Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5406

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (4):** 1857-1861 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Seasonal Phytoplankton Diversity using Palmer's Pollution Index of Pichhola Lake Dist.- Udaipur (Rajasthan) India

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Received: 12.08.2017 | Revised: 23.08.2017 | Accepted: 24.08.2017

ABSTRACT

The present study was carried out during March, 2014 to February, 2015 in order to investigate the seasonal diversity of phytoplankton in Pichhola Lake by analyzing monthly variations. In Pichhola Lake 36 genera of algae were recorded. Out of the total 36 genera, 12 were from Cyanophyceae, 9 from Bacillariophyceae, 12 from Chlorophyceae, and 3 belongs to Desmidiaceae. Among phytoplankton Chlorophyceae were dominant over others. According to Palmer's Index 22 pollution indicating algal genera were observed in Pichhola Lake.

Key words: *Seasonal diversity, Phytoplankton, Palmer's Index, Pichhola Lake.*

INTRODUCTION

Physico-chemical features of any water body grossly influence the trophic status of that water body. These parameters influence the primary productivity (phytoplankton and zooplankton productivity) and in turn the growth of the fish. In general, the growth of a fish is influenced by the quality and quantity of food material available and consumed. Thus, any variation in quality and quantity of food materials will affect the growth rate of the fish. The qualitative and quantitative variations of natural food materials in a water body are influenced by several abiotic and biotic factors. A comparative study of plankton and productivity of certain Udaipur waters in comparison to the selected waters of Rajasthan have been carried out by Sharma[8]. A detailed consideration of biology of lakes reasonably begins with phytoplankton, its productivity and periodicity, Hutchinson[2]. Thus, the qualitative as well as the quantitative knowledge of these organisms, growing in an ecosystem, is of fundamental importance. Murugesan *et al.*[6], studied the plankton population in 19 reservoirs in Tamil Nadu and exhibited phytoplankton dominance (51.6 to 99.9%) with an exception in Varattapallaim. Somani and Pejaver[10] evaluate the pollution in the lake Masunda in Thane (Maharashtra) and found presence of 11 pollution tolerant genera using Palmer's algal genus index. Mishra *et al.*[4], studied the planktonic biodiversity and fisheries potential of lake Goverdhan Sagar another lake connected to lake Pichhola and suggested fisheries management in Goverdhan Sagar in the light of abundance of aquatic macrophytes.

Cite this article: Mishra, V., Sharma, S.K., Sharma, B.K., Sharma, L.L. and Shukla, A., Seasonal Phytoplankton Diversity using Palmer's Pollution Index of Pichhola Lake Dist.- Udaipur (Rajasthan) India, *Int. J. Pure App. Biosci.* **5(4):** 1857-1861 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5406

Bordoloi and Baruah[1] has been assessed phytoplankton in a historical pond of Tinsusukia district (Assam) for water quality and the pollution tolerant phytoplankton genera. A total of 12 Palmer's genera were been reported from the pond having Palmar's score of 28 indicated highly organically polluted status of the pond and need management interventions.

The aim of the present investigation is to study of the phytoplankton abundance with respect to different seasons and the pollution status of the lake.

MATERIAL AND METHODS

The present study was carried out during March, 2014 to February, 2015 with a view to investigate phytoplankton diversity of Lake Pichhola. This zone experiences a subtropical climate with average rainfall ranging from 64 cm. and relative humidity of 75-95 per cent during the monsoon period. The summers are hot (38-41ºC) and winters are cool (1-5ºC) in Udaipur, the southern province of Rajasthan state.

Lake Pichhola is situated in Udaipur district of Rajasthan at Latitude 24°58'N and Longitude 73°68'E.

The phytoplankton samples were collected along with the sampling of water. For the sample collection, an appropriate quantity of water sample (*i.e*. 50 liters) was filtered through bolting silk(mesh size 55 µ)and plankton thus obtained were preserved in 4% neutralized formaline for further quantitative and qualitative analysis.

To calculate heterogeneity of plankton at each sampling site suitable plankton diversity index to assess the trophic status of the sampling site the Palmer's Algal Pollution Index was calculated following Trivedy *et al.*[11].

RESULTS AND DISCUSSION

The algal flora of the lake Pichhola was contributed by four major groups of phytoplankton *viz.,* Cyanophyceae, Bacillariophyceae, Chlorophyceae and Desmidiaceae. Overall 36 genera of algae were recorded in lake Pichhola during the present study. Out of the total 36 genera, 12 were from Cyanophyceae, 9 from Bacillariophyceae, 12 from Chlorophyceae, and 3 belongs to Desmidiaceae. However, Sharma *et al.*[9] found the phytoplanktonic community of water body was represented by six groups namely Chlorophyceae, Bacillariophyceae, Desmidiaceae, Xanthophyceae, Myxophyceae and Dinophyceae. Total 58 forms were identified and out of these 28 belonged to Chlorophyceae, 11 to Bacillariophyceae, 9 to Myxophyceae, 4 to Dinophyceae, 3 to Desmidiaceae and 3 to Xanthophyceae in the water of lake Pichhola. Mishra *et al.*[5] found the average phytoplankton count in Goverdhan Sagar was 36.71 No/ml distributed in 29 genera in the order of dominance - Chlorophyceae, Bacillariophyceae, Cyanophyceae and Desmidiaceae. Apparently therefore, there is significant decline in the biodiversity of phytoplankton.

The monthly average values of all four stations of overall mean phytoplankton density was more at station **C** *i.e.* (148.00 Cells ml^{-1}) followed by station **B** (146.91 Cells ml^{-1}), station **D** (145.00 Cells ml^{-1}) and Station **A** (142.50 Cells ml^{-1}). The trend of dominance among the four phytoplankton groups at station **A** was Chlorophyceae > Cyanophyceae > Bacillariophyceae > Desmidiaceae. At station **B** the trend of dominance was Cyanophyceae > Chlorophyceae > Bacillariophyceae > Desmidiaceae. However, at stations **C** and **D** the relative dominance of four algal groups was Cyanophyceae > Bacillariophyceae > Chlorophyceae > Desmidiaceae. The overall dominance of phytoplankton is similar to the trend found at station **A** (Table 1).

The trends of seasonal variations in phytoplankton population at four stations studied are more or less same, both species wise and in abundance. The phytoplankton population was maximum in month of summer followed by in winter at station **A** and **B**. However, this trend was little bit different at station **C** and **D**, where maximum phytoplankton population was noted during

summers followed by in the months of monsoons.

Palmer[7] has published a composite rating of algae tolerant of organic pollution, assembled from the 165 authors and developed a pollution-tolerant algal index. One of his lists includes 60 most pollution-tolerant algal genera. Among these, 22 algal genera were found in lake Pichhola (Table 2). The Palmer's score at station **A** and **B** was 16 each. Whereas, at station **C** and **D** the score was 24 (Table 3). This indicates probable evidence of organic pollution at station **A** and **B**. Whereas, the higher scores at station **C** and **D** confirms high organic pollution at these stations. Somani and Pejaver[10] evaluated the pollution in the lake Masunda in Thane (Maharashtra) and found presence of 11 pollution tolerant genera using Palmer's algal genus index. Kotadia and Mulia[3] studied phytoplankton diversity and investigated Palmer pollution index for Ghuma Lake in rural area of Ahmedabad (Gujarat) and found 20 algal genus including 7 pollution indicators genus.

Table 1: Annual average values of phytoplankton (Cell ml^{-1}) at four stations of lake Pichhola, Udaipur

Major groups	Station A	Station B	Station C	Station D	Overall Avg.
CYANOPHYCEAE					
Anabaena	9.89	8.44	7.20	6.90	8.11
Nostoc	11.29	10.43	9.71	8.43	9.97
Polycystis	8.00	9.27	-	10.18	9.15
Oscillatoria	-	-	12.00	10.25	11.13
Agmenellum	6.00	7.57	-	-	6.79
Coelospharium	4.71	4.71	-	-	4.71
Microcystis	6.90	8.00	11.17	9.58	8.91
Meriosmopedia	9.60	10.00	-	-	9.80
Spirulina	7.80	9.33	12.20	10.00	9.83
Aphanocapsa	3.75	5.40	-	7.60	5.58
Synechocystis	2.33	3.29	-	-	2.81
Arthrospira	8.40	9.20	10.71	8.43	9.19
TOTAL	**78.67**	**85.65**	**63.00**	**71.37**	**74.67**
BACILLARIOPHYCEAE					
Synedra	5.29	6.29	10.22	8.56	7.59
Nitzschia	8.11	7.89	12.67	10.33	9.75
Fragilaria	6.75	7.88	7.88	6.38	7.22
Navicula	7.17	8.17	11.00	8.50	8.71
Diatoma	6.45	7.55	6.78	6.78	6.89
Tabellaria	5.33	6.83	-	6.83	6.33
Cyclotella	8.33	8.83	12.17	10.17	9.88
Asterionella	6.25	7.75	-	-	7.00
Pinnularia	6.25	8.25	-	-	7.25
TOTAL	**59.93**	**69.43**	**60.71**	**57.54**	**61.90**
CHLOROPHYCEAE					
Pediastrum	6.50	6.60	7.00	6.00	6.53
Protococcus	7.00	7.33	6.00	5.00	6.33
Ulothrix	8.10	7.80	10.86	9.57	9.08
Chlamydomonas	-	-	11.13	10.00	10.57
Spirogyra	11.80	10.20	11.13	10.25	10.85
Tetrasporacylindrica	3.88	3.63	-	-	3.76
Ankistrodesmus	10.75	9.75	13.67	9.67	10.96
Hydrodictyon	6.80	7.20	-	-	7.00
Volvox	8.88	9.67	10.17	8.50	9.31
Chlorella	12.50	11.88	15.50	13.00	13.22
Coelastrum	8.75	9.25	9.50	8.50	9.00
Zygnema	7.60	8.80	-	-	8.20
TOTAL	**92.55**	**92.10**	**94.94**	**80.49**	**90.02**
DESMIDIACEAE					
Cosmarium	4.13	4.63	4.75	3.33	4.21
Ganatozygon	6.17	-	-	-	6.17
Closterium	9.13	7.00	12.50	11.00	9.91
TOTAL	**19.42**	**11.63**	**17.25**	**14.33**	**15.66**

Table 2: Most pollution tolerant algal genera of lake Pichhola in decreasing order following Palmer (1969)

1	*Oscillatoria*
2	*Chlamydomonas*
3	*Chlorella*
4	*Nitzschia*
5	*Navicula*
6	*Synedra*
7	*Ankistrodesmus*
8	*Cyclotella*
9	*Closterium*
10	*Microcystis*
11	*Spirogyra*
12	*Anabaena*
13	*Pediastrum*
14	*Arthrospira*
15	*Fragilaria*
16	*Ulothrix*
17	*Spirulina*
18	*Coelastrum*
19	*Diatoma*
20	*Pinnularia*
21	*Asterionella*
22	*Cosmarium*

Table 3: Palmer pollution index of algal genera found in lake Pichhola

S.No.	Genera considered for Pollution Index with respective score	Score at stations			
		A	**B**	**C**	**D**
1	*Ankistrodesmus (2)*	2	2	2	2
2	*Chlamydomonas (4)*	0	0	4	4
3	*Chlorella (3)*	3	3	3	3
4	*Closterium (1)*	1	1	1	1
5	*Cyclotella (1)*	1	1	1	1
6	*Microcystis (1)*	1	1	1	1
7	*Navicula (3)*	3	3	3	3
8	*Nitzschia (3)*	3	3	3	3
9	*Oscillatoria (4)*	0	0	4	4
10	*Synedra (2)*	2	2	2	2
	TOTAL	**16**	**16**	**24**	**24**

CONCLUSION

From the above discussion from this point of view, lake Pichhola with dominance of Cyanophyceae and Chlorophyceae assigned moderately eutrophic status of the lake with 22 pollution indicating algal genera.

Acknowledgement

The authors are grateful to Prof. O. P. Sharma, Dean, College of Fisheries, MPUAT, Udaipur for extending adequate laboratory facilities and Prof. L. L. Sharma, Former Dean and Head Department of Aquaculture, COF for critical review of the manuscript of the present research work.

REFERENCES

1. Bordoloi, D. and Baruah, P. P. Water quality assessment using phytoplankton in a historical pond of Upper Assam. *Journal of Algal Biomass Utilization.* **5 (2)**: 1-7 (2014).
2. Hutchinson, G. E. A treatise on limnology; Vol.II. John Wiley and Sons, Sons, Inc., New York.1015 pp. (1967).
3. Kotadiya, N. G. and Mulia, N. R. Phytoplankton Diversity, Density and Palmer's Pollution Index of Freshwater Lake, Rural Area of Ahmedabad. *Intenational Global Journal for Research Analysis* **3** (2014).
4. Mishra, V., Sharma, S. K., Sharma, B. K., Upadhyay, B. and Choubey, S. Phytoplankton, Primary Productivity and Certain Physico-Chemical Parameters of Goverdhan Sagar lake of Udaipur, Rajasthan *Universal Journal of Environmental Research and Technology.* **2**: 569-574 (2012).
5. Mishra, V., Surnar, S. R. and Sharma, S. K. Some limnological aspects of Goverdhan Sagar lake of Udaipur, Rajasthan to suggest its fisheries management. *International Journal of Science, Environment and Technology*. **5**: 2943-2948 (2016).
6. Murugesan, V. K., Palaniswamy, R. and Manoharan, S. Productivity of reservoirs in Tamil Nadu with reference to their plankton population.*Journal of the Inland Fisheries Society of India.* **35**: 50-56 (2003).
7. Palmer, C. M. Composite rating of algae tolerating organic pollution. *British Phycological Bulletin* (1969).
8. Sharma, L. L. Some limnological aspects of Udaipur waters in comparison to selected waters of Rajasthan. Ph.D. Thesis, University of Udaipur, Udaipur (1980).
9. Sharma, R., Sharma, V., Sharma, M. S., Verma, B. K., Modi, R. and Singh, K. G. Studies on limnological characteristic, planktonic diversity and fishes (species) in lake Pichhola, Udaipur, Rajasthan (India).*Universal Journal of Environmental Research and Technology.* **1**: 274-285 (2011).
10. Somani,V. and Pejaver, M. Evaluation of pollutionin the lake Masunda, Thane (Maharashtra). *Journal of Ecobiology.* **20 (2)**: 163-166 (2007).
11. Trivedi, R. K., Goel, P. K. and Trisal, C. L.. Practical Methods in Ecology and Environmental Science. Environmental Publishers, Karad (India). 340 pp. (1987).