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Abundance and distribution of phytoplankton in Bhutnal Lake, Vijayapur, Karnataka

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Abstract
Phytoplankton abundance and distribution are of ecological importance, as they are very sensitive to change, therefore Phytoplankton make ideal indicators of aquatic ecosystem. Phytoplankton in lake ecosystem acts as primary producers and forms a bulk of food for zooplankton, fishes and other organisms. The present work aims to study the Phytoplankton seasonal distribution and diversity in Bhutnal lake Vijayapur for the period of one year from June 2017 to May 2018. Throughout the study period, 45 different Phytoplankton genera belonging to 4 groups were observed with a complete domination from Chlorophyta (52.76%) followed by Cyanophyta (26.65%), Chrysophyta (16.61%) and Rhodophyta (3.96%). Phytoplankton population density attained its maximum (999 No./l) during winter season and minimum during monsoon season (56 No./l). Phytoplankton biomass (wet weight) varied from 0.6 mg/l during Monsoon to 3.0 mg/l during winter and Dry weight varied from 0.11 mg/l during monsoon to 1.95 mg/l during winter. Considerably low phytoplankton population was observed during the monsoon and this could be due to the heavy rain fall, excessive flooding, increased water volume, cloudy weather, low transparency, low temperature and low pH.

Keywords: phytoplankton, Bhutnal lake, productivity, abundance

Introduction
Lakes are extremely variable in their physical, chemical and biological characteristics. Water quality, nutrient supply, climatic variations and Human intervention are the main factors determine the tropic status of the lake. Phytoplankton is the primary producer and an important part of the aquatic food chain. The phytoplankton in freshwater bodies is accepted as indicator of water quality. It supports a healthy aquatic ecosystem and used as ecological indicator for the ecological health and pollution (Xu, 1997; Xu, 2001) [1, 2]. Phytoplankton forms the basis of food chain, bio indicators and bio purifiers of the lake ecosystem (Monika *et al*., 2004; Ariyadej *et al*., 2004) [3, 4]. Water temperature, pH, light conditions, nutrient concentrations, and predation by zooplankton and fishes are the principle factors affecting the species composition, abundance and diversity of phytoplankton in the lake (Yu, 2010; Dahl and Wilson, 2000) [5, 6]. Phytoplankton have been widely used to evaluate changes in the water quality of rivers, lakes and other water bodies because of sensitivity of phytoplankton to environmental factors. These studies have even been used as a monitoring tool to help generate early warnings of water pollution (Thiebaut *et al*., 2006) [7]. Primary productivity has been measured by several workers in different water bodies (Singh, 1998; Synudeen, 2002; Mandal *et al*., 2012; Hujare and Mule, 2007) [8, 9, 10, 11]
Bhutnal lake, Vijayapur spread over an area of 534 acres, has the storage capacity of 279.52 million cubic feet, can resume water supply to the city's nine ward at least 70,000 people of the city. The tank will not only help in supplying water, but also recharge groundwater table of the surrounding villages, including Baratagi, Bhutanal, Arakeri and Hanchinal. Literature survey reveals that, limnological work on Bhutnal lake has not been kept up so far. Hence the present study was undertaken on the analysis of seasonal changes in the abundance and distribution of Phytoplankton in the Bhutnal lake, Vijayapur during the period of June 2017 to may 2018.

Materials and Methods
Study area
The present study has been carried out in Bhutnal lake, Vijayapur, Karnataka (16.8852° N, 75.7095° E) to evaluate the seasonal distribution and diversity of phytoplankton for a period of

1 years from June 2017 to May 2018. Sampling for phytoplankton were done in four seasons *viz.*, Monsoon (June – August), Post monsoon (September – November), Winter (December-February) and Summer (March-May), during the early hours between 6 am to 10 am and always collected at the same time on every sampling day. Phytoplanktons were collected from 5 stations in the lake (Fig. 1).

Fig 1: Map showing the location of sampling station

Phytoplankton collection

Plankton samples were collected using plankton net made of bolting silk cloth (60µ pore size) by filtering 100 liters of water. The collected plankton samples were filtered through 60µ pore filtering cloth to separate zooplankton. The phytoplankton sample was made up to a known volume and from which 1ml was taken for estimating the numerical abundance of different genera using a Sedgwick-Rafter type of cell and the values are expressed in number/l.

Results and Discussion

Species composition

A total of 45 genera of Phytoplankton were recorded from the area of which 11 genera belong to Chrysophyta, 14 belong to Cyanophyta, 19 belongs to Chlorophyta and 1 belongs to Rhodophyta. Among all the phytoplankton, Chlorophyta (52.76%) followed by Cyanophyta (26.65%), Chrysophyta (16.61%) and Rhodophyta (3.96%) and it is depicted in Table 1.

Table 1: Percentage (%) contribution of different Phytoplankton groups at Bhutnal lake during the Study period from June 2017 to May 2018

Sl/no		Class/Family	Monsoon	Post Monsoon	Winter	Summer
I	**Chrysophyta**		**16.61**			
	1	*Tribonema ssp*	0.00	1.24	0.00	0.00
	2	*coscinodiscu spp*	16.42	7.30	3.60	10.29
	3	*Gomphonema spp.*	0.00	0.00	0.26	0.46
	4	*Gyrosigma spp.*	0.00	0.00	0.00	0.72
	5	*Fragilaria spp.*	0.00	3.73	0.00	0.00
	6	*Nitzchia spp.*	1.04	1.99	0.00	1.43
	7	*Surirella spp.*	0.00	0.00	0.22	0.00
	8	*Pluerosigma spp*	0.00	2.66	1.73	3.00
	9	*Tabellaria spp.*	4.99	0.75	0.00	0.00
	10	*Uroglenopsis spp.*	0.00	3.57	0.00	0.00
	11	*Planktoniella spp*	0.00	0.00	1.07	0.00
	Total		22.45	21.24	6.87	15.90
II	**Cyanophyta**		**26.65**			
	1	*Anabaena spp.*	0.00	0.41	0.77	2.61
	2	*Aphanizomenon spp.*	0.00	0.00	0.00	0.00
	3	*Lyngbya spp.*	0.00	2.41	1.03	6.32
	4	*Merismopedia spp*	0.83	0.00	0.00	1.50

	5	*Microcystis spp.*	8.73	12.12	9.99	2.28
	6	*Oscillatoria spp.*	5.20	0.00	0.18	0.00
	7	*Phormidium spp.*	3.95	3.24	0.33	1.24
	8	*Aphanocapasa spp*	0.62	3.73	2.79	6.97
	9	*Gomphosphaeria spp*	0.00	0.50	1.29	2.35
	10	*Merismopedia spp*	0.00	0.00	0.29	0.00
	11	*Aphanothece spp*	0.00	0.00	0.59	0.00
	12	*Gleocapsa spp.*	6.86	3.57	1.47	10.42
	13	*Spirulina spp.*	0.00	0.50	0.29	0.00
	14	*Tolypothrix spp*	0.00	1.24	0.00	0.00
	Total		26.20	27.72	19.02	33.68
III	**Chlorophyta**		**52.76**			
	1	*Actinastrum spp*	3.95	1.24	0.00	0.91
	2	*Chlorella spp.*	0.00	2.16	0.00	1.56
	3	*Cosmarium spp.*	3.74	0.58	0.00	0.00
	4	*Cladophora spp.*	0.00	0.00	0.77	3.19
	5	*Dichotomosiphon spp.*	0.00	0.00	0.00	0.39
	6	*Hydrodictyon spp.*	0.00	1.33	1.76	0.52
	7	*Clotserium.spp.*	0.00	0.41	0.00	0.00
	8	*Mougeotia spp.*	5.61	0.50	2.50	4.10
	9	*Stigeoclonium.spp*	20.17	5.64	0.00	0.85
	10	*Pediastrum spp.*	0.00	6.64	0.26	2.08
	11	*Sphaerocystis spp.*	0.00	0.00	0.00	4.95
	12	*Spirogyra spp.*	0.00	17.93	2.42	9.06
	13	*Bulbochaete.spp*	0.00	0.00	0.00	0.59
	14	*pluerotaenium.spp*	0.00	0.00	0.22	0.00
	15	*Dictyosphaerium*	8.73	0.00	0.00	3.52
	16	*Zygnema.spp*	0.00	6.56	62.54	10.55
	17	*Ulothrix spp.*	0.00	0.50	1.98	0.59
	18	*Closteriopsis spp.*	0.00	0.66	0.00	0.00
	19	*Eudorina spp.*	0.00	2.99	0.00	6.38
	Total		42.20	47.14	72.46	49.25
IV	**Rhodophyta**		**3.96**			
	1	*Lemanea spp.*	9.15	3.90	1.65	1.17
	Total		9.15	3.90	1.65	1.17

Species composition of phytoplankton was more diverse during winter period. Chlorophyta found to be the more dominant group than the others. This could be due to the terrestrial runoff might have brought up the sufficient amount of silicate which in turn enhanced the species composition.

The density of phytoplankton ranged between 56 No./ l and 999 No./l and attained its maximum during winter and minimum during monsoon season and are depicted in Fig. 2. Noticeable seasonal and spatial differences were observed among phytoplankton communities and the same is depicted in Fig. 3.

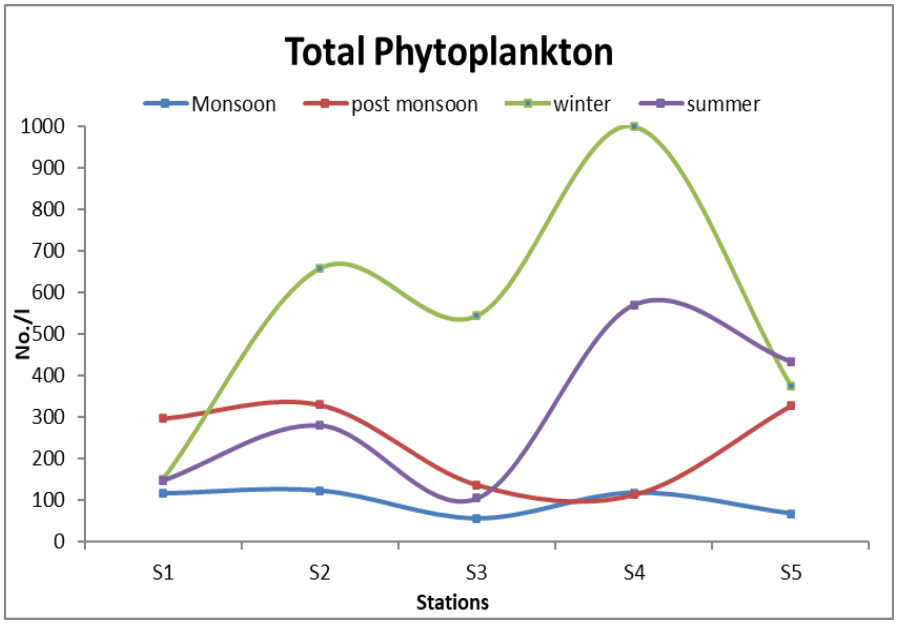

Fig 2: Variation of Total Phytoplankton (No./l) at different stations in Bhutnal lake during the Study period from June 2017 to May 2018

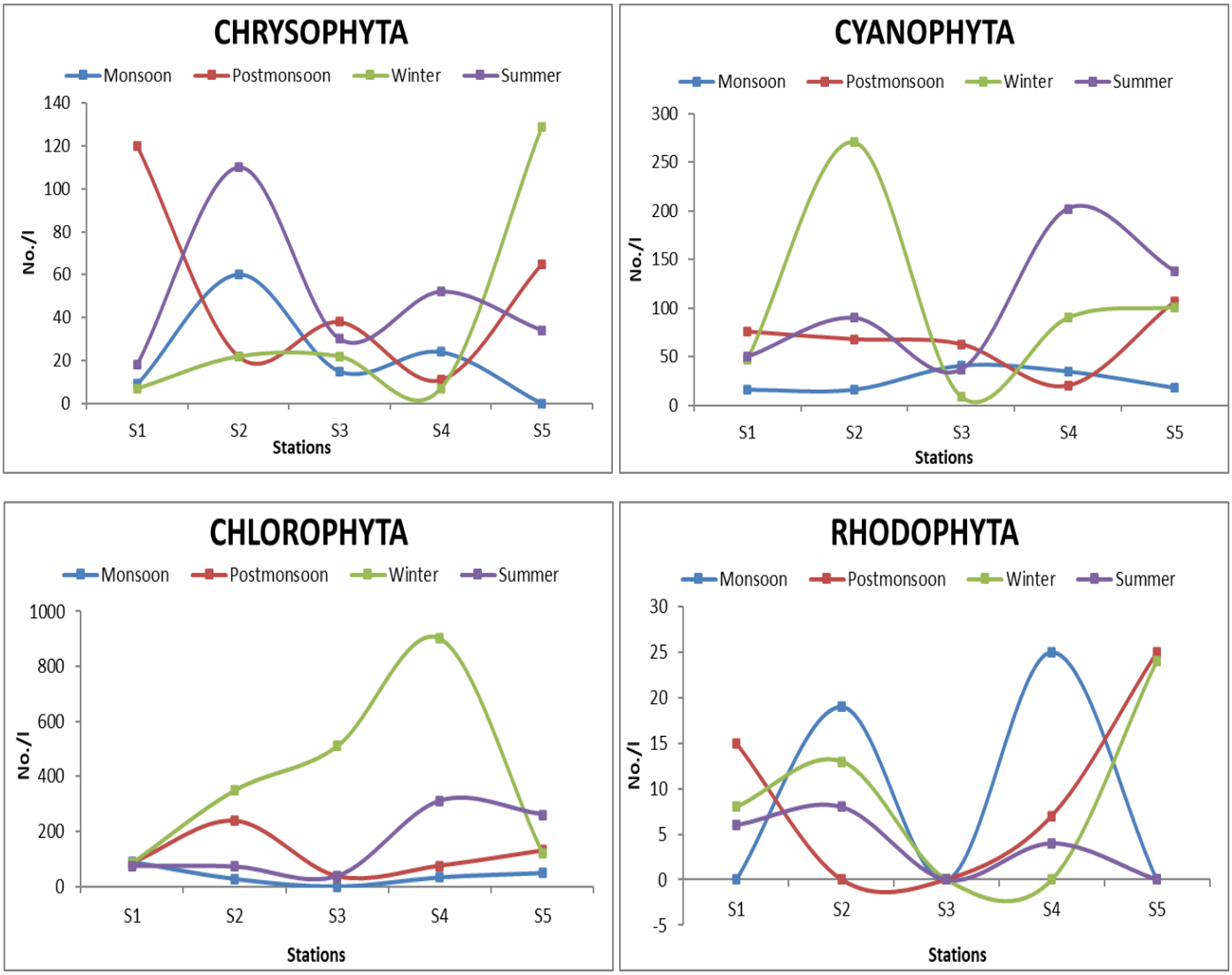

Fig 3: Variation of Chrysophyta, Cyanophyta, Chlorophyta and Rhodophyta (No./l) at different stations in Bhutnal lake during the Study period from June 2017 to May 2018

Considerably low phytoplankton population in Bhutnal lake was observed during the monsoon and this could be due to the heavy rain fall, excessive flooding, increased water volume, cloudy weather, low transparency, low temperature and low pH. The factors such as cloudy weather, low transparency, increase in water volume, high turbidity, high rain fall dilution, over flooding (Sharma and Tiwari, 2011) [12], decreased temperature and low pH (Rajkumar *et al*., 2009) [13], heavy flood (Rajagopal *et al*., 2010) [14], cool conditions brings about the decline in phytoplankton population during monsoon season.

Maximum number of phytoplankton genera occurred during monsoon compared to summer and winter season in the present study and the same was reported by Abdus *et al* (1995) [15]. The reduction in the number of genera (species) may be due to predation (Jhingran, 1982) [16]. The result of the present study are similar with others study on different water bodies (Xia *et al*., 2014; Badsi *et al*., 2012; Nassar and Gharib, 2014; Bazin *et al*., 2014) [17, 18, 19, 20]

Phytoplankton biomass

During the present investigation the phytoplankton biomass (wet weight) varied from 0.6 mg/l during Monsoon at station 1 to 3.0 mg/l at station 4 during winter and Dry weight varied from 0.11 mg/l during monsoon at station 3 to 1.95 mg/l at season 4 during winter (Fig. 4).

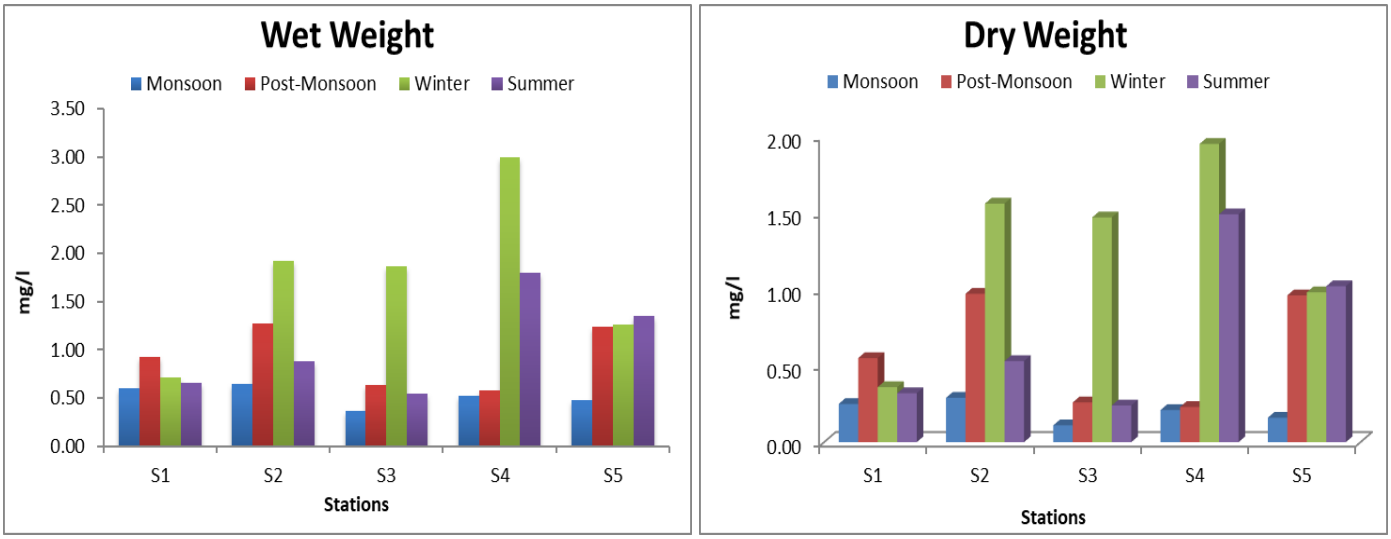

Fig 4: Variation of Phytoplankton Wet weight and Dry Weight (mg.l) at different stations in Bhutnal lake during the study period from June 2017 to May 2018

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