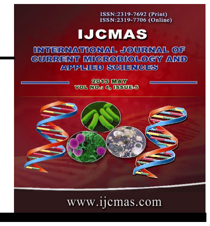
Int.J.Curr.Microbiol.App.Sci (2015) 4(5): 362-376



International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 4 Number 5 (2015) pp. 362-376**
http://www.ijcmas.com

Original Research Article

Biodiversity of Phytoplankton in a Tropical Lake of South India

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A B S T R A C T

Keywords

Lake, Phytoplankton, Cyanophyceae, Chlorophyceae, Bacillario-phyceae, Dinophyceae, Euglenophyceae

Freshwater ecosystems provide vital resources for human beings. As both qualitative and quantitative abundance of phytoplankton are of great importance for imposing sustainable management practices, the present study was aimed at assessing the phytoplankton diversity in a lake in the suburb of Pudukkottai District, Tamil Nadu. Forty-nine species belonging to five groups were recorded of which 11 species belonged to Cyanophyceae, 16 to Chlorophyceae, 14 to Bacillariophyceae, 5 to Euglenophyceae and 1 to Dinophyceae. The present study reveals that each species as well as group appeared to prefer certain months of the year to record their highest counts. Further, in terms of count, among the various groups, the order of dominance was Cyanophyceae > Bacillariophyceae > Chlorophyceae > Euglenophyceae > Dinophyceae.

Introduction

Freshwater ecosystems provide vital resources for humans and are the sole habitat for an extraordinary rich endemic and sensitive biota (Jasmine *et al.*, 2013). The water quality parameters of an aquatic environment greatly influence its productivity (Wetzel, 1983; Ahmed and Singh, 1989; Bais and Agarwal, 1990). Both the qualitative and quantitative abundance of plankton in a water body are of great importance for imposing sustainable management policies as they vary from location to location and aquatic systems within the same location even with similar ecological conditions (Boyd, 1982). The primary productivity of different water bodies have been widely investigated to assess the fish production potentialities of a water body and to formulate sustainable fishery management practices.

Hence the present study was undertaken to assess the phytoplankton community for two years in a lake situated in the suburb in Pudukkottai District, Tamil Nadu.

Materials and Methods

Physico-chemical variables

Water samples were drawn from surface and bottom and stored in separate polyethylene bottles for later analyses in the laboratory. While some physico-chemical variables like estimation of dissolved oxygen (DO), hydrogen-ion- concentration (pH), free carbondioxide (free CO_2), phenolphthalein alkalinity (PPA) and methyl orange alkalinity (MOA) were analysed in the field itself, all other variables were analysed in the laboratory. Duplicate samples of all variables were taken and the average values taken.

The atmospheric, surface and bottom water temperatures were measured using a centigrade mercury thermometer calibrated to 100°C. Atmospheric temperature was measured in shade, while surface water temperature was analysed by taking the surface water in a container and then measuring it. Bottom water temperature was recorded by using a Friedinger's water sampler. The water level of the lake was measured using a graduated rope provided with a weight at one end. The measurement was done on every sampling day at a particular spot. While the transparency of the water column was measured using a Secchi's disc, total dissolved solids (TDS) was estimated by evaporating the water samples in a porcelain dish (Saxena, 1987); dissolved oxygen (DO) was estimated using unmodified Winkler's method (Ellis *et al.*, 1984). While free carbondioxide (free CO_2) and alkalinity (phenolphthalein and methyl orange) were determined according to Saxena (1987), pH was measured in the field itself with a digital pH pen (Hanna) and electrical conductivity was measured using a water analysis kit (Elico). Nutrients like phosphate, silicate, ammonia-nitrogen, nitrite-nitrogen, sulphate, calcium and magnesium were estimated according to APHA (1995). Nitrate-nitrogen (NO_3-N) was estimated after Mackereth (1961) and chloride after Strickland and Parsons (1972). While oxidizable organic matter, nitrogenous organic matter and suspended solids were done following APHA (1995), Trivedy and Goel (1986) and Taylor (1949), biological oxygen demand (BOD) was estimated following the procedure of Sawer and Bradney (1946) and chemical oxygen demand (COD) as per Moore *et al.* (1949).

Phytoplankton analysis

Surface water samples were collected with the help of a satin net (pore diameter 4.5μ) fitted to an aluminium frame between 7:00 and 8:00 am for a period of two years (2011-12 and 2012-13). Collection was done on a monthly basis. The samples were immediately transferred to glass containers for later microscopic analyses. Lugol's solution was also added as a preservative. Care was also taken to observe some fresh samples. The counting of algae was done using a Sedgwick-Rafter Counting Cell (Saxena, 1987). Samples were isolated and identified by standard methods (Pearsall *et al.,* 1946; Desikachary, 1959; Starmach, 1966; Pennak, 1978; Rippka *et al.,* 1979; Prescott *et al.*, 1982; Adoni and Vaishy, 1985; Trivedy *et al.*, 1987; Sridharan, 1989). In addition, diversity indices were also calculated following Trivedy *et al.* (1987). Finally, the results obtained in the present study were statistically treated for a meaningful discussion.

Results and Discussion

The important physiochemical variables along with important nutrients that were estimated during the period of study are presented in Tables 1 and 2.

The various phytoplankters that occurred in the lake during the period of study are presented in tables 3–7. Phytoplankters were represented by 47 species belonging to five groups – Cyanophyceae, Chlorophyceae, Bacillariophyceae, Euglenophyceae and Dinophyceae.

Table 3 records the various cyanophycean species that were recorded during the two year study in Aathivayal Lake. As evident from the table, a total of 11 cyanophycean species were recorded. This included 2 species each belonging to the genus *Anabaena*, *Microcystis* and *Oscillatoria* followed by a single species each belonging to the genus *Gleocapsa*, *Gleocystis*, *Lyngbya* and *Phormidium*. However, among these species, only 4 were perennial (*Anabaena circinalis*, *Lyngbya allorgi*, *Microcystis aeruginosa* and *Oscillatoria limosa*).

A comparison of the perennial species reveals that *L. allorgi* and *O. limosa* preferred the month of August while *A. circinalis* preferred September and *M. aeruginosa*, December to occur in maximum numbers. Thus, even though all these species were perennial, they preferred certain months of the year to occur in maximum numbers. The other cyanophycean species also showed the same trend. Nevertheless, an overall comparison reveals that they generally preferred the period between August and December within which they appeared to prefer August - September the most as 7 of the 11 species recorded their maximum counts during this time.

Literature reveals that Ghosh *et al.* (1974) reported their maximum occurrence during the monsoon period while Singh (1981) recorded their preference for the summer season. Thus there appears to be differences in the seasons of dominance. Literature reveals that Ganapati *et al.* (1953) reported maximal amount of Cyanophyceae to occur when temperature, pH, PPA and MOA were high. In the present study, though there was no significant correlation with temperature, there was a direct correlation with pH, PPA and MOA as they were on the higher side when cyanophyceal counts were high. Further, Ganapati *et al.* (1953) also suggested that increased silicates and phosphates also resulted in high cyanophycean counts. This appeared to be true in the present study also as highest counts were recorded when the levels of the above nutrients were also high. In addition, literature also indicates that many workers have also found a direct correlation between Cyanophyceae and nutrients like calcium, ammonia, nitrate and oxidizable organic matter (Rao, 1977; Hegde and Bharathi, 1985, Sivakami, 1996). This appears to be true in the present study also (r value: Ca = 0.04, NH_3 = 0.06, NO_3 = 0.12, OOM = 0.16).

As to the presence of Cyanophyceae, Pennak (1955) suggested that *Microcystis* could be considered as an indicator of pollution while Sreenivasan (1972) reported that *M. aeruginosa* as an indicator of eutrophication. Nevertheless, Prasad and Jonna (1994) regarded cyanophytes to play a significant role in fish production while Ganapati *et al.* (1953) cautioned that cyanophycean blooms should not be allowed to form a dense scum on the surface as they can cause fish mortality.

Table 4 records the chlorophycean species that were recorded during the period of study. As seen from the table, a total of 16 species were recorded of which 3 species belonged to the genus *Closterium* and two species each belonged to the genus *Scenedesmus* and *Spirogyra* respectively. The remaining species were all represented by a single species belonging to different genera. Among the 16 species, there were six perennial species (*Ankistrodesmus falcatus, Chlorella vulgaris, Closterium elegans, Pediastrum tetras, Scenedesmus armatus* and *Spirogyra macrospora*).

A perusal of perennial species reveals that *P. tetras* and *S. armatus* preferred December while *S. macrospora* and *C. elegans* preferred January and *A. falcatus* and *C. vulgaris* preferred February to record their maximum counts of the year. Thus even though chlorophycean species were recorded throughout the year, each species preferred certain months of the year to record their highest counts. Nevertheless, on the whole, it can be suggested that chlorophyceans preferred the months between August and January within which their most preferred months were December and January as 50% of the chlorophycean species recorded their highest counts during this period.

Among the Chlorophyceae, the most dominant species in terms of number was *Chlorella vulgaris* followed by *Ankistrodesmus falcatus* while the least dominant was *Netrium digitus*. A perusal of the total chlorophycean count (Table 4) reveals that there was a unimodal peak. In general, there was a decreasing trend from March till July followed by a gradual increase to reach the peak in February.

Literature reveals that chlorophytes preferred different periods in different water bodies. Thus, Kohli (1981) suggested that they preferred January and February in a reservoir while Singh (1990) reported their preference in February for a pond and Sivakami (1996) between October and February for a pond in Tamil Nadu. In the present study, the most preferred season was between December and January. Thus, the results of the study are in line with the above workers. The highest counts noticed during the said period could be attributed to the increased availability of the nutrients due to increased runoff entering the system after the rains. Pearsall (1932) suggested that green algal production increased with increasing organic matter. This is true in the present study as the count appeared to increase with increasing organic matter. Zafar (1964) reported high pH values favouring their growth. In the present study also, the chlorophycean count showed a positive correlation between dissolved oxygen and pH (r value = 0.12).

According to Palmer (1959), the presence of some chlorophytes like *Scenedesmus* is an indication of pollution while Hutchinson (1967) suggested that many chlorophytes like *Chlorella* can synthesize cobalamines. However, Jayanthi (1994) reported that chlorophyceae form an important source of food for fishes and hence play an important role in aquaculture.

The Bacillariophyceae that were recorded in the lake are presented in table 5. As seen from the table, a total of 14 species were recorded out of which the genera *Cymbella*, *Gomphonema* and *Pinnularia* were recorded by two species each while the remaining were represented by a single species belonging to different genera. Among the 11 species that were recorded, only 5 species were perennial (*Cyclotella glomerata*, *Diatoma vulgare*, *Fragillaria crotonensis*, *Navicula cryptocephala* and *Pinnularia major*).

A perusal of the perennial species reveals that *C. glomerata* preferred January to record their highest counts while the remaining (*D. vulgare, F. crotonensis, N. cryptocephala* and *P. major*) species recorded their preference for February to occur in maximum numbers. Thus, each bacillarian species appeared to prefer a certain month of the year to record their maximum counts. Nevertheless, a closer perusal reveals that on the whole, they appeared to prefer the period from July to February within which the most preferred period was January and February as 10 of the 14 species recorded their maximum counts during this time.

Among Bacillariophyceae, the most dominant member in terms of count was *Diatoma vulgare* followed by *Pinnularia major* while the least dominant was *Gomphonema lanceolatum*.

A perusal of literature reveals that Bacillariophyceae appeared to prefer different months in different water bodies. While Kastooribai (1991), Jayanthi (1994) and Sivakami (1996) reported their preference during the months from February to May, Sukumaran (1989) and Singh (1990) reported their preference between January and September while Hegde and Bharathi (1985) and Ganai *et al.* (2010) reported their preference during the winter season. Thus, the present study is in line with the observations made by Kastooribai (1991), Jayanthi (1994) and Sivakami (1996).

According to Wetzel (1983), one of the most important factors that control Bacillariophyceae is the negative relationship between diatoms and silicate content. This fact was clearly observed in the present study. However, Pearsall (1932) suggested that diatoms flourished when water is rich in nitrates and phosphates. A similar condition was also observed in the present study. Hegde and Bharathi (1985) however, noticed a relationship between calcium content and dissolved oxygen content with higher concentrations recording higher diatoms. The present study also suggests a similar condition. Further, Ganai *et al.* (2009) also noticed that changes in water temperature are also an important criterion in controlling the composition of Cyanobacteria.

The various euglenophycean and dinophycean populations that were recorded in the lake are presented in table 6. As evident from the table, Euglenophyceae were represented by 5 species belonging to three genera. Of these, two species each were recorded by the genus *Euglena* and *Phacus* and one by the genus *Lepocincilis*. Among the 5 recorded species, 3 were perennial (*Euglena acus*, *Euglena elastica* and *Phacus nordstedtii*).

While *E. acus* preferred February to record its highest counts, *E. elastica* and *P. nordstedtii* preferred March to record their maximum counts. Among the 5 species, *E. acus* was the most dominant species followed by *E. elastica* while the least dominant species was *P. pleuronectes* in terms of count.

In the present study, the most preferred month was March. Literature reveals a wide range of preference with euglenoids choosing a variety of months to occur in maximum number in various water bodies of India. Thus, while Singh (1981) reported its preference in summer, Sukumaran (1989) noticed their preference in October, June, September and December and Kastooribai (1991) in September - October. However, Sivakami (1996) reported their preference in March and August. Thus the present study is in agreement with the observation made by Sivakami (1996).

Literature reveals that the genus *Euglena* and *Phacus* have been commonly recorded in the water bodies of India especially in Tamil Nadu (Sreenivasan, 1968; Franklin, 1970; Jayanthi, 1987; Sivakami, 1996).

Table.1 Variation of physical variables - Aathivayal Lake

S. No.	Physical Variables	Unit	Range
1.	Atmospheric Temperature	°C	29-37
2.	Surface Water Temperature	°C	25.5-33.0
3.	Bottom Water Temperature	°C	25-33
4.	Water Level	cm	140-470
5.	Transparency	cm	51-76

Table.2 Variation of chemical variables - Aathivayal Lake

6.	Dissolved Oxygen (DO)	mg/l	7.0-10.8
7.	Free Carbon-dioxide (Free CO_2)	mg/l	2.3-4.5
8.	Hydrogen Ion Concentration	pH	7.5-8.9
9.	Methyl Orange Alkalinity (MOA)	mg/l	182-308
10.	Phenolphthalein Alkalinity (PPA)	mg/l	–
11.	Electrical Conductivity (EC)	µmhos/cm	110-306
12.	Total Dissolved Solids (TDS)	mg/l	351-565
13.	Phosphate (PO_4)	mg/l	0.34-0.56
14.	Silicate (SiO_2-Si)	mg/l	3.80-7.10
15.	Nitrate-Nitrogen (NO_3-N)	mg/l	0.12-0.30
16.	Nitrite-Nitrogen (NO_2-N)	mg/l	0.06-0.16
17.	Ammonia-Nitrogen (NH_3-N)	mg/l	0.11-0.33
18.	Sulphate (SO_4)	mg/l	1.90-3.60
19.	Calcium ($CaCO_3$)	mg/l	40.60-67.60
20.	Magnesium (Mg)	mg/l	16.60-43.20
21.	Chloride (Cl_2)	mg/l	63.7-231.3
22.	Bioloical Oxygen Demand (BOD)	mg/l	13.8-36.0
23.	Chemical Oxygen Demand (COD)	mg/l	35.6-77.6

Table.3 Monthly occurrence of Cyanophyceae in Aathivayal Lake (i/l)

S. No.	Species	Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1.	*Anabaena circinalis*	2011-12	110	210	260	130	100	90	70	80	180	190	170	100
		2012-13	70	230	280	140	90	40	90	100	170	210	200	170
2.	*Anabaena spiroides*	2011-12	0	0	10	60	70	90	70	60	40	20	0	0
		2012-13	0	0	10	70	90	110	90	80	30	10	0	0
3.	*Gloeocapsa magna*	2011-12	0	10	40	50	80	20	10	0	0	0	0	0
		2012-13	0	0	10	70	80	30	20	10	10	0	0	0
4.	*Gloeocystis ampla*	2011-12	40	70	80	40	20	10	0	0	0	0	0	0
		2012-13	40	80	90	20	20	10	10	0	0	0	0	0
5.	*Lyngbya allorgi*	2011-12	30	60	30	20	20	30	40	50	40	30	10	10
		2012-13	20	70	30	10	10	20	30	60	30	20	10	10
6.	*Microcystis aeruginosa*	2011-12	520	600	400	430	1110	1200	1100	900	800	660	560	480
		2012-13	540	700	560	360	1240	1400	1300	1000	960	700	610	500
7.	*Microcystis flosaquae*	2011-12	110	160	130	120	100	70	0	0	0	30	60	80
		2012-13	160	200	110	80	70	30	0	0	0	0	40	30
8.	*Oscillatoria limosa*	2011-12	50	90	30	20	10	10	20	40	20	10	10	40
		2012-13	60	80	30	20	10	10	20	40	20	10	10	60
9.	*Oscillatoria princeps*	2011-12	10	80	10	0	0	0	10	40	50	20	10	10
		2012-13	10	70	10	0	0	0	10	30	60	30	10	10
10.	*Phormidium calcicola*	2011-12	20	30	20	10	0	0	10	30	30	20	0	0
		2012-13	30	40	20	10	0	0	0	20	30	30	20	0
11.	*Coccochloris stagnina*	2011-12	10	10	20	60	20	10	0	0	0	0	0	0
		2012-13	10	10	10	70	20	10	0	0	0	0	0	0
Total Count		2011-12	900	1320	1030	940	1580	1530	1330	1200	1160	980	820	720
		2012-13	940	1480	1160	850	1630	1660	1570	1340	1330	1010	900	780
Average			920	1400	1095	895	1605	1595	1450	1270	1245	995	860	750

Table.4 Monthly occurrence of Chlorophyceae of Aathivayal Lake (i/l)

S. No.	Species	Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1.	*Ankistrodesmus falcatus*	2011-12	10	30	20	10	10	40	140	160	50	40	30	30
		2012-13	10	40	20	10	10	30	180	190	40	30	30	30
2.	*Chlorella vulgaris*	2011-12	60	150	20	20	140	30	240	270	180	120	100	90
		2012-13	70	130	30	30	170	80	260	280	190	130	120	80
3.	*Chlorophytum lemnae*	2011-12	0	0	10	70	140	40	30	10	0	0	0	0
		2012-13	0	0	20	80	130	40	30	0	0	0	0	0
4.	*Closterium diana*	2011-12	10	70	20	0	0	10	70	20	0	0	0	0
		2012-13	10	30	20	0	0	10	80	40	30	0	0	0
5.	*Closterium elegans*	2011-12	30	70	20	20	20	90	110	70	80	30	20	20
		2012-13	20	60	10	10	30	110	130	90	80	40	30	30
6.	*Closterium lenceolatum*	2011-12	10	60	10	40	90	20	10	0	0	0	0	0
		2012-13	10	60	70	30	70	20	20	0	0	0	0	0
7.	*Monoraphidium arcuatum*	2011-12	0	0	0	0	0	0	0	0	0	0	0	0
		2012-13	10	40	30	20	10	0	0	0	0	0	10	10
8.	*Mougeotia scalaris*	2011-12	0	0	0	0	0	0	0	10	40	70	10	10
		2012-13	0	0	0	0	0	0	0	0	0	0	0	0
9.	*Pondorina morum*	2011-12	0	0	10	20	50	60	30	20	10	10	10	0
		2012-13	0	0	10	30	60	80	40	30	20	20	10	0
10.	*Netrium digitus*	2011-12	0	0	40	20	20	10	0	0	0	0	0	0
		2012-13	0	0	30	20	20	10	0	0	0	0	0	0
11.	*Pediastrum tetras*	2011-12	40	120	40	30	10	140	30	30	30	130	120	20
		2012-13	30	140	120	10	10	150	20	20	20	120	120	20
12.	*Scenedesmus armatus*	2011-12	10	40	60	10	40	40	40	20	20	30	30	30
		2012-13	10	30	30	10	40	50	40	20	30	20	20	20
13.	*Scenedesmus quadricauda*	2011-12	0	0	10	30	60	80	80	40	40	30	30	30
		2012-13	0	0	10	40	60	70	90	50	40	30	30	30

Continued...

Table 4 continued...

S. No.	Species	Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
14.	*Spirogyra macrospora*	2011-12	70	20	30	10	10	20	90	30	30	20	60	70
		2012-13	50	40	40	20	20	30	110	40	30	70	80	80
15.	*Spirogyra singularis*	2011-12	30	60	30	10	10	0	0	0	0	0	0	0
		2012-13	40	50	20	10	10	0	0	0	0	0	0	0
16.	*Ulothrix limnetica*	2011-12	0	0	0	0	0	10	120	30	40	20	10	10
		2012-13	0	0	0	0	0	10	130	60	30	30	10	10
17.	*Zygnema subcylindricum*	2011-12	10	10	30	40	50	60	70	20	20	10	10	10
		2012-13	20	30	40	50	60	80	90	40	20	20	20	30
18.	*Zygnema mucigenum*	2011-12	0	0	0	20	40	60	80	30	20	10	10	10
		2012-13	0	0	0	10	40	40	70	30	20	10	10	10
Total Count		2011-12	280	630	350	350	690	710	1040	1730	560	520	440	330
		2012-13	360	650	500	380	750	810	1160	890	550	520	490	350
Average			320	640	425	665	720	760	1100	1310	555	520	465	340

Table.5 Monthly occurrence of Bacillariophyceae of Aathivayal Lake (i/l)

S. No.	Species	Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1.	*Achanthes granulata*	2011-12	80	30	20	10	10	0	0	0	0	0	0	0
		2012-13	90	40	20	10	10	0	0	0	0	0	0	0
2.	*Cyclotella glomerata*	2011-12	10	20	40	80	110	170	180	120	80	70	30	30
		2012-13	20	30	40	120	150	180	290	240	140	90	60	20
3.	*Cymbella affinis*	2011-12	10	20	30	40	70	90	20	20	0	0	0	0
		2012-13	10	40	40	60	90	110	40	20	10	0	0	0
4.	*Cymbella lenceolata*	2011-12	0	0	0	0	10	40	60	90	10	10	10	10

S. No.	Species	Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
		2012-13	0	0	0	0	10	20	40	70	20	20	20	20
5.	*Diatoma vulgare*	2011-12	20	40	90	110	150	170	200	210	200	110	100	70
		2012-13	20	20	80	110	120	160	210	280	190	100	80	60
6.	*Fragilaria crotonensis*	2011-12	10	20	40	90	120	130	160	170	120	110	90	40
		2012-13	10	30	30	110	140	130	150	190	170	120	130	80
7.	*Gomphonema lenceolatum*	2011-12	40	80	40	20	0	0	0	0	0	0	0	0
		2012-13	50	60	40	30	0	0	0	0	0	0	0	0
8.	*Gomphonema parvulum*	2011-12	0	0	0	0	10	40	70	170	90	100	80	40
		2012-13	0	0	0	0	30	40	50	160	110	110	70	50
9.	*Melosira varians*	2011-12	40	30	60	30	10	0	0	0	0	0	0	0
		2012-13	30	40	30	20	10	0	0	0	0	0	0	0
10.	*Navicula cryptocephala*	2011-12	10	60	40	20	20	110	110	140	130	130	20	20
		2012-13	10	50	30	30	10	120	120	160	160	140	30	30
11.	*Nitzschia commulata*	2011-12	10	0	0	10	60	50	40	120	10	0	0	10
		2012-13	10	0	0	10	60	60	30	110	10	0	0	10
12.	*Pinnularia gibba*	2011-12	0	0	40	40	80	110	140	20	0	0	0	0
		2012-13	0	0	40	60	90	100	160	30	0	0	0	0
13.	*Pinnularia major*	2011-12	40	70	80	30	20	30	40	170	90	90	90	40
		2012-13	20	60	90	40	30	20	30	160	70	90	100	80
14.	*Synedra ulna*	2011-12	0	0	60	70	40	70	140	80	0	0	0	0
		2012-13	0	0	70	80	50	80	120	90	0	0	0	0
Total Count		2011-13	**540**	**760**	**990**	**1230**	**1510**	**2020**	**2340**	**2800**	**1610**	**1320**	**910**	**610**
Average		2011-13	**270**	**380**	**495**	**615**	**755**	**1010**	**1170**	**1400**	**805**	**660**	**455**	**305**

Table.6 Monthly occurrence of Euglenophyceae and Dinophyceae of Aathivayal Lake (i/l)

S. No.	Species	Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Euglenophyceae														
1.	*Euglena acus*	2011-12	220	140	30	120	240	300	420	440	220	140	230	140
		2012-13	210	130	20	110	250	370	440	480	200	150	260	180
2.	*Euglena elastica*	2011-12	100	110	120	120	130	140	150	160	260	190	170	160
		2012-13	70	120	140	160	130	180	110	180	270	200	130	90
3.	*Phacus nordstedtii*	2011-12	10	10	30	80	60	90	140	200	220	220	200	120
		2012-13	20	40	40	60	70	100	160	170	280	210	170	160
4.	*Phacus pleuronectes*	2011-12	0	0	0	0	0	0	40	70	120	90	20	0
		2012-13	0	0	0	0	0	0	20	80	110	80	40	0
5.	*Lepocincilis ovum*	2011-12	0	0	0	0	0	0	90	140	190	180	160	0
		2012-13	0	0	0	0	0	0	70	120	170	120	130	0
Total Count		2011-13	**630**	**550**	**380**	**650**	**880**	**1090**	**1640**	**2040**	**2190**	**1580**	**1510**	**850**
Average		2011-13	**315**	**275**	**190**	**325**	**440**	**545**	**820**	**1020**	**1095**	**790**	**755**	**425**
Dinophyceae														
1.	*Ceratium hirudinella*	2011-12	0	0	10	40	50	60	80	10	0	0	0	0
		2012-13	0	0	0	10	60	90	110	20	0	0	0	0
Total Count		2011-13	**0**	**0**	**10**	**50**	**110**	**150**	**190**	**30**	**0**	**0**	**0**	**0**
Average			**0**	**0**	**5**	**25**	**55**	**75**	**95**	**15**	**0**	**0**	**0**	**0**

Table.7 Phytoplankton Total Count of Aathivayal Lake (i/l)

S. No.	Phytoplankton	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1.	Euglenophyceae	315	275	190	325	440	545	820	1020	1095	790	755	425
2.	Chlorophyceae	320	640	425	665	720	760	1100	1310	555	520	465	340
3.	Bacillariophyceae	270	380	495	615	755	1010	1170	1400	805	660	455	305
4.	Cyanophyceae	920	1400	1095	895	1605	1595	1450	1270	1245	995	860	750
5.	Dinophyceae	0	0	5	25	55	75	95	15	0	0	0	0
Total Count		**1825**	**2695**	**2210**	**2525**	**3575**	**3985**	**4635**	**5015**	**3700**	**2965**	**2535**	**1820**

This is in agreement with the observation made by Hutchinson (1967) who suggested that Euglenophyceae are widely distributed in open waters of lakes. However, the genus *Lepocincilis* appears to be unique as no reference to this genus appears to be recorded in the water bodies of Tamil Nadu.

According to Wetel (1983) euglenophycean development occurs when ammonia and dissolved nitrogen compounds are high while Rao (1977) and Singh and Swarup (1980) reported that there was a direct relationship between iron and euglenoids. In the present study also, there was a direct relationship between ammonia and iron with euglenoids. In addition, Seenayya (1971) and Hegde and Bharati (1985) also suggested that high values of free CO_2, oxidizable organic matter and chlorides supported their growth. In the present study euglenoids recorded a direct correlation with all the above parameters. According to Hutchinson (1967) algal blooms of *Euglena* usually occur in organically polluted bodies of water. Based on this assumption, the present water body can be considered as organically polluted. Dinophyceae was represented by a single species *Ceratium hirudinella*. It was a non-perennial species occurring between September and February and recording its peak in January. A perusal of literature reveals that Sipauba-Tavares *et al.* (2010) and Hosmani and Mruthunjaya (2012) have also reported the occurrence of this group (Dinophyceae) in very small numbers. These findings are in line with the observations noticed in the present study.

In general, among the various groups of phytoplanketers, in terms of class count, Cyanophyceae appeared to dominate followed by Bacillariophyceae, Chlorophyceae, Euglenophyceae and Dinophyceae. The percentage composition of each group was as follows: Cyanophyceae (37.1%), Bacillariophyceae (22.1%), Chlorophyceae (20.6%), Euglenophyceae (19.6%) and Dinophycae (0.71%). A perusal of literature reveals that Sivakami (1996) recorded a hierarchy of Cyanophyceae > Chlorophyceae > Euglenophyceae > Bacillariophyceae while Ganai *et al.* (2010) recorded a hierarchy of Bacillariophyceae > Chlorophyceae > Cyanophyceae > Euglenophyceae while Hosmani and Mruthunjaya (2012) reported a hierarchy of Cyanophyceae > Bacillariophyceae > Euglenophyceae > Chlorophyceae > Dinophyceae in various water bodies of India. Thus it is clear that each water body has its own composition of algal population. Nevertheless, as mentioned by Wetzel (1983) the outstanding feature of phytoplankton communities is the coexistence of a number of algal species.

The present investigation also suggests that each algal group appeared to choose a particular period to show increased counts. Thus Dinophyceae preferred January while Chlorophyceae December and January and Bacillariophyceae February. On the other hand Euglenophyceae preferred February and March while Cyanophyceae preferred August and September to record their highest counts.

With regard to the variation in the phytoplankton population, Hutchinson (1967) suggested that they oscillate temporarily in abundance dominating for a period and then become extremely rare while Tilman (1982) reported that temperature, salinity and nutrient concentration play an important role influencing phytoplanktonic community and Chellappa *et al.* (2009) recorded that phytoplankton growth and development are mainly steered by available solar energy input, hydrodynamic forces such as stratification and mixing in the resulting levels of nitrogen and phosphorus.

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