenoids has been studied by [24] [25]. [26] advocated that more amount of CO_2, phosphate, Nitrate and low content of dissolve oxygen favoured the growth of euglenoids. In general , the member of euglenophyceae have shown poor distribution but in some lake its numbers are high which might be due to efflux of domestic sewage. In number of lakes maximum volume of euglenophyceae was observed during summer month and minimum during monsoon and winter. [27] recorded that the factor like temperature, organic matter and albuminoid ammonia influenced the growth and development of euglenophyceae.

TABLE – 1 SEASONAL VARIATION OF PHYTOPLANKTON IN CHANDLODIA LAKE

PHYTOPLANKTON COMPOSITION		SAMPLING SEASON		
CLASS	**GENERA**	**SUMMER MEAN**	**MONSOON MEAN**	**WINTER MEAN**
CYANOPHYCEAE				
	Anabaena sp.	8	9	7
	Aphanizomenon sp.	3	0	1
	Aulosira sp.	0	0	1
	Cylindrospermum sp.	14	11	10
	Gomphosphaeria sp.	8	9	2
	Lyngbya sp.	10	8	8
	Microcystis sp.	16	12	13
	Nostoc sp.	8	4	0
	Oscillatoria sp.	15	11	13
	Phormidium sp.	10	14	6
	Spirulina sp.	7	4	3
CHLOROPHYCEAE				
	Ankistrodesmus sp.	3	4	5
	Closterium sp.	3	5	2
	Cosmarium sp.	7	4	3
	Chlamydomonas sp.	0	3	6
	Euastrum sp.	0	9	4
	Chlorella sp.	13	11	16
	Stigeoclonium	8	5	10
	Pediastrum sp.	9	14	11
	Eudorina sp.	0	0	2
	Scendesmus sp.	8	11	8
	Spirogyra sp.	8	7	9
	Tetraedron sp.	2	0	2
	Volvox sp.	2	0	0
	Zygnema sp.	6	4	9
BACILLARIOPHYCEAE				
	Cymbella sp.	8	3	3
	Fragilaria sp.	5	8	6
	Navicula sp.	12	11	16

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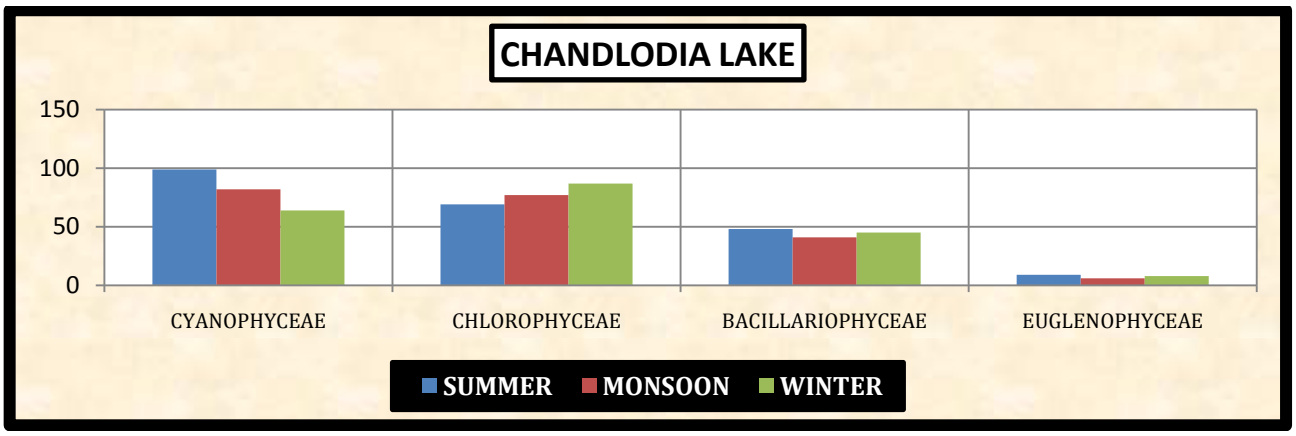
	Pnnularia sp.	4	2	0
	Gomphonema sp.	7	11	9
	Synedra sp.	12	6	11
EUGLENOPHYCEAE				
	Euglena sp.	7	3	5
	Phacus sp.	2	3	3
Total phytoplankton count/ ml		**225**	**206**	**204**
Total phytoplankton count/liter		**67500**	**61800**	**61200**

TABLE - 2 SUMMARY OF PHYTOPLANKTON COUNT/ ML

SR, NO.	CLASS	SUMMER	MONSOON	WINTER	TOTAL
1	CYANOPHYCEAE	99 ± 2.08	82 ± 3.65	64 ± 2.58	245
2	CHLOROPHYCEAE	69 ± 3.87	77 ± 3.24	87 ± 3.14	233
3	BACILLARIOPHYCEAE	48 ± 2.58	41 ± 4.65	45 ± 2.52	134
4	EUGLENOPHYCEAE	9 ± 1.08	6 ± 0.82	8 ± 0.82	23

GRAPH – 1 SEASONAL VARIATION IN DIFFERENT CLASS OF PHYTOPLANKTON



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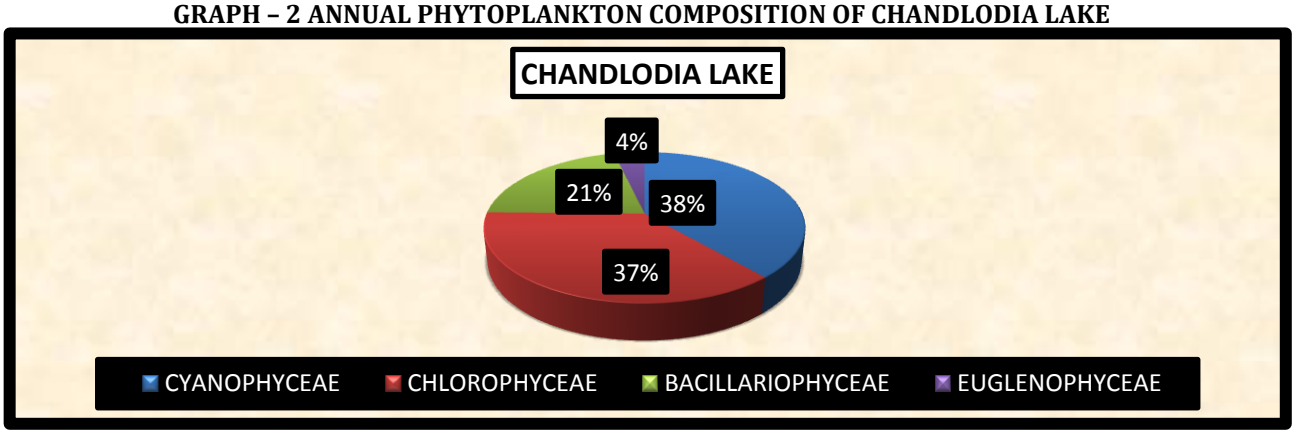
GRAPH – 2 ANNUAL PHYTOPLANKTON COMPOSITION OF CHANDLODIA LAKE



IV. CONCLUSION

From the above result it has been concluded that the water of Chandlodia lake shows high dominance of *Oscillatoria sp., Cylinderospermum sp., Microcystis sp., Phormidium sp., Lyngbya sp. Chlorella sp., Pediastrum sp., Navicula sp. and Synendra* which indicates that this lakes posses high amount of organic waste and therefore the water of the lake is organically polluted. The lake also shows the dominace of cyanophyceae over chlorophyceae , bacillariophyceae and euglenophyceae.

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BIOGRAPHY

Presently I am working as an Assistant Professor in Biology subject at IITE –Gandhinagar. I had completed my MSc., M.Phil and Ph.D from Department of Botany, Gujarat University. I had total four year of Teaching Experience and I also had five years of Research Experience in Bhishma Agri Research Biotech Company as a Scientific Officer.