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RESEARCH ARTICLE

Phytoplankton & Physiochemical studies of two lakes, Haliyal taluk, Uttara Kannada district, Karnataka

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Abstract

Phytoplankton studies at two lakes report the highest diversity in Antrolli Lake. Phytoplanktons were recorded as being highest during summer and less during rainy seasons. Guttigere Lake records 9 species and Antrolli Lake records 52 species, 1 species is common for both the lakes. A total of 32 families were recorded, in that Phacaceae is dominant. As Chlorophyta records the highest number of species, Dinoflagellate and Zygonematophyceae record the lowest number of species. Hydrobiological studies in two lakes with various physiochemical parameters like temperature, pH, TDS, Electrochemical conductivity, Total alkalinity, and Carbonates. Hydro carbonates, Dissolved oxygen, Chlorides, and Chemical Oxygen Demand were conducted monthly from March to August which includes summer and rainy seasons of the two lakes. Some major tests were conducted once in three months i.e. during the summer and rainy seasons and recorded highest in the summer season only. Antrolli Lake has fewer chemical constituents than Guttigere. So Antrolli Lake has good water which is fit for drinking as per the above results from our study.

Keywords: Antrolli Lake, Guttigere Lake, Marshy area, Phytoplanktons, Physiochemical parameters.

Introduction

Limnology (from the Greek: limné = pool or pond; logos = discourse or study), the study of inland waters, is the scientific discipline focused on all inland waters of the Earth. These days, the term, limnology, may be replaced by or subsumed under other terms of scientific inquiry such as aquatic ecology, hydrobiology, or even hydrology. (Likens, 2022). The term phytoplankton is used for the large group of planktonic plants that live in surface waters. They are in general photoautotrophic prokaryotes and Eukaryotes. Thus even those with a simple Bacterial cell structure are photosynthetic and obtain most of their energy from sunlight. There is always some debate as to exactly which organisms to include in this group as among the single-celled and simple multicellular forms. Some species have rather complex nutritional requirements and may be partially dependent on organic substrates (heterotrophic) so obligate autotrophy is difficult to demonstrate (Harris, 2012). Hydrobiological study of two ponds (Laxman Singh Pond and Kyarakoppa Pond) and two lakes (Nuggikeri Lake and Devaragudihal Lake) situated in Dharwad. Both Kyarakoppa Pond and Nuggikeri Lake were disturbed by cattle bathing, washing of clothes and occasional duck hunters. These water bodies supported macrophytes including species of Hydrilla, Vallisneria, Najas and Nymphaea (Hegde, 1985). Shashikanth recorded a limonological study of Nagaral Dam, Chincholi, Kalaburgi, Karnataka, India by monthly analysis of physio-chemical and heavy metal parameters of Calcium, magnesium, Chloride, and Nitrate, concluded that too good for drinking and agricultural purposes in the year 2018. A survey of Wet wetland macrophytes from Wetlands of Haliyal Taluk reported Dicotyledons were predominant in the study areas, from the diversity point of view Cyperaceae was the dominant family, followed by Commelinaceae, Lentibulariaceae and Scropulariaceae. Eight species

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documented, have medicinal value. Among the morpho-ecological groups, emergent anchored were the dominant and the least submerged rooted group. Shannon diversity index revealed comparatively high diversity in the riparian wetland of Bomanahalli dam. Yadoga and Murukwad are in fairly good condition, whereas Sambrani and Ajgaoh are highly polluted and not suitable for fishing (Singh & Rajan, 2015). Limnological studies of two rivers in Uttara Kannada District, Karnataka state reported 25 physicochemical factors were analyzed turbidity, dissolved oxygen and sulphate were higher in river Aghanashini than in river Kali. A monthly study of phytoplankton for two years in rivers Aghanashini and Kali revealed that there were 7 phytoplankton groups consisting of 40 genera comprising 226 taxa. Among the total genera and species, Baillariophyceae (diatoms) was the dominant group comprising 18 (45%) genera and 116 (51.32%) species. Among these rivers, Aghanashini supported more number of genera (39) and species (191), while Kali had less number of genera (25) and species (74) (Bhat, 2004). An Ecological Study of Phytoplankton in Four Freshwater Bodies of Dharwad recorded Nuggikeri Lake, Mugad Lake, Rayapur Pond & Kotur Pond reported such as topography, climatic conditions, physico-chemical factors, rate of reproduction, death and water movement. In natural waters, algae generally show a periodicity corresponding to the different seasons of the year (Dodagoudar, 1989). Sharath Chandra & Rajashekhar reported 59 cyanobacterial species belonging to 27 genera from different freshwater habitats of Kaiga in Uttara Kannada district of Karnataka during the period from June 2009 to May 2011 This study indicates the maximum occurrence and abundance of Chroococaceae (23.73%) and Phormidaceae (18.64%) members in all the sites, whereas Stigonemataceae (1.7%) shows very less occurrence in the year 2015. Kanavi, Karnataka Koppa Minor Irrigation tank of Belgavi District, Karnataka by laboratory analysis tests concludes that it is useful for drinking purposes because of the less anthropogenic activity (Gokavi and Sunkad, 2017). Ecological Studies on the River Kali with Special Reference to the Factories Effluents around Dandeli (North Kanara) reported the present study covers a 10 km stretch of Kali River around the Dandeli area where it receives effluents-from the industries regarding physical and chemical parameters (Krishnamurthy, 1991).

Material methods

Study area

Haliyal is a town panchayat city and Taluka in Uttara Kannada District Malenadu region of Karnataka.it is located 103km towards the East of the district headquarters Karwar. There are about 128 villages in Haliyal taluka Yadoga (2km), Buzurkanchanalli (4km), Tergaon (5km), Kesarolli (5km), Tatwanagi (7km) are the nearby villages to Haliyal. Haliyal is surrounded by Dharwad taluk towards the East, Kalagatagi taluk towards East, Supa taluk towards the West, Hubali taluk towards East, Alnavar taluk towards North, Dandeli and Yellapur taluk towards South. Guttigere Lake: The Sarkar Kere is also known as Guttigere Kere situated about 1.1 km north of Haliyal. And water spread area is about 15.4 acres. It is situated at DMS 15°20'31.5"N 74°45'51.9"E. The lake records 550 m altitude above sea level. Antrolli Lake: Antrolli Kere is situated in Antrolli village right in front of the Muttalmari village. This is about 5.9 km North of Haliyal. The total area of this lake is 5 acres and has lush greenery surrounding it. It is situated at DMS 15°20'31.5"N 74°45'51.9"E. The lake records 550 m altitude above sea level.

Collection of Samples

Samples were collected in three forms i.e. Water sample, and Phytoplankton. The water sample was collected monthly once for Physicochemical tests. Phytoplankton samples were also collected monthly in the morning hours (8-10 am) once to assess the diversity and documentation.

Identification of phytoplankton

An Introduction to Phytoplanktons: Diversity and Ecology (Ruma Pal & Avik Kumar, 2013).Training Manual on Phytoplankton Identification Taxonomy (Gopinathan et al., 2010) Phytoplankton identification and water quality monitoring along the fish-cage belt at Magat dam reservoir, Philippines (Francis & Jonathan, 2016). Freshwater Algae Identification and Use as Bioindicators (Edward B. G. & S. C. David, 2010).

Physio-chemical Parameters

Physio-chemical Parameters were conducted minor tests monthly and some major tests for two seasons with the following standard methods: Chemical Oxygen Demand (Champika, 1993); Total Alkalinity Test (APHA test, 1992); Dissolved Oxygen test (Winkler method); Electrochemical Conductivity: This has been conducted in Shilpa Biologicals Pvt. Ltd.; Chloride Test (Mohr's test); Determination of Total Hardness by Volumetric (EDTA) Method (FSSAI, 2015); Determination of Calcium by Volumetric Method (FSSAI, 2015):; Determination of Magnesium by Calculation Method (FSSAI, 2015); Determination of Chlorophyll content in a given sample by UV spectrophotometric method (Aminot & Franscico, 2000).

Results

Phytoplanktons were recorded as being highest during summer and less during rainy seasons. Guttigere Lake records 9 species and Antrolli Lake records 52 species, 1 species is common for both lakes (Table 1 & Fig. 1-5). A total of 32 families were recorded, in that Phacaceae is dominant.

Total Classes of phytoplanktons (Table-2) in Guttigere and Antrolli are Cyanophyceae (4), Bacillariophyta (8), Charophyta (2), Chlorophyceae (1), Chlorophyta (18), Cyanobacteria (7), Diadesmidaceae (1), Dinoflagellata (1), Euglenozoa (8), Gyrista

Table 1: Comparative account of Phytoplankton in Guttigere Lake and Antrolli Lake

Sl. No.	*Scientific name*	*Class*	*Family*	*G*	*A*
1	*Akashiwo sanguine* (K.Hirasaka) Gert Hansen & Moestrup,	Dinoflagellata	Gymnodiniaceae	-	-
2	*Anabaena flos-aquae* Brébisson ex Bornet&Flauhault	Cyanobacteria	Nostocaceae	-	-
3	*Anabaena sphaerica* Bornet&Flahault	Cyanobacteria	Nostocaceae	-	+
4	*Arthrospira platensis* Gomont	Cyanobacteria	Microcoleaceae	-	+
5	*Asterococcus superbus* (Cienkowski) Scherffel	Chlorophyta	Palmellopsidaceae	-	+
6	*Aulacoseira granulata* (Ehrenberg) Simonsen,	Gyrista	Aulacoseiraceae	-	+
7	*Chlorella vulgaris* Beijerinck	Chlorophyta	Chlorellaceae	+	-
8	*Closterium sp.*	Zygnematophyceae	Closteriaceae	-	+
9	*Cocconei splacentulan* Ehrenberg,	Ochrophyta	Cocconeidaceae	+	-
10	*Coelosphaerium dubium* Grunow	Cyanobacteria	Merismopediaceae	+	-
11	*Coscinodiscus radiatus* Ehrenberg	Bacillariophyta	Coscinodiscaceae	+	-
12	*Cosmarium formosulum* Hoff	Charophyta	Desmidiaceae	+	-
13	*Desmodesmus bicellular* (Chodat) S.S.An, T.Friedl&E.Hegewald	Chlorophyta	Scenedesmaceae	-	+
14	*Desmodesmus maximus* (West &G.S.West) Hegewald	Chlorophyta	Scenedesmaceae	-	+
15	*Diadesmi sconfervacea* Kützing,	Diadesmidaceae	Bacillariophyta	-	-
16	*Encyonema paradoxum* Meneghini	Bacillariophyta	Cymbellaceae	-	+
17	*Euglena acus* (O.F.Müller) Ehrenberg	Euglenozoa	Euglenaceae	-	+
18	*Eunotia valida* Hustedt,	Ochrophyta	Eunotiaceae	-	+
19	*Gomphonema affinopsis* D. Metzeltin, H. Lange-Bertalot& F. García-Rodríguez,	Bacillariophyta	Gomphonemataceae	-	+
20	*Gomphonema lagenula* Kützing	Bacillariophyta	Gomphonemataceae	-	+
21	*Gomphonema lanceolatum* C.Agardh,	Bacillariophyta	Gomphonemataceae	+	-
22	*Gomphonema pumilum* (Grunow) E.Reichardt& Lange-Bertalot	Bacillariophyta	Gomphonemataceae	-	+
23	*Gyrosigma kuetzingii* (Grunow) Cleve	Gyrista	Pleurosigmataceae	-	+
24	*Lepocinclis acus* (O.F.Müller) B.Marin&Melkonian	Euglenozoa	Phacaceae	+	+
25	*Lepocinclis fusiformis* (H.J.Carter) Lemmermann,	Euglenozoa	Phacaceae	-	+
26	*Lepocinclis ovum* (Ehrenberg) Lemmermann	Euglenozoa	Phacaceae	-	+
27	*Microcystis aeruginosa* (Kützing) Kützing,	Cyanophyceae	Microcystaceae	+	-
28	*Microcystis flosoquoel*	Cyanophyceae	Microcystaceae	-	+
29	*Microcystis novacekii* (Komárek) Compère	Cyanophyceae	Microcystaceae	-	+
30	*Microcystis smithii* Komárek & Anagnostidis	Cyanophyceae	Microcystaceae	-	+
31	*Monoraphidium griffithii* (Berkeley) Komárková-Legnerová,	Chlorophyceae	Selenastraceae	-	+
32	*Monoraphidium consortium* (Thuret) Komárková-Legnerová	Chlorophyta	Selenastraceae	-	+
33	*Navicula germanic* J. H. Wallace	Ochrophyta	Naviculaceae	-	+
34	*Navicula viridula*	Ochrophyta	Naviculaceae	-	+
35	*Neidium affine* (Ehrenberg) Pfitzer	Gyrista	Neidiaceae	-	-
36	*Nitzschia frustulum* (Kützing) Grunow,	Gyrista	Bacillariaceae	-	+
37	*Nitzschia umbonata* (Ehrenberg) Lange-Bertalot,	Gyrista	Bacillariaceae	-	-
38	*Nitzschia vasnaii* H. P.Gandhi	Gyrista	Bacillariaceae	-	-
39	*Oscillatoria nigra* Vaucher J. P.	Cyanobacteria	Oscillatoriaceae	-	+
40	*Oscillatoria ornata* f. planctonicaElenkin,	Cyanobacteria	Oscillatoriaceae	-	+
41	*Pediastrum simplex* Meyen	Chlorophyta	Hydrodictyaceae	-	+
42	*Pediastrum tetras* (Ehrenberg) Ralfs	Chlorophyta	Hydrodictyaceae	-	+
43	*Peranema inflexum* Skuja	Euglenozoa	Peranemataceae	-	+

44	*Phacus longicauda* (Ehrenberg) Dujardin	Euglenozoa	Phacaceae	+	-
45	*Phacus ovalis* Skvortzov	Euglenozoa	Phacaceae	-	+
46	Pinnularia sp.	Gyrista	Pinnulariaceae	-	+
47	*Pleurisigma sp.*	Bacillariophyta	Pleurosigmataceae	-	+
48	*Rhizosolenia setigera* Brightwell,	Bacillariophyta	Rhizosoleniaceae	-	+
49	*Scenedesmus acuminatus* (Lagerheim) Chodat	Chlorophyta	Scenedesmaceae	-	+
50	*Scenedesmus bicaudatus* Dedusenko	Chlorophyta	Scenedesmaceae	-	+
51	*Scenedesmus dimorphus* (Turpin) Kützing	Chlorophyta	Scenedesmaceae	-	+
52	*Stauridium tetras* (Ehrenberg) E.Hegewald	Chlorophyta	Hydrodictyaceae	-	+
53	*Staurodesmus validus* (West &G.S.West) Thomasson	Charophyta	Desmidiaceae	-	+
54	*Tetradesmus obliquus* (Turpin) M.J.Wynne	Chlorophyta	Scenedesmaceae	-	+
55	*Tetraëdron minimum* (A.Braun) Hansgirg	Chlorophyta	Hydrodictyaceae	-	+
56	*Tetraëdron trigonum* (Nägeli) Hansgirg	Chlorophyta	Hydrodictyaceae	-	+
57	*Tetrastrum heteracanthum* (Nordstedt) Chodat	Chlorophyta	Scenedesmaceae	-	+
58	*Trachelomonas planctonica* var. *oblonga* Dreżepolski	Euglenozoa	Euglenaceae	-	+
59	*Trachelomonas volvocina* (Ehrenberg) Ehrenberg	Euglenozoa	Euglenaceae	-	+
60	*Treubaria setigera* (W.Archer) G.M.Smith	Chlorophyta	Treubariaceae	-	+
61	*Ulothrix sp.*	Chlorophyta	Ulotrichaceae	-	+

G: Guttigere Lake, **A:** Antrolli Lake, +. Present, -. Absent

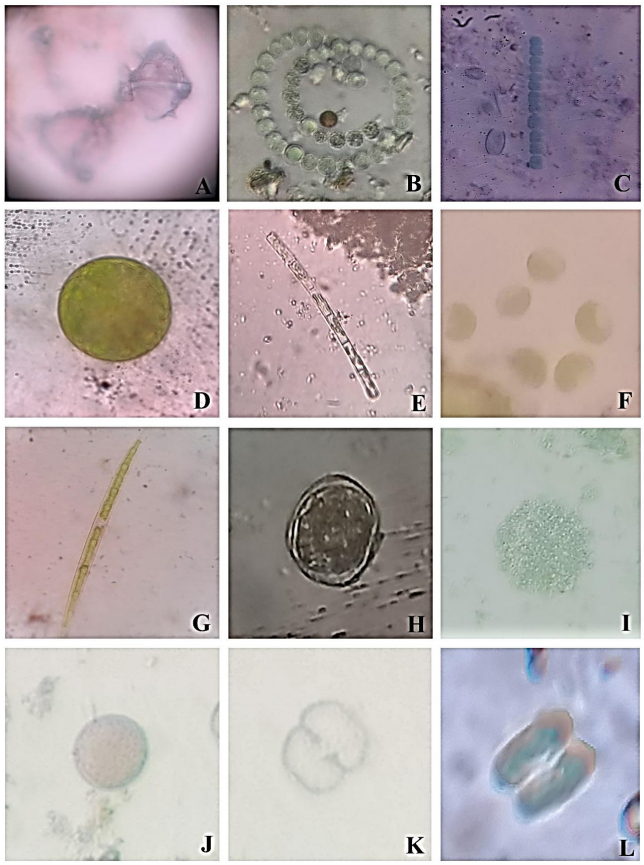

Figure 1: A. *Akashiwo sanguinea;* **B.** *Anabaena flos-aquae;* **C.** *Anabaena sphaerica;* **D.** *Asterococcus superbus;* **E.** *Aulacoseira granulata;* **F.** *Chlorella vulgaris;* **G.** *closterium limneticum;* **H.** *Coconeis placentula;* **I.** *Coelosphaerium dubium;* **J.** *Coscinodiscus radiatus;* **K.** *Cosmarium formosulum;* **L.** *Desmodesmus bicellularis*

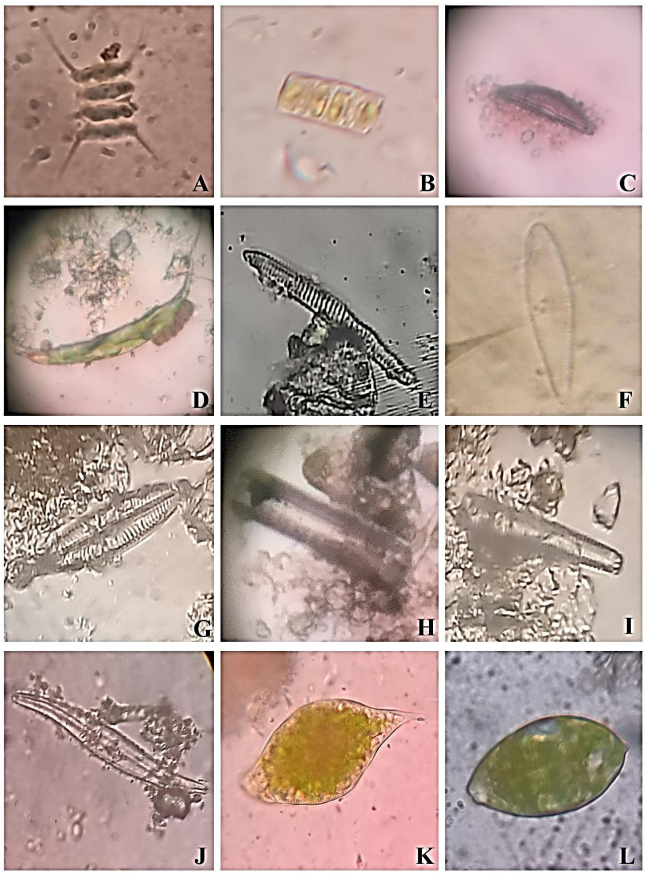

Figure 2: A. *Desmodesmus maximus;* **B.** *Diadesmis confervacea,* **C.** *Encyonema paradoxum;* **D.** *Euglena acus,* **E.** *Eunotia valida,* **F.** *Gomphonema affinopsis,* **G.** *Gomphonema lagenula,* **H.** *Gomphonema lanceolatum,* **I.** *Gomphonema pumilum,* **J.** *Gyrosigma kuetzingii,* **K.** *Lepocinclis fusiformis,* **L.** *Lepocinclis ovum*

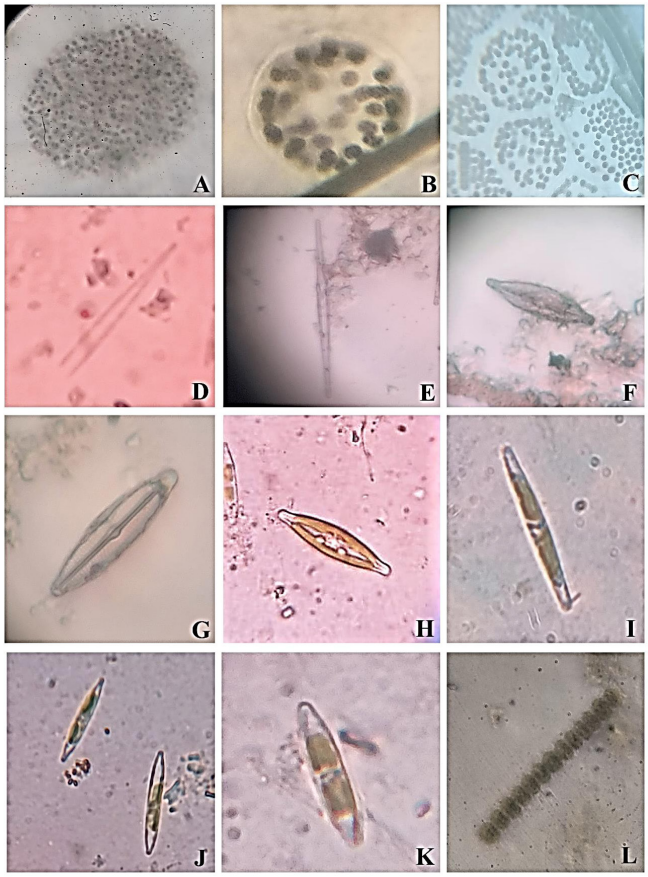

Figure 3: A. *Microcystis aeruginosa* **B.** *Microcystis novacekii,* **C.** *Microcystis smithii,* **D.** *Monoraphidium griffithii,* **E.** *Monoraphidium contortum;* **F.** *Navicula germainii,* **G.** *Navicula viridula;* **H.** *Neidium affine,* **I.** *Nitzschia frustulum,* **J.** *Nitzschia umbonata,* **K.** *Nitzschia vasnaii;* **L.** *Oscillatoria nigra*

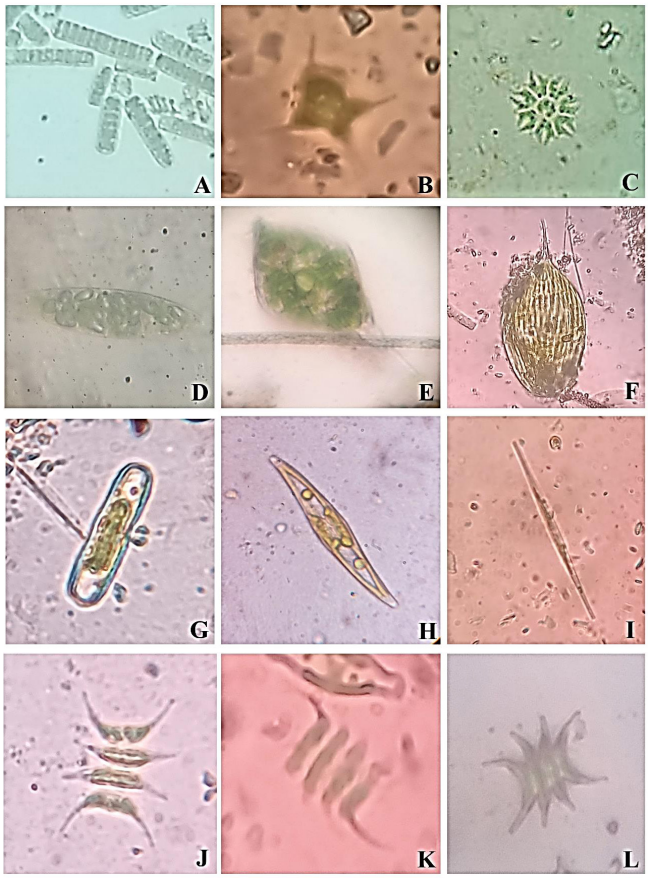

Figure 4: A. *Oscillatoria ornata,* **B.** *Pediastrum simplex,* **C.** *Pediastrum tetras;* **D.** *Peranema inflexum;* **E.** *Phacus longicauda,* **F.** *Phacus ovalis;* **G.** *Pinnularia acrosphaeria,* **H.** *Pleurisigma sp.;* **I.** *Rhizosolenia setigera,* **J.** *Scenedesmus acuminatus;* **K.** *Scenedesmus bicaudatus;* **L.** *Scenedesmus dimorphus*

(7), Ochrophyta (4), Zygnematophyceae (1). As Chlorophyta records the highest number of species, Dinoflagellate and Zygonematophyceae record the lowest number of species.

As per our observation of phytoplankton diversity in Antrolli lake reports Scenedesmaceae (7), Hydrodictyaceae (5), Phacaceae (4), Gomphonemataceae & Microcystaceae (3), etc are with two and one species (Fig-6). Phytoplankton diversity in Guttigere lake reports Phacaceae (2), Chlorellaceae, Cocconeidaceae, Merismopediaceae, Coscinodiscaceae, Desmidiaceae, Gomphonemataceae & Microcystaceae reports only one species from each family (Fig-7).

Antrolli Lake records the highest content of chlorophyll from phytoplanktons in the summer season. Guttigere Lake records less chlorophyll content of phytoplanktons. The reason for the difference in chlorophyll is due to less number of phytoplankton in Guttigere Lake.

Various physiochemical parameters like temperature, pH, TDS, Electrochemical conductivity, Total alkalinity, and Carbonates. Hydro carbonates, Dissolved oxygen, Chlorides, and Chemical Oxygen Demand were conducted monthly

Table 2: Dominant Phytoplankton Classes from Guttigere Lake & Antrolli Lake

Class	*No. of species*
Cyanophyceae	4
Bacillariophyta	8
Charophyta	2
Chlorophyceae	1
Chlorophyta	18
Cyanobacteria	7
Diadesmidaceae	1
Dinoflagellata	1
Euglenozoa	8
Gyrista	8
Ochrophyta	4
Zygnematophyceae	1
Total	61

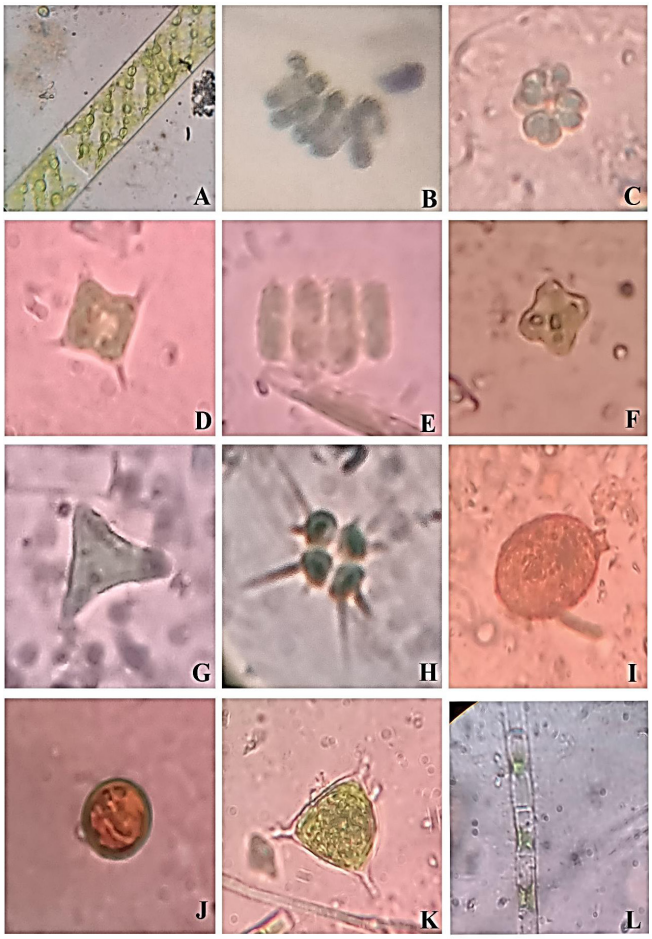

Figure 5: A. *Spirogyra varians;* **B.** *Spirulina plateensis;* **C.** *Stauridium tetras;* **D.** *Staurodesmus validus;* **E.** *Tetradesmus obliquus;* **F.** *Tetraedron minimum;* **G.** *Tetraëdron trigonum;* **H.** *Tetrastrum heteracanthum;* **I.** *Trachelomonas planctonica var. oblonga;* **J.** *Trachelomonas volvocina;* **K.** *Treubaria setigera;* **L.** *Ulothrix sp.*

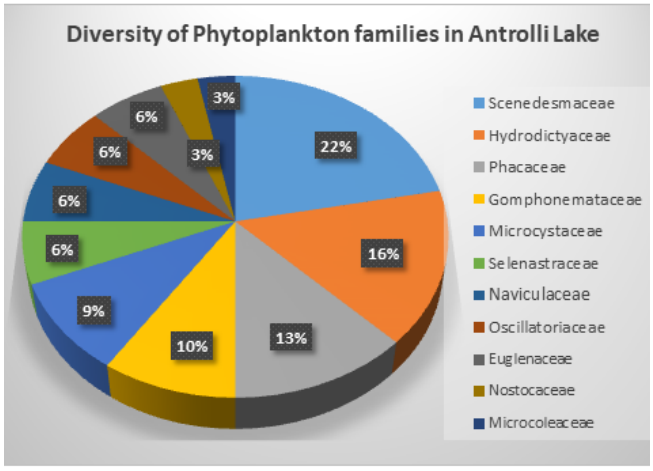

Figure 6: Diversity of phytoplankton families in Antrolli lake

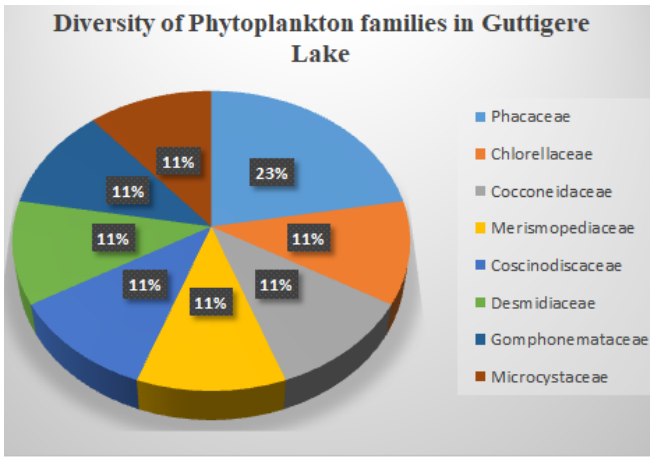

Figure 7: Diversity of phytoplankton families in Guttigere lake

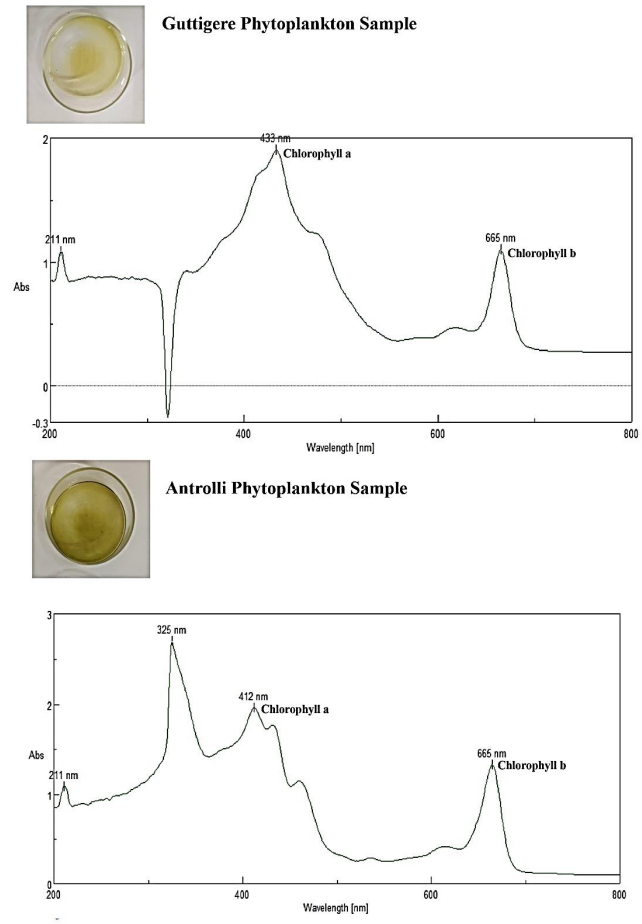

Figure 8: Absorbance of Chlorophyll a & Chlorophyll b of Phytoplanktons at Guttigere & Antrolli Lakes

from March to August which includes summer and rainy seasons of the two lakes. Some major tests were conducted once in three months i.e., during summer and rainy season. Tests include Chlorophyll (Chlorophyll a, Chlorophyll b, Total chlorophyll) content from phytoplanktons (Fig. 8), calcium,

Table 3: Data showing the tests conducted regularly (Guttigere & Antrolli Lakes)

Physiochemical parameters	*March*	*March*	*April*	*April*	*May*	*May*	*June*	*June*	*July*	*July*	*August*	*August*
Location	G	A	G	A	G	A	G	A	G	A	G	A
Date	12th Mar 23	25th Mar 23	15th Apr 23	29th AP 23	13th MY 23	27th MY 23	17th JN 23	30th JN 23	15th JL 23	18th JL 23	11th AG 23	11th AG 23
Temperature^{0}C	28	29	30	29	32	28	28	25	23	23	26	25
PH	8.46	8.74	8.9	8.1	9.36	8.49	8.92	8.6	8.3	8.5	8.6	8.7
TDS in ppm	426	425	415	416	425	281	262	281	145	145	197	195
Electro Chemical Conductivity (S/m)	496	450	470	455	470	450	460	480	460	470	480	455
Total Alkality	30	40	30	35	25	30	30	40	30	35	35	30
CO32-mg/ml	10	10	10	10	10	10	10	20	10	25	10	10
HCO3 mg/ml	20	30	20	25	15	20	20	30	20	35	25	20
DO mg/ml	0.8	1.6	1.6	1	0.8	0.8	3.6	1.6	2	2.8	1.6	2
Chloride mg/ml	10.65	14.2	14.2	10.65	7.1	8.87	21.3	24	10.6	17.75	21.3	14.2
COD mg/ml	18	16	17	18	18	19	18	18	19	17	16	19

G.- Guttigere Lake; **A.**- Antrolli Lake;**MA**- March; **AP**-April; **MY**-May; **JN**- June; **JL**- July; **AG**-August

calcium hardness, Total hardness, and Magnesium hardness.

Physiochemical parameters of Guttigere lake during two seasons include Temperature (Summer- 30, Rainy-19), pH (Summer- 8.90, Rainy-8.61), TDS(Summer- 421 in ppm, Rainy-203 in ppm), Electrochemical conductivity (Summer- 478, Rainy-460), Total alkalinity (Summer-28.3, Rainy-30), Carbonates (Summer- 18.3mg/ml, Rainy-20mg/ml), Hydro carbonates (Summer-18.33 mg/ml, Rainy-20mg/ml), Dissolved oxygen(Summer- 1.06mg/ml, Rainy-2.8mg/ml), Chlorides (Summer- 10.65 mg/ml, Rainy-15.95 mg/ml), Chemical Oxygen Demand (Summer- 17.3 mg/ml, Rainy-18.7 mg/ml) (Table-3).

Physiochemical parameters of Antrolli lake during two seasons include Temperature (Summer- 28.6, Rainy-24), pH (Summer- 8.44, Rainy- 8.55), TDS (Summer- 374 in ppm, Rainy-213 in ppm), Electrochemical conductivity (Summer- 451, Rainy- 475), Total alkalinity (Summer-35, Rainy- 37.5), Carbonates (Summer- 10 mg/ml, Rainy-22.5 mg/ml), Hydro carbonates (Summer-25 mg/ml, Rainy-32.5 mg/ml), Dissolved oxygen (Summer- 3.5mg/ml, Rainy-2.2 mg/ml), Chlorides (Summer- 11.24 mg/ml, Rainy- 20.8 mg/ml), Chemical Oxygen Demand (Summer- 17.6 mg/ml, Rainy-17.5 mg/ml) (Table 3).

Some major tests were conducted during summer season records Hardness (Guttigere-152 mg/ml as $CaCO_3$ & Antrolli-128 mg/ml as $CaCO_3$), Total hardness (Guttigere-152.33 mg & Antrolli- 128.1 mg), calcium (Guttigere-32.0 mg/ml & Antrolli- 27.25 mg/ml), calcium hardness (Guttigere- 80 mg/ml & Antrolli- 68 mg/ml), Magnesium (Guttigere- 17.54 mg/ml & Antrolli- 14.61 mg/ml), Magnesium Hardness (Guttigere-17.33 mg/ml & Antrolli- 14.66 mg/ml). Chlorophyll tests were carried out using UV spectrophotometer absorbance. Chlorophyll a (Guttigere- 12.34 mg/ml & Antrolli- 15.0 mg/ml), Chlorophyll b (Guttigere- 5.99 mg/ml & Antrolli- 7.21 mg/ml), Total chlorophyll content (Guttigere- 18.34 mg/ml & Antrolli- 22.25 mg/ml) &Total chlorophyll content in phytoplankton (Guttigere- 73.37 mg/ml & Antrolli- 257 mg/ml) (Table-4).

Some major tests were conducted during the rainy season records of Hardness (Guttigere-156 mg/ml as $CaCO_3$ & Antrolli- 80 mg/ml as $CaCO_3$), Total hardness (Guttigere-150.5 mg & Antrolli- 80.6 mg), calcium (Guttigere-41 mg/ml& Antrolli- 32 mg/ml), calcium hardness (Guttigere- 103 mg/ ml & Antrolli- 80 mg/ ml), Magnesium (Guttigere- 53.46 mg/ml & Antrolli- 0 mg/ml), Magnesium Hardness (Guttigere- 53.46 mg/ml& Antrolli-0 mg/ml). Chlorophyll tests were carried out using UV spectrophotometer absorbance. Chlorophyll a (Guttigere-4.7 mg/ml & Antrolli- 12.5 mg/ml), Chlorophyll b (Guttigere-1.91 mg/ml & Antrolli- 10 mg/ml), Total chlorophyll content (Guttigere- 6.61 mg/ml & Antrolli- 22.25 mg/ml) & Total chlorophyll content in phytoplankton (Guttigere- 19.83 mg/ml & Antrolli- 67.5 mg/ml) (Table-4).

Table 4: Two seasonal (Summer & Rain) major tests conducted.

Parameters	*Guttigere Lake*	*Antrolli Lake*	*Guttigere Lake*	*Antrolli Lake*
Season	Summer-April-may	Summer-April-may	Rainy-July-August	Rainy-July-August
Hardness mg/ml as CaCo3	152	128	156	80
Total Hardness in mg	152.23	128.16	156.53	80.06
Calcium mg/ml	32.064	27.25	41.68	32.06
Calcium Hardness mg/ml	80	68	103.07	80.06
Magnesium mg/ml	17.54	14.61	53.46	0
Magnesium Hardness mg/ml	17.33	14.66	53.46	0
Chlorophyll a mg/ml	12.34	37.17	4.7	12.5
Chlorophyll b mg/ml	5.99	27.16	1.91	10
Total chlorophyll content	18.34	64.34	6.61	22.5
Total chlorophyll content in phytoplankton	73.37	257.3	19.83	67.5

Conclusion

The water is fit for agricultural needs but not for drinking due to high phytoplankton and algal diversity. Washing clothes during summer and rainy seasons is common in Antrolli Lake as it does not have protection around it. Washing cattle and vehicles is also regularly done in this lake. Guttigere Lake has fencing around it so fewer activities are observed like washing clothes and cattle washing. So the above lakes need to get rid of some activities like washing clothes and cattle.

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