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STUDIES ON SEASONAL VARIATION OF PHYTOPLANKTON, ZOOPLANKTON DIVERSITY AND PHYSICOCHEMICAL CHARACTERISTICS IN WETLANDS OF TIPTUR TALUK, TUMKUR DIST, KARNATAKA STATE, INDIA

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Abstract: An attempt has been made to study the diversity of phytoplankton and zooplankton and physico-chemical characteristics of wetland water in four wetlands of Tiptur taluk of Tumkur district, Karnataka for a period of two years during June 2010 to May 2012. All the selected wetlands are surrounded by coconut garden in all the sides and having a direct connection with the Hemavathi river channel. Altogether 32 species of zooplankton, 114 species of phytoplankton, were recorded. Among these zooplankton, Rotifers constitutes 14, followed by Protozoa 4, Copepod 6 and Cladocera 8. While in phytoplankton, Chlorophyceae was the most dominant class 62, followed by Bacillariophyceae 27, Cyanophyceae 17 and Euglenophyceae 8. The diversity of plankton is more in pre monsoon compared to post monsoon and monsoon season. The seasonal abundance of planktonic communities in relation to wetland health was correlated. A seasonal variation in physico-chemical properties of water was observed throughout the study period and seasonal comparisons were made as monsoon, pre-monsoon and post-monsoon. The results of the present investigations are compared with literature values and investigation reveals that there is a fluctuation in the physico-chemical characters of the water; this will be due to entry of rain water and change in the temperature and salinity as season changes.

Key words: Wetlands, Biodiversity, Phytoplankton, Zooplankton, Physico-chemical parameter

INTRODUCTION

Wetlands are defined as areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters Ramsar convention Bureau (2006). Water quality provides current information about the concentration of various solutes at a given place and time. The physico-chemical parameters are very important in study of any environment especially aquatic environment apart from the general interest in understanding the condition of water and its impact on the aquatic biota, observation on the short term changes on the physico-chemical parameter may also have practical implication in pollution studies. Sediments have an impact on ecological quality because of their quality, or their quantity, or both (Stronkhorst *et al*., 2004.)

The freshwater communities i.e., phytoplankton, zooplankton, macrophytes and macro invertebrates are sensitive to environmental factors. The phytoplankton community shows high diversity with the seasonal fluctuation, which indicates the diversity in ecological niches. The zooplankton occupying the secondary level in the food chain play a key role in the transformation of food energy synthesized by the phytoplankton to the higher tropic level. In India considerable investigations have been made by the various authors and researchers but little information is available on limnological studies in Karnataka. There is no serious study on biological characteristics of the selected wetlands of Tiptur. Hence, an effort has been made to know the diversity of planktonic communities preferably phytoplankton and zooplankton. This investigation will provide the basic information of planktonic diversity of entire ecology and the current status of wetlands.

MATERIALS AND METHODS

The present study was carried out in 4 wetlands of Tiptur taluk, from June 2010 to May 2012. Samples were collected on the basis of seasonal wise. The water samples were collected between 8.00 a.m. to 9.00 a.m. The DO and BOD are analysed using common method. TheWT, AT and pH were measured at the place of sampling sites. Immediately after arrival into the laboratory the conductivity of the samples were measured. The remaing parametrs are analysed in the laboratory by standard methods of APHA (2005). For the plankton analysis i.e. phytoplankton and zooplanktons used standard keys and published literature. The phytoplankton species have been identified by using keys - Edmondson, 1959, Subrahmanyan, 1968 and. Subrahmanyan, 1971, Adoni *et al.*, 1985. The zooplankton species have been identified with the help of standard keys of Needham and Needham, 1972. The quantitative estimation was done by using Sedge wick – Rafter Cell and expressed as numbers/L.

RESULTS AND DISCUSSION

The study recorded 114 species of phytoplankton belonging to 31 genera and 21 families under the 3 classes (Table 1). Among these Chlorophyceae comprised of 62 species (belonging to 19 genera, 12 family), followed by Cyanophyceae 17 species (12 genera, 5 family), Bacillariophyceae 27 species (16 genera, 4 family), Euglenophyceae 8 species, 2 genera has been recorded (Table 1). A total of 32 species of zooplankton belonging to 28 genera and 15 families under the 3 classes were recorded; 14 species of rotifera were belonging to 11 genera and 9 family, 6 species of copepod belonging to 6 genera and 3 families and 8 species of Cladocera belonging to 7 genera and 3 families, 4 species of Protozoans were recorded during the study period from the 4 study sites (Table 2).

Population density of phytoplankton and zooplankton in wetland bodies of Tiptur taluk shown there were a marked difference in their density and occurrences in season wise.

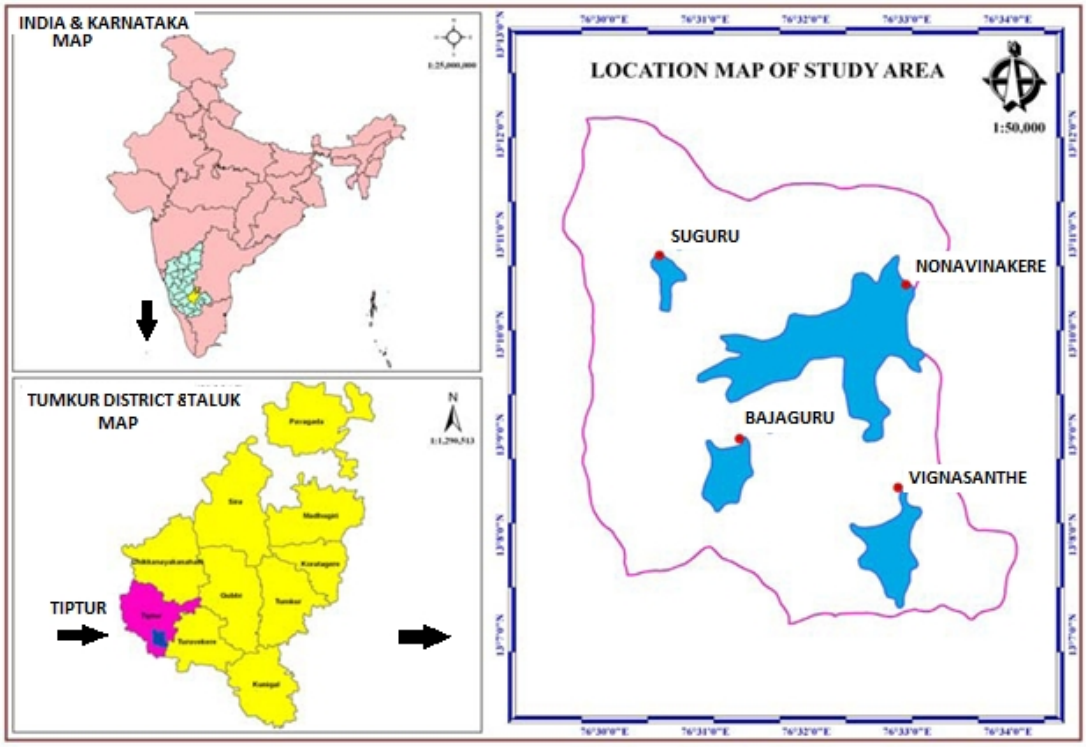

Fig. 1. Map showing the study sites

Table 1. Seasonal variation of phytoplankton in the wetlands of Tiptur during 2010-12

No.	Parameters	June 2010 to May 2011			June 2011 to May 2012		
		Monsoon	Post Monsoon	Pre Monsoon	Monsoon	Post Monsoon	Pre Monsoon
Station-1	Cyanophyceae	2945.25	4460.75	9619.75	3114.5	4829.75	9754.5
	Chlorophyceae	3032.25	4858	5951.5	3232.75	4965.5	6438
	Baciliariophyceae	1487.75	2239	7688	2000.75	2277.75	8527.5
	Euglenophyceae	15.75	75.25	2569	8	69.5	2551.25
Station-2	Cyanophyceae	885.5	1212.5	2784	726.5	1523.5	3739.5
	Chlorophyceae	5402.5	8439.5	9021.5	6203.5	8855	9236
	Baciliariophyceae	4086.75	3687.25	8644.5	4366.5	4185.75	8815.5
	Euglenophyceae	0.75	1.75	11.75	4	1.5	13.75
Station-3	Cyanophyceae	1278.25	2899.5	4576.5	1741	2819.5	5096.5
	Chlorophyceae	4096.5	8107.25	8542.25	4458	8836.75	8088.5
	Baciliariophyceae	2980.75	4583.5	9990.5	3259.75	5018.25	10037.25
	Euglenophyceae	0.75	3.75	20	3	5.5	26.75
Station-4	Cyanophyceae	3177.25	3992.75	7645.5	3456.25	4111.25	8205
	Chlorophyceae	2365.25	7472.25	5349.5	2675.75	10128	6755
	Baciliariophyceae	1711	425.75	3569.25	1910.25	517.5	4129.5
	Euglenophyceae	6.75	43	2624.75	10.25	40.5	2652.25

Table 2. Seasonal variation of zooplankton in the wetlands of Tiptur during 2010-12

Sl. No.	Parameters	June 2010 to May 2011			June 2011 to May 2012		
		Monsoon	Post Monsoon	Pre Monsoon	Monsoon	Post Monsoon	Pre Monsoon
Station-1	Rotiferies	106.25	45	135.25	97.75	54.75	142.25
	Protozoan	34	4	94	49	11	109.25
	Copepoda	16.25	38.5	100.5	20.75	46	114.5
	Clodocera	86.25	186.5	285	93.5	141.5	291.25
Station-2	Rotiferies	31	7.5	92.5	36.25	8.5	100
	Protozoan	22	4.75	71	31.75	15.75	91.75
	Copepoda	9	28.75	72.5	14.25	31.25	83.75
	Clodocera	50.75	156.25	242.5	54.75	149.25	238.5
Station-3	Rotiferies	39.5	50.75	267.5	50	44	344.75
	Protozoan	30.75	10	83	40.5	21.25	93
	Copepoda	13.5	34.5	69.5	18.75	38	84
	Clodocera	68.75	143.25	238.75	57.75	144.5	241.5
Station-4	Rotiferies	69	53.75	100	69.5	64.5	55.75
	Protozoan	35	12.5	87.75	49.5	26.75	103
	Copepoda	14.25	35.75	84.5	21.5	43.5	95.75
	Clodocera	65.5	112.5	279	77.25	134.25	284.75

Table 3. Average values of physico-chemical characteristics of wetland water of Tiptur during 2010-2012

No.	Parameters	Station-1	Station-2	Station-3	Station-4
1	Air temperature	26.96	26.82	26.45	27.14
2	Water temperature	25.31	24.53	24.31	25.03
3	PH	7.68	7.77	7.75	7.63
4	Turbidity	30.19	47.92	43.48	35.58
5	EC	276.42	496.04	520.25	265.96
6	TDS	122.37	302.21	304.54	154.42
7	Chloride	25.64	21.10	28.96	65.34
8	Total hardness	112.38	153.23	178.75	125.29
9	Calcium	21.79	32.80	37.79	22.17
10	Magnesium	18.11	27.20	31.65	19.37
11	Alkalinity	69.00	152.04	174.37	134.42
12	Acidity	16.96	43.81	11.90	14.58
13	Nitrate	0.22	0.14	0.13	0.21
14	Phoshate	0.26	0.20	0.18	0.25
15	Iron	0.20	0.17	0.14	0.11
16	Silicon	0.20	0.44	0.68	0.22
17	DO	5.07	6.13	5.63	5.17
18	BOD	5.05	3.37	4.03	4.71
19	Carbon dioxide	2.03	1.45	1.74	1.64
20	Sulphate	129.75	87.46	109.87	137.75
21	COD	40.34	22.62	28.45	29.85
22	DOM	1.27	1.05	1.30	1.76

Note: Except pH, Water tempreture, Air tempreture (degree celcius), Electrical conductivity (micromhos per centimeter) all the parameters are expressed in Mg/l.

Table 4. The status of Phytoplankton and zooplankton in the wetland of Tiptur during June 2010 to May 2012

1	Cyanophyceace	12	17	1	Rotifers	11	14
2	Chlorophyceace	19	62	2	Protozoans	4	4
3	Bacillirophyceace	16	27	3	Copepoda	6	6
4	Euglenophyceace	2	8	4	Cladocera	7	8
	Total	**49**	**114**		**Total**	**28**	**32**

Cyanophyceace: The seasonal occurrences of cyanophyceace ranged from a maximum and minimum of 9619.75- 2945.25, 3739.5-726.5, 5096.5 -1278.25 and 8205-3177.25 in Pre Mansson and Mansoon of 2011 at station1,3and in 2012 at 2&4 respectively.In the present investigation, the density of cyanophyceace in all the four water bodies was found to be maximum during summer seasons. It may be due to higher water temperature. Zafar (1967), Hegde and Bharati (1985) and Swarnalatha and Narasinga Rao (1993) were of the opinion that high temperature favours the luxuriant growth of blue-greens.

Chlorophyceae: The seasonal density of chlorophyceae in station-1and 2 ranges a maximum of 6438 to minmum 3032.25, 9236-5402.5 O/L in pre mansoon 2011-12 and mansoon 2010-11 respectively. In station 3and 4 it ranges 8836.75 to 4096.4 and 10128-2365.25 O/L in post mansoon 2011-12 and mansoon 2010-11 respectively. Huisman *et al*., 2005 ; James and Paul, 1992. Hegde and Bharati, 1985, pointed that alkaline pH is one of the important factors that regulate the presence of chlorophyceae in aquatic medium. In the present study all the stations are fairly alkaline pH in nature.

Bacillariophyceae: Seasonally the density was found to be highest of 8527.5 O/L, 8815.5 O/L, 10037.3 O/L and 4129.5 O/L during pre-mansoon 2011-12 in all stations. Lowest of 1487.75 O/L in mansoon 2010-2011at station -1, but at station -2, 3687.25 O/L in post mansoon in 2010-11, in station-3, it was 2980.75 O/L in mansoon 2010-11 and 425.75 O/L in post mansoon in 2010-11.Verma and Mohanty, 1995; Swarnalatha and Rao (1998) and Harikrishnan *et al*. (1999) stated that alkaline pH favours the abundance of diatomic population. It is true in case of Station 1 and 4 wetlands.

Euglenophyceae: Season wise variation in the present investigation indicated that the highest density of 2624.75 O/L and 2569 O/L in pre-mansoon 2010-11 at station-4 and 1, respectively and lowest density 1 O/L at station 2 and 3 during mansoon 2010-11. Researchers like Munawar (1974), Hegde and Bharathi (1985) and Puttaiah and Somashekar (1987) have considered that free carbon dioxide, dissolved oxygen, phosphate are the chief factors that regulate the distribution of Euglenoids in the fresh water bodies.

Zooplankton diversity

Rotifera: Seasonally, the highest average of 344.75 O/L in pre-mansoon 2011-12 at station while lowest average of 7.5 O/L at station 2 in post mansoon 2010-11. Several researchers such as Bhagat and Meshram (2007), have studied the dynamics of rotifers in Ansadi dam of Maharashtra and opined that alkalinity in the range of 8.5 to 9.5 mg/l is congenial for the proper development of rotifers and their abundance was in order of copepods> rotifers> cladocerans>protozoans.

Protozoans: Seasonally, a more density was found 109.25 O/L, 91.75 O/L, 93.0 O/L and 103 O/L, in pre-mansoon 2011-12 at station 1, 2, 3 and 4 respectively. All stations have shown a minimum of 4 O/L , 4.75 O/L, 10.0 O/L and 12.5 O/L post-mansoon 2010-11. The densities of protozoans were more at station -1, this may be due to more organically polluted water.

Copepoda: Seasonally, higher concentration 114.5, 83.75, 84.0 and 95.75 O/L was found at station-1, 2, 3 and 4 respectively in pre-mansoon 2011-12. Minimum of 16.25, 9, 13.5 and 14.25 O/L was found at station- 1, 2, 3 and 4 in mansoon 2010-11. If the regularity is accounted for, it is observed that higher density of Copepoda in station-1, with high BOD and low DO important parameters that appear to regulate the population of copepods. However it is rather difficult to point out a particular factor responsible for the distribution, a similar opinion has been represented by Sehgal, 1980.

***Cladocera*:** In the current studies the seasonal occurrences of Cladocera numerical density varied from 285 O/L in pre-mansoon 2010-11 at station-1 to lowest of 50.75 O/L at station-2 in mansoon 2010-11. Many zooplankton, particularly the Cladocera, exhibit marked diurnal vertical migrations.

CONCLUSIONS

The study findings indicated that the climatic variables are expressed in the diversity and density of the different group of phytoplankton and zooplankton were more in the pre monsoon, species richness changed with monsoon climatic impact and decreased during the monsoon period. Since the wetlands are under the semi-arid region, the prevailing temperature and nutrient loads by various ways enhances the population abundance. Because of over-exploitation of pollution free water for various domestic and agriculture purpose, will reduce diversity of these organisms. Therefore fluctuation of planktonic communities occurs seasonally and indicated that wetlands of Tiptur are similar like other tropical fresh water wetlands.

REFERNCES

Adoni, A.D. 1985. Work book on Limnology. Pratibha Publishers, Sagar.

Bohra, C. and Kumar, A. 2004. Plankton diversity in the wetland of Jharkhand.In: Biodiversity and environment (Ed.: A. Kumar). ABD Publ. Jaipur, pp. 91-123.

Edmondson, W.T. 1959. Fresh water Biology, 2 Edition, John Wiley and Sons, New York, pp. 1248.

Harikrishnan, K., Sabu Thomas, Sanil Geroge, Paul Murugan, Sathish Mundayoor and Das, M.R. 1999. A Study on the distribution and ecology of phytoplankton in the

Kuttanad wetland ecosystem, Kerala, India. *Poll. Res*., 18(3): 261-269.

Hegde, G.R. and Bharati. 1985. Comparative phytoplankton ecology of fresh water ponds and lakes of Dharwad, Karnataka state, India. Proc. Nat. Symp. Pure and Appl. Limnology. *Bull. Bot. Soc. Sagar*, 32: 24-29.

Munawar. 1974. Limnological studies of fresh water ponds of Hyderabad, India.14. The Biocenose Periodicity and species composition of unicellular and colonical phytoplankton in polluted environments. *Hydrobilogica*, 45: 1-32.

Needham, J.G. 1972. A guide to the study of freshwater biology. Holden-day, Inc. San Francisco pp. 108.

Puttaih, E.T. And Somashekar, R.k. 1987, b distribution of Euglenoids in lake of Mysore with Phykos, 26: 39-46.

Ramsar Convention Burea 2006. Guidelines for the future development of the list of wetlands.

Rao, V.N.R., Mohan, R., Hariprasad, and Ramasubramaniam, V. 1993. Seasonal dynamics of physicochemical factors in a typical high attitude lake: An assessment in relation to phytoplankton. *Indian Environment. Biology,* 14(1): 63-075.

Selvam, V. 2003. Environmental classification of mangrove wetland of India. *Current Science,* 6: 757-765.

Stronkhorst, J., Brils, J., Batty, J., Coquery, M., Gardner, M., Mannio, J., O'Donnell, C., Steenwijk, J. and Frintrop, P. 2004, Discussion document on Sediment Monitoring Guidance for the EU.

Subramanyan, R. 1968. The Dinophyceae of the Indian Seas. Marine Biological Association of India, CMFRI, Cochin. Part-1. 1-129.

Subramanyan, R. 1971. The Dinophyceae of the Indian Seas. Marine Biological Assiciation of India, CMFRI, Cochin. Part-2. 1-334

Swarnalatha, N. and Narsing Rao, A . 1998. Ecological studies of Banjara lake with reference to water pollution. *J. Env. Biol.*, 179-186.

Swarnalatha, N. and Narsing Rao, A. 1993. Ecological investigation of two lentic environments with reference to Cyanobacteria and water pollution. Indian *J. Microbiol. Ecol*., 3: 41-48.

Verma, J.P. and Mohanty, R.C. 1995. Phytoplankton of Malyanta pond of Laxmi Sagar and its correlation with physico-chemical parameters. *Poll. Res*., 14: 243-253.

Zafar, A.R. 1967. On the ecology of certain fresh water ponds of Hyderabad, India. III-. The Periodicity. *Hydrobiologia*, 30(1): 96-112.