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RESEARCH ARTICLE

ASSESSMENT OF PHYTOPLANKTON DIVERSITY AND PHYSICO-CHEMICAL PARAMETERS IN CHIKKAKERE, PERIYAPATNA, MYSORE, KARNATAKA STATE, INDIA

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ABSTRACT

The present studies were carried out on the diversity of phytoplankton in relation to physico- chemical parameter from July 2012 to June 2013 in chikkakere, Periyapatna, Mysore, Karnataka. The water samples were analyzed to physical and chemical parameters by following the standard methods of APHA (2005) and Trivedi and Goel (1984). The quantitative analysis of phytoplankton was done by Lackey's drop method modified by saxena (1987). Total 29 species were recorded which are belonging to Bacillariophyceae, Chlorophyceae, Cyanophyceae, Euglenophyceae and Desmidiaceae. Diversity indices have been discussed by using PASTA Software Program. The diversity indices includes Shannon and Weiner index, Berger and Parker index, Simpson index, Margalef's index and Pielous index which determines status of the water body. The statistical program Pearson's correlation matrix has been discussed by using SPSS 20.0 Software program. The Pearson's correlation matrix explained Total Hardness is directly correlated with calcium, chloride and total alkalinity. The higher values of nitrate and phosphate observed in the month of May which leads in formation blooms in the lake. Microcystis aeruginosa blooms are dominant and occurred throughout year in the lake.

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INTRODUCTION

Water is the prime source for all life forms on the earth. The physical, chemical and biological parameters determine the quality of water. The decline in biotic community and changes in water quality majorly depends on the rapid industrialization, pesticides used in agriculture, sewage disposal and anthropogenic activities. The phytoplankton have been an interesting group for investigation because of their very primitive nature and a worldwide distribution, which is due to their capability to exist under most varied environmental condition (Musharaf Khan *et al*., 2011). Phytoplankton are free floating unicellular filamentous and colonial autotrophic organisms that grow in aquatic environments whose movement is more or less dependent upon water currents (Millman *et al*., 2005). Algae are ideally suited for water quality assessment because they have rapid reproduction rates and very short life cycles making them valuable indicators of short term impacts. Algal assemblages are sensitive to some pollutants and they readily accumulate pollutants and algal metabolism is also sensitive to the variation of environment and natural disturbances (Wan Maznah Wan Omar, 2010). Algal diversity in lakes plays an important role in their conservation. More the diversity more useful is a water body. The qualitative and quantitative studies of phytoplankton have been utilized to assess the quality of water (Adoni *et al*., 1985; Chaturevedi *et al*., 1999; Ponmanikam *et al*., 2007.) One of the remarkable aspects of the lakes environment is the large number of phytoplankton species that are present at any given time. Such species diversity appears as a paradox (Hutchinson, 1967). The physico- chemical characteristics of water plays an important role in algal biodiversity and population dynamics of planktons (sumita srivastava *et al*., 2010)

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MATERIALS AND METHODS

Study area

Chikka kere is situated at latitude of 12° 20′ 31.38″N, longitude of 12° 05′ 71.64″E at an elevation of 2815ft. It is about 68Km from Mysore near Periyapatna taluk in upparagere village. The shape of the lake is irregular. There is no source for the lake

water and it depends on the rain water. Inflow of sewage from the village was observed. The three temples situated near the lake as a result frequently animals sacrifice and ethical incarnation was made by the devotes. The water used for many anthropogenic activities like washing clothes, cattles, agricultural purpose and for fishing activity. Foul smelling of water was observed due to the death and decay of the microorganisms mainly Microcystis. Microcystis bloom was observed throughout the year because of this water looks greenish in color and aquatic weeds like Typha, Aquatic Ipomoea and limenodendron was observed.

Physico-chemical analysis

Water samples were collected on a monthly basis from the chikkakere lake of Periyapatna, Mysore district, Karnataka for a period of one year from July 2012 to June 2013. For the present study, three sampling sites in lake were selected taking into account anthropogenic activities such washing of clothes and utensils, bathing, ethical incarnation etc. Surface water was collected from all the three sampling sites in lake. Collections were made using plastic cans of 1-L capacity. The plastic containers were rinsed thoroughly with sampling water before use. After filling the containers, they were labeled with site number and date of collection and transferred to laboratory for the analysis of chemical parameters (APHA, Trivedi and Goel). The pH, water temperature, total dissolved solids (TDS), electric conductance and salinity were measured using the multi parameter tester 35 devises on the spot. Turbidity was measured using digital turbidiometer model H1- 93703 portable microprocessor turbidity meter on the spot.

The estimation of free carbon dioxide was also done on the spot by titrating samples against 0.1N Sodium hydroxide using phenolphthalein as an indicator. The fixation of dissolved oxygen (DO) was also done on the spot. For DO fixation, the water samples were taken carefully into 300 mL BOD Bottles, avoiding air bubbles. Potassium iodide and manganous sulphate reagents were added soon after collection precipitation formed, which is dissolved by adding conc. Sulphuric acid and titrated against 0.025N sodium thiosulphate using starch as an indicator. For the rest of the chemical parameters (chloride, calcium, total alkalinity, total hardness, BOD, COD, nitrate and phosphate) a water sample was brought to the laboratory and was analyzed.

Biological parameters

Phytoplankton were collected for biological analysis at three different sites of the lake by filtering the water sample with the help of plankton net of mesh size 63 µm and 30cm diameter. The final volume of filtered sample is 50ml. The sample is transferred to 100ml sterile plastic bottle and labeled mentioning the time, date and place of sampling. The collected sample is preserved by using 1ml of 4% formaldehyde and 4-5 drops of lugol's iodine solution. Lugol's iodine solution is added to the sample to preserve the color of the organism. The preserved samples are taken to laboratory for further analysis. The quantitative analysis of phytoplankton was done by Lackey's drop method modified by saxena (1987). In Lackey's drop method, the coverslip was placed over one drop of water sample in the slide, permanent slide is done by using DPX and whole coverslip were examined under Labomed trinocular microscope (LX400) with image transferor (DCM 35 USB 2.0) and photographs was taken and species identification was done by using standard monographs like Prescott, Desikachary, research articles and research personnel. After that organisms were counted in each drop. This procedure is repeated three times for each samples and number of organism is measured as organism per liter.

Formula used for the calculation of plankton as Org/L is

$$\text{Plankton Org/L} = \frac{nXc\ X100}{V}$$

n= No. of plankton counted in 0.1ml of sample
c= total volume of concentrated in ml
V= total volume of water filtered through net

RESULT AND DISCUSSION

Physicochemical parameters

Variation in the physico- chemical parameters are shown in table1. Water of the lake shows alkaline nature throughout the year. The pH was fluctuated 9.64 to 10.23 and was highest in February and lowest in June. The water temperature (WT) ranges from 22.16 °C to 36.6 °C. it was recorded highest in April and lowest in December. Fluctuation in water temperature was observed due to difference in the sampling time. The electric conductance varies from 594ppm to 3.08ppt. The highest of EC recorded in May it is due to the accumulation of the ionic compounds and lowest in January. Total dissolved solids (TDS) found varies from 433 ppm to 2.23 ppt. The minimum value of TDS found in July and maximum value in May. In the present study TDS was constantly increases indicate the disturbance due to anthropogenic activities. Salinity depends on the amount of ions present in that water body. The Salinity ranges from 133 ppm to 1010 ppm. The minimum value of Salinity found in January and maximum value in May. Suspended particles present in the water gives a turbid nature to the water. Suspended particles like clay particles and phytoplankton increases the turbidity. The penetration of the light decreases with the Increase in the turbidity as a result phytoplankton growth affected. Turbidity ranges from 2 NTU to 175.67 NTU. The minimum value of Turbidity found in June and maximum value in May.

Carbon-di-oxide (CO2) recorded in Chikka kere ranges from 0.00 ppm to 5.86 ppm. The minimum value of CO2 found in July, August, September, November, January, February, March, April, May and June and maximum value in December. The values of Dissolved oxygen (DO) range from 2.70 ppm to 4.33 ppm. The minimum value of found in the month of October, March and May and maximum value in the month of June. The DO is the amount of oxygen dissolved in the water. Decrease in the value of the DO indicates the pollution status of the water body. The presence of carbonates and bicarbonates in the water results in hardness. Total Hardness ranges from 134.67 ppm to 405.33 ppm. The minimum value of total hardness found in October and maximum value in May. The amount of Calcium ranges from 18.71 ppm to

59.85 ppm. The minimum value of calcium found in October and maximum value in June. Chloride value varies from 103.19 ppm to 996.84 ppm. The minimum value of found in the month of August and maximum value in the month of May. The amount of total alkalinity ranges from 153.3 ppm to 453.33 ppm. The Higher values of salinity indicate the pollution (Das *et al*., 2009). The minimum value of total alkalinity found in September and maximum value in May. Both Chemical oxygen demand (COD) and Biological oxygen demand (BOD) is used as an indicator of organic pollution. Increase in the values indicates the organic pollution due to sewage inflow.

The COD values in ranges from 101.33 ppm to 797.33 ppm. The minimum value of COD found in November and maximum value in May. BOD is the measure of a microbial activity in the water. The BOD value varies from 32.44 ppm to 54.07 ppm. The minimum value of BOD found in January and maximum value in May. The presence of higher values of nitrate and phosphate results in the eutrophic nature of the water. This may further responsible for the formation of algal blooms. Increase in values of nitrate and phosphate due to the increase in domestic wastes and sewage contamination. The Nitrate values ranges from 0.05 ppm to 1.51 ppm. The minimum value of Nitrate found in August and maximum value in May. The Phosphate values ranges from 0.02 ppm to 0.96 ppm. The minimum value of Phosphate found in August and maximum value in May.

pH increased with the increase in temperature. The salinity is highly correlated with electric conductance ($r=.984^{**}$, $p<0.01$, n=12). The salt ions of both carbonates and bicarbonates which are results in increased the electric conductance. As the amount of ionic concentration increases salinity also increases.

Total dissolved solids was negatively correlated with Total hardness($r=-.611^{*}$, $p<0.05$, n=12), Calcium ($r=-.700^{*}$, $p<0.05$, n=12), Chloride ($r=-.612^{*}$, $p<0.05$, n=12), Phosphate ($r=-.584^{*}$, $p<0.05$, n=12) and Euglenophyceae ($r=-.611^{*}$, $p<0.05$, n=12). Turbidity had showed positively highly correlation with Chloride ($r=.730^{**}$, $p<0.01$, n=12), total alkalinity ($r=.754^{**}$, $p<0.01$, n=12), Nitrate ($r=.723^{**}$, $p<0.01$, n=12). The dissolved oxygen is negatively correlated with turbidity ($r=-.625^{*}$, $p<0.05$, n=12) it shows that the debris, clay particles which are present in the water increases the turbidity level and gradually decreases dissolved oxygen. Total hardness had showed positive correlation with Calcium($r=.807^{**}$, $p<0.01$, n=12), Chloride ($r=.909^{**}$, $p<0.01$, n=12), total alkalinity ($r=.838^{**}$, $p<0.01$, n=12) and Phosphate($r=.729^{**}$, $p<0.01$, n=12). Presence of calcium, chloride ions results in hardness which in turn results in the alkalinity of the water.

Chloride had showed positively highly correlation with total alkalinity ($r=.886^{**}$, $p<0.01$, n=12), biochemical oxygen demand ($r=.730^{**}$, $p<0.01$, n=12), Nitrate ($r=.848^{**}$, $p<0.01$, n=12), Phosphate($r=.853^{**}$, $p<0.01$, n=12) and Euglenophyceae ($r=.801^{**}$, $p<0.01$, n=12).

Table 1. Monthly variation in the Physico- chemical parameters from July 2012- June 2013

Parameters	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
pH	9.72	9.81	10.03	9.68	9.85	9.8	10.01	10.23	10.2	10.11	9.96	9.64
WT	25.3	25.03	25.93	26.9	24.63	22.16	25.2	33.46	35.1	36.6	27.26	26.3
EC	611	636.7	627	643.3	726.7	796.3	594.8	985.7	1134.3	1424.3	3.08*	1795.7
TDS	433	450	445	458.7	514.7	565.3	621.3	698.3	819	1.04*	2.23*	1.21*
Salinity	296.7	309.3	305	315	354	389	425	486.3	574.33	753.66	1.68*	879.66
Turbidity	23.89	41.71	28.69	2.96	2.34	4.11	52.57	62.16	118.3	12.95	175.7	2
CO2	0	0	0	3.98	0	5.86	0	0	0	0	0	0
DO	3.78	2.97	3.78	2.7	3.51	3.78	2.97	3.24	2.7	3.51	2.7	4.33
Hardness	158.7	137.3	138.7	134.7	149.3	150.7	169.3	258.7	184	226.67	405.3	302.67
Calcium	18.7	18.7	38.48	18.17	23.51	20.31	18.7	28.86	21.38	27.79	54.51	59.85
Chloride	113.6	103.2	123.1	118.3	147.7	160	195	236.7	217.73	370.15	996.8	326.6
TA	246.7	200	153.3	173.3	200	173.3	226.7	306.7	213.33	273.33	453.3	200
COD	106.7	541.3	269.3	456	101.3	106.7	133.3	152	325.33	346.67	797.3	176
BOD	38.93	34.6	41.09	34.6	47.58	36.77	32.44	36.77	38.93	43.25	54.07	36.76
Nitrate	0.29	0.05	0.39	0.42	0.45	0.46	0.51	0.15	0.47	0.29	1.51	0.22
Phosphate	0.04	0.02	0.03	0.03	0.04	0.04	0.05	0.15	0.37	0.82	0.96	0.13

WT- water temperature, EC-Electric conductance, TDS- Total dissolved solids, CO2- Dissolved Carbon-di-oxide, DO- Dissolved oxygen, TA- Total alkalinity, BOD- Biochemical oxygen demand, COD- Chemical oxygen demand
(* indicates the month of May EC is in ms and salinity is in ppt, in the month of April, May and June TDS is in ppt)

Pearson's correlation matrix

Statistical analysis of physico-chemical and biological parameters for Pearson's correlation matrix was shown in table 2. Pearson's correlation matrix is used to find out the inter relationship between the physico- chemical parameters and biological parameters. The obtained data of physico-chemical and biological parameters are subjected to SPSS 20.0 version to get a Pearson's correlation matrix. The pH is positively correlated with water temperature ($r=.727^{**}$, $p<0.01$, n=12). The water temperature is influenced by the environmental temperature. During the pre monsoon season the water level in a lake decreases by increasing in environmental temperature as well as water temperature. It makes mark on that the level of

Total alkalinity had showed positively highly correlation with Phosphate ($r=.785^{**}$, $p<0.01$, n=12) and Euglenophyceae ($r=.736^{**}$, $p<0.01$, n=12). Chemical oxygen demand had showed negatively correlation with the dissolved oxygen ($r=-.616^{*}$, $p<0.05$, n=12). Nitrate shows negative correlation with the electric conductance ($r=-.604^{*}$, $p<0.05$, n=12) and salinity ($r=-.586^{*}$, $p<0.05$, n=12) and marked strong correlation with parameter BOD ($r=.724^{**}$, $p<0.01$, n=12). The biological parameters Cyanophyceae had showed negative correlation with Chlorophyceae ($r=-.809^{*}$, $p<0.05$, n=12) and Euglenophyceae shows positive correlation with phosphate ($r=.950^{**}$, $p<0.01$, n=12).

Table 2. Pearson's correlation matrix for physico- chemical and biological parameters

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	1																				
2	.727**	1																			
3	.020	.435	1																		
4	.331	-.013	-.163	1																	
5	.079	.453	.984**	-.142	1																
6	.496	.303	-.455	.000	-.436	1															
7	-.385	-.373	-.097	.174	-.129	-.344	1														
8	-.361	-.269	.533	-.319	.482	-.625*	.011	1													
9	.158	.273	.022	-.611*	.011	.613*	-.313	-.041	1												
10	-.085	.017	.182	-.700*	.136	.299	-.305	.335	.807**	1											
11	.169	.184	-.280	-.612*	-.276	.730**	-.214	-.257	.909**	.676*	1										
12	.326	.310	-.358	-.407	-.343	.754**	-.346	-.355	.838**	.429	.886**	1									
13	.038	.143	-.440	-.424	-.462	.631*	-.095	-.616*	.459	.311	.665*	.549	1								
14	.162	.110	-.338	-.475	-.381	.479	-.280	-.071	.559	.476	.730**	.640*	.437	1							
15	.086	-.094	-.604*	-.322	-.586*	.723**	.012	-.402	.614*	.426	.848**	.697*	.587*	.724**	1						
16	.403	.560	-.055	-.584*	-.036	.623*	-.261	-.293	.729**	.436	.853**	.785**	.621*	.692*	.640*	1					
17	-.535	-.499	.150	.093	.122	-.274	.084	.310	-.289	-.190	-.365	-.364	-.222	-.399	-.401	-.462	1				
18	.566	.527	-.031	.177	.037	.165	-.128	-.420	.154	-.117	.161	.300	-.042	.185	.188	.279	-.809**	1			
19	-.189	-.505	-.334	.213	-.400	-.201	.662*	.080	-.218	-.162	-.093	-.171	-.084	.160	.121	-.250	.093	-.100	1		
20	.187	.082	.136	.465	.117	.150	.504	-.080	-.190	-.266	-.133	-.239	-.166	-.137	.039	-.026	.224	-.193	.332	1	
21	.269	.418	-.120	-.705*	-.094	.439	-.196	-.198	.641*	.390	.801**	.736**	.605*	.685*	.593*	.950**	-.447	.241	-.166	-.200	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

1.pH, 2. WT, 3. EC, 4. TDS, 5. Salinity, 6. Turbidity, 7. CO2, 8. DO, 9. Total hardness, 10. Calcium, 11. Chloride, 12. Total alkalinity, 13. COD, 14. BOD, 15. Nitrate, 16. Phosphate, 17. Chlorophyceae, 18. Cyanophyceae, 19. Bacillariophyceae, 20. Desmidiaceae, 21. Euglenophyceae

Table 3. List of Phytoplankton species of Chikkakere

Chlorophyaceae	*Anabaena circinalis* Robenhorst
Characium gracilipes F.D.Lambert S	*Arthrospira platensis* (Nordstedt) Gomont
Scenedesmus quadricauda (Turpin) Brébisson	*Microcystis aeruginosa*
Scenedesmus dimorphus (Turpin) Kützing	*Phormidium fragile* Gomont
Golenkinia radiata Chodat	Bacillariophyaceae
Oedogonium Sp	*Synedra ulna* (Nitzsch) Ehrenberg
Oocystis gigas W.Archer	*Fragilaria rumpens* (Kützing) G.W.F.Carlson
Tetraedron apiculatum (Reinsch)	*Melosira granulata* (Ehrenberg) Ralfs
Zygnema pectinatum (Vaucher) C.Agardh	*Navicula gracilis* Ehrenberg
Tetraedron minitum A.Braun	*Nitzschia gracilis*
Selenastrum minutum (Nägeli) Collins	*Fragilaria brevistriata* Grunow
Cyanophyaceae	Desmidaceae
Oscillatoria prolifica Gomont	*Cosmarium lundelli*
Arthrospira gomontiana Setchell	*Closterium lunula* Ehrenberg & Hemprich ex Ralfs
Oscillatoria princeps Vaucher	Euglenaceae
Merismopedia convoluta Brébisson ex Kützing	*Euglena minuta* Prescott
Anabaena microspora Kleb.	*Lepocinclis ovum* Ehrenberg

Phytoplankton diversity

Diversity of Phytoplankton is helpful in assessing the status of the lake. List of recorded phytoplankton species was shown in table 3. In present study 29 species of algae was recorded which belongs to Bacillariophyceae, Chlorophyceae, Cyanophyceae, Euglenophyceae and Desmidiaceae. In these 5 classes, Cyanophyceae members are dominant among them Microcystis aeruginosa were the dominant species which present throughout the year. In summer season the species level increases considerable. Due to death and decay of this species the foul smelling was emitted from the lake. To know the diversity of phytoplankton the data was subjected to PAST software. The calculated diversity indices are shown in Table 4.

Shannon wiener index

Shannon wiener index (1949) contains both richness and dominance of the species. The Shannon Weiner index increases with increase in number of taxa.

It is represented as follows,

(H′)=∑pi in pi

Where pi=proportion of the ith species and in natural logarithm.

This index helps in determining pollution status of the water body. According willham and Dorris (1966) stated that values of the index >3 indicates clean water, values <3 indicates moderate pollution and values <1 considered as heavily polluted. In the present study, the value ranges from 0.7356 to 1.609. The higher value recorded in November and lower values in March, April and May. The lake is moderately polluted in months of June, July, August, September, October, November, December and January. It heavily polluted during February, March, April and May.

Table 4. Calculation of diversity indices of Chikkakere

Taxa_S	4	5	4	5	6	5	4	3	3	3	3	4
Individuals	8400	9800	8400	11200	14000	14000	12600	12600	11200	11200	11200	8400
Simpson_1-D	0.67	0.73	0.67	0.69	0.76	0.74	0.52	0.49	0.41	0.41	0.41	0.67
Shannon_H	1.24	1.48	1.24	1.39	1.61	1.47	1.00	0.85	0.74	0.74	0.74	1.24
Evenness_e^H/S	0.87	0.87	0.87	0.80	0.83	0.87	0.68	0.78	0.70	0.70	0.70	0.87
Margalef	0.33	0.44	0.33	0.43	0.52	0.42	0.32	0.21	0.21	0.21	0.21	0.33
Fisher_alpha	0.40	0.51	0.40	0.50	0.60	0.49	0.38	0.28	0.28	0.28	0.28	0.40
Berger-Parker	0.50	0.43	0.50	0.50	0.40	0.40	0.67	0.67	0.75	0.75	0.75	0.50

The diversity indices explain about the dominance, evenness and abundance of the species. Diversity indices like Simpson's, Shannon wiener, Pielou's evenness, Margalef's index, Fisher's alpha index and Berger-Parker index were disused.

Simpson's diversity index

Species richness as a measure on its own takes no account of the number of individuals of each species present. It gives equal weight to those species with very few individuals and those with many individuals. Simpson's index (D) is a measure of diversity, which takes into account both species richness, and an evenness of abundance among the species present. In essence it measures the probability that two individuals randomly selected from an area will belong to the same species. The formula for calculating D is presented as:

$$D = \frac{\sum n_i(n_i - 1)}{N(N-1)}$$

Where ni = the total number of organisms of each individual species

N = the total number of organisms of all species

The value of D ranges from 0 to 1. With this index, 0 represents infinite diversity and 1 no diversity. That is, the bigger the value the lower the diversity. The index value ranges from 0.4063 to 0.7347. The maximum value observed in January and minimum value observed in March, April and May. The result shows that the species are not evenly distributed.

Pielou's evenness index

Pielou's evenness index (1975) measures the evenness of the species. The index is expressed as,

$$J=\frac{H'}{\log(S)}$$

If H is the observed Shannon Weiner index, the maximum value this would take is log(S) where S is the total number of species in the habitat. The Pielou's index ranges from 0.6814 to 0.8743. The higher value observed in August and the lower value in January. The result shows that the phytoplankton diversity is not evenly distributed.

Margalef's index

The Margalef's index is also similar to Menhinick index. It also measures richness of species. It is calculated using the formula

$$D=\frac{(S-1)}{In\ N}$$

It is calculated as the species number (S) minus 1 divided by the logarithm of the total number of individuals (N). The present work showed Margalef's index values ranges from 0.2118 to 0.5237. The higher value observed in November and the lower value in February. From the above result the species diversity is less in the lake.

Fisher's alpha index

The index is the alpha parameter. The index of diversity that assumes that the abundance of species follows the log series distribution:

$$\alpha x, \frac{\alpha x^2}{2}, \frac{\alpha x^3}{3}, \ldots\ldots\ldots \frac{\alpha x}{n}$$

The index value ranges from 0.28 to 0.59.The maximum value observed in November and the minimum value in February. The higher value in November shows that the abundance of species where as lower values in February shows less abundance of species.

Berger-Parker index

it is simple measures of the numerical importance of the most abundant species. It is represented as follows:

$$D = \frac{N\ max}{N}$$

Where Nmax is the number of individuals in the most abundant species and N is the total number of individuals in the sample. In the present study it indicates that individuals of the community in all months are not evenly distributed. The index ranges between 0.75 to 0.4.The value is higher in month of March, April and May and lower value found in month of November and December.

Conclusion

Based on the above study, during summer season water quality of chikkakere becomes heavily polluted due to the lowering of water level and increase in organic load. Higher values of both physical and chemical parameters like pH, EC, Salinity, turbidity and total hardness, calcium, chloride, nitrate, phosphate, BOD, COD respectively leads to eutrophication in the lake. The Phytoplankton diversity helps in assessing the water quality of the lake. The diversity of phytoplankton is affected by these physico- chemical parameters. From the biodiversity indices it is clear that the Phytoplankton diversity is not evenly distributed in the lake which indicates the pollution status of the water body. From both physico-chemical and phytoplankton diversity it can be concluded that the water quality of the lake is very poor and it is unfit for drinking purpose. The domestic, agricultural, anthropogenic activities and sewage contamination reduces the water quality and disturb the lake ecosystem.

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