



RESEARCH ARTICLE

DIVERSITY OF BLUE-GREEN ALGAE IN RELATION TO PHYSICO-CHEMICAL PARAMETERS OF  
KONANDUR POND, THIRTHAHALLI TALUK, KARNATAKA

1,\*Dr. Nagaraj Parisara, 2Narayana, J. and 3Puttaiah, E.T.

<sup>1</sup>Department of Environmental Science, Sahyadri Science College (Autonomous),  
Shivamogga-577201, Karnataka

<sup>2,3</sup>Department of P.G. Studies and Research in Environmental Science, Kuvempu University,  
Shankaraghatta- 577 451, Karnataka, India

ARTICLE INFO

**Article History:**

Received 15<sup>th</sup> January, 2016  
Received in revised form  
28<sup>th</sup> February, 2016  
Accepted 20<sup>th</sup> March, 2016  
Published online 26<sup>th</sup> April, 2016

**Key words:**

Blue-Greens,  
Physico-Chemical Parameters,  
Konandur Pond.

ABSTRACT

Studies were conducted to determine the occurrence and abundance of Blue-Greens in relation to physico-chemical characteristics of Konandur pond in Thirthahalli taluk, Karnataka. A total of 14 species of Blue-Greens belonging to 10 genera were recorded of which *Gleocapsa* consists of 3 species followed by *Nostoc* and *Oscillatoria* with 2 species. The physico-chemical parameters were analyzed as per standard methods. The study revealed that, pond water was not much polluted. In the light of standard of water quality recommended by BIS, the pond water should be used for human consumption and cooking after proper treatment.

Copyright © 2016, Dr. Nagaraj Parisara et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Dr. Nagaraj Parisara, Narayana, J. and Puttaiah, E.T. 2016. "Diversity of blue-green algae in relation to physico-chemical parameters of konandur pond, Thirthahalli Taluk, Karnataka", *International Journal of Current Research*, 8, (04), 29049-29054.

INTRODUCTION

The role of water in nature is unique not only from the point of human consideration; even the numerous organisms make aquatic medium their abode. Understanding such aquatic life requires a sound knowledge not just for organisms themselves but also of those of external influences of the medium that affect them. The physical and chemical properties of fresh water bodies are characterized by the climatic, geochemical, geomorphological and pollution conditions. The quality of aquatic life depends on the water quality. In order to utilize fresh water bodies successfully for all purposes, it is very important to study the physicochemical factors which influence the biological productivity of the water body. Cyanobacteria are also called as "Blue – green alga" is relatively simple, primitive life forms of earth, closely resemblances to the bacteria. They are morphologically diverse group of unique photosynthetic organisms which shows the great importance because of their very long existences for well over 3.5 billion years and cosmopolitan distribution in all aquatic body i.e. terrestrial, fresh water and marine

(Chellapa and Chellapa , 2004; Desikachary, 1959; Gupta and Kulkarni, 2014 ; Mulani and Sonule, 2015) Physico-chemical parameters play a vital role in determining the distributional pattern and quantitative abundance of organisms inhabiting a particular aquatic ecosystem (Santhoshkumar Singh et al., 2009).

MATERIALS AND METHODS

Study area

Konandur pond of Theerthalli taluk at Shimoga district, Karnataka situated between 13° 27' and 14° 39' North latitude and between 74° 38' and 76° 4' East longitude. This water body is located at a distance of 80 km from Shimoga surrounded by agricultural fields which is utilized by the local people for drinking, irrigation, fishing, laundry etc.

Water quality analysis

Water was sampled on monthly basis, between 8 to 10 am from June 2001 to May 2003. This water samples were collected in good quality polythene bottles. Water temperature was recorded at the sampling site itself.

\*Corresponding author: Dr. Nagaraj Parisara  
Department of Environmental Science, Sahyadri Science College  
(Autonomous), Shivamogga-577201, Karnataka.

Table 1. Physico-chemical parameters of Konandur pond during 2001-2003

Parameters		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	
MONTHS	2001	Jun	35	32	7.1	20.2	68	4.22	12.4	0.92	12.2	28.6	42	8.24	2.84	7.8	11.4	2.1	0.18	0.6	52
		Jul	34	30	7.2	20	66	4.68	12.2	0.98	10.6	26.8	40.5	8.12	2.14	7.6	12	1.98	0.23	0.62	48
		Aug	31	27	7.1	20.2	66.4	4.92	11.2	1.2	10.2	26.36	40.44	9.02	2.64	6.78	12.2	1.78	0.12	0.8	54.22
		Sep	31	27	7.3	19.2	58.06	5.12	11.8	1.22	10.8	25.02	41.5	9.2	2.02	7.42	11.4	1.88	0.16	0.12	52.12
		Oct	31	28	7.1	16.6	59.2	5.24	10.4	1.22	9.8	22.6	41.5	6.8	1.22	5.8	14	1.1	1.22	0.92	51.42
		Nov	29	26	7.1	12.2	58.72	5.54	9.42	1.42	8.6	23	42.2	7.1	1.92	6.28	14.2	1.32	0.92	0.8	50.2
	Dec	27	26	6.9	14.4	48.6	6322	8.72	1.48	8.8	24	42.5	7.8	1.94	5.28	14.6	1.11	1.1	0.96	54.2	
	2002	Jan	30	28	7.1	12.8	46.41	6.88	8.22	1.32	6.6	22.6	42	6.4	1.2	4.9	13.2	0.82	1.22	0.8	58.8
		Feb	31	29	6.8	14.5	46.2	5.12	8.4	1.21	6.4	22.6	43.12	7.4	1.82	4.8	10.4	1.8	1.5	0.9	64.2
		Mar	35	30	7.2	12.8	60.22	3.98	8.9	1.24	8.6	18	42.62	7.2	2	6.8	12	1.56	1.06	0.98	52.8
		Apr	34	30	6.8	14	66.82	3.98	9.2	1.38	9.2	16	48.4	8.2	2.8	8.2	16.2	0.8	1	0.98	54
		May	32	29	7.2	14.2	72.12	3.82	8.4	1.58	12.2	16.2	49.6	7.6	2.34	8.6	17.6	1	0.36	0.88	52.6
		Jun	31	29	7.2	20.6	70.4	4.12	9.2	0.68	11.6	19.6	44	9.52	3.2	7.4	14.2	1	0.9	0.99	60.4
		Jul	30	28	7.3	20.8	69.6	4.42	9.4	0.72	12.4	26.5	42	9.96	3	7.2	13.2	1.05	1.06	0.38	55.4
		Aug	28	26	6.8	19.8	67.3	4.88	9.8	1.4	11.2	26.4	41.66	9.44	2.89	7	14.2	0.6	0.36	0.89	56.8
		Sep	29	27	7.3	20.2	65.7	5.1	10.2	1.62	10.6	26.2	38.66	9.5	2.56	6.45	12.62	0.9	0.98	1.1	54.2
		Oct	31	28	7.1	18	63.2	5.12	9.82	1.44	10.2	22.4	39.62	6.8	2.8	6.2	10.4	1	1.06	0.98	54.22
		Nov	29	26	7.1	16	61.7	5.22	9.4	1.41	9.4	21.5	41.1	6.92	2.81	6	10	1.02	1.03	1.04	56.2
		Dec	28	27	7.2	14.4	60.6	5.11	9.2	1.22	8.2	26.3	41.42	6.88	3.1	4.8	10.4	1.1	0.66	1.6	58.6
	2003	Jan	29	26	7.2	14	59.6	5.98	9	1.22	6.12	24.6	40.1	6.9	3	3.9	11.2	0.96	0.9	1.12	60
		Feb	29	27	7.1	12.8	57.23	5.28	8.8	1.42	6	24.2	41.66	8.2	3.2	3.6	11.4	1.88	1.26	0.66	62.4
		Mar	30	28	7.1	12.6	56.4	3.68	8.4	1.1	7.4	18.2	42.52	8.2	3.1	6.4	12.4	1.02	1.1	0.36	58.2
		Apr	34	31	7.1	12.4	58.23	3.64	8.2	1.54	8.62	16.4	46.2	8.8	2.2	8.6	13.6	0.98	0.88	1	54.6
		May	36	35	6.9	12	60.4	3.52	7.8	1.52	12.8	16.6	47.4	8.6	2.2	9.3	15.2	0.64	0.33	0.89	52.2
		Avg	31	28.3	7.09	16.03	61.13	4.824	9.52	1.269	9.523	22.52	42.52	8.0333	2.4558	6.546	12.834	1.22	0.816	0.849	55.32
		Min	27	26	6.8	12	46.2	3.52	7.8	0.68	6	16	38.66	6.4	1.2	3.6	10	0.6	0.12	0.12	48
		Max	36	35	7.3	20.8	72.1	6.88	12.4	1.62	12.8	28.6	49.6	9.96	3.2	9.3	17.6	2.1	1.5	1.6	64.2

A1 = Air Temperature

A5 = Conductivity

A9 = Chemical oxygen demand

A13 = Magnesium

A17 = Nitrate-nitrogen

A2 = Water Temperature

A6 = Dissolved oxygen

A10 = Total hardness

A14 = Sulphate

A18 = Phosphate

A3 = pH

A7 = Free carbon dioxide

A11 = Total alkalinity

A15 = Chloride

A19 = Total dissolved solids

A4 = Turbidity

A8 = Biological oxygen demand

A12 = Calcium

A16 = Ammonical Nitrogen

All parameters are expressed in terms of Mg/l except Temperature (°C), pH, Turbidity (NTU) and conductivity ( $\mu$ mhos).

**Table 2. Seasonal variation of physico-chemical parameters of Konandur pond**

Parameters	2001-2002			2002-2003		
	Monsoon	Post-monsoon	Pre-monsoon	Monsoon	Post-monsoon	Pre-monsoon
Air temperature	32.75	29.25	32.25	29.5	29.25	33.00
Water temperature	29.0	27.00	30.25	27.5	26.75	29.5
pH	7.175	7.05	7.05	7.15	7.15	7.00
Turbidity	19.9	14.00	12.45	20.35	15.6	13.875
Conductivity	64.615	53.2325	58.065	68.25	61.275	61.34
Dissolved oxygen	4.735	5.97	4.03	4.63	5.3575	4.225
Free carbondioxide	11.9	9.19	8.3	9.65	9.355	8.725
Biological oxygen demand	1.08	1.36	1.395	1.105	1.3225	1.3525
Chemical oxygen demand	10.95	8.45	8.705	11.45	8.48	9.1
Total hardness	26.695	23.05	18.85	24.675	23.7	18.2
Total alkalinity	41.035	42.05	44.45	41.58	40.06	45.935
Calcium	8.645	7.025	8.45	9.605	6.875	7.6
Magnesium	2.41	1.57	2.675	2.9125	2.9275	2.24
Sulphate	7.4	5.565	6.975	7.0125	5.225	7.1
Chloride	11.75	14.00	13.15	13.555	10.5	14.05
Ammonical nitrogen	1.925	1.0575	1.13	0.8875	1.02	1.29
Nitrate-Nitrogen	0.1725	1.115	0.8925	0.825	0.9125	0.98
Phosphate	0.535	0.87	0.7275	0.84	1.185	0.935
Total dissolved solids	51.585	53.655	56.85	56.7	57.255	55.9

**Table 3. BIS standards for the potability of water**

Sl.No.	Parameters	Permissible limit	Maximum limit
1	Turbidity (NTU)	2.5	10
2	pH	7.0-8.5	6.5-9.2
3	Dissolved oxygen	4.0	6.0
4	Total dissolved solids	500	1500
5	Biological oxygen demand	2.0	3.0
6	Total hardness	200	600
7	Chemical oxygen demand	10	-
8	Calcium	75	200
9	Magnesium	30	150
10	Sulphate	200	400
11	Chloride	200	1000
12	Nitrate nitrogen	45	45
13	Phosphate	-	-
14	Conductivity ( $\mu$ mhos)	1000	2250

Source: Central pollution control Board

**Table 4 . Diversity of Blue-Greens in Konandur pond of Thirthahalli taluk during June 2001 to May 2003**

Sl.No.	Name of the organism
1	<i>Anabaena spiroides</i>
2	<i>Chroococcus turgidus</i>
3	<i>Gleocapsa magma</i>
4	<i>Gleocapsa repustris</i>
5	<i>Gleocapsa sanguinea</i>
6	<i>Merismopedia punctate</i>
7	<i>Microcystis marginata</i>
8	<i>Nostoc linkia</i>
9	<i>Nostoc microscopicum</i>
10	<i>Oscillatoria earlei</i>
11	<i>Oscillatoria tenuis</i>
12	<i>Spirulina spiroides</i>
13	<i>Scytonema hotmanii</i>
14	<i>Arthrospira nidulans</i>

Dissolved oxygen was fixed on the spot itself in BOD bottles. Remaining water quality parameters were estimated as per the standard methods (APHA, 1998). The water has undergone moderate changes in its physico-chemical properties due to

ecological degradation, overflowing of water from adjacent paddy fields and other excessive human activities. In the present investigation, an attempt has been made to assess the suitability of water for human consumption and domestic purposes.

Table 5. Seasonal variation of Blue-Greens in Konandur pond

2001-2002			2002-2003			2001-2003		
Monsoon	Post-monsoon	Pre-monsoon	Monsoon	Post-monsoon	Pre-monsoon	Monsoon	Post-monsoon	Pre-monsoon
7232	10006	9430	7233	10048	9431	7232	10027	9430

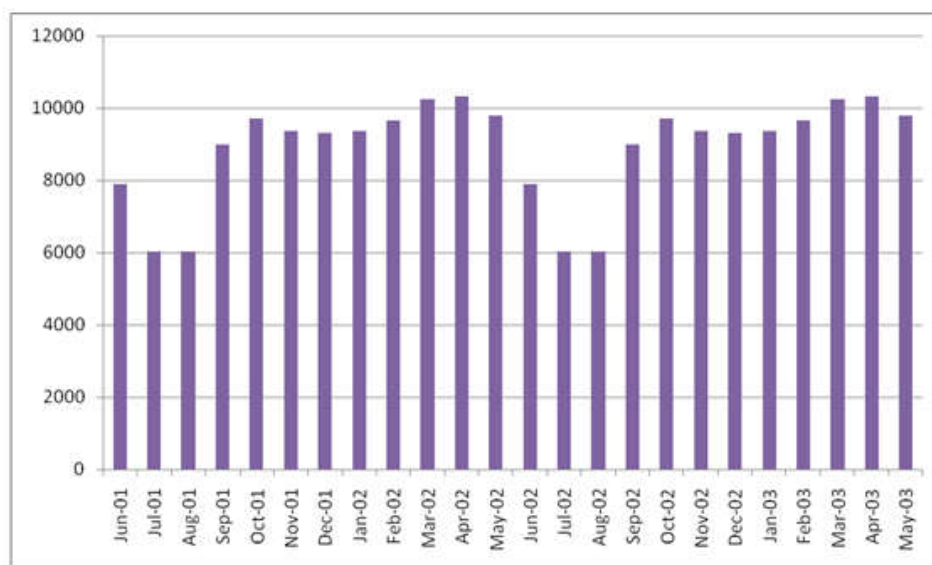


Figure 1. Monthly occurrence of Blue-Greens in Konandur pond (org/l) 2001-2003

### Estimation of Blue-Green algae

Planktonic forms were collected by using a plankton net made of bolting silk cloth of meshes of 10  $\mu\text{m}$  fixing a glass bottle of 100 ml at a narrow end. For taking the samples of qualitative analysis, the net was towed for 5 minutes just below the surface of water (Green and Holden, 1960). Tows were restricted to a small area around each sampling point. The samples were immediately transferred to other bottles and preserved by adding 4% formalin as per the practice of Welch (1948).

The qualitative estimation was done by taking one ml of sample from the stock samples at each time and repeated 5 times. Uniform distribution was made by agitating the samples thoroughly. Qualitative identification of planktonic organisms was done with the help of monographs and plankton are identified upto species level (Adoni et al., 1985 ; Bharathi and Hegde ,1982 ; Hegde and Bharathi (1985).

## RESULTS AND DISCUSSION

The increase of the human population and in turn increase of the pollution on the water bodies have resulted in growth of the microorganisms in such water. Due to increase in concentration of various parameters such as calcium, magnesium, phosphate, nitrogen and other components act directly on the growth of the phytoplankton and other microorganisms. The phytoplankton had been considered as one of the indicators of the water quality. The change in the water chemistry disturbs the aquatic flora and fauna that also includes the phytoplankton. Hence the study of the phytoplankton density and diversity have been carried out.

### Water Quality

Physico-chemical parameters recorded from Konandur pond (Table 1). The average air temperature of the pond region is 31° C with a minimum of 27° C and a maximum of 36° C were recorded. The average water temperature of the pond shows 28.3° C and the values were fluctuated between 26 and 35° C. The pH of water is 7.1 which is the neutral condition and it was fluctuated between the circum neutral range (6.8-7.3). The turbidity of the pond water was found in the range between 12-20.8 NTU and the average value was 16.03 NTU recorded in Konandur pond. Conductivity of the pond water was fluctuated between 46.2 and 72.12  $\mu\text{mhos/cm}$  and the average was 61.13  $\mu\text{mhos/cm}$ . The average concentration of dissolved oxygen was 4.83 mg/l and the values were ranged between 3.52-6.88 mg/l.

The free carbon dioxide in the Konandur pond was fluctuated between 7.8 and 12.4 mg/l and the average value of carbon dioxide during the study period is 9.52 mg/l. BOD concentration in Konandur pond was fluctuated between 0.68 to 1.62 mg/l and the average BOD was 1.27 mg/l. The average COD value was 9.52 mg /l while the values were fluctuated between 6.0-12.8 mg/l. The total hardness of the water was fluctuated between 16-28.6 mg/l and the average hardness value in the pond shows 22.53 mg/l. The average value of the total alkalinity in this pond indicates 42.518 mg/l and the range of the value was between 38.66-49.6 mg/l. The average value of calcium concentration in this pond was 8.03 mg/l and the range of this parameter was between 6.4-9.96 mg/l. The magnesium concentration in the pond shows less compared to calcium concentration and the average magnesium was 2.46 mg/l and the range of this parameter was between 1.2-3.2 mg/l.

The average sulphate concentration shows 6.55 mg/l and the range of the sulphate from this pond was between 3.6-9.3 mg/l. The average chloride concentration was 12.83 mg/l and the range of this parameter was between 10-17.6 mg/l. The ammonical nitrogen was 1.22 mg/l and the range of this parameter was between 0.6-2.1 mg/l. The nitrate nitrogen of the pond water was fluctuated between 0.12-1.5 mg/l and its average value 0.816 mg/l recorded. The concentration of the phosphate in the study pond was fluctuated between 0.12-1.6 mg/l and the average value was 0.85 mg/l. The total dissolved solids recorded in this pond and the average value was 55.32 mg/l and the range of the parameter was found between 48.0-64.2 mg/l ( Table 1 ).

The seasonal variation of the parameters was represented in Table 2. In this table the two years data was represented separately. Among air and water temperatures in 2001-02 slightly high temperature was found in Konandur pond (Table 2). The pH values showed no greater variations among the seasons as well among the years. A little variation among seasons and through out the study period as found in all the parameters. All other parameters exhibited no significant differences among the comparison of the values. In the light of standard of water quality recommended by BIS (Table 3), the pond water should be used for drinking and cooking after proper treatment. In order to maintain the health of the tank with respect to water quality it is essential that authorities should take immediate step on the following points.

- Washing of clothes and vehicles should be prevented.
- Awareness should be created regarding the impact of water pollution on the human health.
- People should be advised at least to boil the water to disinfect the pathogens before using the water for drinking purpose.

### Distribution of Blue-green Algae

#### Periodicity

A total of 14 species of Blue-Green algae belonging to 10 genera were recorded of which *Gleocapsa* consists of 3 species followed by *Nostoc* and *Oscillatoria* with 2 species respectively. Distribution and monthly occurrence of the Blue-Greens is presented in Table 4 and Figure 1. Table 5 represents the seasonal variation of the Blue-Green algae in Konandur pond. In this water body, the density of the phytoplankton was observed highest in pre-monsoon compared to other seasons (Table 5). Mahadev and Hosmani (2004, 2005) have studied the community structure of cyanophyceae in two polluted lakes of Mysore city. Amit Kumar and Radha Sahu (2012) studied the ecology of the sewage stabilization pond of HEC area, Hatia, Ranchi to determine the occurrence and abundance of cyanobacteria in relation to physico-chemical characteristics of sewage pond. The Blue-Green algal diversity of this pond can be used as biomonitor of water quality. From the present findings, it is clear that Konandur pond water is most favourable for the formation of algae. The chief factors controlling the cyanophyceae in water are temperature,  $p^H$ , dissolved oxygen, carbon dioxide and phosphate (Singh, 1960). Munawar (1970) reported that cyanophyceae occur more in waters rich in calcium and dissolved organic matter.

The present study has revealed that  $p^H$  of the water was neutral in nature at Konandur pond. Stevenson and White (1995), Gopinath (1995) and Niranjana (1996) opined that higher phosphate content supports luxuriant growth of cyanophyceae members. In the present study, the concentration of phosphate was more (average 0.85 mg/l) which harboured good number of blue greens.

### Conclusion

The study assessed the evolution of water quality in pond water of Konandur pond, of Theerthahalli taluk, Karnataka. In this present investigation it was found that the maximum and minimum parameters were not at the level of pollution. The algal diversity of this pond can be used as biomonitor of water quality of the area. Thus, it is clear that Konandur pond water is favourable for the formation of Blue-green algae.

### REFERENCES

- Adoni, A.D., Gunwant Joshi, Kartik ghosh, Chourasia, S.K., Vaishya, A.K., Manoj yadav and Verma, H.G. 1985. Work book on Limnology. Prathiba publishers, Sagar, India.
- Amit Kumar and Radha Sahu. 2012. Ecological studies of cyanobacteria in sewage pond of H.E.C industrial area, Ranchi, India. Bioscience Discovery, 3(1):73-78.
- APHA, 1998. Standard Methods for the Examination of Water and Waste Water, 20th ed. Public Health Association, Washington, D.C.
- Bharati, S.G. and Hegde, G.R. 1982. Desmids from Karnataka State and Goa part III. Genus *Cosmarium corda*. Nova Hedwigia. Band XXXVI. Braunschweig : 733-757.
- BIS: 3025. 1993. Methods of sampling and Test (Physical and Chemical) for water and waste water, 1st Revision, 1- 2.
- Chellapa, S. L. and Chellapa, N. T. 2004. Fresh water phytoplankton assemblage and the blooms of toxic Cyanophyceae of Campo Grande reservoir of Rio Grande do North State of Brazil, Indian. *Hydrobiology*. 7:151- 177.
- Desikachary, T. V. 1959. Cyanophyta ICAR New Delhi Studies on the algal flora of kole lands in Thrissure District, Kerala.
- Gopinath, K. 1995. Ecological studies on the Hemavathi river basin. Ph.D. Thesis. University of Mysore, Mysore: 250.
- Green, J. and Holden, M.J. 1960. The hydrology and plankton of the river Sokoto. *J. Anim. Ecol.*, 29: 65-84.
- Gupta, G. and Kulkarni, P. (2014). Fresh water cyanophycean algae from Durg and Rajnandgaon dist. (C.G.), In dia. *International Journal of Science and Research*. 3 (8): 1337-1341.
- Hegde, G.R. and Bharati, S.G. 1985. Comparative phytoplankton ecology of fresh water ponds and lakes of Dharwad, Karnataka state, India. *Proc. Nat. Symp. Pure and Appl. Limnology*. (Ed. Adoni, A.D.). *Bull. Bot. Soc. Sagar*. 32 : 24-39.
- Mahadev J and SP Hosmani, 2004. Community structure of cyanobacteria in two polluted lakes of Mysore city. *Nat. Environ. Pollut. Tech.*, 3:523-526
- Mahadev, J. and Hosmani, S.P. 2005. Algae for bimonitoring of organic pollution in two lakes of Mysore city. *Nat. Environ. Pollut., Tech.*, 4:97-99

- Mulani, R.M. and Sonule, M. D. 2015. Fresh Water Cyanophycean Algae from Yelderi Dam Parbhani District (M. S.), India. *International Journal of Science and Research*, vol 4(1): 740-742.
- Munawar, M. 1970. Limnological studies of fresh water ponds of Hyderabad, India. II. The Biocenose- Distributions of unicellular and colonial phytoplankton in polluted and unpolluted environments. *Hydrobiologia* 36: 105-128.
- Munawar, M. 1970. Limnological studies on freshwater certain polluted and unpolluted environments. *Hydrobiol.*, 39(1): 105-128.
- Niranjana, P. 1996. Ecological studies on Suvarnavati and Chikkahole reservoirs of Mysore district. Ph.D. Thesis, Mysore University, Mysore.
- Santhokumar Singh, A. Dakua, D. and Biswas, S. P. 2009. Physico-chemical parameters and fish enumeration of Maijan Beel (Wetland) of Upper Assam, *Geobios*, 36: 184-188.
- Singh, V.R. 1960. Phytoplankton ecology of the inland waters of Uttar Pradesh. *Proc. Review. Gen. Hydrobiol.*, 69: 553-565.
- Stevenson and White, K. D. 1995. Comparison of natural and human determinants of phytoplankton communities in the Kentucky river basin, U.S.A., *Hydrobiologia* 297: 201-216.
- Welch, P.S. 1948. Limnological methods, Balkistan philadelphia, U.S.A: 281-381.

\*\*\*\*\*