Estimation of Phosphate and its Correlation with Biodiversity of Freshwater Algae

Monisha.B

(Reg.No.16PBO009)

Thesis Submitted to

Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore-641 043.

In Partial Fulfillment of the Requirements for The Degree of Master of Science in Botany

April 2018

Signature of the Head of the Department

Signature of the Supervisor

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1. INTRODUCTION

Fresh water and Algae Biodiversity

Water supports life on earth and around which the entire fabric of life is woven. Ponds, as sources of water, are of fundamental importance to man. Ponds and lakes constitute aquatic ecosystem. The ponds and lakes constitute a huge array of organisms ranging from lower phytoplanktons to higher plants and variety of zooplanktons. In developing nations, water sources are used for domestic purposes such as Washing of cloths, bathing, domestic or agricultural use, for transport, defense, ritual or industrial use, social aggrandizement, swimming, fish farming or the creation of the picturesque and sometimes as a source of Drinking water (Ress, 1997,Narayan *et al.*, 2007, Bishnoi and Malik, 2008).

Increased human activities over the last few years are imposed a greater stress on these ecosystems resulting in changes in their features. There is a need for scientific management of exploitation and conservation of these natural resources. To achieve this goal there is an urgent need of basic and applied research on various aspects of aquatic ecosystems. In India algal diversity in fresh water wetlands along with their physic -chemical characteristics of the concerned water bodies' studies were important (Selvaraj *et al,* 2014).

The Indian researchers has described the condition of Indian freshwater resources and their management as a prominent environmental problem with nutrition enrichment, acidification and domestic waste, sewage, agricultural and industrial effluents contamination by toxic substances identified as major impacts (Sachidanandamurthy and Yajurvedi, 2006 Shekhar *et al.,* 2008; Senthilkumar and Sivakumar, 2008, Rajgopal *et al.* 2010).

Tamil Nadu is bestowed with a large number of perennial and temporary ponds. The biodiversity of algal flora in the water bodies shows a correlation with reference to their occurrence and the physicochemical factors. The algae serve as the primary producers in the food chain and the productivity depends upon the quality of water (Elaiyaraj *et al.,* 2014).

Water Qualitative analysis

The availability of fresh water is potentially one of the most pervasive crises of the coming century. Water-related decisions will determine the future of major ecosystems, health of regional economies and political stability of the nations. Water quality plays an important role in promoting agricultural production and standard of human health. Water quality is much depending on the desired use of water, hence different uses require different criteria of water quality assessment as well as standard method for reporting and comparing

result of water analysis (Babiker *et al.*, 2007). Therefore, understanding of the chemical composition of water is essential for evaluating its suitability for different purposes. Further, it is possible to understand the change in quality due to water–rock interaction (weathering) or any type of anthropogenic influences. In the last few decades, due to rapid industrialization and increase in human population, there has been a tremendous pressure on the demand of fresh water (Singh *et al.* 2014; Chandra *et al,* 2014; Singh *et al*, 2017).

Water pollution not only affects water quality but also threats human health, economic development and social prosperity .A large population in India still lives in absolute poverty in both urban and rural area lacking access to clean drinking water and basic sanitation. Access to safe drinking water remains an urgent necessity, as 30 % of urban and 90 % of rural Indian population still depend completely on untreated surface or groundwater resources (Kumar *et al,* 2005, Singh *et al*, 2017).

Physicochemical analysis of water

Temperature

Temperature is known to play an important role in maintaining all ecosystems including the aquatic ones. The organisms are tolerant to specific ranges of temperature, outside which they cannot function. Egbore (1978) stated that a small variation in temperature effects density of water, which in turn influences the movements of aquatic organisms as well as dissolved substances in water. Temperature controls chemical and biological reactions in aquatic organisms and play important role in shallow water bodies as the change are rapidly distributed across the water mass (Somani, 2002).

pH

pH a function of dissolved carbon dioxide content (Odum, 1971) that can illustrate the metabolism of CO_2 and Oxygen in water has been habitually recorded.

Total Dissolved Solids

According to WHO (1997) Total Dissolved Solids higher than 200mg/l makes the water non-potable. With incessant misuse of the city wetland, for over a couple of decades, now the water has become unfit for routine uses including human consumption. The researchers are of consensus that the release of untreated sewage and industrial effluent are the main sources of chlorides and other chemicals leading to high TDS and hardness in the wetland waters.

Phosphate

Phosphorus is one of the essential nutrients necessary for the nutrition and growth of living organisms. It occurs in relatively low amount to the needs of plants. Surface waters and groundwater are contaminated by both natural and anthropogenic sources of phosphates.

Natural sources of phosphorus are atmospheric deposition, natural decomposition of rocks and minerals, weathering of soluble inorganic materials, decaying biomass, runoff, and sedimentation. Anthropogenic sources include; fertilizers, wastewater and septic system effluent, animal wastes, detergents, industrial discharge, phosphate mining, drinking water treatment, forest fires, synthetic material development surface .In natural, phosphorus occurs as dissolved phosphate - the most significant form of phosphorus in natural water. Orthophosphate (Nolan *et al.*, 2000), thermodynamically stable form of phosphate is the commonly identified form of phosphate in laboratory analysis and it is readily used by plants. The unstable form of phosphate is Polyphosphates which convert later into Orthophosphate (Odum, 1971) Phosphates are moderately soluble. Transportation by runoff and soil erosion can highly enhance the levels of phosphate in surface waters. A low concentration of phosphate in water bodies is largely by uptake of plants and adsorption by metal oxides. (.Fadiran *et al,* 2008). Naturally occurring levels of phosphates are not harmful to human health, animals or the environment, but extremely high levels of phosphates can cause digestive problem.

Excessive amounts of phosphates in water bodies leads to eutrophication. Eutrophication accelerates algal growth to extreme quantities. An excessive alga on the water surfaces clogs pipelines, restricted recreation and foul odours, when they eventually decay. Algal blooms cause health problems such as skin irritation and death of both human and animals. (Oram, 2005; Fadiran *et al*, 2008)

The World Health Organization (WHO), in 1980 concluded that there is no nutritional basis for the regulation of phosphorus levels in the US drinking water supplies(Zuane 1990) USEPA's recommendation to avoid eutrophication (1) total PO4 – P _ 0.05 mg/L in a stream at a point where it discharges into a lake or reservoirs, (2) total PO4 –P _ 0.1 mg/L in streams that do not discharge directly into lakes or reservoirs, and (3) total PO4– P _ 0.025 mg/L for reservoirs (Oram, 2005)

The Swaziland Water Services Corporation (SWSC) recommends a PO4–P (total) of _1.0 mg/L for drinking water. For the purpose of monitoring and water rating the following are the useful requisite levels of total PO4–P (Oram 2005), 0.01-0.03 mg/L: level in uncontaminated lakes; 0.025-0.1 mg/L: levels at which plant growth is stimulated; 0.1 mg/L: maximum acceptable for avoidance of rapid eutrophication; > 0.10: high level resulting in accelerated algal growth problems (Fadiran *et al*, 2008).

Biological analysis of water

Phytoplankton plays an important role in aquatic ecosystems by producing oxygen and food. They sustain all other forms of life, ensuring ecological balance (Khan, 2003). The biota of an aquatic ecosystem comprises micro fauna and macro fauna, besides a wide range of organisms including microphytes and macrophytes. Phytoplankton present in wastewater systems can be used as indicators of water pollution (Torres, 2008). They also play a role in nutrient sequestration and removal of other contaminants from wastewaters. Studies on micro algal diversity and their monitoring water quality show that changes in phytoplankton composition reflect not only variation in water quality, but also changes in physical and chemical variables and biotic interactions. This implies the importance of biomonitoring studies in a variety of aquatic ecosystems. Ecological studies include seasonality of phytoplankton and variation of physico- chemical factors in water bodies and evaluate the relationship between algal taxa and environmental factors (Ajayan *et al.,* 2011; Thirugnanmoorthy 2009; Elaiyaraj *et al.,* 2016).

A number of study have been carried out on ecological condition of freshwater bodies in various parts of India (Gulati and Schultz, 1980; Rana, 1991; Singh *et al*., 2002; Smitha *et al.,* 2007), but southern part of Tamilnadu, the ecological studies of freshwater body is very scanty (Smitha *et al.,* 2007). Most of the ponds are getting polluted due to domestic waste, sewage, industrial and agricultural effluents (Shiddamallayya and Pratima, 2008; Shekhar *et al.,* 2008). The requirement of water in all lives, from micro-organisms to man, is a serious problem today because all water resources have reached to a point of crisis due to unplanned urbanization and industrialization(Rajagopai *et al.,*2010).

The qualitative and quantitative studies of phytoplankton have been utilized to assess the quality of water (Adoni *et al,* 1985, Shekhar *et al,* 2008). Several phytoplankton species have served as a bioindicators and it is a well suited tool for understanding water pollution studies (Ahmad, 1996; Rajgopal *et al,* 2010).

Cyanophyta

Cyanobacteria are photosynthetic prokaryotes found in most places and other aquatic systems. Since they have the ability to grow in different environments with little moisture and light, they can be found in almost all habitats. The species diversity, annual and seasonal variation of the cyanobacterial assemblage were investigated in different habitats namely, temple pond, paddy field, estuaries, lakes, rivers and streams, ponds and sulfur spring (Joishi, 2014). They also play a vital role in the maintenance and build up of the fertility of soil (Joishi, 2014).

Chlorophyceae

Chlorophyceae show an ability to tolerate a wide range of environmental condition. It represents a morphologically diverse group of photosynthetic organisms usually identified as green algae. They usually grow in the mixed community and shows colonization. It has been studied that members of Chlorophyceae tend to be more abundant in nutrient rich and standing water bodies. This is the largest and heterogenous group of freshwater algae ranging in size from microscopic unicellular or coenocytic to large colonies and extensive filamentous (Singh *et al, 2017*) 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 The dominance of chlorophyceae might be due to high dissolved contents. (Verma *et al*, 2014) the green algae prefer water with higher concentration of dissolve oxygen (Verma *et al*, 2014). The 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 (Verma *et al, 2014).*

Bacillariophyceae

This group includes a large number of unicellular and colonial genera which differ from other algae in the shape of their cells (Verma *et al*, 2014). The diatoms in Littoral zone are important contributors of the primary production in shallow aquatic ecosystem. Some of the genera of diatoms are pollution tolerant (Patil *et al*, 2013). *Synedra acus*, *Gomphonema* sp.and *Melsosira* sp. are found in organically rich in water and play an important role in water quality assessment and tropic structure. Daitoms are important in Paleolimnological studies to reconstruct the past eutrophication of lakes on basis of paleolimnological evidences. Bacillariophyceae members have shown significant positive with temperature, chlorine and phosphate. High temperature favours the growth of diatoms (Verma *et al*, 2014)

Application on Microalgae

Microalgae have been considered as potential source of new renewable energy feedstock. Cultivation of microalgae provides many advantages for sustainable development as follows: 1) energy security (micro algal biomass is renewable feedstock), 2) food security (production of micro algal biomass uses smaller foot print and non-arable land, therefore, no competition with food crop on price and land used), 3) CO2-fixation (from atmosphere or industrial flue gas, hence, reduces global warming), 4) Up take nitrogen and phosphorus from

waste water (consequently reduce eutrophication in aquatic ecosystems) and 5) restoration of land (by fertilizer or soil conditioner obtained from biomass residue). (Adhoni, 2015)

With the above few literature, the present study is focused on the physico chemical analysis including estimation of Phosphate and algal biodiversity of fresh water bodies of South India. The objective of the present study is as follows

1. Sample collection
2. Estimation of biomass of microalgae from different freshwater bodies
3. Physicochemical analysis of water sample of different freshwater bodies

REVIEW OF LITERATURE

Singh and Kumar (2017) studied the determination of chlorophyceae members abundance in Rawatsar Pond Of Hanumangarh District, Rajasthan State. The investigation shows a total of 14 distinct species of Chlorophyceae family were identified belonging to 7 genera and 5 varieties, during the period of January 2014 to August 2015. Out of 7 genera, *Scenedesums* (4 species and 3 varieties), *Pediastrum* (3 species and 1 variety) were abundant at the studied site. Algae characterization was performed based on morphological characters using light microscope and This is the first time that algal flora has been reported from Rawatsar pond. The result shows the presence of *Scenedesmus* and *Pediastrum* suggest eutrophic condition of water body. This study provides information regarding diversity and abundance of algal species in Rawatsar pond of Hanumangarh district, which may be used to determine environmental condition of the water bodies in the Hanumangarh district.

Tiwari *et al, (2017)* studied the hydrogeochemical study of surface water in Pratapgarh district has been carried out to assess the major ion chemistry and water quality for drinking and domestic purposes. In the present study twenty-five surface water samples were collected from river, ponds and canals and analysed for pH, electrical conductivity, total dissolved solids (TDS), turbidity, hardness. The analytical results show mildly acidic to alkaline nature of surface water resources of Pratapgarh district. For quality assessment, values of analysed parameters were compared with Indian and WHO water quality standards, which shows that the concentrations of TDS and total hardness are exceeding the desirable limits in some water samples. Water Quality Index (WQI) is one of the most effective tools to communicate information on the quality of any water body. The computed WQI values of Pratapgarh district surface water range from 28 to 198 with an average value of 82, and more than half of the study area is under excellent to good category

Chettri and Thapa (2016) studied physicochemical characteristic and periphytic algal communities of river Roru-Chu, East Sikkim, India: A preliminary investigation. In the investigation it was found that the periphytic algal community of Roruchu was represented by 54 taxa which belongs to 3 major class namely Bacillariophyceae (27 sp), Chlrophyceae (17sp) and Cyanophyceae(10 sp).In the present study the physico-chemical analysis of water reveals the richness in Dissolve oxygen and TDS(36-48mg/l) which might have favoured the growth of periphytons. The stream was found to be devoid of any major industrial polluting

source. The result showed that the stream is having crystal free water and are free from pollution as chlorophyceae are better represented.

Elayaraj *et al,* (2016) studied the phytoplankton diversity and biomass production under changing weather variables. The investigation shows relation between phytoplankton composition and weather variables in a shallow pond at Chidambaram taluk of Tamil Nadu. Seasonal differences in the quantitative and qualitative composition were analyzed. The pond water was sampled in the period from January to December 2015. Results showed an increased concentration in physico-chemical parameters and phytoplankton density during summer season followed by premonsoon and monsoon season. In the present study over 62 species of phytoplankton represented by 22 species of Cyanophyceae, 17 species of Chlorophyceae, 15 species of Bacillariophyceae and 8 species of Euglenophyceae were recorded. in post monsoon season Temperature (27.6- 30.9°C); pH (7.89 – 7.92); electrical conductivity (698.0 - 745.6µs); total dissolved solids (115 – 124mg/l) and Phosphate (1.93-2.04 mg/l). The results of the present study indicated that the water of the pond lies below the level of eutrophication.

Arumugam *et al, (*2015*)* studied biodiversity of phytoplankton in a tropical lake of South India Freshwater ecosystems provide vital resources for human beings. The present study was aimed at assessing the phytoplankton diversity in a lake in the suburb of Pudukkottai District, Tamil Nadu. The result shows 49 species belonging to 5 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.

Yenkar, (2015) studied the biodiversity of fresh water algae of Rotha-Ii reservoir of Wardha district of Maharastra, India. The present study can enrich our knowledge of algal floral found in the reservoir along with its physic-chemical parameters which was evaluated by standard procedur and by culture media. In order to identify the biodiversity of reservoir, the micro image projection systems were used. In this study 44 algal species were recorded, in which 31 belongs to Chlorophyceae, 10 to Bacillariophyceae, 3 to Cyanophyceae. Since, the reservoir show the presence of various algal species.

Eswari *et al,* (2015) studied the piece of investigation was carried out to study the pond water as well as sea water quality, physico-chemical characteristic of both the water of India. The investigation shows the physico-chemical characteristics of the water. In the present study various parameters like appearance, odour, turbidity ntu, total dissolved solids and electrical conductivity, ph, alkalinity, total hardness. Calcium, magnisium, sodium, potassium, iron, manganese, free ammonia nitrite, nitrate, chloride, fluoride, sulphate, phosphate (pond water and seawater) was analyzed. By observing the result it can be concluded that the parameters which were taken for study the water quality are below the pollution level for ground water which satisfy the requirement for the use of various purposes like domestic, agricultural, industrial etc

.Adhoni *et al* (2015) studied the estimate physical and chemical parameters and to determine the algal diversity in ten lakes in the district of Hubli and Dharwad. Lipid content of algae will be analyzed. Physico-chemical analysis of lakes was done to check eutrophication of lakes by estimating the amount of physical factors like pH, turbidity, temperature, electrical conductivity and chemical parameters like alkalinity, calcium, magnesium, total hardness, potassium, sodium, phosphates, chloride, sulphate, nitrates, D.O, C.O.D, B.O.D present, which indeed serve as nutrients for the growth and proliferation of algal species. In this investigation, two lakes were found to be entropic and algal diversity present in all ten lakes were determined. Nuggekeri and Unkal Lake had high levels of nutrients along with Good amount of dissolved oxygen, conductivity (1254, 983.3µs), calcium, Sulphates and low nitrate level was detected as it is accumulated by algae; such factors are most favorable for algal growth and proliferation. High levels of phosphates (5.4, 3.7 mg/l) were also found in these two lakes. Ortho-phosphorus directly effects the distribution of algae as this phosphorus is used in metabolic process. Hence these two lakes had vast algal diversity and biomass *Crucigeninia crucifera , Pediastrum simplex , Scenedesmus abundans , Westella botryoides Microcystis aeruginosa Navicula sp Nitzchia longissima.* About 20 different algal species were isolated and studied for lipid content. Out of this four species showed high potential for biofuel production.

Yadhav *et al,* (2015) studied the water quality index of Pahuj River at Unnao Balaji, Madhya Pradesh. In the presen study the samples were collected from 10 different locations and analyzed for various physico-chemical parameters like Temperature, pH, Turbidity, Total

Hardness, Chloride, Dissolved Oxygen, Biological Oxygen Demand, Fluoride, Iron and Nitrate. Water Quality Index serves as the basis for environment assessment of water in relation to pollution load categorization and designation of classes. The result showed he value of Water Quality Index (WQI) at almost all location indicates that water of Pahuj River at Unnao Balaji is unfit for drinking purpose due to disposal of heavy amount of sewage into the River

Patil *et al,* (2015) studied Limnological study of Venna Lake, Mahabaleshwar, Maharashtra, India. The present shows the quality of water and algal growth of this lake, physic-chemical and biological parameters like temperature, pH, total alkalinity, dissolved oxygen, free CO_2, total hardness, phosphate, silica and algal biodiversity. The study show the correlation between physic-chemical parameters and occurence of algae found. During premonsoon season the Ph (7); Temperature (21 – 23); orthophosphate (0.22mg/l) were observed. This nutrient value of Pre monsoon period showed more number of Chlorophyceae followed by Bacillariophyceae. There was no record on Cyanophycean members in the pre momsoon season. Members of Chlorophyceae showed constant occurence throughout the year. Microcystis observed only during summer season.

Kumar *et al,* (2014) studied Algal bioderversity in fresh water reservoir of durg. In the present study they studied the physic-chemical properties of water and seasonal algal diversity of Shivnath river. The investigation revealed the presence of 25 different species of algae. In the study members of Chlorophyceae dominated the algal community, followed by the members of Cyanophyceae and Euglenophyceae. Zygnematales and Chlorococales showed maximum species diversity.

Elayaraj and Selvaraju (2014) studied water quality variation and screening of microalgal distribution in Thachan pond Chidambaram taluk of Tamil nadu. The study was conducted to monitor the water quality and microalgal distribution .The important parameters tested were temperature (29ºC-41.1ºC), pH (6.9-8.5), turbidity, electric conductivity (462.1-582 µS), total dis-solved solids (212-380 mg/l), turbidity, alkalinity, free CO2, dissolved oxygen, chloride, nitrate and phosphate(0.284-0.685 mg/l). Microalgal distribution studies were ob-served. Monthly fluctuations of different seasonal diversity i.e., 35 algal species belongs to four groups viz., Cyanophyceae (41%), Chlorophyceae (27%), Euglenophyceae (14%) and Bacillariophyceae or Diatoms (17%). In the study Microalgae producing biotoxin such as

Microcystis aeruginosa, Chroococcus minor, Oscillatoria curviceps, Oscillatoria tenuis, Anabaena spiroides, Nostoc pruniforme and *Aphanocapsa grevillei* were recorded in the pond. The result shows the pond was found to be moderately polluted and showed a trend of increasing eutrophication. The significant correlations were noted in the different parameters.

Joishi(2014) The present studies were carried out to know the occurrence, distribution, species richness and diversity of Cyanobacteria in relation to water chemistry in four different river systems such as Netravati of Dharmasthala, Kumaradhara of Subramanya, Sita and Shambhavi of Karkala of Western Ghat region for two consecutive years in the month of October 2012 and 2013 respectively. The investigation shows the total of 41 species belonging 16 genera was observed in these four rivers during the study period. Maximum number of 21 species was identified in Netravati river followed by 18 species in Kumaradhara river 14 species in Sita river and 13 species in Shambhavi river throughout the study period. In the year 2012, 13 species each were identified both in Netravati river and in Kumaradhara river while nine and eight species were identified in Sita river and Shambhavi river respectively. While in the year 2013, maximum number of 18 species was identified in Netravati river followed by 16 species in Kumaradhara river, 11 species in Sita river sand 09 species in Shambhavi river. *Oscillatoria limosa* was the most dominant species which was present in all the rivers in both the years, but abundant in Netravati and Kumaradhara river. *Microcystis aruginosa* was present in all the rivers except during first year in Netravati and Shambhavi rivers. Some species were particular to some rivers. Even though some species were rare in some rivers, however those were frequent in some other rivers. *Microcystis scripta* was one of the rare species identified in Sita river only during 2013. Occurrence and species richness was more in such conditions where pH was slightly alkaline and dissolved oxygen content was more.

Jyotsna *et al.,* (2014) studied Seasonal variation of microalgae in relation to the physico-chemical parameters of Karagam lake, Srilakakulam district, A.P. India. In the present investigation some hydrographical and chemical studies were made on Karagam lake. In this study, Seasonal changes in growth and distribution of phytoplankton along with physic-chemical parameters were studied. The average values of pH(7.48), turbidity, conductivity (626), dissolved oxygen, B.O.D, carbonate, bicarbonate, dissolved solids(314mg/l), chloride, fluoride, ammonia, nitrate, phostphate (1.87µg/l), silicate were recorded. The microalga was identified. The dominant members belongs to Chlorophyceae (26genera) followed by Bacillariophyceae (18genera), Cynophyceae (17 genera) and Euglenophyceae (3 genera). During the two years of investigation, different algal forms present in this pond were

Chlorophyceae 39.89%, Cynophyceae 22.4%, Bacillariophyceae 34.35% and Euglenophyceae 3.36%. Cyanophyceae have shown very close positive relation with temperature and phosphate. Bacillariophyceae showed positive relation with temperature, chlorine and phosphate. Dominance of blue green algae is observed when there is low number of diatoms and green algae.

Kadhim, (2014) studied Monthly variation of physic-chemical characteristics and phytoplankton species diversity as index of water quality in Euphrates River in Al-Hindiya barrage and Kifil city region of Iraq. In the present study the seasonal variations in physic-chemical and biological characteristics of the water. Water samples were collected on a monthly basis and analyzed for estimation of air and water temperature, pH, conductivity concentration and salinity, total dissolved solids, dissolved oxygen, alkalinity, total hardness, calcium and magnesium hardness, nitrite, nitrate, and phosphours concentration were also recorded. A total of 167 species were identified. They belongs to 7 divisions including Bacillariophyta (75 species), Cynophyta (40 species), Chlorophyta (3 species). Some algal genera dominanted mostly in the study such as *Nitzchia, Gomphonema, Cymbella, Synedra, Phormidium, Scendesmus and Euglena.*

Verma *et al.*, (2014) studied seasonal variation in the phytoplankton biodiversity of Chandlodia Lake. The present investigation shows the 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 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.

Adbar (2013) studied Physico-chemical characteristics and phytoplankton of Morna lake, Shirala (M.S) India. Morna Lake is largest Lake of Shirala Tahsil in Sangli District, Maharashtra. The Physico - chemical analysis of lake water exhibited richness in nitrogen (nitrite and ammonia) and orthrophosphates (Summer season 0.023mg/l; Rainy season 0.037mg/l; Winter season 0.053mg/l) which favored the growth of phytoplankton. They recorded dominance of Cyanophyceae (*Microcystis aeruginosa*; *Oscillatoria brevis; Merismopedia elegans*) in summer and rainy season and Bacillariophyceae (*Navicula plecenta; Nitezshia patea*) in winter revealed distinct seasonal variation in the distribution of phytoplankton. The Lake was found to be moderately polluted and showed a trend of increasing eutrophication.

Airsang and Lakshman (2013) studied the diversity of Chlorophyceae related to physic chemical parameters in Shetter lake of Navalgund, Dharwad district in Karnataka India. The present deals mainly with the study of phytoplankton belonging to the class Chlorophycea in Shetter lake. Detailed physicochemical characteristics of this lake were analyzed. The variable Temperature, pH, Turbidity, Alkalinity, Total hardness, Dissolved oxygen, biological oxygen demand, Nitrates, Phosphates and Chemical Oxygen demand were played an important role in the diversity of Chlorophyceae members. The total dissolved solids (1159mg/l) indicate the general nature of the water quality. Total dissolved solids were found high in value in the month of march during the study. They reduced the algal population. Therefore, they concluded that the water of the lake is not fit for consumption according to drinking water

Kipngetich (2013) this research was to estimate the levels of phosphates and sulphates in three selected springs. The analysis of phosphates requires good digestion which converts phosphorus to orthophosphate in the process. Therefore, ascorbic acid digestion method was employed in the phosphate analysis. The sulphates spectrophotometric analysis is based on the formation of colloids by sulphates and Barium chloride. With this method the greatest challenge was instability of conditioning reagent with time. Several timing trials were done to come up with the optimum time for reaction between the addition of conditioning reagent and sample analysis. Sampling was done at selected springs in Baraton Location, Sironoi Location and Kaptildil Location, all situated in Chesumei Constituency, Nandi County, Rift valley province in Kenya. The selected water springs are commonly used by residents for domestic purposes. The research showed that there is a significant level of phosphates and

sulfates in all sampled water. Phosphates concentrations were between the range of 2.79 mg/L to 622 mg/L, while sulphates were in the range of 109.8 mg/L to 250.98 mg/L.

Jeyachitra *et al.,* (2013) studied Physico-chemical and biological factors in the distribution of Cyanobacteria population in three different sampling sites(Botanical garden, singanallur lake in coimbatore and theneir lake in pallakad) of South India. The current work was involved in the distributional analysis of the Cynobacteria strains present in the predominant water outlets present in the city, for analysis the types of strains found during the different seasonal interims. The cynobacteria population in the vicinity was analyzed using the physic-chemical factors like pH(7.7), temperature (27), electrical conductivity(1880.5), carbonate, bicarbonate, chloride, calcium , magnesium, total phosphorous (0.25), inorganic phosphours, sulphate, sulphite, ammonical nitrogen, nitrate, nitrate, silicate, iron, zinc, copper and manganese and algal flora(qualitative) were also studied and compared their variation among the three different freshwater bodies. In addition, biological parameters such as primary production gross primary productivy, net primary productivy and community respiration rate were also studied. Totally 64 taxa of Cynobacteria belonging to 7 families were isolated. During 2nd (November 2002- feburary 2003) as many as 23 species of Cyanobacteria were reported from botanical garden

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John and Francis (2013) studied new additions to the freshwater algae – Chlorophyceae. The present study of algal biodiversity of Western ghats (Idukki district, Kerala) is an unexplored area to a great extent. This is the first systematic study conducted on the 'algal flora of western ghats', and other parts of Idukki. Through extensive field visit during various seasons, algal specimens are collected, preserved and identified. The specimens are located with the help of a gps and digital images are produced through advanced digital photomicrography. The result shows 19 new taxa belonging to the class chlorophyceae are collected, identified as new to science and new reports from Indian subcontinent and Kerala state. The collections are preserved at the algal research division of the research centre at sacred heart college, Thevara, Cochin, Kerala.

Bajpai *et al.,* (2013) studied Physico-chemical characteristics of Lakhna Devi temple water tank, Lakhna, Bakewah, U.P. with reference to Cyanobacterial diversity. The result investigated the fresh water bodies in populated plains of tropical countries face various

dirtubances in the form of pollutant and nutrient inflow, heavy metal and elemental preciption (wet or dry) and constant silt inflow (natural or anthropogenic). In lentic water bodies the physic-chemical characteristics shows very much variation because in summer they have less and in rains large amount of water. These adverse constrain effectively influence the algal assemblage and can be good indicator of overall health of the water body and some of the 31 species of Cyanobacteria recorded from the study site viz *Microcystis aerughinosa, Aphanothecea microscopis*.

Sheikh *et al.*, (2013) studied the physico-chemical analysis of three fresh water springs in district Pulwama of Kashmir Valley viz: Sandyasar naag (Ladhu), Batenaag (Khrew) and Sonaraaz naag (Shar).The samples were collected on monthly basis from January to June 2011. The various parameters were analyzed. The determined values of the three springs depicted slight variations for depth, pH, temperature, alkalinity, ammonical Nitrogen, Calcium hardness, chlorides, DO, free CO2 and nitrite Nitrogen. However marked differences were observed for conductivity, orthophosphorous and magnesium hardness. Moreover the variations for total hardness and TDS depicted ascending and descending trend.

Kumar (2013) Present study has been conducted to study the physico-chemical characteristics of a fresh water body located at Dadri,District G. B. Nagar (U. P.). Water samples collected were analyzed for some physico-chemical parameters i.e. Water temperature, pH, Total Solids, Hardness, Dissolved oxygen (D.O.), B.O.D, Chloride, Phosphate and alkalinity etc. These parameters were found in higher concentration above freshwater limits.

Hassan *et al.*, (2010) studied Seasonal variations in phytoplankton abundance and their composition in five stations in the middle region (between Al-Hindiya barrage to Kifil City) of the Euphrates River in Iraq between March, 2004, and February, 2005. The result showed a total 151 taxa of phytoplankton were identified, belonging to Bacillariophyceae (98), Chlorophyceae (33), Cyanophyceae (14), Euglenophyceae (2), Xanthophyceae (2), and Dinophyceae (2). The total abundance of phytoplankton cells varied from 136 to 5312 cells l-1 with maxima in spring and fall. Bacillariophyceae were the most abundant group at all stations. The study recorded four species as new records for Iraqi. The phytoplankton was indicative of oligotrophic conditions although it showed some signs of organic pollution near cities.

Rajagopal *et al.,* (2010) studied Zooplankton diversity and physico-chemical conditions in three perennial ponds of Virudhunagar district, Tamilnadu. The present study to, assess the zooplankton species richness, diversity, and evenness and to predict the state of three perennial ponds according to physico-chemical parameters. A total of 47 taxa were recorded:. More number of zooplankton species were recorded in Chinnapperkovil pond (47 species) followed by Nallanchettipatti (39 species) and Kadabamkulam pond (24 species). Among the rotifers, Branchionus sp. is abundant. Diaphanosoma sp. predominant among the cladocerans. Among copepods, numerical superiority was found in the case of Mesocyclopes sp. Cypris sp. repeated abundance among ostracoda. Present study revealed that zooplankton species richness (R1 and R2) was comparatively higher (R1: 4.39; R2: 2.13) in Chinnapperkovil pond. The species diversity was higher in the Chinnapperkovil pond (H': 2.53; N1: 15.05; N2: 15.75) as compared to other ponds. The water samples were analyzed for temperature, pH, electrical conductivity, alkalinity, salinity, phosphate, hardness, dissolved oxygen and biological oxygen demand. Higher values of physico-chemical parameters andzooplankton diversity were recorded in Chinnapperkovil pond as compared to other ponds. The zooplankton population shows positive significant correlation with physico-chemical parameters like, temperature, alkalinity, phosphate, hardness and biological oxygen demand, whereas negatively correlated with rainfall and salinity.

Rajgopal *et al.,(2010)* Investigations were carried out on the diversity of phytoplankton in relation to physico-chemical parameters with respect to pollution status of two perennial ponds of Sattur area, Tamil Nadu. Fifty species were identified belonging to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. High value of physico-chemical parameters and low phytoplankton diversity were recorded in the Chinnapperkovil pond, whereas low value of physico-chemical parameters and high phytoplankton diversity were recorded in the Nallanchettipatti pond. Class Chlorophyceae qualitatively and quantitatively dominated in both the habitats when compared to other taxa. *Pediastrum leonensis, Frustulia rhomboides, Microcystis aeruginosa, Oscillatoria angusta, Closterium acerosum s*pecies dominated in Chinnapperkovil pond and Spirogyra maxima, *Zygnema caeruteum* and *Fragilaria oceanica* dominated in Nallanchettipatti pond. Abundance of such specific taxa (e.g. *Closterium acerosum, C. dianae, C. lineatum, Anabaena aequalis, Oscillatoria angusta and Navicula membranacea*) in the Chinnapperkovil and Nallanchettipatti (e.g. *Merismopedia glauca and Fragilaria oceanica*) ponds suggests that these taxa can be

considered as pollution indicators.the result shows Phytoplankton species diversity and physico-chemical parameter profiles indicate the Chinnapperkovil pond to be meso-eutrophic whereas the Nallanchettipatti pond is oligo-eutrophic.

Chaudhary and Pillai (2009) studied a algal bioversity and releated physic chemical parameters in Sasthamcottah Lake, Kerala (India). The result investigated that the physic chemical parameters studied included D.O, B.O.D, C.O.D, Nitrate, Phosphate, Hardness, Total alkalinity, pH, Electrical conductivity from four different station and the phytoplankton diversity was studied in relation to some physic chemical parameters. A total of 10 species of phytoplankton were identified belonging to Chlorophyceae, Bacillariophyceae and Dynophyceae.

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3. MATERIALS AND METHODS

3.1. Sample collection

The water samples of the present study were collected from five different lakes. The five sampling stations were Kurichi kulum, Krishnampatti Lake, Kumaraswamy Lake, Perumpallam Anai and Ooty Lake. With a view to understand the effect of elements on phytoplankton in the natural water sources, water samples were analysed for the physico-chemical and biological parameters

3.2 Estimation of biomass of microalgae from different freshwater bodies

3.2.1 Qualitative analysis

Known volumes of the sample were collected labeled. The samples were concentrated using R-8C laboratory centrifuge at kept in a 5000rpm for 10minutes. The concentrated samples were preserved using FAA solution. Preserved samples in bottles are mixed uniformly by gentle inversion and then exactly 1ml of sample is pipette out into the 50X mangnification for analysis. A monocular compound microscopic is used in the counting of plankton with different eyepieces such as 10X, 15X and 20X. Identification of the organisms were performed using manuals of algae (Philipose, 1967, Fritsch, 1997).

3.2.2 Quantitative analysis

Phytoplanktons, the microscopic plants that drift in the water column, contain chlorophyll, which captures energy from sunlight for photosynthesis. The collected phytoplankton was filtered through whatmann filter paper. The total biomass of the collected water sample were analysed by taking initial weight and final weight of the filter paper.

3.3 Physicochemical analysis of water sample of different freshwater bodies

The Physico-chemical analyses of five different freshwater bodies were analysed. The parameters include- pH, temperature, electrical conductivity, Total dissolved Solids, salinity and Phosphate by following APHA method (1995).

3.3.1 pH

pH was measured in the water sample in the field using pH meter.

3.3.2 Temperature

Temperature was measured in the water sample in the field using Thermometer.

3.3.3 Electrical conductivity (soluble salts concentration)

The electrode of the conductivity meter is dipped into the sample, and the readings were noted for stable value.

3.3.4 Total dissolved solids

About 100ml of unfiltered water sample in silica crucible was evaporated by placing it in a hot air oven at 105°C for 1 hour, and later in desiccators. Then the crucible was taken out of the desiccators and weight was recorded. The difference in the initial and final weight was noted.

Calculation

Total solids mg/L = $(W_2 - W_1) \times 1000$/ml of sample

Where W_2 and W_1 are recorded in mg

3.3.5 Salinity

The salinity of the water sample were analysed using Multi – parameter PCS Testr^{TM35}, EUTECH Instruments, Oakton.

3.3.6 Phosphate

In acidic condition, orthophosphate reacts with ammonium molybdate to form molybdophosphoric acid. It is further reduced to molybdenum blue by adding reducing agent such as stannous chloride or ascorbic acid. The blue colour developed after addition of ammonium molybdate is measured at 690 or 880nm within 10-12 minutes after development of colour by using blank. The concentration is calculated from the standard graph. The intensity of the blue coloured complex is measured which is directly proportional to the concentration of phosphate present in the sample.

a. Stock phosphate solution: Dissolve 219.5mg anhydrous Potassium dyhydrogen phosphate
   in distilled water and dilute 1000ml. 1ml = 50mg PO_4^{3}-P

b. Phosphate working solution: Dilute 5ml stock solution to 100ml with distilled water. 1ml = 2.50mg PO_4^{3}-P
c. Ammonium molybdate solution: Dissolve 20g Ammonium molybdate solution in 475ml distilled water and add 25ml con sulphuric acid and store in a glass stoppered bottle.
d. Strong acid reagent: Add 150 ml con sulphuric acid to 300ml distilled water. Add 2ml nitric acid cool, dilute to 500ml.
e. Sodium hydroxide 6N: Dissolve 24g NaOH and dilute to 100ml.
f. Phenolphthalein indicator: Dissolve 0.5g in 500ml 95% ethyl alcohol. Add 5ml distilled water.
g. Stannous chloride reagent 1: Dissolvfe 2.5g fresh stannous chloride in 100ml glycerol.
   Heat on water bath to ensure complete dissolution.
h. Dilute stannous chloride reagent 2: Mix 8ml stannous chloride reagent 1 with 50ml glycerol and mix thoroughly.
i. Potassium Antimonyl tartrate solution: Dissolve 2.7 g in 800ml distilled water and dilute to 1000ml.
j. Ascorbic Acid: Dissolve 3.52g in 200ml distilled water. The solution is stable for a week at 4°C.
k. Combined Reagent: Mix 50ml, 5N sulphuric acid, 15ml ammonium molybdate solution and 30ml ascorbic acid solution. Add 5ml potassium antimonyl tartratesolution and mix well. This solution must be prepared daily.

Sample collection, preservation and storage

The sample should be collected in polythene container. Conventional sampling practice should be followed.

Calibration

a. Into a series of 100ml Nessler tubes pipette appropriate amounts of phosphate working solution to cover the range of 5-30mg/ L or 0.3-2mg/L P when Stannous chloride/Ascorbic acid reagent is used as reducing agent.
b. Add 4ml ammonium molybdate followed by 0.5ml stannous chloride or 8ml combined reagent and dilute to 100ml with distilled water and mix well. Allow to stand for 10 minutes.

c. Prepare blank using distilled water in the same way.
d. Measure the intensity of blue coloured complex at 690nm or 880nm between 10 and 12 minutes after the development of the colour.
e. Plot absorbance vs. phosphate concentration to give a straight line passing through the origin.

Procedure

Orthophosphate

Take suitable volume of the sample in a nessler tube and contain according to the procedure described for the preparation of calibration curve. From the calibration curve, compute the concentration of phosphate in the volume of sample taken. Calculate and express the result in mg/L PO_4^{3-}-P.

3.4 Correlation between physicochemical analysis and Algal Biodiversity

A correlation Table was made between physico chemical analysis and algal Biodiversity.

4. RESULTS

4.1 Sample collection

4.1.1 Kurichi kulam.

Latitude 10°57'56''N and Longitude 76°57'48''E. It is located in Coimbatore city nearby Madukarai, Irugur town. It covers an area of 280 acers. This lake enhances the ground water level around of the area. Kurichi lake receives water from the Noyyal river. Kurichi Lake is excellent habitat for birds and many bird watchers.

4. 1.2 Krisnampathy lake

Latitude 11°0'21.6''N and Longitude 76°55'40.7994''E. The catchment area of the lake is 2600 hectares with with the current lakebed area of 21.853 hectares and the water storage capacity of 8.48 Mcft. It is situated west of.Coimbatore on the Thadagam to Thondamuthur road. It has two main feeding sources, one from Koilmedu that receives water from the research farm area of Tamil Nadu Agricultural University and the karperayan channel that drains from the marudamalai forest area directly joining the lake. It also receives water from the Noyyal River through the Chitrachavadi channel. The lake has four inlets including three sweage inlets. It has only one outlet in the form of masonry weir located under a bridge. The bridge is located on the thondamuthur to Thadagam road from the town. The length of the weir a height of 1.40. There are about 300 hunts located in the foreshore area of the lake occupying about 1.214 hectares.

4.1.3 Kumaraswamy lakes

Latitude 11°0'7.2''N and Longitude 76°56'38.4''E. It is situated on the Thondamuthur road. It receives excess water from the Selvampathy Lake. It has catchment area of 1600 hectares with the current lakebed area of 4.281 hectares and the water storage capacity of 6 Mcft. It receives sewage water through many sewage inlets. The lake has only one sluice has an outlet. The north and east side of the lake is lined with several hutments.

4.1.4 Perumpallam anai

Perumpallam dam is located in Sathyamangalam, Erode District, Tamilnadu. It is fed by rain water by the Kadambur hills and Bhavani River. It measures roughly 2 km long and 40 metres in height and occupies 65.29 hectares of land. Water shed area is around 44.53 km and receives up to 15459 cusecs of water. The dam has a withholding capacity of 115.80

million cusecs and can discharge 14.660 cusecs/second. The dam has a gateway on either side of the dam to discharge water through canals to irrigate the adjacent lands. The right side canal irrigates over 545.17 hectares of lands while the left side canal irrigates over 485.42 hectares of land. The deepest point in the dam measures 16.69 metres.

4.1.5 Ooty lake

Latitude 11.4016°N and Longitude 76.6882°E. It situated in Ooty, in the Nilgiri district, Tamil Nadu State, India. The water spread area of the lake is 20 Ha with a maximimum depth of 12 meter and average depth of 6 meter (Neelakandan 2008). Artificial lake located at distance of 84km from Coimbatore city. The lake covers an area of 65 acres. The surface area is 3.885 km^{2}. The lake was formed by damming the mountains streams flowing down Ooty vally. The lake is surrounded by Eucalyptus trees.

4.2 Estimation of biomass of microalgae from different freshwater bodies

In the present study five lakes were subjected to the study of biodiversity of planktonic algae. The analysis of water sample from the selected lake showed the presence of 26 algal species. Of the 26 species of algae 16 belonged to Chlorophyceae, 7 to Bacillariophyceae and 3 to Cyanophyceae.

The maximum number of algae species was found in Kurichi lake where the number was 9(Chlorophyceae < Cyanophyceae< Bacillariophyceae), which was followed by Krishanampathy lake showing the presence of 8 members(Chlorophyceae< Bacillariophyceae; Absence of Cyanophyceae), followed by Ooty lake showing the presence of 5 members (presence of Chlorophyceae alone), followed by Kumaraswamy lake showing the presence of 4 members(Chlorophyceae< Bacillariophyceae), followed by Perumpallam Anai showing the presence of 3 members(Bacillariophyceae< Cyanophyceae). The diversity of species in Cyanophyceae and Bacillariophyceae was less in number and hence most of the lake was not polluted.

4.3 The description of the algal diversity identified in the present study

CHLOROPHYTA

Scenedesmus acuminatus (Lagerh) (Plate 1, figure 3)

FAMILY: SCENEDESMACEAE

Scenedesmus possess four – or eight- celled(rarely 16-celled) coenobia, co9mposed of ellipsoid, oblong or fusiform cells usually grouped in one plane with the long axes of the cells parallel to one another; the cells sometimes lie two alternating rows .The terminal cells of the row commonly differ in shape and ornamentation from the others. (Fritsch 1997).

Pediastrum tetras (Plate 1, figure 4*)*

FAMILY: HYDRODICTYACEAE

The smallest coneobia are found in *P.tetras* when they are four –or eight-celled. The number of cells is usually some multiple of two and they are commonly arranged in distinct rings around a central one. (Fritsch, 1997)

Kirchneriella lunaris (Kirchn) Moeb (Plate 4, figure 3)

FAMILY: SELENASTRACEAE

Kirchneriella common in plankton of lakes, is very similar, but here the cells are aggregated in one or more groups within a wide mucilage-envelope.(Fritsch 1997)

Merismopedia convolute (Breb) (Plate 3, figure 1)

FAMILY: MYXOPHYCEAE

The tabular ones of Merismopedia with cells distributed in a single layer in groups of four, result from division along two planes only, in rare instances the cells posses individual mucilage envelopes. (Fritsch 1997)

Scenedesmus quadricauda (Plate 2, figure 5)

FAMILY: SCENEDESMACEAE

Colonies usually four-celled. Cells oblong-cylindrical without rounded ends and arranged in a linear series. Poles of terminal cells with a long more or less straight or curved spine. Cell wall smooth and without ridges. (Philipose, 1967)

***Scenedesmus armatus*. var. *bicaudatus* (Guglielmetti) Chodat** (Plate 4, figure 4)

FAMILY: SCENEDESMACEAE

Colonies two celled. Differs from the type in having a long spine from one of the poles of the terminal cell only, the spines of the two terminal cells alternating with each other. Longitudinal ribs usually seen only in the internal sells. (Philipose, 1967)

***Scenedesmus incrassatulus* (Bohlin)** (Plate 6, figure 2)

FAMILY: SCENEDESMACEAE

Colonies of four cells. Cells in liner or subalternating series, fusiform, curved with the outer side convex and the inner side more or less straight. Ends of cells stumpy and with apical nodules. (Philipose, 1967)

***Scenedesmus dimorphus* (Turpin) Kuetzing** (Plate 6, figure 3)

FAMILY: SCENEDESMACEAE

Colonies 8 celled with the cells arranged in a linear or subaliternating series. Differ from *S.obliqus* outer cells of the colony being more or less lunate and the apices of the cells being a attenuated. (Philipose, 1967)

Westella sp (Plate 4, figure 2)

FAMILY: SCENEDESMACEAE

Colonial chlorophyte with spherical cells usually in groups of 4 or 8, often connected to other groups via the remnants of parent cell walls. Single cup-shaped chloroplast, more pyrenoid, irregular colonies. The cell groups are loosely connected in the center of the colony by fragments of old mother cell (Robin and Metthew, 2016).

Coelastrum sp **(**Plate 2, figure 7)

FAMILY: SCENEDESMACEAE

Coelastrum colonies contain approximately 8–32 spherical, oval, or angular cells joined to form a hollow colony. The cells often have wall extensions where they join other cells in the colony. The chloroplast is cup-shaped or parietal, with a single pyrenoid. (Robin and Metthew, 2016)

Oocystis marsonni (Plate 6, figure 1)

FAMILY: OOCYSTACEAE

Oocystis marsonni cells are oval, with rounded poles. The cells may be solitary or in colonies of 2–8 cells. Cells are football-shaped,,with a slight amount of apical thickening, but lack apical knobs. Each cells has one or more grooved chloroplasts, each with pyrenoid. Multiple generations are often enclosed inside sequential mother cell walls. (Robin and Metthew, 2016)

Spirogyra colligate **(**Plate 3, figure 3)

FAMILY: ZYGNEMATACEAE

Cells containone or more chloroplast that spiral around the inside of the cell wall. The end wall between adjacent cells may be folded or flat. Sexual The genus *Spirogyra* has distinctive, ribbon-like, spiraling chloroplasts dotted with pyrenoids (Robin and Metthew, 2016)

Tetraedron muticum **(**Plate 3, figure 4)

FAMILY: HYDRODICTYACEASE

Cells small, flat and triangular with the sides slightly concave and angles broadly rounded or truncate. Cells wall smooth.(Philipose, 1967)

Scenedesmus bicaudatus (Plate 4, figure 4)

FAMILY: SCENEDESMACEAE

Colonies two to four celled. Differs from the type in having a long spine from one of the poles of the terminal cell only, the spines of two terminal cells alternating with each other. Longitudinal ribs usually seen only in the internal cells. (Philipose, 1967)

Crucigenia sp **(**Plate 6, figure 4)

FAMILY: SCENEDESMACEAE

Colonies 4 celled joined in colonies. 4 celled colonies quadrate with minute rectangular space at the center. Cells flattened and triangular with rounded ends. Outer sides of cells are concave. (Robin and Metthew, 2016)

Eudorina sp **(**Plate 2, figure 6)

FAMILY: VOLVOCACEAE

Colonies with eight to sixty four cells. Cells are spherical, oval or cylindrical colonies. Each cell has a large, cup-shaped chloroplast, a reddish anterior eyespot, and two equal length flagella that emerge from the colonial mucilage through visible cannals. (Robin and Metthew, 2016)

BACILLARIOPHYTA

Eunotia pectinalsi (Plate 3, figure 2)

FAMILY: BACILLARIOPHYCEAE

Eunotia pectinalsi var.minor the connecting - bands save an arched contour so that the new valves formed during division as large as those of the parents (Fritsch, 1997).

Navicula rodiosa **(**Plate 5, figure 5)

FAMILY: NAVICULACEAE

The valves are narrow and lanceolate, with acutely rounded ends. The axial area is narrow and linear. The central area is rhombic. The raphe is straight with proximal ends that are hooked to the secondary side. The transapical striae are strongly radiate, bent in the valve center and convergent near the poles. Lineolae number 28-32 in 10 μm. (Robin and Metthew, 2016)

Nitizschia rostella (Plate 5, figure 7)

FAMILY: BACILLARIACEAE

Commonly solitary, tube like strands (multiage tubes). Cells are elliptical, linear or sigmoid in value view. The raphe is displaced to one margin, but the raphs of esch valve are diagonally opposite. The rape structure itself is supported by bars (fibulae) that appear as dots along the margin of valve under light microscopy.

Navicula sp (Plate 5, figure 6)

FAMILY: NAVICULACEAE

The cells vary considerably in shape, especially in valve view, but in the main they are naviculoid (boat shaped) and may have rounded ,acute or capitates end. There is a rape in both valves. (Robin and Metthew, 2016)

Cyclotella sp (Plate 2, figure 8)

FAMILY: BACILLARIOPHYCEAE

A small disc- shaped diatom differentiated by a distinct valve pattern. The inner zone is plain. Expect for one or two strutted process, and may also have smart wart-like projections. Around the edge is a borad band of heavy striate. The cella are rectangular in gridle view. Each cell contains numerous discoid chloroplasts. (Fritsch, 1997)

CYANOPHYTA

Aphanothecea stagnina (Plate 1, figure 1)

FAMILY: CHLOROCOCCACEAE

It is in palnelloid colonial form not sharply demarcated from one another. It can be distinguished from those with elongate oblong sometimes curved, cells exhibiting preferencial growth in one direction and dividing only along the plain perpendicular to their long axis. The species of aphanothecea, on other hand, usually appear as large colonies, visible to naked eye and composed of numerous cells which are rather loosely embedded in structure less mucilage and often undergo displacement after division; occasional cells are groups of cells may show individual mucilage envelopes. Sometimes when the surface layer

of the mucilage is firmer, the colonies acquire a definite shape, but more or usually they are amorphous Microcystis comprises mainly planktonic types. (Fritsch, 1997)

Microcystis aeruginosa Kutz (Plate 1, figure 2)

FAMILY: MICROCYSTACEAE

It is in palnelloid colonial form not sharply demarcated from one another. A small microscopic colonies of which contain large numbers of closely packed cells. In some species the boundary of the enveloping mucilages well defined. In the abundant *M. aeruginosa* Kutz the colonies are often clathrate, although their forms depend on the degree of water movement. (Fritsch 1997).

Phormidium unicatum **(**Plate 7, figure 2)

FAMILY: CYANOPHYCEAE

Phormidium unicatum are narrow, unbranched, and lack heterocysts or akinetes. The individual cells are cylindrical, and can be slightly longer, shorter, or equal in length and width, but not coinlike. The trichomes may be surrounded by a sticky sheath, but this feature can be influenced by environmental conditions. (Robin and Metthew, 2016)

4.4. Physicochemical analysis of water sample of different freshwater bodies

4.4.1 pH

pH is the negative logarithm of hygrogen ion concentration of water. It is mainly controlled by carbonic systems. The carbonic system includes CO_2, CO_3 and HCO_3 (Chettri and Thapa, 2016). The interaction among these carbonic compounds affects the values of pH. The pH values ranges from 0 to 7 and 7 to 14. The pH of 0 to 7 is defined as acidic and 7 to 14 is defined as alkaline pH (Shinde *et al*, 2011).

pH influences the aquatic production. The organisms present in water bodies like phytoplankton, zooplankton and other aquatic plants are able to adapt an average pH. These organisms are not able to withsatand abrut changes in the aqutic pH. (Ajit Kumar *et al* 2014).

In the present study the pH of five lakes were measured. The measured pH showed an acidic trend in all the lakes. Among the lakes observed the pH value was found to be maximum in 6.5(Kurichi, Krishnampathy, Kumarasamy and Perumpallam anai) and a minimum pH value of 6 in and Ooty lake. The pH of the above lakes were compared with

that of indian drinking water standard. The pH of the lakes observed in the present study was under the drinking water limits.

4.4.2 Temperature

The aquatic organisms are affected by Temperature in different ways. The aquatic organisms are live in a narrow temperature range and are not able to withstand too low or too high temperature. The metabolism and reproduction of the aquatic organism is affected by temperature. The increase in temperature increases the toxicity of the pollutant present in the water bodies. The growth and death of microorganisms and the oxygen demand are also influenced by water temperature (Toma, 2011).

In the present study the temperature of the water bodies were measured in five lakes. The temperature range was observed to be maximum at 27°C and minimum at 19.5°C. The temperature of kurichi lake showed 26.5°C; Krishnampathy lake showed 27°C; Kumarasamy lake showed 27°C; Perumpallam anai showed 26°C and ooty lake showed 19.5°C. The Temperature of the above lakes was compared with that of indian drinking water standard. The Temperature of the lakes observed in the present study was above the drinking water limits.

4.4.3 Electrical Conductivity

Electrical conductivity is a numerial expression ability of an aqueous solution to carry electric current (Shinde *et al*, 2011). Electrical conductivity of the water depends on the nature and the concentration of salts (Yadav *et al,* 2013). The dissolved ions are the conductors. The major positively charged ions are sodium, (Na+) calcium (Ca+2), potassium (K+) and magnesium (Mg+2). The major negatively charged ions are chloride (Cl), sulfate (SO4 -2), carbonate (CO3 -2), and bicarbonate (HCO3 -). Nitrates (NO3 -2) and phosphates (PO4 -3) are minor contributors to conductivity, although they are very important biologically. Conductivity will vary with water source: ground water, water drained from agricultural fields, municipal waste water, rainfall.

In the present study maximum electrical conductivity value was recorded was 2150µs in Krishnampathy lake and the minimum electrical conductivity of 444µs in Perumpallam anai. In Kurichi lake the electrical conductivity value was found to be 1343µs and 1222µs in Kumarasamy lake. The Ooty Lake showed electrical conductivity value of 499µs. The Electrical conductivity of the above lakes was compared with that of indian drinking water standard. The Electrical conductivity of the lakes observed in the present study was above the drinking water limits.

4.4.4 Total Dissolved Solid (TDS)

TDS are very useful parameters describing the chemical constituents of water and can be considered as general of edaphically relation that contributes to productivity within the water body (Shinde, 2011). In the present study maximum value of TDS was observed in Krishnampathy lake (1.53) and the minimum value was 0.310 in Perumpallam anai. The TDS values of other three lakes were 0.892, 0.867 in Kurichi, Kumarasamy lake and 0.355 in Ooty lake. The Total dissolve solids of the above lakes were compared with that of indian drinking water standard. The Total dissolve solids of the lakes observed in the present study was below the drinking water limits.

4.3.5 Salinity

Salinity is a measure of amount of salts in the water. Increase in Dissolved ions increases salinity and conductivity. Salts and other substances affect the quality of water used for irrigation or drinking. Salinity is the major ecological factor which controls the present and absence of phytoplankton population of fresh water. Each organism has a typical salinity range (Sivakumar, 2012).

In the present study maximum value of salinity was1.07ppt in Krishnampathy lake and the minimum salinity value was found 0.210ppt in Perumpallam anai. The salinity value of other three lakes were 0.626 in Kurichi lake, 0.867 in Kumarasamy lake and 0.355 in Ooty lake. The Salinity of the above lakes were compared with that of indian drinking water standard. The Salinity of the lakes observed in the present study was below the drinking water limits.

4.3.6 Phosphate

Phosphate is nutrient for plant growth and fundamental element in the metabolic reaction of plants and animals. It controls algal growth and primary productivity. In most natural waters phosphate ranges from 0.005 - 0.020mg/L. algae require only small amount of phosphate. Excess amount of phosphate can cause eutrophication leading to excessive algal growth.

In the present study maximum value of Phosphate was 0.3 mg in (Krishnampathy lake, Kurichi lake and Kumaraswamy lake) and the minimum Phosphate value was found 0.1mg in Perumpallam anai and Ooty lake. The Phosphate of the above lakes were compared with that of indian drinking water standard. The Phosphate of the lakes observed in the present study was above the drinking water limits except Perumpallam and Ooty lake.

4.4 Correlation between physicochemical analysis and Algal Biodiversity

Correlation was performed between the physicochemical parameter and algal biodiversity (Table 3.1). A positive correlation was found between pH and Conductivity; pH and TDS; Temperature and Conductivty and Temperature and salinity. From the table 3.2, 3.3, 3.4 and 3.5 corellation between physicochemical parameters and algal biodiversity were made. A positive correlation was noted between Temperature and *Scenedesmus quadricauda, Scenedesmus acuminatus and Oocystis marsonni; Conductivity and Oocystis marsonni and Syndra ula; TDS and Syndra ula.* Phosphate was found no correlation with the algal biodiversity.

Figure 1

Estimation of biomass of microalgae from different freshwater bodies

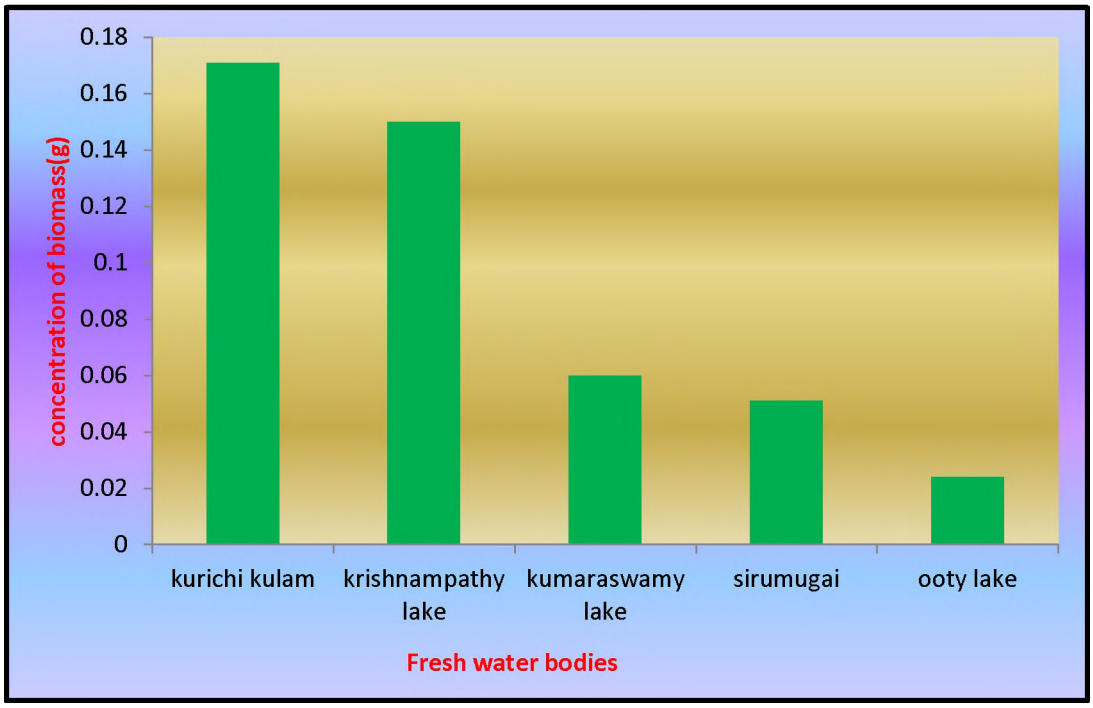


Figure 2

Physicochemical analysis of water sample of sample of different freshwater bodies - pH

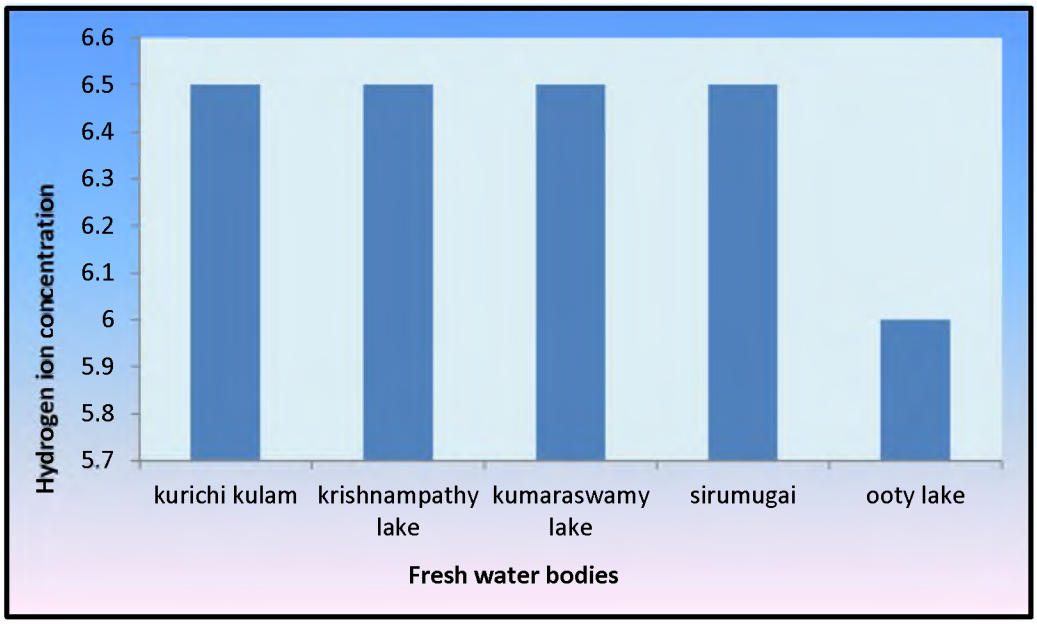


Figure 3

Physicochemical analysis of water sample of different freshwater bodies - Temperature

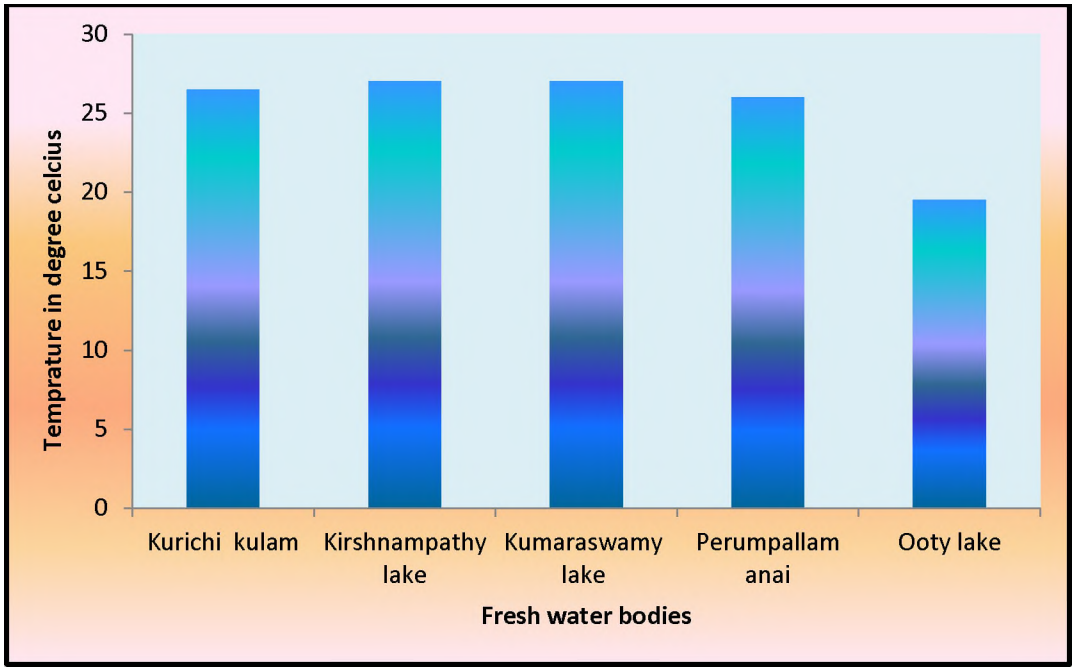


Figure 4

Physicochemical analysis of water sample of different freshwater bodies - Conductivity

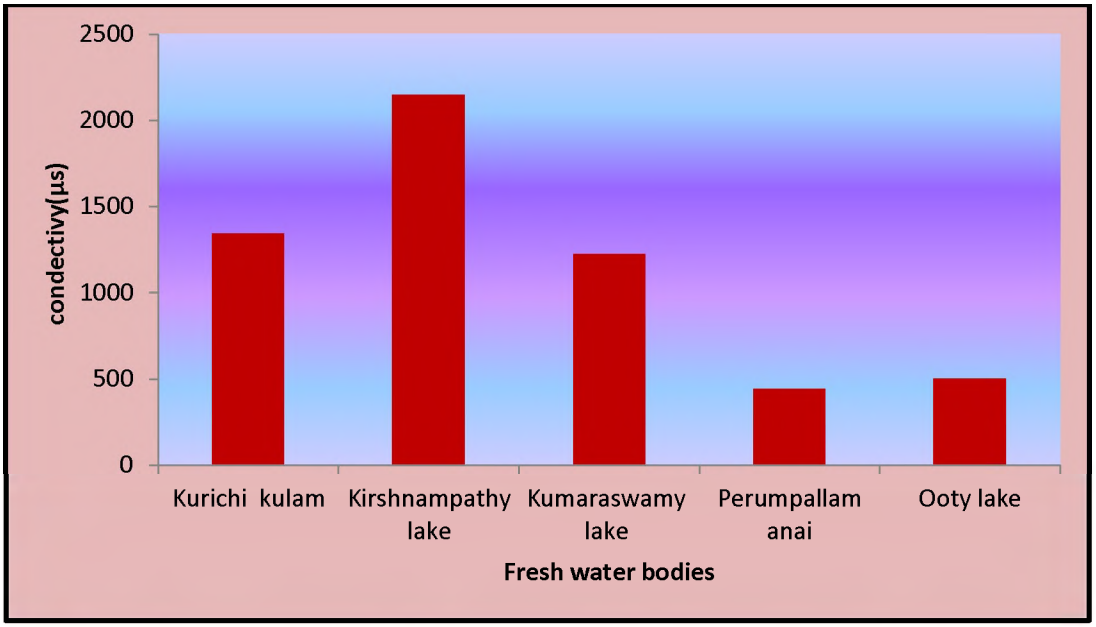


Figure 5

Physicochemical analysis of water sample of different freshwater bodies – Total Dissolved Solids (TDS)

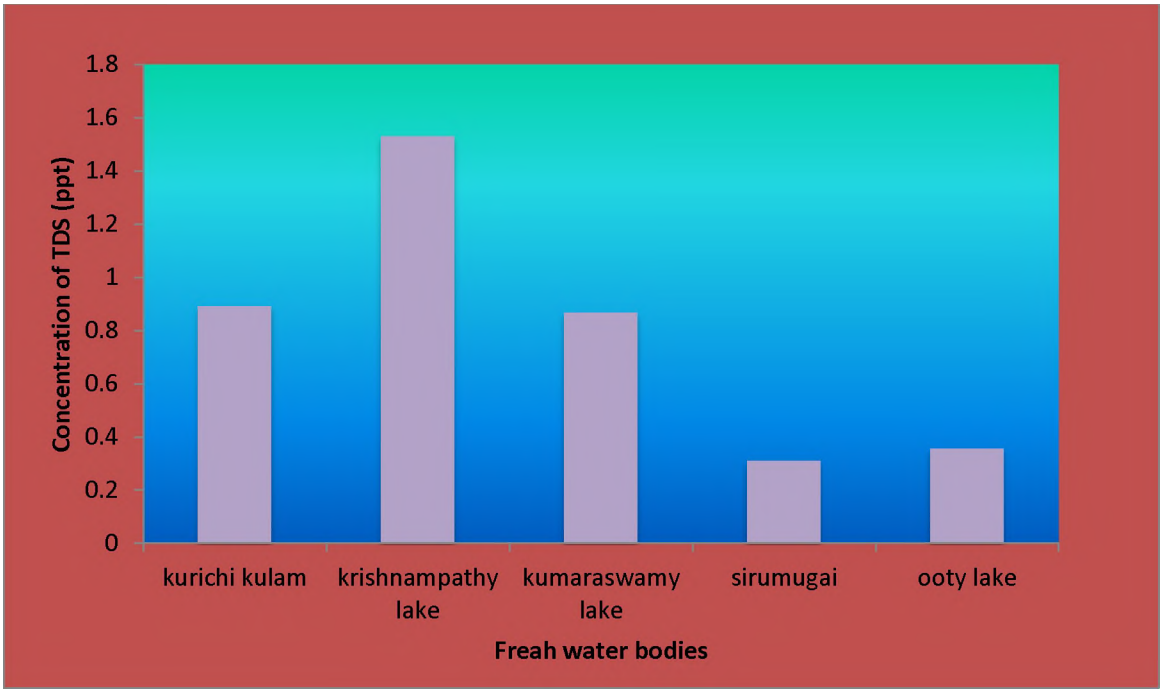


Figure 6

Physicochemical analysis of water sample of different freshwater bodies - Salinity

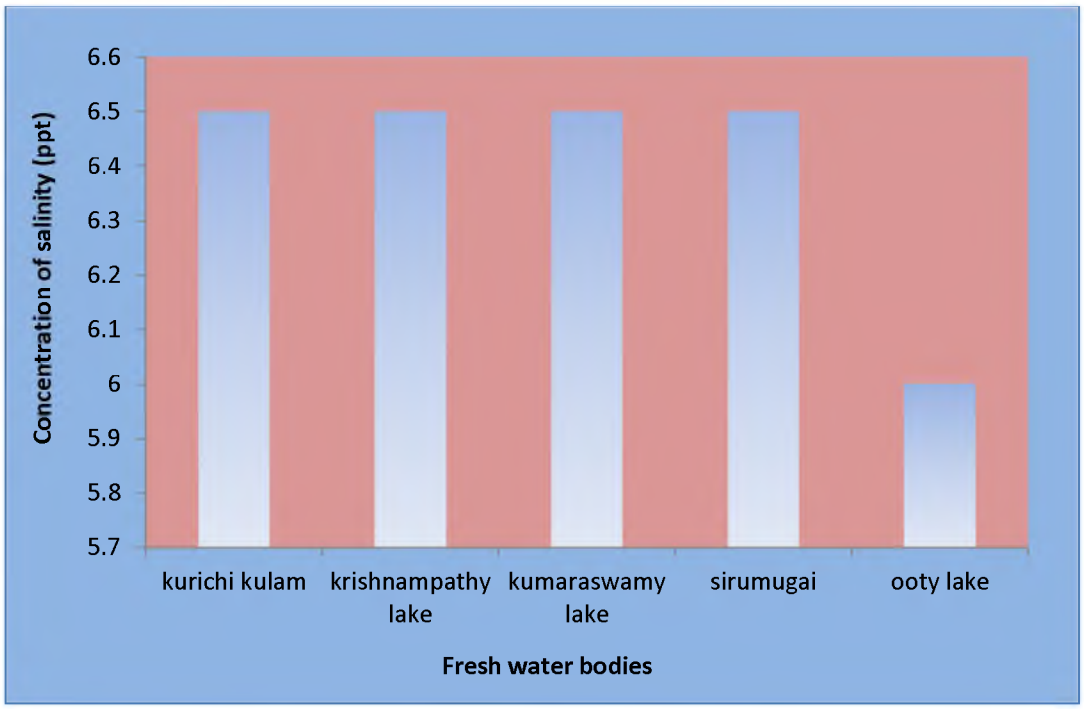


Figure 7

Physicochemical analysis of water sample of different freshwater bodies - Phosphate

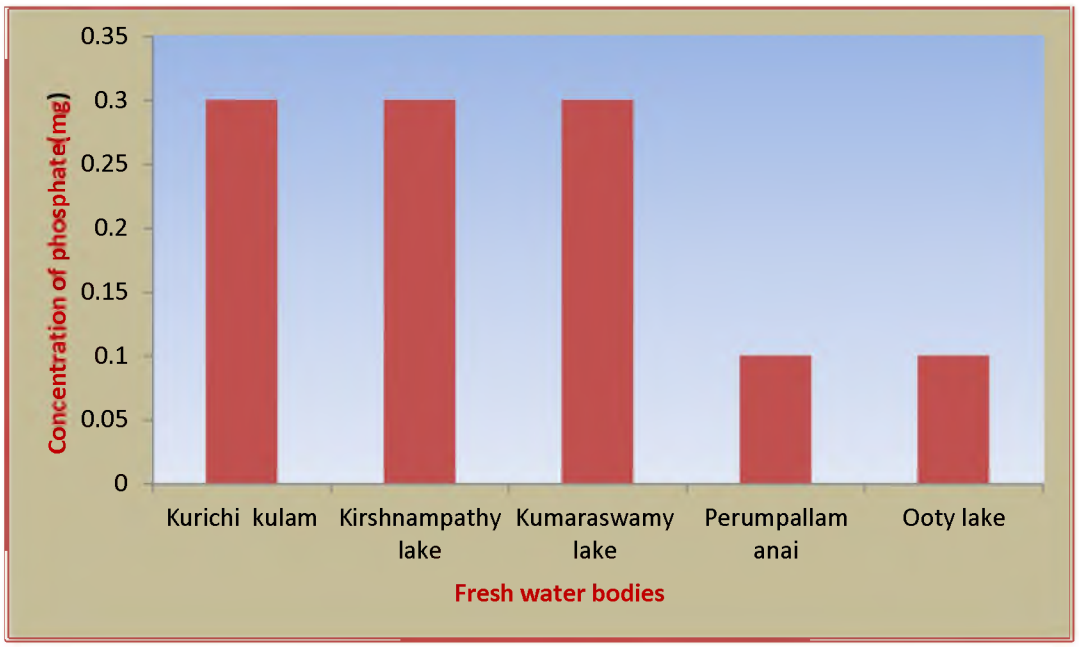


Figure 8

Phosphate Standard

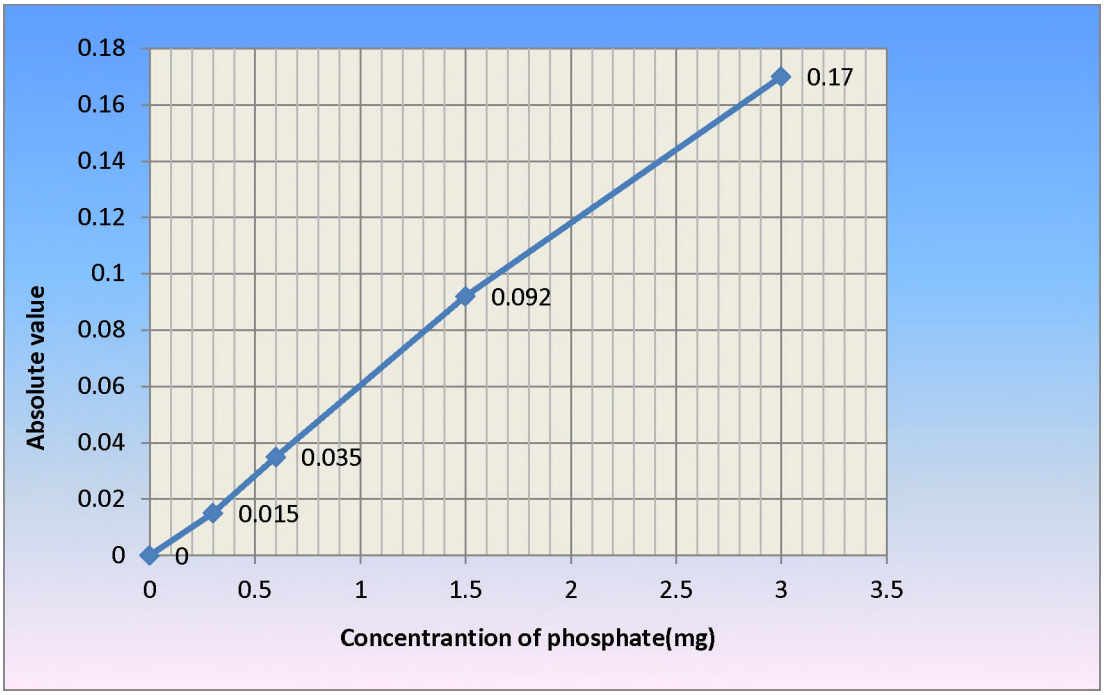


Figure 9

Estimation of Phosphate from the fresh water bodies

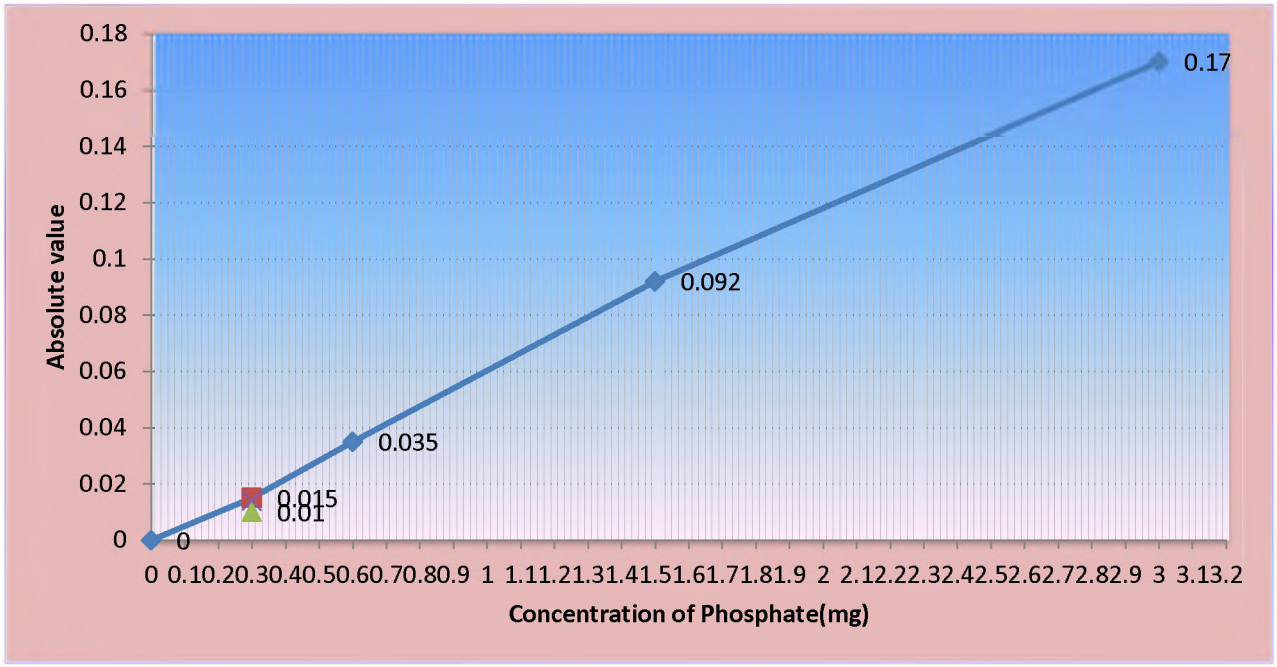


Table 1. Biodiversity of phytoplankton present in five different freshwater bodies

S.NO	Name of the species	Lake 1	Lake 2	Lake 3	Lake 4	Lake 5
	Chlorophyceae					
1	*Scenedesmus quadricauda*	P	A	A	A	A
2	*Scenedesmus incrassatulus*	A	A	A	A	P
3	*Scenedesmus armatus*	A	p	A	A	A
4	*Scenedesmus bicaudatus*	P	p	A	A	A
5	*Coelastrums sp*	P	A	A	A	A
6	*Scenedesmus dimorphus*	A	A	A	A	P
7	*Tetraedron muticum*	A	A	P	A	A
8	*Scenedesmus acuminatus*	P	A	A	A	A
9	*Pediastrum tetras*	P	A	A	A	P
10	*Merismopedia convolute(berb)*	A	A	P	A	A
11	*Oosystis marsonni*	A	A	A	A	P
12	*Spirogra colligata*	A	A	P	A	A
13	*westella sp*	A	P	A	A	A
14	*Crucigenia tetrapedia*	A	P	A	A	p
15	*Eudorina sp*	P	A	A	A	A
16	*Kirchneriella lunaris*(krirchn).moeb	A	P	A	A	A
	Bacillariophyceae					
17	*Cyclotella sp*	P	A	A	A	A
18	*Eunotia pectinalsi*	A	A	P	A	A
19	*Synedra ula*	A	A	A	P	A
20	*Navicula radiosa*	A	P	A	A	A
21	*Navicula sp*	A	P	A	A	A
22	*Nitzchia rostellata*	A	P	A	A	A
23	*Fragilaria sp*	A	A	A	P	A
	Cynophyceae					
24	*Aphanothecea stagina*	P	A	A	A	A
25	*Microcystis aeruginosa*	P	A	A	A	A
26	*Phormdium uncinatum*	A	A	A	P	A

Lake 1- kurichi klulam, Lake 2 - Krishnampathi lake, Lake 3 - Kumaraswamy lake, Lake 4 - Perumpallam anai, Lake 5 - Ooty lake; P – Present, A- Absent.

Table 2

Physicochemical analysis of water sample of different freshwater bodies

S. No	Parameters	Kurichi	Krishnampathy lake	Kumaraswamy lake	Perumpallam anai	Ooty lake	Indian drinkin water standard
1	pH	6.5	6.5	6.5	6.5	6	6.5-8.5
2	Temparature	26.5°C	27°C	27°C	26°C	19.5°C	15 - 23°C
3	Conductivity(µs)	1343	2150	1222	444	499	300
4	TDS(ppt)	0.892	1.53	0.867	0.310	0.355	2ppt
5	Salinity(ppt)	0.626	1.07	0.608	0.210	0.241	2ppt
6	Phosphate (mg/l)	0.3	0.3	0.3	0.1	0.1	5mg

Table 3

Correlation between the physico-chemical parameters and algal biodiversity

	Ph	Temperature	Conductivity	TDS	Salinity	Phosphate
Ph	1	0.991641826	**0.504808392***	**0.581194651***	0.494818407	0.6123724
Temperature		1	**0.591563166***	0.663357523	**0.583931766***	0.696034
Conductivity			1	0.994542905	0.998751436	0.8630877
Tds				1	0.9947149	0.8630877
Salinity					1	0.8484368
Phosphate						1

	pH	Temperature	Conductivity	TDS	Salinity	Phosphate	*Scenedesmus quadricauda*	*Scenedmus incrassatulus*	*Coelastrum sp*
pH	1	0.991641826	**0.504808392***	**0.581195***	0.494818	0.612372436	-0.40824829	0.40824829	0.25
Temperature		1	0.591563166*	0.663358	**0.583932***	0.696033962	**-0.511371891***	0.369324143	0.31315005
Conductivity			1	0.994543	0.998751	0.860184233	-0.722445294	-0.389109244	0.812672885
TDS				1	0.994715	0.863087716	-0.751116791	-0.298073139	0.809122383
Salinity					1	0.848436828	-0.75069065	-0.370132196	0.828421784
Phosphate						1	-0.666666667	-0.166666667	0.40824829
							1	-0.166666667	-0.612372436
								1	-0.40824829
									1

	pH	Temperature	Conductivity	TDS	Salinity	Phosphate	*Scenedesmus dimorphous*	*Scenedesmus acumicum*	*Merismopedia convolute*	*Oosystis marsonni*
pH	1	0.991641826	0.504808392*	0.581195*	0.494818	0.612372436	0.40824829	-0.612372436	0.40824829	-1
Temperature		1	0.591563166*	0.663358	0.583932*	0.696033962	0.369324143	-0.553986215*	0.29830027	-1
Conductivity			1	0.994543	0.998751	0.860184233	-0.389109244	0.251370305	-0.310270968	-0.5048084*
TDS				1	0.994715	0.863087716	-0.298073139	0.186102214	-0.276573346	-0.5811947*
Salinity					1	0.848436828	-0.370132196	0.272386017	-0.346673113	-0.4948184
Phosphate						1	-0.166666667	-0.166666667	-0.166666667	-0.6123724
							1	-0.666666667	0.166666667	-0.4082483
								1	-0.666666667	0.6123724
									1	-0.4082483
										1

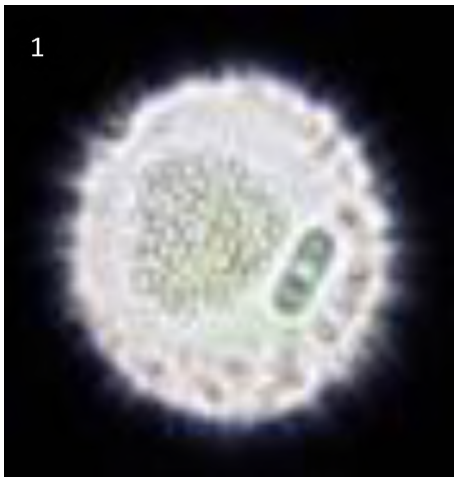
	pH	Temperature	Conductivity	TDS	Salinity	Phosphate	*Spirogyra colligata*	*Westella sp*	*Eudorina sp*	*Krichberiella lunaris*	*Cyclotella sp*
pH	1	0.991641826	0.504808392*	0.581195*	0.494818	0.612372436	0.40824829	0.25	0.40824829	0.25	-0.612372436
Temperature		1	0.591563166*	0.663358	0.583932*	0.696033962	0.369324143	0.31315005	0.29830027	0.31315005	-0.625010089
Conductivity			1	0.994543	0.998751	0.860184233	-0.389109244	0.812672885	-0.310270968	0.812672885	-0.274435388
TDS				1	0.994715	0.863087716	-0.298073139	0.809122383	-0.276573346	0.809122383	-0.36257252
Salinity					1	0.848436828	-0.370132196	0.828421784	-0.346673113	0.828421784	-0.306271359
Phosphate						1	-0.166666667	0.40824829	-0.166666667	0.40824829	-0.166666667
							1	-0.40824829	0.166666667	-0.40824829	-0.666666667
								1	-0.40824829	1	-0.40824829
									1	-0.40824829	0.166666667
										1	-0.40824829
											1

	pH	Temperature	Conductivity	TDS	Salinity	Phosphate	*Eunotia pectinalis*	*Synedra ula*	*Navivula sp*	*Nitzchia rostella*
pH	1	0.991641826	**0.504808392***	**0.581195***	0.494818	0.612372436	0.25	0.25	-0.612372436	0.40824829
Temperature		1	0.591563166*	0.663358	**0.583932***	0.696033962	0.31315005	0.1391778	-0.696033962	0.440348017
Conductivity			1	0.994543	0.998751	0.860184233	0.072138284	**-0.548697835***	-0.860184233	0.80128357
TDS				1	0.994715	0.863087716	0.110804055	-0.475867603	-0.863087716	0.772616585
Salinity					1	0.848436828	0.090982739	-0.544300248*	-0.848436828	0.774149733
Phosphate						1	0.40824829	-0.612372436	-1	0.666666667
							1	-0.25	-0.40824829	-0.40824829
								1	0.612372436	-0.40824829
									1	-0.66666667
										1

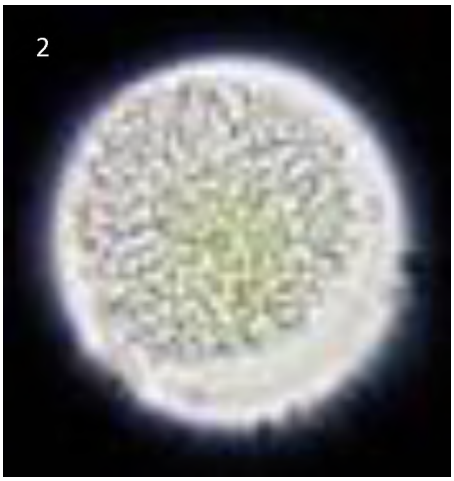
PLATE I

KURCHI LAKE

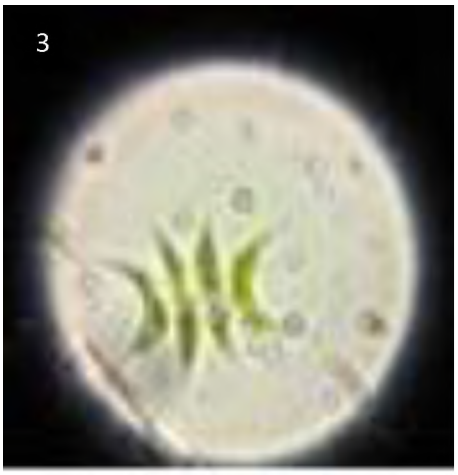
Aphanothecea Stagnina



Microcystis Aeruginosa **Kutz**



Scenedesmus Acuminatus(**Lagerh**



Pediastrum Tetras

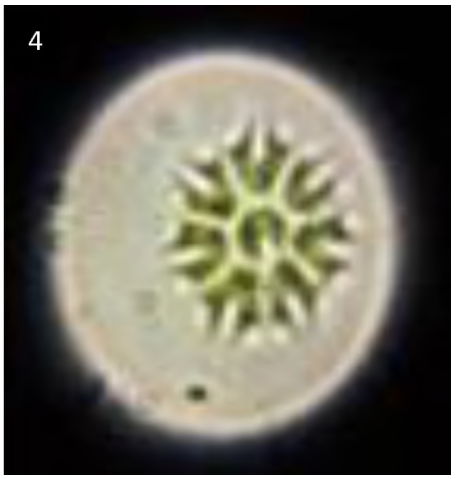
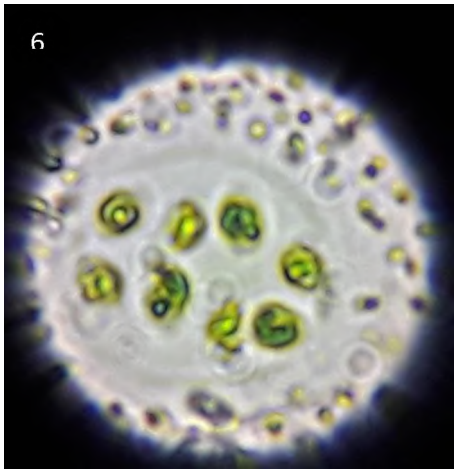


PLATE 2

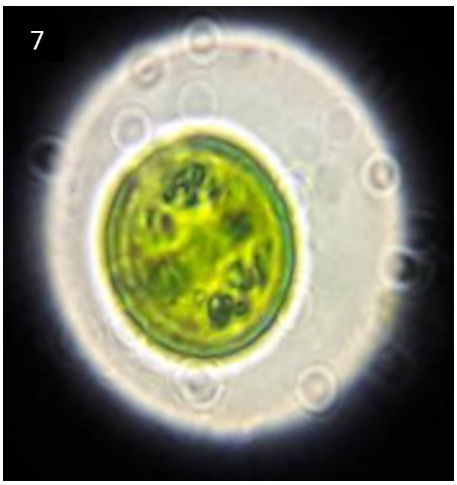
KURCHI LAKE

Scenedesmus Quadricauda

Eudorina sp



Coelastrum sp



Cyclotella sp

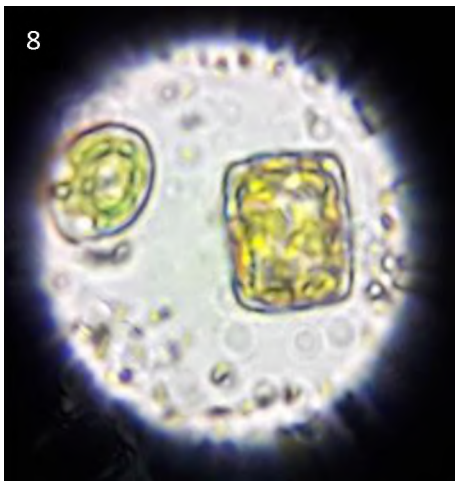
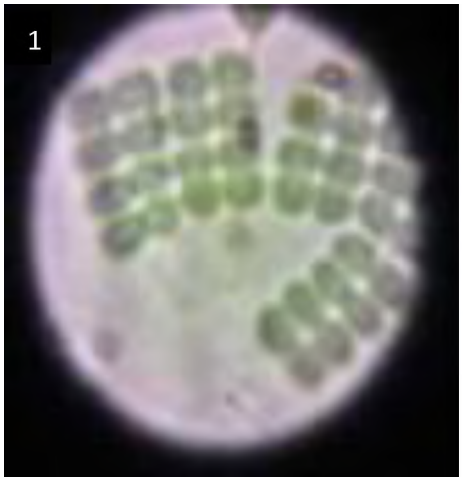


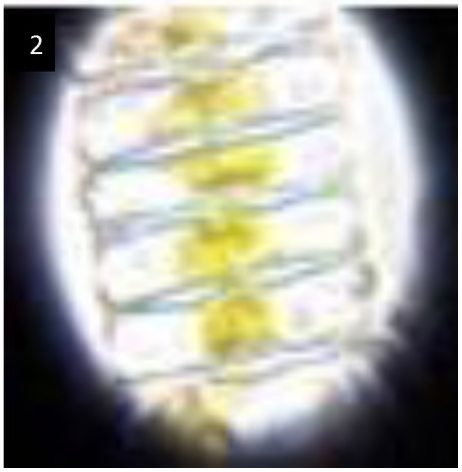
PLATE 3

KUMARASWAMY LAKE

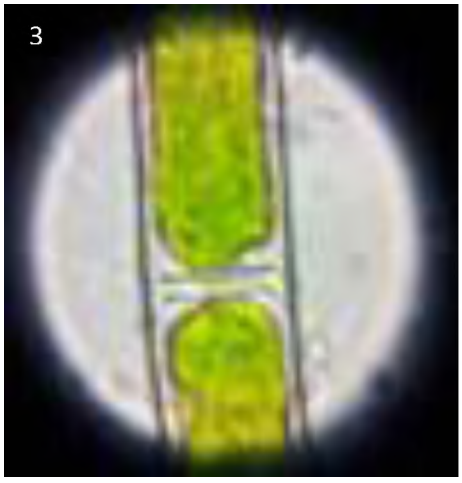
Merismopedia convolute **(Breb)**



Eunotia pectinalsi



Spirogra colligata



*Tetraedron Muticum***(A. Barun)**

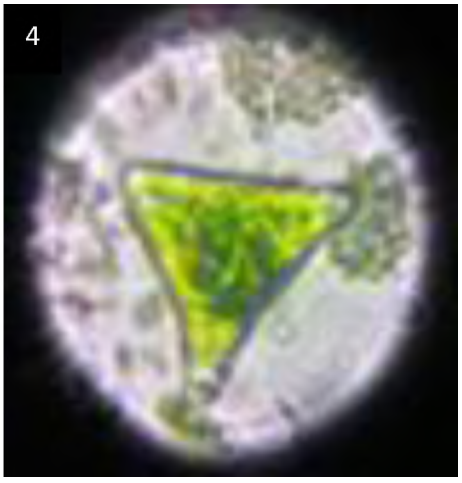
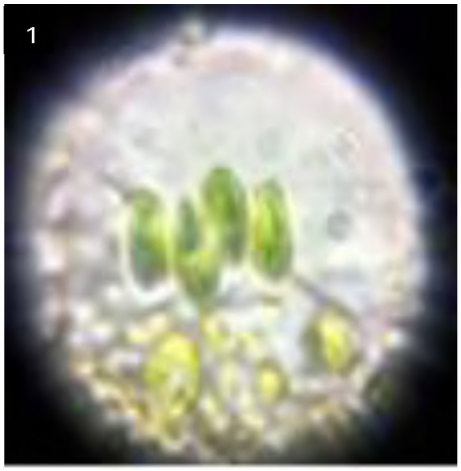


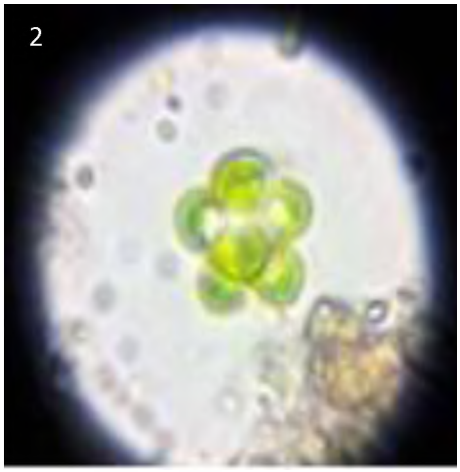
PLATE 4

KRISNAMPATHY LAKE

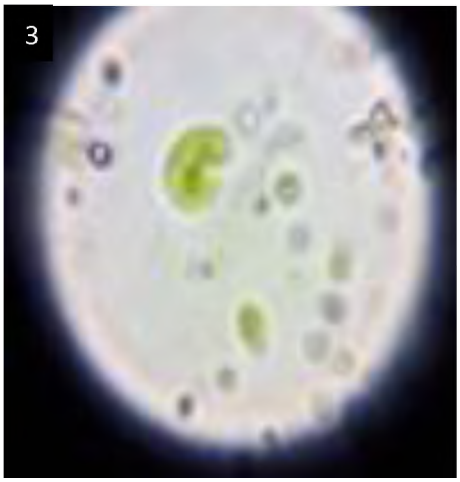
S.armatus*. Var. *bicaudatus



Westella .sp



***Kirchneriella lunaris*(Kirchn)Moeb**

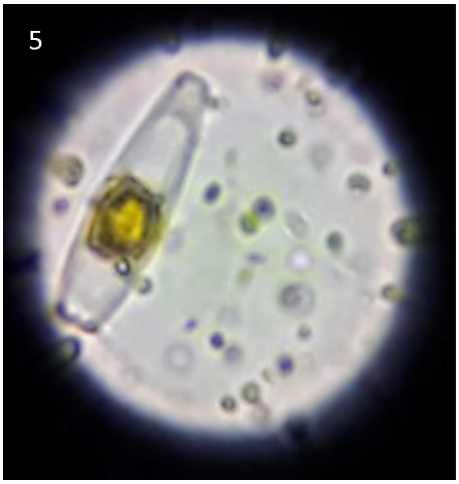


Scenedesmus bicaudatus

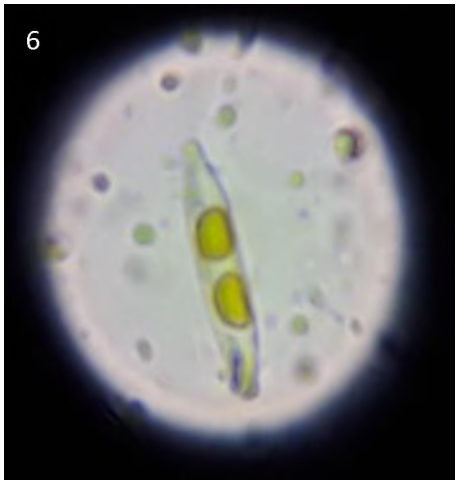
PLATE 5

KRISNAMPATHY LAKE

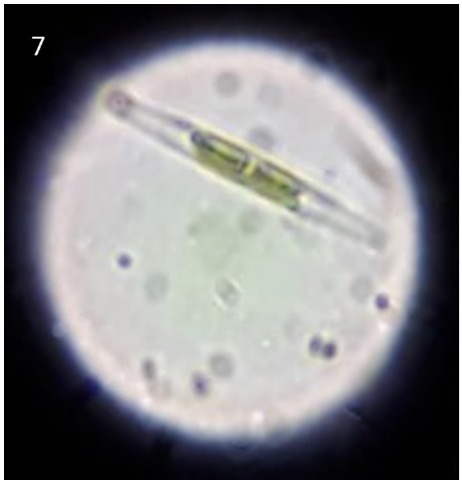
Navicula radiosa



Navicula sp



Nitzschia rostellata



Cruciginia tetrapedia

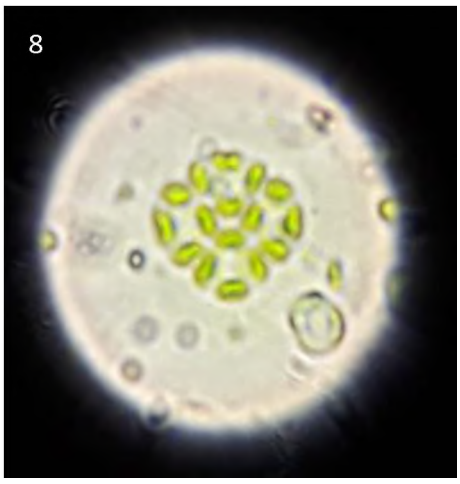
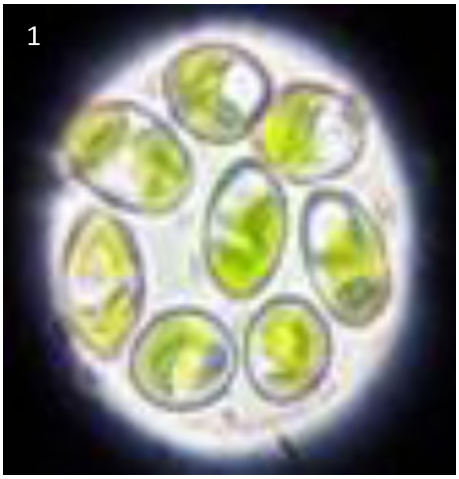


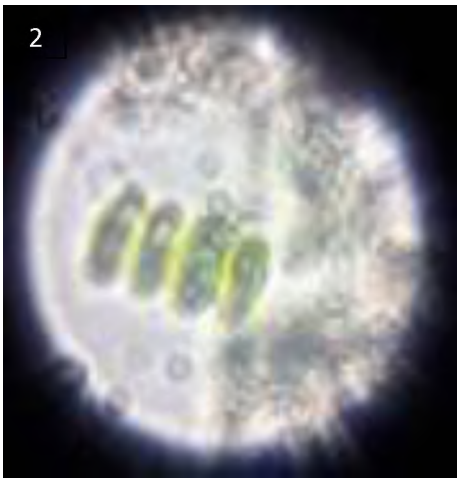
PLATE 6

OOTY LAKE

***Oocystis marsonni* .**



***S. incrassatulus* (Bohlin)**



***S.diamorphus*(Turpin)Kuetzing**

Cruciginia tetrapedia

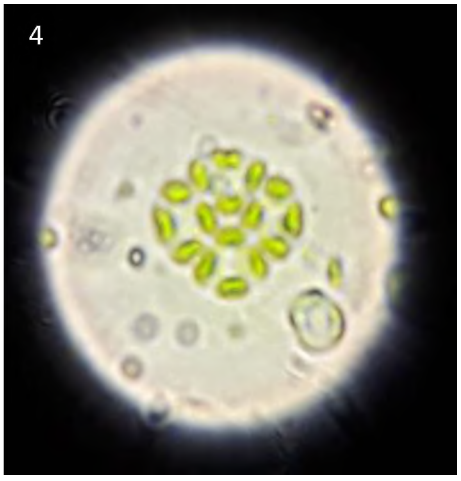
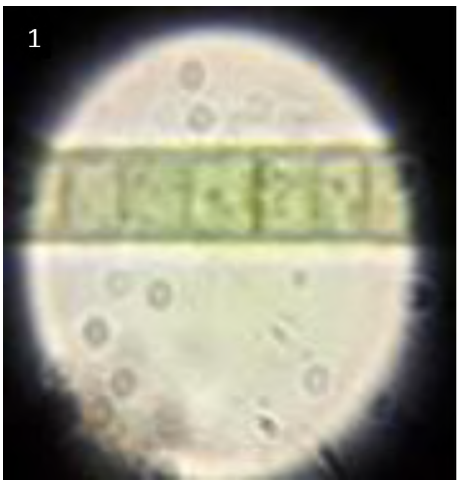


PLATE 7

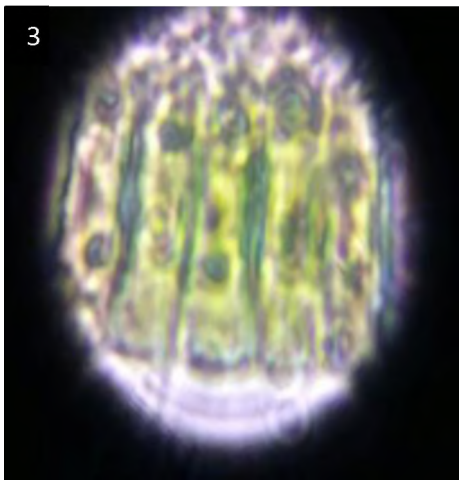
PERUMPALLAM ANAI

Synedra ula



Phormdium uncinatum

Fragilaria sp



LAKES OF SOUTH INDIA

Kurichi kulam

Kirsnampathi Lake

Kumaraswamy lake

Perumpallam anai

Ooty lake

DISCUSSION

The algal biodiversity in the three lakes (Kurichi, Kumaraswamy and Krishnampathy) of the present study showed high Chlorophyceae followed by Bacillariophycea and a few Cyanophyceae. Similarly Rajgopal *et al.,(2010)* in his investigation on the diversity of phytoplankton in relation to physico-chemical parameters with respect to pollution status of two perennial ponds of Sattur area, Tamil Nadu reported Fifty species were identified belonging to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. High value of physico-chemical parameters and low phytoplankton diversity were recorded in the Chinnapperkovil pond, whereas low value of physico-chemical parameters and high phytoplankton diversity were recorded in the Nallanchettipatti pond. Class Chlorophyceae qualitatively and quantitatively dominated in both the habitats when compared to other taxa. *Pediastrum leonensis, Frustulia rhomboides, Microcystis aeruginosa, Oscillatoria angusta, Closterium acerosum* species dominated in Chinnapperkovil pond and *Spirogyra maxima, Zygnema caeruteum and Fragilaria oceanica dominated in Nallanchettipatti* pond. Abundance of such specific taxa *(e.g. Closterium acerosum, C. dianae, C. lineatum, Anabaena aequalis, Oscillatoria angusta and Navicula membranacea*) in the Chinnapperkovil and Nallanchettipatti *(e.g. Merismopedia glauca and Fragilaria oceanica)* ponds suggests that these taxa can be considered as pollution indicators.the result shows Phytoplankton species diversity and physico-chemical parameter profiles indicate the Chinnapperkovil pond to be meso-eutrophic whereas the Nallanchettipatti pond is oligo-eutrophic

Similar results were also observed by Jyotsna, *et al.,*(2014). Seasonal variation of microalgae in relation to the physico-chemical parameters of Karagam lake, Srilakakulam district, A.P. India were studied. In his study, Seasonal changes in growth and distribution of phytoplankton along with physic-chemical parameters were studied. The average values of pH(7.48), turbidity, conductivity (626), dissolved oxygen, B.O.D, carbonate, bicarbonate, dissolved solids(314mg/l), chloride, fluoride, ammonia, nitrate, phostphate(1.87µg/l), silicate were recorded. The microalgae was identified. The dominant members belongs to Chlorophyceae (26genera) followed by Bacillariophyceae (18genera), Cyanophyceae(17 genera) and Euglenophyceae (3 genera). During the two years of investigation, different algal

forms present in this pond were Chlorophyceae 39.89%, Cyanophyceae 22.4%, Bacillariophyceae 34.35% and Euglenophyceae 3.36%.

Ashish W.Yenkar,(2015) also reported the same in his study by reporting the biodiversity of fresh water algae of Rotha-Ii reservoir of Wardha district of Maharastra,India. The present study can enrich our knowledge of algal floral found in the reservoir along with its physic-chemical parameters which was evaluated by standard procedur and by culture media. In order to identify the biodiversity of reservoir, the micro image projection systems were used. In this study 44 algal species were recorded, in which 31 belongs to Chlorophyceae, 10 to bacillariophyceae, 3 to Cynophyceae. Since, the reservoir shows the presence of various algal species.

The present study ia also supported by Patil S.V *et al.*,(2015) in his Limnological study of Venna Lake , Mahabaleshwar, Maharashtra, India. The present shows the quality of water and algal growth of this lake, physic-chemical and biological parameters like temperature, pH, total alkalinity, dissolved oxygen, free CO_2 , total hardness, phosphate, silica and algal biodiversity. The study show the correlation between physic-chemical p[arameters and occurance of algae found. During premonsoon season the Ph (7); Temperature (21 – 23); orthophosphate (0.22mg/l) were observed. This nutrient value OF Pre monsoon period showed more number of Chlorophyceae followed by Bacillariophyceae. There was no record on Cyanophycean members in the pre momsoon season. Members of Chlorophyceae showed constant occurance throughout the year. Microcystis observed only during summer season.

In the present study, The algal biodiversity in Ooty and Perumpallam lake showed high number of Bacillariophyceae followed by Chlorophyceaen members. Similarly Deepak Chettri and Thapa, M.P (2016) studied physicochemical characteristic and periphytic algal communities of river Roru-Chu, East Sikkim, India: A preliminary investigation. In the investigation it was found that the periphytic algal community of Roruchu was represented by 54 taxa which belongs to 3 major class namely Bacillariophyceae(27 sp), Chlrophyceae(17sp) and Cyanophyceae(10 sp).In the present study the physico-chemical analysis of water reveals the richness in Dissolve oxygen and TDS(36-48mg/l) which might have favoured the growth of periphytons. The stream was found to be devoid of any major industrial polluting source. The result showed that the stream is having crystal free water and are free from pollution as chlorophyceae are better represented.

CONCLUSIONS

When compared with Indian standard drinking water limits the physic-chemical analysis of the water bodies in the present study was high in temperature and conductivity, whereas it was low in pH, TDS, salinity, and phosphate. The physic-chemical analysis of three water bodies of Coimbatore district Kurichi lake, Krisnampathi lake were more or less similar in all the parameters. The physic-chemical analysi of Ooty and Perumpallam anai were comparatively low. The algal biodiversity in three lakes of Coimbatore district showed a pattern of high Chlorophyceae followed by Bacillariophyceae and a few Cyanophyceae. The algal biodiversity of Ooty and Perumpallam anai showed a pattern of high in Bacillariophyceae followed by a few Chlorophyceae. The present study concluded that the physicochemical parameter - Phosphate was found no correlation with the algal biodiversity. It also concluded that the three lakes of Coimbatore district are below Eutrophication and the other two lakes Ooty and Perumpallam anai showed a crystal clear water which fits to agricultural purposes.

SUMMARY

In the present study five lakes were subjected to the study of biodiversity of planktonic algae. The analysis of water sample from the selected lake showed the presence of 26 algal species. Of the 26 species of algae 16 belonged to Chlorophyceae, 7 to Bacillariophyceae and 3 to Cyanophyceae. The maximum number of algae species was found in Kurichi lake where the number was 9(Chlorophyceae < Cyanophyceae< Bacillariophyceae), which was followed by Krishanampathy lake showing the presence of 8 members(Chlorophyceae< Bacillariophyceae; Absence of Cyanophyceae), followed by Ooty lake showing the presence of 5 members (presence of Chlorophyceae alone), followed by Kumaraswamy lake showing the presence of 4 members(Chlorophyceae< Bacillariophyceae), followed by Perumpallam Anai showing the presence of 3 members(Bacillariophyceae< Cyanophyceae). The diversity of species in Cyanophyceae and Bacillariophyceae was less in number and hence most of the lake was not polluted.

Among the lakes observed the pH value was found to be maximum in 6.5(Kurichi, Krishnampathy, Kumarasamy and Perumpallam anai) and a minimum pH value of 6 in and Ooty lake. The pH of the above lakes were compared with that of Indian drinking water standard. The pH of the lakes observed in the present study was under the drinking water limits. The temperature range was observed to be maximum at 27°C and minimum at 19.5°C. The temperature of kurichi lake showed 26.5°C; Krishnampathy lake showed 27°C; Kumarasamy lake showed 27°C; Perumpallam anai showed 26°C and ooty lake showed 19.5°C. The Temperature of the above lakes were compared with that of indian drinking water standard. The Temperature of the lakes observed in the present study was above the drinking water limits. Maximum electrical conductivity value was recorded was 2150µs in Krishnampathy lake and the minimum electrical conductivity of 444µs in Perumpallam anai. In Kurichi lake the electrical conductivity value was found to be 1343µs and 1222µs in Kumarasamy lake. The Ooty lake showed electrical conductivity value of 499µs. The Electrical conductivity of the above lakes were compared with that of indian drinking water standard. The Electrical conductivity of the lakes observed in the present study was above the drinking water limits. Maximum value of TDS was observed in Krishnampathy lake (1.53) and the minimum value was 0.310 in Perumpallam anai. The TDS values of other three lakes

were 0.892, 0.867 in Kurichi, Kumarasamy lake and 0.355 in Ooty lake. The Total dissolve solids of the above lakes were compared with that of indian drinking water standard. The Total dissolve solids of the lakes observed in the present study was below the drinking water limits. maximum value of salinity was1.07ppt in Krishnampathy lake and the minimum salinity value was found 0.210ppt in Perumpallam anai. The salinity value of other three lakes were 0.626 in Kurichi lake, 0.867 in Kumarasamy lake and 0.355 in Ooty lake. The Salinity of the above lakes were compared with that of indian drinking water standard. The Salinity of the lakes observed in the present study was below the drinking water limits. maximum value of Phosphate was 0.3 mg in (Krishnampathy lake, Kurichi lake and Kumaraswamy lake) and the minimum Phosphate value was found 0.1mg in Perumpallam anai and Ooty lake. The Phosphate of the above lakes were compared with that of indian drinking water standard. The Phosphate of the lakes observed in the present study was above the drinking water limits except Perumpallam and Ooty lake.

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