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SEASONAL VARIATIONS IN PHYTOPLANKTON POPULATIONS IN TWO FRESHWATER LAKES AT UDUPI DISTRICT, KARNATAKA, INDIA

[1*]Saroja. Naik, M. and [2]Dr. Gopal, G.V.

[1]Dept. of Botany, RIE Manasagangotri, Mysore
[2]Dept. of Botany DESM, RIE, Manasagangotri, Mysore

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ABSTRACT

Variations in the phytoplankton communities like Cyanophyceae, Chlorophyceae, Euglenophyceae, Bacillariophyceae, and Dinophyceae in two lakes of Udupi district, Karnataka have been discussed. This lake during a certain period supported as many as 26 species of Cyanophyceae, 30 species of Chlorophyceae, 7 species of Euglenophyceae, 8 species of Bacillariophyceae and 2 species of Dinophyceae. The growth of phytoplankton influenced by physicochemical parameters such as water temperature, dissolved oxygen, water pH, biological oxygen demand, chemical oxygen demand, nitrates, phosphates etc.

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INTRODUCTION

Lakes are ecological systems that can integrate changes throughout their water bodies, resulting from anthropogenic activities. Lakes are more stable as compared to terrestrial ecosystems because of their peculiar physical, chemical and biological characteristics. Plankton forms are the basic link chain for all aquatic animals. The phytoplankton is the primary producers and they constitute the first level in the aquatic food chain. Phytoplankton abundance and diversity in any part of the lake determines the abundance and diversity of organisms belonging to higher trophic levels (e.g.; zooplankton, mollusks, and fishes). This paper deals with occurrence and distribution of phytoplankton during the years 2013-2014 and 2015-2016. The physicochemical parameters might have regulated their appearance or disappearance in two lakes of Udupi District.

MATERIALS AND METHODS

Two lakes have been selected from Udupi district of Karnataka. Manipalla Lake, Manipal, and Brahmavara, Chantaru Lake. Five sampling stations will be selected in each lake. The water samples will be collected twice in a month from the selected sampling sites. The water samples will be analyzed for water temperature, dissolved oxygen, BOD, COD, pH, nutrients like phosphate and nitrates and the phytoplankton will be analyzed following the standard methods for the examination of water analysis.

Water Temperature

Surface water temperature will be recorded by the standard thermometer, immediately after the collection of samples from selected stations of each lake (as for the procedure followed by Goel and Trivedy; 1985).

Dissolved Oxygen

Testing of dissolved oxygen by using Winkler's reagent. Samples will be collected in 125ml Oxygen bottles, carefully avoiding air bubbles. The titration for determination of dissolved oxygen will be done within 6 hours of the collection after all the precipitates had settled (as for the procedure followed by Goel and Trivedy; 1985).

Corresponding author: **Saroja. Naik, M.,**
Dept. of Botany, RIE Manasagangotri, Mysore.

Water pH

Surface water pH will be observed using a pH meter (WTH pH 320) (as for the procedure followed by Hosamani and Bharathi; 1980).

Biological Oxygen Demand (B.O.D)

B.O.D is the quantity of the oxygen required by a definite volume of liquid for oxidizing the organic matter contained in it by microorganisms under the specified condition. It will be determined by measuring the loss of dissolved oxygen of the sample after incubating it for 5 days at 20^0c.

Chemical Oxygen Demand (COD)

The Chemical Oxygen Demand determination is a measure of oxygen equivalent to that portion of organic matter in a sample oxidized by a strong chemical oxidant. It will be determined by as per the methods described APAH (1995).

Nutrients

The nutrients will be estimated following standard methods described by Strickland and Parsons (1972), (Hosamani and Bharathi; 1980). The nutrients are as follows: Nitrates and phosphates. The surface water samples will be collected and preserved in polythene bottles for analysis of nutrient such as nitrates. Acid washed glass bottles were used for collection of water samples for the estimation of phosphate.

Phytoplankton Collection and Analysis

Phytoplankton samples will be collected using a Heron-Tranter net (length 1.2m, mouth area 0.25m² with the mesh size of 60µ). Samples will be fixed in 4% formalin and later preserved in 2% formalin in the laboratory for further analysis.

RESULTS AND DISCUSSION

The two lakes Chantaru and Manipalla are geographically located in Udupi and their coordinates are the latitude of Manipalla lake Manipal is 55^0 46'North and longitude is 74^0 44'East, 54Ft. The latitude of Chantaru lake Brahmavara is 55^0 45'North and longitude is 74^0 46'East, extending up to 55Ft in a semi-rural area of Brahmavara and Manipal of Udupi District.

Table 1. Two yearly averages of certain related physic-chemical factors in two lakes of Udupi district (ppm)

Factors	2013 - 2014		2015 - 2016	
	Chantaru Lake	Manipalla Lake	Chantaru Lake	Manipalla Lake
Water temperature	26.98	30.59	26.72	29.35
Dissolved oxygen	6.86	8.83	6.92	9.02
pH of water	7.79	7.89	7.88	8.30
Biological oxygen demand	4.20	4.14	4.24	4.15
Chemical oxygen demand	28.94	28.92	29.06	29.25
Nitrate - Nitrogen	2.83	2.67	2.76	2.44
Phosphate-Phosphorus	1.27	2.69	1.29	2.67

Changes in physicochemical complexes of the two lakes during the years 2013-14 and 2015-16 were an increase in water temperature, pH, dissolved oxygen, biological oxygen demand, chemical oxygen demand, phosphate-phosphorus, nitrate-nitrogen etc.

Table 2. Distribution of Cyanophyceae, Chlorophyceae, Euglenophyceae, Bacillariophyceae, and Dinophyceae in Chantaru Lake at Brahmavara

	Phytoplankton Forms	2013 - 14	2015 - 16
	CYANOPHYCERE	bbb	bbb
1	Anabalnopsis amoldii	bb	bb
2	Anabaena circularis	bb	bb
3	Anabaena flosquae	bbb	bbb
4	Aphanizomenon flos-aquae	a	_
5	Aphanocapsa sp	-	a
6	Aphanothece stagnina	-	a
7	Ghosphaeria ocellatum	-	a
8	Lyngbya ceylanica	bb	bb
9	Merismopedia duplex	bb	-
10	Merismopedia elegans	bb	-
11	Merismopedia glauca	a	-
12	Merismopedia punctuate	a	-
13	Microcystis floraquaes	a	a
15	Nostoc sp.	bbb	bbb
16	Oscillatoria Chalybea	bbb	bbb
17	Oscillatoria curviceps	bbb	bbb
18	Oscillatoria princeps	bbb	bbb
19	Oscillatoria viridis	bb	-
20	Phormidium sp	-	a
21	Raphidiopsis curvata	a	-
22	Rivularia sp	bb	bb
23	Spirulina princeps	b	b
24	Stigeonema sp	a	-
25	Synechocyhstis sp	a	-
26	Trichodesmium sp.	bbb	bb
CHLOROPHYCEAE			
27	Actinastrum sp	-	a
28	Chlorella vulgaris	bb	bb
29	Closterium acerosum	a	-
30	Closterium microsporum	b	b
31	Coelastrum cambricum	b	-
32	Coelastrum microsporum	bb	bb
33	Cosmarium cucumis	-	a
34	Desmidium grevillii	bb	bb
35	Dichotomosiphon indicum	a	-
36	Dimorphococeus lunatus	bb	-
37	Eudorina elegans	b	b
38	Tetraedron muticum	a	a
39	Micrasterias furcata	-	a
40	Mougeotia sp	-	b
41	Oedogonium sp.	-	b
42	Pandorina morum	b	b
43	Pediastrum duplex	bb	bb
44	Pediastrum simplex	bb	bb
45	Pediastrum tetras	bb	bb
46	Scenedesmus abundans	b	a
47	Scenedesmus obliguus	bb	bb
48	Sphaerocystis sp	-	b
49	Spirogyra adornata	-	a
50	Spirogyra alternata	-	a
51	Spirogyra sp.	bbb	bbb
52	Staurastrum paradoxum	-	a
53	Stigeoclonium elongatum	-	b
54	Ulothrix moniliformis	-	a
55	Volvox globator	b	b
56	Zygnema cruciatum	-	bb
EUGLENOPHYCEAE			
57	Euglena acus	bbb	bbb
58	Euglena elastrica	bbb	bbb
59	Euglena tripteris	b	b
60	Lepocinclis fusiformis	bb	bb
61	Lepocinclis texta	a	a
BACILLARIOPHYCEAE			
62	Asterionella sp.	bb	bb
63	Gomphonema sp.	bbb	bbb
64	Melosira granulata	bbb	bbb
65	Navicula Cuspida	bbb	bbb
66	Pinnularia sp.	a	a
DINOPHYCEAE			
67	Glenodinium sp.	a	a
68	Peridinium pusillum	b	b

a:50-100, b:100-200, bb:200-500, bbb:500&above o/l

Table 3. Distribution of Cyanophyceae, Chlorophyceae, Euglenophyceae, Bacillariophyceae, and Dinophyceae in Manipalla lake, Manipal

	PHYTOPLANKTON FORMS	2013-14	2015-16
	CYANOPHYCEAE		
1	Anabalnopsis amoldii	bbb	bbb
2	Anabena circularis	bb	bb
3	Anabena flosquae	bb	bb
4	Aphanizomenon flos-aquae	-	b
5	Aphanocapsa sp	-	a
6	Aphanothece stagnina	a	-
7	Ghosphaeria ocellatum	-	a
8	Lyngbya ceylanica	-	b
9	Merismopedia duplex	-	a
10	Merismopedia elegans	-	b
11	Merismopedia glauca	-	a
12	Merismopedia punctuate	-	a
13	Microcystis floraquaes	bb	bb
14	Nostoc sp.	bb	bb
15	Oscillatoria Chalybea	-	a
16	Oscillatoria curviceps	bbb	bbb
17	Oscillatoria princeps	bbb	bbb
18	Oscillatoria viridis	-	a
19	Phormidium sp	-	a
20	Raphidiopsis curvata	-	a
21	Rivularia sp	-	bb
22	Spirulina princeps	-	a
23	Stigeonema sp	-	b
	CHLOROPHYCEAE		
24	Chlorella valgaris	bb	bb
25	Closterium acerosum	b	bb
26	Closterium microsporum	bb	bb
27	Coelastrum cambricum	bbb	bbb
28	Coelastrum microsporum	b	b
29	Cosmarium cucumis	-	a
30	Desmidium grevillii	-	b
31	Dichotomosiphon indicum	-	a
32	Dimorphococeus lunatus	bb	b
33	Eudorina elegans	-	a
34	Tetraedron muticum	bb	bb
35	Micrasterias furcata	-	b
36	Mougeotia sp	-	a
37	Oedogonium sp.	bbb	bbb
38	Pandorina morum	-	a
39	Scenedesmus abundans	b	a
40	Scenedesmus obliguus	bb	bb
41	Selenastrum gracile	bb	bb
42	Sphaerocystis sp	-	a
43	Spirogyra adornata	-	a
44	Spirogyra alternata	-	a
45	Spirogyra sp.	a	a
46	Staurastrum paradoxum	-	b
47	Stigeoclonium elongatum	-	a
48	Ulothrix moniliformis	-	a
49	Volvox globator	b	b
50	Zygnema cruciatum		
	EUGLENOPHYCEAE		
51	Euglena acus	bbb	bbb
52	Euglena elastrica	b	b
53	Euglena tripteris	bb	b
54	Lepocinclis fusiformis	a	b
55	Lepocinclis ovum	a	a
56	Phacus curvicauda	-	a
57	Strombomonas gibberosa	-	b
	BACILLARIOPHYCEAE		
58	Asterionella sp.	bbb	bbb
59	Gomphonema sp.	bbb	bbb
60	Melosira granulate	bbb	bbb
61	Navicula Cuspida	bb	bb
62	Pinnularia sp.	bbb	bbb
63	Pinnularia biceps	=	a
64	Pinnularia major	-	a
65	Tabellaria sp	-	a
	DINOPHYCEAE		
66	Glenodinium sp	a	a
67	Peridinium pusillum	bb	b

a:50-100, b:100-200, bb:200-500, bbb:500&above o/l

Above 26 species of Cyanophyceae, 30 species of Chlorophyceae, 7 species of Euglenophyceae, 8 species of Bacillariophyceae and 2 species of Dinopyceae occurred during 2013-14 and 2015-16. In which *Aphanizomenon flos-aquae, Lyngbya ceylanica, Merismopedia elagans, Merismopedia glauca, Merismopodia punctata, Merismopodia duplex, Phormidium sp, Stigeonema sp, and Synechocystis sp*ecies Cyanophycean members occurred in lesser numbers. It is of interest to note that during 2015-16 *Rivularia sp and Synechocystis sp* found only in lesser numbers in Manipalla Lake at Manipal (Table2). *Closterium microsporum, Coelastrum microsporum, Volvox globator, Cosmarium cucumis, Micrasterias furcata, Mougeotia sp, Spirogyra adornata, Staurastrum paradoxum, Ulothrix moniliformis, Dichotomosiphon indicum, Stigeoclonium elongatum* are Chlorophyceae members found in lesser numbers in both lakes but *Actinastrum sp* found only in Chantaru lake at monsoon seasons during 2015-16. *Micrasterias furcata, Mougeotia sp, Oedogonium sp* were not found in Chantaru lake during 2013-14 but it is found in lesser numbers during 2015-16 in Manipalla lake *Oedogonium sp* found more in number during 2013-14 and 2015-16. In Manipalla lake *Sphaerocystis sp, Spirogyra adornata, Spirogyra alternate, Staurastrum paradoxum, Stigeoclonium elongatum, Ulothrix moniliformis* was not found during 2013-14 but it is found in 2015-16 in lesser numbers (Table2). Euglenophyceae members like *Phacus curvicauda and Strombomonas gibberosa* were not found during 2013-14 but it is found in lesser numbers in 2015-16 only in Manipalla lake (Table 3). The Bacillariophyceae members like *Pinnularia biceps, Pinnularia major*, *Tabellaria sp* were not found in Chantaru lake but found in Manipalla lake during the year 2015-16 in very lesser numbers (Table 3). Changes in the physicochemical complexes of the lakes during the years 2013-14 and 2015-16 were an increased in pH, dissolved oxygen, water temperature, biological oxygen demand, chemical oxygen demand. On the other hand factors like nitrate-nitrogen and phosphate-phosphorus were decreased (Table 1).

The rise in dissolved oxygen content and a consequent decrease in the nitrates and phosphates, the Cyanophycean and Chlorophyceae members distributed in monsoon, winter and summer seasons in both the lakes. Whereas *Tetraedron muticum* and *Pediastrum simplex* were not found in monsoon season in Chantaru lake. Euglenophyceae members like *Lepocinclis fusiformis*, *Euglena tripteris and Euglena elastic* were not found in Chantaru lake in winter seasons, but it was not found in Manipalla lake in monsoon season. *The Lepocinclis texta* found only in Chantaru lake in monsoon season. Bacillariophyceae members well distributed in all seasons in both the lakes during the years 2014-14 and 2015-16. Dinophyceae members *like Peridinium pusillum* found in monsoon and winter seasons in Manipalla lake whereas it was distributed only in the winter season in Chantaru lake. *Glenodinium sp* found only during the winter season in Manipalla lake and it was found in monsoon and summer seasons in Chantaru lake.

Conclusion

Phytoplankton is one of the important components of the aquatic ecosystem. Freshwater lakes play an important role in the social ecology of the region in which they are located. The lakes located in human dominating areas are facing threat due to various factors including anthropogenic activities for example bathing, washing clothes, cleaning animals and

vehicles, dumping solid wastes etc such as activities intern leads to the loss of aquatic biodiversity, especially plankton biodiversity. In Chantaru lake Cyanophyceae and Chlorophyceae populations are dominated. Euglenophyceae and Bacillariophyceae populations are dominated in Manipalla lake. Dinophyceae populations equally distributed in both the lakes. In this way, Phytoplankton distribution can be clearly observed due to various physic-chemical parameters in monsoon, winter and summer seasons.

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