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WATER QUALITY STATUS AND PHYTOPLANKTON COMPOSITION OF CERTAIN WATER BODIES IN HOSANAGAR TALUK, KARNATAKA

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ABSTRACT

Present Study was under taken to investigate the Phytoplankton composition & Physico-chemical characteristics of Two lentic water bodies in Hosanagar Taluk. Hosanagar Taluk is situated in Karnataka state and lies between 13º 36' to 14º 6' North latitude and 74º 48' to 75º 18' East longitude. Physico-chemical analysis of the tanks exhibited more Nitrate concentration than Phosphate, which favored the growth of Phytoplankton. Temperature of the water body varied from (Tank-1, 24.5º- 25º C & Tank-2, 24.8º-29.5º C), Sulphate (Tank-1, 10.5-121.1mg/L & Tank-2, 8.8-23.2mg/L). Tank-1 showed dominance of Chlorococcales (39.39%) in Pre monsoon and Monsoon (26.14%) and Diatoms (37.28%) in the post monsoon. Tank-2 showed dominance of Diatoms (27.62%) in the pre monsoon and monsoon (30.89%) seasons and post monsoon seasons by blue greens (43.44%). The results witnessed seasonal variation of Phytoplankton distribution, and the high density of blue greens indicated increasing eutrophication.

KEY WORDS: *Fresh water tanks*, *Physico-chemical Characteristics*, *Phytoplankton.*

INTRODUCTION

Lakes provide a multitude of uses and are prime regions for human settlement and habitation. They are used mainly for drinking and municipal water supply, industrial, navigation, commercial and recreational fisheries, boating and agricultural uses. Aquatic Macrophytes, which are one of the important part of the wetlands are also used by the local people for several useful purposes (Narayana et al.2006). Water quality assessments are conducted to define the conditions of the pond. With the advent of industrilisation & increasing populations, the range of requirements for water has increased with great demand for good quality water. Different workers (Dwivedi et al. 2005, Mathew Thomas et al. 2006, Sulabha and Prakasam, 2006) studied relationship with different Physico-chemical factors and algal growth.

Aquatic life has different requirements with respect to the physico-chemical characteristics of a body. Absence of toxic chemicals and availability of adequate amount of oxygen, nutrients are essential factors for growth and reproduction (Narayana et al. 2003). Phytoplankton constitutes the primary producers in an aquatic ecosystem. They are the main source of food for higher consumers such as zooplankton, fishes and other aquatic organism. Quality of an aquatic ecosystem depends on abiotic properties and biological diversity. Hence the purpose of this study was to investigate the present status of two tanks in terms of its water quality and distribution of Phytoplankton in response to seasonal changes. The increasing anthropogenic influences in recent years in and around aquatic ecosystems and their catchment areas have contributed to a large extent to deterioration of water quality and dwindling of water bodies leading to their accelerated eutrophication. Some of the tanks in the area are on the verge of disappearance due to eutrophication, and encroachment.

STUDY POINTS

Hosanagar taluk is situated partly in densely forested, hilly malnad region on western part of Shimoga district, in this taluk two tanks have been selected for study. Tank-1, Vaddinagere tank has a

catchment area of more than 5 hectares, water spread area of 1.25 Hect, Vaddagere tank is surrounded by agricultural land on one side, human settlement on other side, and scrub jungle on the two sides. Tank-2, Uramundhina kere tank has a catchment area of about 3 to 4 hectares, water spread area of 5.98 Hect. Harohittalu tank is surrounded by agricultural land on one side and forest cover on its other sides. Tank water is being used by the local people for bathing, swimming and washing clothes.

MATERIALS AND METHODS

Physico-chemical and biological characteristics of the tank water were studied at monthly intervals, during the period from May 2004 to June 2005. Physico-chemical analysis of the water was done as per standard methods recommended by APHA (1998). For the identification of Phytoplankton Standard keys provided by APHA (1998), Needham & Needham (1962) & Fritch (1945) were used.

RESULT'S AND DISCUSSION

Water bodies can be carefully characterised by the three major components: Hydrology, physico-chemical characteristics, & Biology. A complete assessment of water quality is based on appropriate monitoring of these components (Chapman, 1996). Hence the Phytoplankton composition and physico-chemical characteristics during different seasons of the year were observed and presented in Table-1 & 2. The yearly average and Standard deviation of phytoplankton density & physico-chemical characteristics of two tanks are given in Table –6 and 7.

Oxygen content is a vital feature of any water body because it greatly influences the solubility of metals and is essential for all forms of biological life. During the present study D.O was recorded minimum during post monsoon season (2.8 mg/l in tank-1) and in monsoon 2.8 mg/l in tank-2) and maximum during monsoon season (3.2 mg/l in tank-1) & post monsoon (5.2 mg/l in tank-2). The factors affecting the oxygen balance in water bodies are input from the atmosphere & photosynthesis and out put through respiration.

Water temperature showed seasonal variation in the two tanks. In tank-1 minimum temperature was recorded during post monsoon season (24.8ºC) and maximum during pre monsoon (29.5ºC), and in tank-2 temperature was minimum (24.5ºC) during monsoon & maximum (25ºC) in the pre monsoon season. Hutchinson (1957) mentioned that temperature is important in controlling both the quality and quantity of planktonic flora.

Lower concentration of Total hardness was recorded in monsoon season in both the tanks (18.0mg/l in tank-1 & 8.1mg/l in tank-2) and higher concentration in pre monsoon season (33mg/l in tank-1) and post monsoon (45 mg/l in tank-2). The water in the present study is termed as soft according to Kannan (1991).

In the present study conductivity ranged between 46μmhos/cm to173.7 μmhos/cm. In tank-1 it was minimum during monsoon (46μmhos/cm) & in tank-2, it was minimum during post monsoon season (101μmhos/cm), conductivity was maximum during pre monsoon season in both the tanks (173.7μmhos/cm in tank-1, and 129μmhos/cm in tank-2).

The pH value of water is an important index of acidity and alkalinity and is the resulting value of the acidic/basic interactions of a number if its mineral and organic compounds. pH of the water varied between 6.7 to 7.7, pH was recorded below 7 during pre monsoon season (6.8 in tank -1, 6.7 in tank -2) and above 7 during post monsoon season (7.39 in taank-1, 7.7 in tank-2). Highest and lowest value of pH was recorded in different months due to increased and decreased human and other biological activities (Sinha, 1995).

Phosphate is one of the important factors that control the algal population in ponds and lakes. Phosphorus in Lake Water occurs in both organic and inorganic forms. Major part of the inorganic phosphate is present in the form of orthophosphates (PO_4^{3-}). Phosphate showed minimum values during post monsoon season (0.15 mg/l in tank-1 & 0.004 mg/l in tank-2) and maximum values during monsoon season (0.4mg/l in tank-1 & 0.37 mg/l in tank-2) Zutchi and Khan (1988) have also observed similar situations. This was evident that due to the surface runoff from the surrounding crop fields fertilised with phosphate.

Oxidation of ammonia first produces nitrite and then nitrate. Nitrates showed seasonal variation with minimum values during pre monsoon season (0.5mg/l in tank-1, 0.09mg/l in tank-2) and maximum in mansoon (2.2mg/l) in tank-1 and post monsoon (0.33mg/l) in tank-2.because the run off water entering the tank during monsoon season carries nitrates, probably by the transport of nutrients from the water shed areas with the runoff water (R.Purushothama et all, 2005), Sudhakar (1989) have also observed highest concentration of nitrates during post monsoon and monsoon season.

Table- 1: Phytoplankton composition and seasonal variation of Vaddagere tank (T-1) and Harohittalu tank (T-2).

Sl. No.	Phytoplankton	Family	Monsoon		Post monsoon		Pre monsoon		Abundance
Cyanophyceae			T-1	T-2	T-1	T-2	T-1	T-2	
1.	*Anabaena*	Chroococaceae	-	-	-	-	+	-	R
2.	*Aphanocapsa*	Chroococaceae	+	+	+	+	+	+	D
3.	*Merismopedia*	Chroococaceae	-	+	+	+	+	+	D
4.	*Microcystis*	Chroococaceae	+	+	+	+	+	+	D
5.	*Nostoc*	Nostacaceae	-	-	+	-	+	-	SD
6.	*Oscillatoria*	Oscilatoriaceae	-	-	+	+	+	+	D
7.	*Phormidium*	Oscilatoriaceae	+	+	+	+	+	+	D
8.	*Spirulina*	Oscilatoriaceae	+	+	+	+	-	+	D
9.	*Tetraspora*	Tetrasporaceae	+	-	-	-	-	-	R
Chlorophyceae									
10.	*Ankistrodesmus*	Oocystaceae	+	+	+	+	+	+	D
11.	*Coelastrum*	Coelastraceae	+	+	+	+	+	+	D
12.	*Crucigenia*	Scenedesmaceae	-	+	+	+	+	+	D
13.	*Dictyosphaerium*	Dictyosphaeriaceae	-	-	-	-	+	+	R
14.	*Kirchneriella*	Oocystaceae	+	+	+	+	+	+	D
15.	*Oocystis*	Oocystaceae	+	+	-	+	-	+	D
16.	*Pediastrum*	Hydrodictyaceae	-	-	+	+	+	+	SD
17.	*Scenedesmus*	Scenedesmaceae	-	+	+	+	+	+	D
18.	*Selenastrum*	Oocystaceae	-	+	+	+	+	+	D
19.	*Spirogyra*	Zygnemataceae	+	+	+	+	+	+	D
20.	*Tetrastrum*	Hydrodictyaceae	-	-	-	-	+	-	R
21.	*Zygnema*	Zygnemataceae	+	-	+	-	+	+	D
22.	*Arthrodesmus*	Desmidiaceae	+	+	-	+	+	+	D
23.	*Cosmarium*	Desmidiaceae	+	+	+	+	+	+	D
24.	*Closterium*	Desmidiaceae	+	+	+	+	+	+	D
25.	*Desmidium*	Desmidiaceae	-	+	+	+	+	+	D
26.	*Euastrum*	Desmidiaceae	+	-	-	+	+	+	D
27.	*Micrasterias*	Desmidiaceae	+	+	+	+	-	+	D
28.	*Pleurotaenium*	Desmidiaceae	+	-	-	-	+	-	SD
29.	*Spondylosium*	Desmidiaceae	+	-	+	-	+	-	SD
30.	*Staurastrum*	Desmidiaceae	+	+	+	+	+	+	D

31.	*Tetraedron*	Oocystaceae	+	+	+	+	+	+	D
32.	*Triploceras*	Desmidiaceae	+	-	-	-	-	-	R
Bacillariophyceae									
33.	*Anomoeoneis*	Bacillariophyceae	+	+	+	+	+	+	D
34.	*Cyclotella*	Coscinodiscaceae	-	-	+	+	-	+	SD
35.	*Cymbella*	Cymbellaceae	+	+	+	+	+	+	D
36.	*Fragilaria*	Fragillariaceae	+	+	+	+	+	+	D
37.	*Gomphonema*	Gomphonemataceae	+	+	+	+	-	+	D
38.	*Gyrosigma*	Gomphonemataceae	-	-	-	-	+	+	R
39.	*Melosira*	Coscinodiscaceae	+	+	+	+	+	+	D
40.	*Navicula*	Naviculaceae	+	+	+	+	+	+	D
41.	*Nitzchia*	Nitzchiaceae	+	+	+	+	+	+	D
42.	*Pinnularia*	Naviculaceae	+	+	+	+	+	+	D
43.	*Stauroneis*	Bacillariophyceae	+	+	-	+	+	+	D
44.	*Surirella*	Surirellaceae	-	-	-	-	+	-	R
45.	*Tabellaria*	Tabellariaceae	+	+	-	+	+	+	D
Euglenophyceae									
46.	*Euglena*	Euglenaceae	+	+	+	+	+	+	D
47.	*Phacus*	Euglenaceae	+	-	+	+	+	+	D
48.	*Trachelomonas*	Euglenaceae	+	+	+	+	+	+	D

Note: D = Dominant, SD = Sub dominant, R = Rare
+ = Present, - = Absent.

Table-2: Seasonal average values of Physico-chemical characteristics of Vaddagere tank and Harohittalu tank water.

Sl. No.	**Parameters**	**Monsoon**		**Post monsoon**		**Pre monsoon**	
		T-1	**T-2**	**T-1**	**T-2**	**T-1**	**T-2**
1.	Temperature (ºC)	28.2	24.5	24.8	24.7	29.5	25
2.	pH	7.37	7.3	7.39	7.7	6.8	6.7
3.	Dissolved Oxygen (mg/l)	3.2	2.8	2.8	4.8	3.4	5.2
4.	Total Hardness (mg/l)	18.2	34	26.2	45	33.0	35
5.	Conductivity (µmhos/cm)	46	101.7	74.5	106	173.7	129
6.	Sulphate (mg/l)	8.8	12.1	23.2	56.5	11.9	10.6
7.	Phosphate (mg/l)	0.4	0.37	0.15	0.004	0.2	0.202
8.	Nitrate (mg/l)	2.2	0.21	1.6	0.33	0.5	0.09

Sulphate content of water ranged between8.8 to 56.5mg/l, minimum value was recorded during monsoon (8.8mg/l) in tank-1 & pre monsoon (10.6mg/l) in tank-2. Maximum value during post monsoon (23.2mg/l in tank-1& 56.5mg/l in tank-2).

Phytoplanktons constitute the primary producers in an aquatic ecosystem. They are the main sources of food for higher consumers such as zooplankton, fishes and other aquatic organisms. Quality of an aquatic ecosystem depends on abiotic properties and biological diversity. Hence the quality and quantity of Phytoplankton population bear much influence on the production potential of an aquatic ecosystem.

Extensive work has been carried out on Phytoplankton of different wetlands of India (Hari Krishna et al. 1999, Bhatt et al. 1999, and Jyothi et al. 1992).

Altogether 48 taxa of phytoplankton were recorded during the study period, out of which 14 taxa belonging to Chlorococcales, 9 to blue greens, 13 to Diatoms, 9 to Desmids and 3 to Euglenoids (Table–1). Maximum density of phytoplankton was recorded in pre monsoon season and minimum during monsoon season (Table-3).

Table-3: Seasonal variation of Phytoplankton density in Vaddagere tank and Harohittalu tank (O/L).

Phytoplankton	**Monsoon**		**Post monsoon**		**Pre monsoon**	
	T-1	**T-2**	**T-1**	**T-2**	**T-1**	**T-2**
Chlorococcales	1238	845	2349	1431	4626	3327
Diatoms	1216	1210	2571	689	3138	3355
Desmids	799	544	860	684	1443	1891
Blue greens	727	1178	566	2341	1088	3352
Euglenoids	755	139	549	244	1449	221

In tank-1, during pre monsoon about 40% of total population was occupied by Chlorococcales, 27% by Diatoms, 12% by Euglenoids, where as Desmids and Blue greens occupied 12% and 9% respectively. In monsoon season populations of Chlorococcales were 27%, Diatoms 25%, Desmids 19%, and Blue greens and Euglenoids 15.3% & 15.7% respectively in post monsoon season phytoplankton was dominated by Diatoms which occupied 37.2% while chlorococcales 34%, Desmids 12.5%, Blue greens and Euglenoids 8.2% & 7.9% respectively. on yearly average Chlorococcales density was high (Table-6). Significant positive correlation of Chlorococcales was found with Electrical conductivity (Table-4) and negative correlation with nitrates, desmids showed significant negative correlation with pH. Density of Blue greens showed significant positive correlation with Euglenoids (Table-5).

Table-4: Correlation matrix. Physico-chemical parameters v/s different groups of Phytoplankton.

Parameters	**Chlorococcales**		**Diatoms**		**Desmids**		**Blue greens**		**Euglenoids**	
	T-1	**T-2**	**T-1**	**T-2**	**T-1**	**T-2**	**T-1**	**T-2**	**T-1**	**T-2**
Temperature (ºC)	.450	.**990***	.039	.866	.651	.972	.891	.**988***	.849	.661
pH	-.937	-.778	-.707	-.957	-.**993***	-.837	-.962	-.562	-.982	.095
Dissolved Oxygen (mg/l)	.505	.813	.101	.535	.697	.752	.918	.947	.881	.934
Total Hardness (mg/l)	.971	.874	.983	.627	.885	.822	.640	.977	.703	.887
Conductivity (µmhos/cm)	.**990***	.958	.843	.**996***	.995	.981	.881	.833	.918	.288
Sulphate (mg/l)	.010	-.281	.424	-.621	-.230	-.374	-.584	.011	-.512	.646
Phosphate (mg/l)	-.614	-.221	-.886	.162	-.407	-.124	-.028	-.495	-.113	-.936
Nitrate (mg/l)	-1.**000****	-.701	-.921	-.918	-.964	-.768	-.789	-.464	-.839	.208

- *Correlation is significant at 0.05 level.
- ** Correlation is significant at 0.01 level.

Table-5: Correlation matrix of different groups of Phytoplankton.

Parameters	**Chlorococcales**		**Diatoms**		**Desmids**		**Blue greens**		**Euglenoids**	
	T-1	**T-2**	**T-1**	**T-2**	**T-1**	**T-2**	**T-1**	**T-2**	**T-1**	**T-2**
Chlorococcale	1.000	1.000								

s										
Diatoms	.910	.927	1.000	1.000						
Desmids	.971	.995	.784	.959	1.000	1.000				
Blue greens	.806	.957	.487	.777	.924	.923	1.000	1.000		
Euglenoids	.854	.551	.560	.197	.954	.466	**.996***	.770	1.000	1.000

Table-6: Phytoplankton density of Vaddagere tank and Harohittalu tank with Average and Standard deviation.

Parameters	Average		Std. Deviation	
	T-1	T-2	T-1	T-2
Chlorococcales (O/L)	2737.6	1751.3	1727.1	1060.9
Diatoms (O/L)	2308.3	2338.0	987.5	2460.2
Desmids (O/L)	1034.0	735.6	355.5	563.6
Blue greens (O/L)	793.66	1710.3	267.3	933.8
Euglenoids (O/L)	917.66	201.3	471.5	55.19

Table-7: Physico-chemical characteristics of Vaddagere tank and Harohittalu tank with Average and Standard deviation

Parameters	Average		Std. Deviation	
	T-1	T-2	T-1	T-2
Temperature (ºC)	27.50	24.7	2.42	0.25
pH	7.18	7.2	0.33	0.50
Dissolved Oxygen (mg/l)	3.13	4.26	0.30	1.28
Total Hardness (mg/l)	25.80	10.40	7.4	2.06
Conductivity (µmhos/cm)	103.50	110.56	76.2	15.96
Sulphate (mg/l)	14.63	26.26	7.5	25.93
Phosphate (mg/l)	0.25	0.19	0.13	0.18
Nitrate (mg/l)	1.43	0.21	0.8622	0.12

Density Of Phytoplankton In Tank-2, during pre monsoon season 27.62% of total population was occupied by Diatoms, 27.3% by Chlorococcales, 27.59% Blue greens, 15.56% and 1.81% by Desmids and Euglenoids respectively. In monsoon season population of diatoms was more with 30.89%, 21.57% Chlorococcales, 30.08% of Blue greens, 13.89% Desmids and 3.56% Euglenoids. In the post monsoon season phytoplankton was dominated by Blue greens, which occupied 43.44%. While Chlorococcales 26.55%, Diatoms 12.78%, Desmids 12.68% & Euglenoids 4.52% respectively, on yearly average blue greens density was high (Table-6). However Chlorococcales were high in pre monsoon season, high total hardness and temperature were found favorable for them. Ashish Tiwari and Chauhan, 2006, also observed similar variations. The species of diatoms grow luxuriantly with higher values of temperature, total hardness, dissolved oxygen, conductivity and lowest concentration of nitrate. Significant positive correlation of Chlorococcales was found with Water temperature, Diatoms with electrical conductivity and blue greens with water temperature (Table-4).

In the present study Scenedesmus occurred throughout the year, similarly *Cymbella* and *Nitzchia* were also recorded. The studies conducted by Chaturvedi et al. 1999 considered that presence of *Scenedesmus* throughout the year indicates water as organically polluted, Ashesh Tiwari and Chauhan, 2006 also concluded similar observation. *Microcystis* was regularly present throughout the

year and was also dominant, which indicates eutrophic nature. Vasisht and Sra (1979) also concluded the same results in their findings.

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