P: ISSN NO.: 2321-290X RNI : UPBIL/2013/55327 Shrinkhla Ek Shodhparak Vaicharik Patrika
E: ISSN NO.: 2349-980X Vol-III * Issue-VII* March-2016

Physico-Chemical Characteristics and Phytoplanktonic Diversity of Urpod Beel, Goalpara Assam (India)

Sikha Rani Kalita
Assistant Professor,
Deptt. of Zoology,
SBMS College,
Sualkuchi, Assam

Rezina Ahmed
Associate Professor,
Deptt.of Zoology,
Cotton College,
Guwahati,Assam

Moushumi Das
Associate Professor,
Deptt. of Zoology,
USTM, Meghalaya

Abstract

The present study was carried out in Urpod Beel, Goalpara, Assam to investigate the physico-chemical parameters of water and the phytoplanktonic diversity during the year March, 2015 to February, 2016. A total of 61 species and 41 genera belongings to five main algal groups namely Cyanophyceae, Chlorophyceae ,Bacillariophyceae, Xanthophyceae and Euglanophyceae were recorded. Out of them Chlorophyceae formed the most abundant group with 30 species and21 genera. This was followed by Cyanophyceae (15species and 9 genera), Bacillariophyceae (10 species and 8 genera), Euglanophyceae (4species and 2 genera) and Xanthophyceae with 2 species and only one genera. The study reveals that the high DO and under the permissible level of other physico-chemical parameters have considerable influence on the growth of phytoplankton.

Keywords: phytoplankton; Physico-chemical parameters, Urpod beel.

Introduction

Plankton community is heterogeneous groups of tinny plants (Phytoplankton) and animals (Zooplankton) adapted to suspension in the sea and fresh water (Battish 1992). The great majority of the floating plants in the water body are the microscopic algae collectively called phytoplankton. Phytoplankton is a predominant type of a plant found in most aqua culture ponds. The quality and quantity of phytoplankton is good indicator of water quality.

Fresh water algae occur abundantly in ponds, lakes, slow flowing streams, wetlands etc. Algal growth in various habitats significantly influences the ecosystem. Algae play a key role in fresh water ecosystem as primary producer and also support secondary productivity. Thus it is essential to study algal community in fluctuating physico-chemical scenario of water bodies to conserve and manage the ecosystem. Some notable works on this has been recently done by Onuoha *et.al.*, 2010; Nwankwo and Onyema, 2004; Khare, 1999; Choudhary and Singh, 2001; Verma and Mohanty, 1995 etc. The related works from North Eastern India are confined to Yadava *et.al.*, 1987; Goswami & Goswami, 2001; Sarma (2004, 2009, 2010); Yasmin *et.al*., 2011; Summarwar, 2012; Ghosh *et.al.,* 2012; Giripunje *et.al.*, 2013; Sarwade and Kamble, 2014; Bharti and Niyog, 2015; Belkhode and Sitre, 2016.

Urpod beel is situated at Agia in Goalpara district, Assam. Goalpara district is located approximately 25°33' to 26°12' N latitude and 90°7' to 91°5' E longitude. The climate is hot and humid in summer and dry cool in winter. On the basis of temperature and rainfall the season of the area is divided mainly to pre-monsoon (March - May), monsoon (June - August), post-monsoon (September - November) and winter (December - February). Urpod beel is a natural beel, rich in natural resources and one of the biggest beel of lower Assam, India.

Objective of the Study

This present investigation was designed to assess some physico-chemical characteristics of Urpod beel water along with its phytoplanktonic diversity and was carried out during March 2015 – February 2016.

Materials and Methods

For the present investigation the surface water samples were collected from the selected spots of the beel from March, 2015 to February, 2016 regularly at an interval of 30 days. The samplings were done in triplicate and were collected in sterilised plastic bottles completely to exclude any air space, sealed tightly and transported to the laboratory. The temperature and pH of the samples were measured in the field at

time of sample collection by mercury thermometer and digital pH meter respectively. Other analyses were done according to the standard method prescribed by APHA (2012). For algal analysis, the collected samples were preserved in acidified formaldehyde solution (20% formaldehyde solution + glacial acetic acid in 1:1 ratio). The microscopic analysis were done following Sourins (1978), Hosmani and Bharathi (1980). Identifications were done by using standard key and literature (Desikachary 1959, Prescott 1961, Bellinger and Sigee 2010, Likens, 2010, Gustaaf et al. 2010).

Results and Discussion

The result of physcico-chemical analysis during the study period is shown in tabular form (Table I) where the water temperature varied from 17.8 to 30.2°C. pH value ranged from 6.5 to 7.0. DO value from 6.2to 10.0 mg/l. BOD and Free CO_2 varies from 6.4 to 8.0 mg/l. and 5.6 to 6.0 mg/l respectively. The other parameters are also found under the permissible limit. The water colour is clear in pre-monsoon, monsoon and post-monsoon but in winter the colour of water is slightly turbid due to lack of rainfall.

Table I : Shows the Average Seasonal Physico-Chemical Characteristics of Urpod Beel Water During March 2015 to February 2016.

S. No.	Parameters	Season			
		Pre-monsoon (Mean value)	Monsoon (Mean value)	Post-Monsoon (Mean value)	Winter (Mean value)
1	Water Temperature ˚C	22.3°	30.2°	24.4°	17.8°
2	Transparency(cm)	44.8	58.7	47.2	43.2
3	pH	7.0	6.8	6.5	6.5
4	DO (mg/l)	6.2	8.5	10.0	8.8
5	BOD (mg/l)	7.4	8.0	6.6	6.4
6	TotalAlkalinity(mg/l)	32.0	28.0	30.0	30.0
7	Total Hardness(mg/l)	34.0	32.0	28.0	30.0
8	Calcium(mg/l)	18.0	18.0	16.0	16.0
9	Magnesium(mg/l)	16.0	14.0	12.0	14.0
10	Chloride(mg/l)	4.0	2.0	2.0	2.0
11	Sulphate(mg/l)	6.0	6.0	5.0	4.5
12	Nitrate(mg/l)	1.0	1.0	0.8	0.8
13	Phosphate(mg/l)	0.15	0.1	0.1	0.12
14	Free CO_2(mg/l)	6.4	5.6	6.0	6.0
15	Total Dissolved Solids(TDS) (mg/l)	18.0	16.0	12.0	14.0
16	Total Suspended Solids(TSS) (mg/l)	60.0	66.0	64.0	62.0
17	Sodium(mg/l)	0.60	0.62	0.64	0.64
18	Potassium(mg/l)	1.32	1.38	1.40	1.43
19	Zinc(mg/l)	0.258	0.250	0.242	0.240
20	Copper(mg/l)	0.002	BDL	0.002	BDL
21	Chromium(mg/l)	BDL	BDL	BDL	BDL
22	Cadmium(mg/l)	0.002	0.002	0.003	0.003

BDL- Bellow Detectable Level

The planktonic algae that were recorded from the study period are listed in table (Table II and Fig 1). There are 61 species belonging to 41genera representing five classes of algae, namely Cyanophyceae, Chlorophyceae, Bacillariophyceae, Xanthophyceae and Euglanophyceae. Among them Chlorophyceae is with highest 30 number of species followed by Cyanophyceae (15), Baccillariohyceae (10), Euglanophyceae (4) and Xanthophyceae with 2 species.

Table II: Seasonal Variations of Phytoplanktonic Diversity During March ,2015 to February, 2016 in Urpod Beel Water.

Class	Phytoplankton species	Pre-Mon	Mon	Post-Mon	winter
CYANOPHYCEAE	1. *Anabaena orientalis* Dixit	+++	++	++	
	2. *A. Spiroides* Kleb	+++	++	++	++
	3. *A. Variabilis* Kutz	+++	++	++	++
	4. *Nostoc muscorum* C. Agardh	++	++	+	-
	5. *N. commune* Vaucher	++	+	+	-
	6. *Oscillatoria acuminata* Gomont	+++	++	++	++
	7. *O. rubescens* DC.	+++	++	++	++
	8. *Phormidium corium* C. Agardh	++	+	-	-
	9. *P. favosum* Bory	+	+	-	-
	10. *Gomphosphaeria aponina* Kutz.	+++	++	++	++
	11. *Aphanocapsa litoralis* Hansg.	+	+	-	-
	12. *Aulosira fertilissima* S.L. Ghose	+	+	-	-

	13. *Calothrix marchica* Lemmerm	++	+	-	-
	14. *Microcystis aeruginosa* Kuetz.	++	+	-	-
	15. *M. viridis* A. Braun	++	++	-	-
CHLOROPHYCE AE	16. *Pandorina morum* Bory	++	-	-	+
	17. *Volvox aureus* Ehrenb	+++	++	+	++
	18. *Volvox sp*.	+++	++	++	+++
	19.*Chlorococcum humicola* (Nag.)Rob	++	-	-	+
	20. *Pediastrum constrictum* Hassall	++	-	-	-
	21. *Tetraedron pusillum* West	+++	++	+	++
	22. *T. quadratum* (Reinsch)	+++	++	+	++
	23. *Chlorella vulgaris* Beijer	++	-	-	-
	24. *Ankistrodesmus falcatus* (Corda)	+++	++	++	+++
	25. *A. gracilis* (Reinsch)	+++	++	+	++
	26. *Closteriopsis longissima* West	+++	++	++	++
	27. *Coelestrum spharicum* Naeg	+++	++	++	++
	28. *C. microporum* Naeg	+++	++	++	++
	29. *C. reticulatum* Senn	++	+	-	++
	30. *Scandesmus arcuatus* (Lemmerm.)	++	-	-	-
	31. *S. dimorphus* (Turp.) Kutzing	+	-	-	-
	32. *Gonatozygon sp*.	+++	++	++	+++
	33. *Anthrodesmus convergens* Ehrenb.	+++	++	+	++
	34. *A. curvatus* W.B. Turner	+++	++	++	++
	35. *Closterium calosporum* Wittr.	+++	++	++	++
	36. *Cosmarium auriculatum* Reinsch	+++	++	+	++
	37. *Desmidium baileyi* (Ralfs)	+++	++	++	++
	38. *Euastrum ansatum* Ehrenb	+++	++	++	++
	39. *E. Sinuosum* West & G. S.	+++	+	+	++
	40. *Micrasterias foliacea* Baley	+++	++	+	++
	41. *Micrasterias sp*.	+++	++	++	+++
	42. *Pleurotaenium maculatum* W.B. Terner	+++	++	+	++
	43 *Staurastrum sp*.	+++	++	++	++
	44. *Xanthidium trilobum* Carter	+++	++	+	++
	45. *Triploceras gracile* Bailey	+++	+	+	++
BACILLARIOPHY CEAE	46. *Navicula rhynchocephala* Kuetz	++	++	+++	++
	47. *N. viridula* Kuetz	++	++	+++	++
	48. *Fragilaria brevistriata* Grun	+	+	++	-
	49. *Cyclotella bodanica* Eul	+	+	++	-
	50. *Cymbella affinis* Kuetz	-	+	++	+
	51. *Pinularia viridis* (Nitz.) Ehr	+	++	++	+
	52. *Nitzschia sp*.	-	-	+	-
	53. *Malosira varians* Ag	-	-	+	+
	54. *Gomphonema lanceolatum* Ehr	+	++	++	+
	55. *G. Parvulum* (Kuetz.) Grun	-	+	++	+
XANTHOPHYCE AE	56. *Botryococcus sp*.	+	++	++	+++
	57. *Botrococcus sp*.	-	+	++	++
EUGLENOPHYC EAE	58. *Euglena gracilis* Klebs	+	++	+++	+
	59. *E. viridis* Ehr	+	++	++	++
	60. *Phacus acuminatus* A. Stokes	++	+	++	+++
	61. *Phacus sp*.	+	+	++	++

- =absent; + = present in only one month of the season;
++ = present in two months of the season;
+++ = present in all months of the season

Variation of algal abundance that occurred in different seasons of the year in the lake was in following order: (1) Pre-monsoon > Winter > Monsoon > Post-monsoon for Chlorophyceae. (2) Pre-monsoon > Monsoon > Post-monsoon > Winter for Cyanophyceae. (3) Post-monsoon > Monsoon > Winter > Pre-monsoon for Bacilariophyceae , (4) Post-monsoon > Winter > Monsoon > Pre-monsoon for Euglanophyceae and (5)Winter>Post-Monsoon> Monsoon>Prer-Monsoon for Xanthophyceae.

The availability of Chlorophyceae was higher in pre-monsoon due to intensive development of

Micrasterias sp., *Volvox* sp., *Gonatozygon* sp., *Coelestrium* sp.,*Closteriopsis sp., Tetraedron* sp., *Ankistrodesmus* sp.,*Anthrodesmus sp., Closteriumsp., Cosmariumsp., Desmidiumsp., Euastrum sp., Pleurotaenium sp., Staurastrum* sp., *Xanthidium sp.and Triploceras sp*. The species availability gradually declined and again increased in winter season. The dominance of different genera of Cyanophyceae of the lake was in the following order: *Anabaena > Oscillatoria >Gomphosphaeria> Nostoc >Mycrosystis > Calothrix > Phormidium >Aphanocapsa> Aulosira >Spirulina > Gleocapsa*. In Bacillariophyceae the genera encountered was in the following order of dominance: *Navicula > Gomphonema >Pinularia >Fragilaria> Cyclotella > Cymbella>Melosira* . Only two genera under four species have been observed in Euglenophyceae and among them availability of *Euglena* was higher than that of *Phacus*. Under the class Xanthophyceae only one genera *Botryococcus* was found.

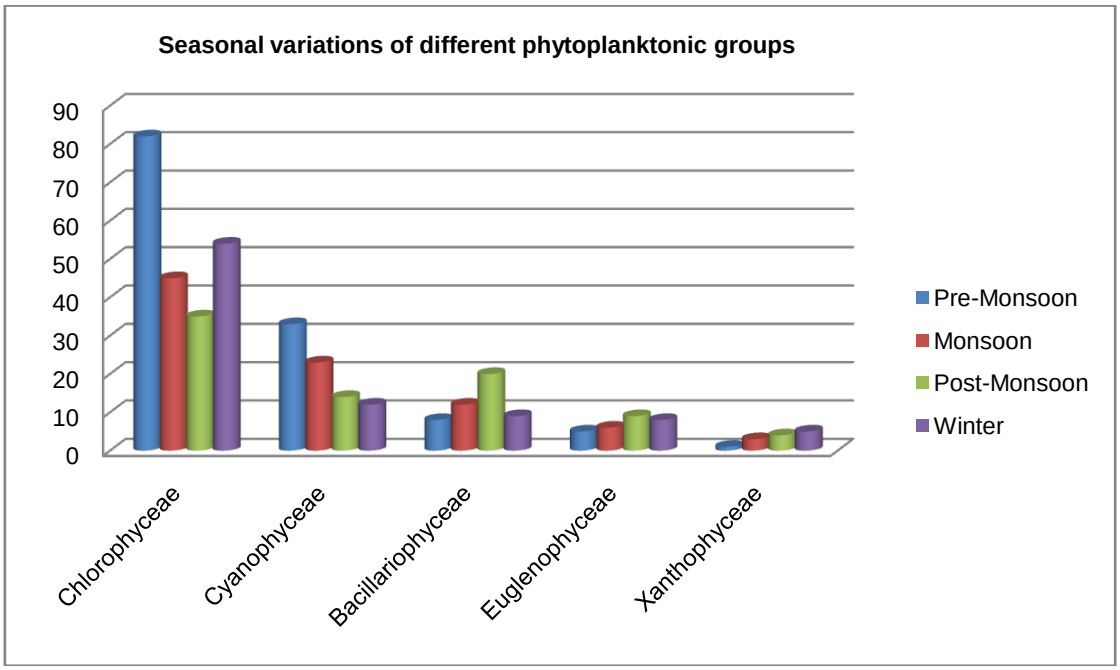

Fig. 1 :- Seasonal variations of different phytoplanktonic groups in Urpod Beel Goalpara, Assam during the season March 2015 to February 2016

In contrast to Chlorophyceae, Cyanophyceae and Bacillariophyceae the species availability of Euglanophyceae and Xanthophyceae were less. Clear water, weedy odour and high dissolved oxygen observed in the lake are the indicators for abundance of algal growth, which was supported by Verma and Mohanty (1995). The pH range between 5.0 to 8.5 is best for phytoplankton growth (Robert 1974) which is in conformity with our findings, where we observed pH range between 6.5 to 7.0. The similar result was also observed by Sarkar and Chowdhury (1999).

Conclusion

In the lake the abundance of algal bloom might have led to increase in dissolved oxygen and reduction of BOD and Free CO_2 which enhanced the primary productivity. The high abundance of Chlorophyceae is also an indicator of productive water (Boyd 1981), which thereby indicates about increased zooplankton and fish growth and diversity in the lake.

References

1. APHA (2012). *Standard methods for Examination of Water and Waste Water* (22st edn.), American Public Health Association Inc., Washington D.C.
2. Battish ,S.K .(1992). *Fresh water Zooplankton of India*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Bombay, Calcutta. 1-213.
3. Bellinger, E. and Sigee, D. D. (2010). *Freshwater Algae: Identification and Use as Bioindicators*. ISBN: 978-0-470-05814-5. 284 pp.
4. Belkhode, P.P. and Sitre, S.R. (2016). Phytoplankton Diversity of Dham River in Wardha District of Maharastra State, India. *Indian J. of Fundamental and Applied Life Sciences.* Vol. 6(1) 10-13 pp.
5. Bharti, P.K. and Niyog, U.K. (2015). Plankton diversity and aquatic ecology of a fresh water lake at Bharti Island, Larsemann Hills, East Antarctica. *Article 5,* Vol. 1, Issu 2, 137-144 pp.
6. Boyd, C. E. (1981). *Water Quality in Warm Water Fish Ponds*. Craftmaster Printers, Inc. Opelika, Alabama.
1. 7. Choudhary, S. and Singh, D.K. (2001). Phytoplankton population of Boosra lake (Gaighat block, Muzaffarpur, Bihar). *Environment & Ecology* **19**: 171-174
7. Desikachary, T. V. (1959). *Cyanophyta*, ICAR, New Delhi.
8. Giripunje, M.D., Fulke, A.B., Khoirnar, K., Meshram, P.U. and Paunikar, W.N. (2013). A Review of Phytoplankton Ecology in Freshwater Lakes of India. *Lakes, reservoirs and ponds* vol 7(2): 127-141 pp.
9. Ghosh, S., Barinova, S. and Keshri, J.P. (2012). Diversity and seasonal variation of phytoplankton

community in the Santragachi Lake, West Bengal, India. *Q Science Connect.* 3.
10. Goswami, M. M and Goswami ,N . (2001). Studies on productivity indicators in Mori beel of Assam *Tropical Zoology* **2** & **3**: 1-9.
11. Gustaaf ,M .and Hallegraeff. (2010). *Algae of Australia*: *Phytoplankton of Temperate Coastal Waters*. ISBN: 9780643100398. 432 pp.
12. Hasmani,S. P and Bharati, S. G .(1980). Limnological studies in Ponds and Lakes in Dharwar Comparative Phytoplankton Ecology of four waterbodies. *Phycos* **19,** 27-43 pp.
13. Khare, P. K. (1999). Phytoplankton as indicator of water quality and pollution status of Jagat Sagar Pond, Chhattarpur (M.P.). *Geobios. New reports,* **18**(2): 107-110.
14. Likens, G.E. (2010). *Plankton of Inland Waters*. ISBN: 9780123819949. 412 pp. Nwankwo, D.I .and Onyema, I.C. (2004). A check-list of planktonic algae off Lagos Coast. *J. Sci. Res. Dev*. **9**: 75-82.
15. Onuoha, P. C. Nwankwo, D. I., Vyverman, W. (2010). A checklist of phytoplankton species of Ologe lagoon, Lagos south-western Nigeria. *Journal American Science*.**6**(9):297- 302.
16. Prescott, G. W. (1961). *Algae on the Western Great Lakes Area*. Wm. C. Brown Company Publishers. Dubuque, Lowa.
17. Robert ,D. S., Robert, W.H. and Evereft ,L .G. (1974). Phytoplankton distribution and water quality indices for lake Lead (Colorado River). *Phycology*, 10:323:333.
18. Sarwade, A.B. and Kamble, N.A. (2014). Plankton diversity in Krishna River, Sangli, Maharashtra. *J. of Ecology and the Natural Environment* Vol. 6(4). 174-181 pp.
19. Sarkar, S. K. and Chowdhury, P. Basu. (1999). Role of some Environmental Factors on the Fluctuation of Plankton in a Lentic Pond at Calcutta. *Limno. Res. India*, ISBN 81-7035-204-5. 108-132.
20. Sharma, B. K .(2004). Phytoplankton communities of a floodplain lake of the Brahmaputra river basin, Upper Assam. *J Ind. Fish Asson.* **31**: 27-35.
21. Sharma ,B .K. (2009). Composition, abundance and ecology of phytoplankton communities of Loktak Lake, Manipur, India. *J. Threatened Taxa* **1**(8): 401-410
22. Sharma ,B. K .(2010). Phytoplankton diversity of two floodplain lakes (pats) of Manipur, northeastern India. *J. Threatened Taxa*. **2**(11): 1273-1281
23. Sourins,. A (Ed.) (1978). *Phytoplankton manual* UNESCO press, Paris, 337 pp.
24. Summarwar, S. (2012). Studies on Plankton diversity in Bisalpur reservoir. *Int. J. of Life Science Biotechnology and Pharma Research.* Vol. 1(4): 65-72 pp.
25. Verma,J .P. and Mohanty, R. C. (1995). Phytoplankton of Malyanta Pond of Laxmisagar and its correlation with certain physic-chemical parameters. *Pol. Res.***14**:243-252.
26. Yadava ,Y. S. Singh, R. K., Choudhury, M. and Kolekar ,V. (1987). Limnology and productivity in Dighali beel (Assam). *Trop. Ecol.* **28**: 137-146.
27. Yasmin ,F., Buragohain, B. B. and Medhi, K. K .(2011). Planktonic Desmid Flora of South of the Eastern Himalayas: A Systematic Approach on Algae-I. *Intern. J Bot.* **7**:154-161.