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Seasonal Dynamics of the diversity of Phytoplankton in Gaurala Lake of Bhadrawati, District Chandrapur, Maharashtra, India

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Abstract

The present research paper surveys the seasonal dynamics of the diversity of Phytoplankton in Gaurala Lake, Bhadrawati, Chandrapur District, Maharashtra, India. Sum of 87 species of phytoplankton were discovered through four different families: Cyanophyceae (21 species), Chlorophyceae (31 species), Bacillariophyceae (27 species)and Euglenophyceae (8 species) from September 2023 to August 2024. The group Chlorophyceae showed dominance among other groups. Chlorophyceae>Cyanophyceae> Bacillariophyceae> Euglenophyceae.

Keywords: *Phytoplankton, species, Gaurala lake, algae.*

Introduction

Phytoplankton are tiny, photosynthetic biotic living organisms that spend their entire lives floating on the water surface (Phyto,which means plants, and plankton, which means microscopic, floating organisms). Phytoplankton are the nanoscopic, single-celled, drifting and colonizing photosynthetic organisms or algae, and grow in aquatic areas [9].They are the main producers. They are essential because they feed zooplanktons, fish and other aquatic organisms with live food and shelter.

Phytoplankton are photosynthetic, absorb sunlight and nutrients, and prepare their own food. Phytoplankton release molecular oxygen (O2) into the atmosphere and water during photosynthesis. Phytoplankton is estimated to produce 70% of the oxygen on Earth and regulate the CO2/O2 balance. They also have a significant impact because they control the amount of dissolved oxygen, a gas that is essential to aquatic life. The density of phytoplankton determines an aquatic environment's productivity.

The diversity and density of phytoplankton are under the control of water health and status, and other biotic communities in water bodies. Phytoplankton are a crucial component of ecosystems, as they generate energy and organic material throughout the environment. Phytoplankton makes an essential contribution to the biodiversity in Lakes and reservoirs; its biotic composition is fundamental for the food cycle.

The distribution and population of phytoplankton are significantly influenced by the chemical and physical properties of water [14].

Study Area

Bhadrawati town is located in the Chandrapur District of Maharashtra, India. Bhadrawati town lies 26 km from Chandrapur city, spanning 20 km² (8 sq mi), between latitudes 20°06'35" N and longitudes 79°07'2" E.

The Gaurala Lake is situated close to the Ganesh Temple in the Gaurala locality, on the way to Bhadrawati Railway Station Road, between the latitudes 20^{0}08'93.51" N and longitudes 79^{0}11'24.53" E, and at an elevation of 226.33 meters above the mean sea level. The Gaurala Lake is a persistent water body. The primary supply of water during the monsoon season comes from rainfall. Singhada agriculture, fishing, bathing, and washing are the main uses of the lake.

Methodology

Water samples for planktonic study were collected every month at 8:30 to 10:30 am from the Lake. The plankton net was used to filter 50 L of water. Lugol's iodine was added to the collected samples and allowed to settle. Sedimentation usually takes 24 hours. Supernatants were then discarded, concentrations were prepared to 50 millilitres and they were then kept in 4% formalin for further research. Samples for the quantitative analysis were centrifuged for 10 to 15 minutes at

250 rpm. After shaking the concentrated samples, a single drop was taken using a standard dropper onto a slide. After carefully covering the entire drop with the cover glass, it was examined with a Zeiss Primostar (Electronic compound Light) microscope.

Microphotographs were taken and phytoplankton were identified up to the genus and, whenever possible, up to species level based on their reproductive and physical characters. Standard literature was used to identify phytoplankton, such as G.W. Prescott (1954), G. M. Smith (1918) and G. M. Smith (1926)[4,5,10,11].

Result and Discussion

In this research paper, the results obtained are shown in Table 1. Sum of 87 phytoplankton were found in Gaurala Lake from September 2023 to August 2024. The recorded phytoplankton are divided into four different families as follows: order Chlorophyceaea(45.95%)>Cyanophyceae(27.17%)>Bacillariophyceae(16.22%)>Euglenophyceae (10.81%). The Chlorophyceae members showed dominance over all other species. Sum of 30 species of Chlorophyceae were found in Gaurala Lake, among which *Coelastrum, Chlamydomonas, Chlorella, Scenedesmus, and Ulothrix* were found dominant over other species. Sum of 21Cyanophyceae species were found in Gaurala lake, among which *Oscillatoria, Microcystis and Spirulina* were dominant over further species. The Bacillariophyceae family, sum of 28 species were found in Gaurala lake, among them *Diatom, Synedra, Gomphonema, Navicula and Diadesmis confervaceae* were dominant over other species. In Euglenophyceae, sum of 08 species were present in Gaurala Lake, in which Phacus, Trachelomonas and Euglena were found to be dominant.

A researcher discovered that Spirogyra, *Scenedesmus, Cosmarium, Cladophora, Gloecystis* and *Chlorella* were dominant in Chlorophyceae from Ujani Reservoir of Maharashtra[7]. Chlorophyceae was at its least in the monsoon season and at its most in the winter. Bacillariophyceae was at its least in the rainy season and at its most in the summer. Cyanophyceae was at its least in the summer and at its most in the winter in the Sahastradhara stream at Uttarakhand[8]. The sum of 75 phytoplanktons recorded from both Nandgaon and Arwat Lake and Chlorophyceae were dominant in both lakes[2]. The variety of Chlorophyceae in Vijasan Lake in Bhadrawati was examined and found sum of 24 species. The monsoon season had the largest number of Chlorophyceae species, while the winter season had the lowest[6]. Phytoplankton species were found in the Ogane-Aji River, comprising 16 Chlorophyceae species (40%), 11 Bacillariophyceae species (27.5%), 10 Cyanophyceae species (25%), and 3 Euglenophyceae species (7.5%). Chlorophyceae was highest, where *Desmidiaceae* and *Chlorellaceae* were dominant, and Euglenophyceae was least [12]. In the river of Erai near Chandrapur recorded the Chlorophyceae (17 species)>Cyanophyceae (08 species)> Bacillariophyceae (07 species)> Euglenophyceae (02 species) [3]. In Beledanga wetland, sum of 48 genera of phytoplankton were discovered,with maximum phytoplankton discovered in the monsoon and the minimum phytoplankton discovered in Winter, including an abundance (27%) of Bacillariophyceae[1]. In Azhagankulam Pond in Tirunelveli, Tamil Nadu, India recorded the number of species of plankton increased from December and reached its most in March[13].

Table 1: List of Phytoplanktons discovered in Gaurala Lake

Sr. No.	Genera/Species	Winter	Summer	Monsoon
A	**Chlorophyceae**			
1.	*Ankistrodesmus falcatus (Corda) Ralfs. 1848*	+	-	-
2.	*Chlamydomonas polypyrenoideum Presc*	+	+	+
3.	*Chlorella vulgaris Bejierinck, 1890*	+	+	+
4.	*Chlorococcum humicola (Naeg.) Rab. 1868*	+	-	+
5.	*Coelastrum astroideum De Notaris 1867*	+	-	+
6.	*Coelastrum spharicum Nageli., 1849*	+	-	+
7.	*Cosmarium angulosum Brebisson 1856*	+	-	-
8.	*Cosmarium leave Rabenhorst var. leave 1868*	+	-	-
9.	*Cosmarium lundelli Delponte 1877*	+	-	+
10.	*Cosmarium moniliforme (Turpin) Ralfs.*	+	-	+
11.	*Eudorina elegans Ehrenberg, 1832*	+	-	-
12.	*Kirchneriella lunaris (Kirchner) Moebius, 1894*	+	-	-
13.	*Mougeotia C. Agardh, 1824*	+	-	+
14.	*Oedogonium cuspidatum Kutzing*	+	-	-
15.	*Oedogonium grande Kutzing ex Hirn 1900*	+	-	-
16.	*Oocyctis natans var. Major G. M. Smith 1918*	+	-	+
17.	*Oocystis nodulosa West et. West- 1894*	+	+	+
18.	*Pandorina morun Bory de St. Vincent, 1824*	+	+	+
19.	*Pithophora roettleri (Roth) Wittrock 1877*	+	-	-
20.	*Pleodorina californica W. R. Shaw 1894*	+	-	-
21.	*Scenedesmus arcuatus Lemmermann, 1899*	+	-	+
22.	*Scenedesmus dimorphus (Turp.) Ktz. 1834*	+	+	+

23.	*Scenedesmus falcatus*	+	-	+
24.	*Scenedesmus oblicus (Turpin) Kuetzing 1833*	+	-	+
25.	*Scenedesmus perforatus Lemm. 1903*	+	-	+
26.	*Scenedesmus quadricauda var. Westii G. M. Smith 1904*	+	+	-
27.	*Spirogyra pellucida (Hassall) kutzing 1849*	+	-	-
28.	*Spirogyra rhizobranchiales C. Jao*	+	-	-
29.	Ulothrix variabilis (Kutzing) Kutzing 1849	+	-	+
30.	*Ulothrix zonata (Weber & Mohr) Kuetz. 1833*	+	+	+
31.	*Volvox aureus Ehrenberg, 1832*	+	-	-

B	Cyanophyceae	Winter	Summer	Monsoon
1.	*Anabaena cylindrica Lemm. 1896*	+	-	-
2.	*Anabaena sphaerica Bornet & Flahault, 1886*	+	-	-
3.	*Chrococcus limneticus var. distans G. M. Smith 1961*	+	-	-
4.	*Chrococcus turgidus Naeg.*	+	-	+
5.	*Coelomoron pusillum(Goor) Komarek 1988*	+	-	-
6.	*Leptolyngbya Africana*	-	-	+
7.	*Lyngbya Birgei G. M. Smith 1916*	+	-	+
8.	*Merismopedia tenuissima Lemm. 1898*	+	+	+
9.	*Microcystis aeruginosa Kuetz emend Elenkin. 1849*	+	+	+
10.	*Microcystis flos-aquae (Wittr.) Kirch. 1898*	+	+	+
11.	*Nostoc carneum Vaucher ex Barnet & Flahault*	+	-	-
12.	*Oscillatoria limosa C. Agardh ex Gomont 1892*	+	+	+
13.	*Oscillatoria princeps vaucher ex Gomont 1892*	+	+	+
14.	*Phormidium aerugineo caeruleum (Gomont)1988*	+	-	+
15.	*Planktothrix agardhii 1988*	-	-	-
16.	*Pseudoanabaena catenate Lauterborn 1915*	+	-	-
17.	*Spirulina fusiformis Woronichin, 1934*	+	+	-
18.	*Spirulina meneghiniana Zanardini ex Gomant 1892*	+	+	-
19.	*Spirulina princeps West & G.S. West 1902*	+	+	-
20.	*Spirulina subsalsa Oerested ex Gomat 1892*	+	+	-
21.	*Synechococcus major Schroteri*	+	-	-

C	Bacillariophyceae	Winter	Summer	Monsoon
1	*Amphora veneta Kutzing 1844*	+	-	-
2	Aulacoseira italica (Ehrenberg) kutzing, 1844	+	-	-
3	*Coscinodiscus jonesianus (Grevelle) Ostenfeld,1915*	+	-	-
4	*Cyclotella meneghiniana Kutzing, 1844*	+	-	-
5	*Cymbella hantzschiana Krammer, 2002*	+	-	-
6	*Diadesmis confervacea Kutzing, 1844*	+	+	-
7	*Fragilaria capucina Desmazieres 1830*	+	+	-
8	*Frustule rhomboids (Ehrenberg) De Toni 1891*	+	-	-
9	*Gamphonema affine Kutzing 1844*	+	+	-
10	*Gamphonema gracile Ehrenb. 1838*	+	+	-
11	*Gomphonema augur Ehr. Lange-Bertalot 1985*	+	+	-
12	*Gomphonema vibrio Ehr. 1843*	+	+	-
13	*Melosira varians C. Agardh 1827*	+	+	-
14	*Navicula cryptocephala Kutzing 1844*	+	+	-
15	*Navicula cuspidate (Kutzing) Kutzing 1844*	+	+	-
16	*Navicula gregaria Donkin 1861*	+	+	-
17	*Navicula radiosa Kutzing 1844*	+	+	-
18	*Nitzschia acicularis (Kutzing) W. Smith 1853*	+	+	-

19	*Nitzschia reversa W. Smith 1853*	+	+	-
20	*Nitzschia amphibia Grunow 1862*	+	+	-
21	*Nitzschia palea (Kutz.) W. Smith, 1856*	+	+	-
22	*Pinnularia microstauron (Ehrenberg) Cleve 1891*	+	+	-
23	*Pinnularia subanglica Krammer 2000*	+	+	-
24	*Pinnularia viridis (Nitzsch.) Ehr. 1843*	+	+	-
25	*Rhopaldia gibba* Ehrenberg O. Muller 1895	+	-	-
26	*Synedra acus Kutzing, 1844*	+	+	-
27	*Synedra ulna (Nitzsch) Ehrenberg, 1832*	+	+	-

D	Euglenophyceae	Winter	Summer	Monsoon
1.	*Euglena acus O. F. (Muller) Ehrenberg 1830*	+	-	+
2.	*Euglena gracilis Klebs 1883*	+	-	+
3.	*Lepocincilis fusiformis (H.J. Carta) Lemm. 1901*	+	-	+
4.	*Phacus caudatas Huenbner 1886*	+	-	+
5.	*Phacus circumflexus Pochman 1942*	+	-	+
6.	*Trachelomonas bacillifera Playfair 1915*	+	-	-
7.	*Trachelomonas daybowskii Drezepolski 1923*	+	-	-
8.	*Trachelomonas volvocina (Ehrenberg) Ehrenb. 1834*	+	-	-

Phytoplankton of Gaurala Lake

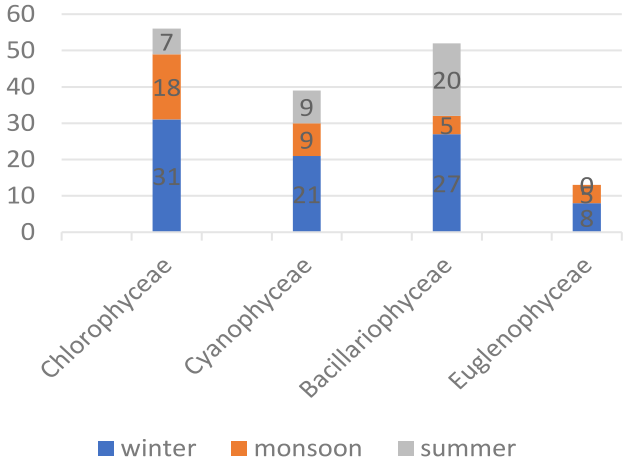

Fig. 1: Seasonal diversity of Phytoplllankton in Gaurala Lake

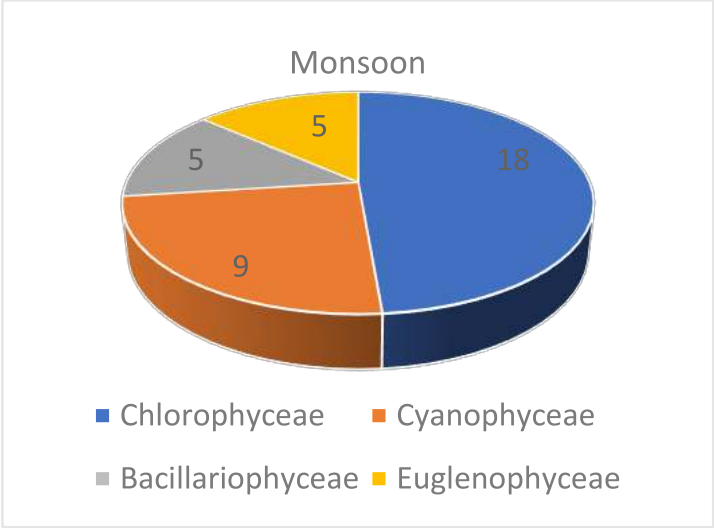

Fig. 2: Duistribution of Phytoplankton in Monsoon

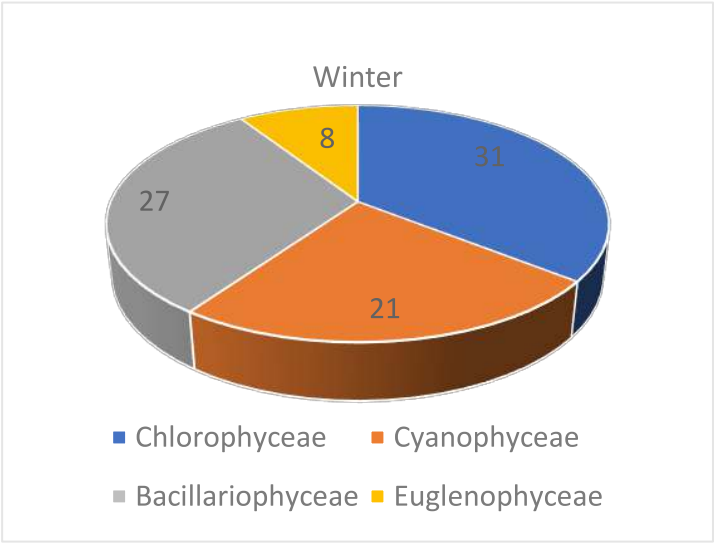

Fig. 3: Duistribution of Phytoplankton in Winter

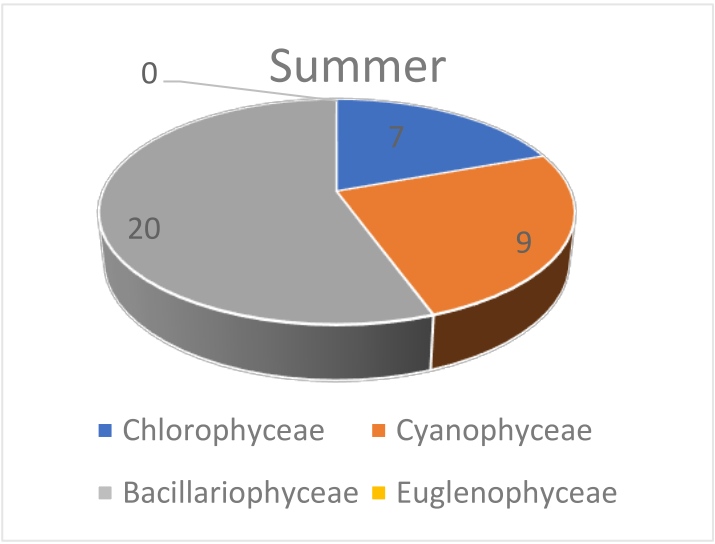

Fig. 4: Duistribution of Phytoplankton in Summer

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