Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231-6345 (Online)
An Online International Journal Available at http://www.cibtech.org/jls.htm
2013 Vol. 3 (4) October-December, pp.5-9/Bordoloi et al.
Research Article

SEASONAL DYNAMICS IN PHYTOPLANKTON ABUNDANCE AND ITS DIVERSITY IN OPEN TYPE WETLANDS OF JORHAT DISTRICT, INDIA

***Bordoloi R.[1], Abujam S.K.S.[2] and Goswami U.C.[3]**
[1]Department of Zoology, D. R. College, Golaghat, Assam 785621, India
[2]Department of Life Sciences, Dibrugarh University, Assam 786004, India
[3]Department of Zoology, Gauhati University Assam - 781014, India
**Author for Correspondence*

ABSTRACT
Variations in phytoplankton abundance and diversity of the open wetland (Nahatia) of Jorhat district Assam was investigated during January 2011 to December 2011. Phytoplankton samples were collected through plankton net of blotting silk No. 25 & 55 from different 10 sampling sites on monthly basis. Samples were preserved with 4% formalin solution and Lugol's solution and then stored in labeled glass vials in the field. In the laboratory, 1ml of the plankton sub sample was withdrawn with a wide-mouthed pipette from field samples and placed on a Sedge-wick rafter-counting chamber for species identification and counts with help of standard keys through microscopy. The student t-test of significance was used to partition numerical abundances of plankton biotypes seasonally. Phytoplankton comprised 55 species and a mean density of 1142 unit/ml. Dominant group of phytoplankton was Bacillariophyceae (35.55%) followed by Chlorophyceae (32.66%) and Myxophyceae (31.76%). Phytoplankton species showed bi model seasonal patterns of occurrence. Two peaks were observed in the summer and monsoon season. Highest numerical abundance was observed in summer and lowest during winter season. All groups have numerical significant abundance seasonally and there is significant seasonal difference at the 0.05 level and correlation is significant at the 0.01 level.

Key Words: *Open Wetland, Phytoplankton, Abundance, Diversity, Nahatia, Jorhat, Assam.*

INTRODUCTION
The study of species composition, their numerical density and relative dominance of plankton are important features with respect to any freshwater body. Phytoplankton converts light energy to chemical energy through primary production which makes them very important in the food web. As far as plankton diversity, abundance and its importance were concerned, several workers studied in different lentic and lotic waterbody of the country. Among the prominent workers are Dey (1981); Misra *et al.*, (1981); Pant and Sharma, (1983); Kar (1984); Goswami (1985); Agarwala (1996); Acharjee (1997); Goswami (1997); Das (1998) and Abujam *et al.*, (2011). The effects of environmental factors on plankton dynamics has been studied by several authors (Sarkar and Basu, 2000; Hassan *et al.*, 2004, Susanne *et al.*, 2005; Nowrouzi and Valavi, 2011; Ogbuagu *et al.*, 2011). The influence of seasonal abundance and diversity of plankton biotypes varies significantly, with physical factors like temperature and light intensity being the most important and chemical factors like dissolved oxygen, pH, salinity, hardness, electrical conductivity and nutrient level. The present study has been taken up the abundance and seasonal variations in phytoplankton diversity in the regular flooded wetlands Nahatia of Brahmaputra basin.

MATERIALS AND METHODS
The Nahotia (Open type) wetlands are located in the geographical ordinates of $26^0 48^/$-$26^0 49^/$N and $94^0 12^/$-$94^0 13^/$ E. Phytoplankton samples have been collected from the surface layer of the studied wetlands from January 2011 to December 2011. For qualitative and quantitative analysis of plankton, 50 litres of water sample were filtered randomly from different sites of the beels every month through plankton net of blotting silk No. 25 & 55, 1 ml of the filtrate containing the collected plankton was preserved. Samples were preserved with 4% formalin solution and Lugol's solution and stored in labeled glass vials in the

field. In the laboratory, 1ml of the plankton sub sample was taken with a wide-mouthed pipette from field samples and placed on a Sedge-wick rafter-counting chamber for species identification and counts with the help of standard keys of Needham and Needham (1974), Maosen (1978), Jeje and Fernando (1991), Egborge (1994). The phytoplankton was recorded as unit per ml.

RESULTS AND DISCUSSION

Composition of Phytoplankton

Altogether 55 species of Phytoplankton were observed in open wetland (Table 1). A total of 1142 unit/ml of Phytoplankton water was counted in the wetland during the study period. Dominant group of phytoplankton in the wetland was Bacillariophyceae (35.55%) followed by Chlorophyceae (32.66%) and Myxophyceae (31.76%) was given Table 2. The seasonal variation of phytoplankton densities with the studentized t-test of significance has been given in Table 3. The average Bacillariophyceae counts were higher in the pre-monsoon and monsoon (56.66 ± 6.66 and 43 ±5.61 unit/ml) than post monsoon and winter season (14±4.0 and 11±1.0 cells/ml); with statistically significant seasonal difference (t = 5.572), at the 0.05 level and significant correlation (r = 0.996). Correlation is significant at the 0.01 level. Again, the average Myxophyceae counts were also higher in the pre-monsoon and monsoon (43.5 ± 4.97 and 37 ± 5.14 unit/ml) than post monsoon and winter season months (17 ±3.51 and 11 ±1 cells/ml); with statistically significant seasonal difference (t = 6.464), at the 0.05 level and significant correlation (r = 0.997). Correlation is significant at the 0.01 level.

Table 1: Phytoplankton diversity in the Nahatia wetland

Bacillariophyceae	Myxophyceae	Chlorophyceae
Pinularia sp.	*Anabaena sp.*	*Netrium sp.*
Eunotia sp.	*Rivularia sp.*	*Ulothrix sp.*
Cymbella sp.	*Spirulina sp.*	*Spirogyra sp.*
Stauroneis sp.	*Oscillatoria sp.*	*Desmidium sp.*
Cocconeis sp.	*Microsteris sp.*	*Chaetophora sp.*
Synedra sp.	*Coelosphaerium sp.*	*Chlorella sp.*
Tabellaria sp.	*Microcystis sp.*	*Microphora sp.*
Cycotella sp.	*Lyngbya sp*	*Zygnema sp.*
Asterionella sp.	*Nostoc sp.*	*Rhodomonas sp.*
Gomphonema sp.		*Anacystis sp.*
Campylodiscus sp.		*Botrydium sp.*
Diatoma sp.		*Euastrum sp.*
Navicula sp.		*Nitzchia sp.*
Frustulia sp.		*Euglena sp.*
Tribonema sp.		*Pediastrum sp.*
Flagellaria sp.		*Eudorina sp.*
Melosira sp.		*Mougeotia sp.*
Asterionella sp		*Volvox sp.*
Calonies sp.		*Tetraedon sp.,*
		Scenedesmus sp.,
		Closterium sp,
		Cosmarium sp.
		Ankistodesmus sp.
		Chlamydomonas sp.
		Characium sp.
		Microspora sp.
		Flagellaria sp.

Table 2: Monthly variation of phytoplankton in the Nahatia wetland (unit/ml)

Months	Bacillariophyceae	Myxophyceae	Chlorophyceae
Jan	10	11	12
Feb	12	11	10
Mar	50	50	40
Apr	70	50	50
May	50	45	50
Jun	32	29	30
Jul	50	52	55
Aug	40	35	50
Sept	35	32	34
Oct	22	21	20
Nov	10	15	25
Dec	10	12	21
	406 (35.55 %)	363(31.76 %)	373 (32.66 %)

Table 3: Seasonal variation of phytoplankton densities with the studentized t-test of significance

Phytoplanktons	Seasons	Mean	Se	t-test	Sig. t-value	Correlation (r)
Bacillariophyceae	winter	11	1	t= 5.572	p = 1.670	0.996
	pre-monsoon	56.66	6.66			
	monsoon	43	5.61			
	Post monsoon	14	4			
Myxophyceae	winter	11	0	t= 6.464	p= 4.64	0.997
	pre-monsoon	43.5	4.97			
	monsoon	37	5.14			
	Post monsoon	16	2.64			
Chlorophyceae	winter	11	1	t = 6.273	p = 6.061	1
	pre-monsoon	46.66	3.33			
	monsoon	37	7.35			
	Post monsoon	17	3.51			

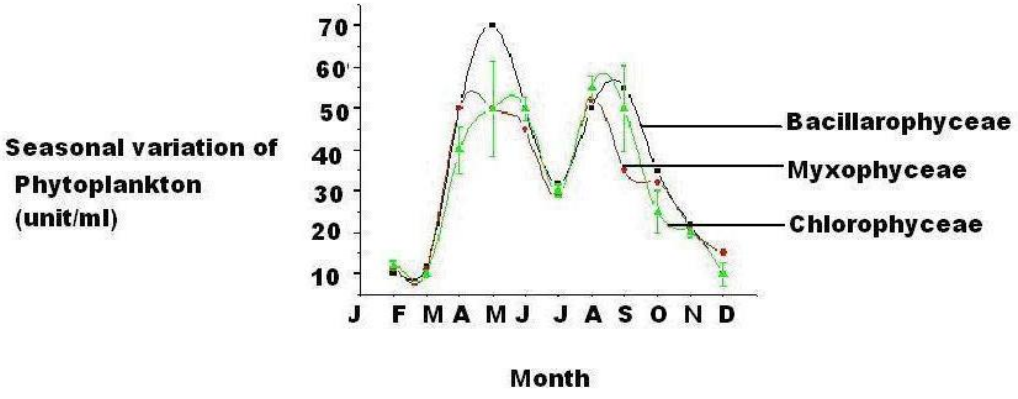

Figure 1: Seasonal variation of the Phytoplankton in the Nahatia wetland of Jorhat District (January 2011- December 2011)

The average Chlorophyceae counts were higher in the pre-monsoon and monsoon (46.66 ± 3.33 and 37 ±7.35 unit/ml) than post monsoon and winter season months (17 ± 7.3 and 11 ± 1 cells/ml); with statistically significant seasonal difference (t =6.27), at the 0.05 level and significant correlation (r = 1). Correlation is significant at the 0.01 level.

Phytoplankton production showed (Figure 1) bimodal cycle with one peak in pre-monsoon (March-May) and monsoon (June-August). Seasonal abundance of Bacillariophyceae (56.66 unit/ml) followed by 43 unit/ml, 14 unit/ml and 11 during winter, pre-monsoon, monsoon and post monsoon respectively. Highest mean value was during summer season and gradually decreases during post monsoon and least during winter season. Average mean value of Myxophyceae was about 43.5 unit/ml (pre-monsoon), 37unit/ml (monsoon) 16/unit/ml (post monsoon) and 11unit/ml (winter). Highest value was encountered in pre-monsoon season and least value during winter. Chlorophyceae was recorded as 46.66u/ml in pre-monsoon followed by 37unit/ml in monsoon, 17unit/ml in post monsoon and 11unit/ml in winter. Highest was recorded in pre-monsoon and lowest in winter. Similar observation was made by Sreenivasan (1964) and Mathew (1975). Again, seasonal fluctuation of planktons depends on environmental factors.

Freshwater phytoplankton populations are seasonally variable and are regulated by both chemical and physical factors (Hutchinson, 1967). Physical characteristics of a lake, reservoir, or pond such as depth, volume and lake surface area can influence by phytoplankton assemblages. In many stratified freshwater lakes and reservoirs, blooms of chrysophytes, chlorophytes or dinoflagellates form at varying depths throughout the euphotic zone where nutrient concentrations are high and these organisms can select optimum light levels (Fee, 1976). Nutrient concentrations, nutrient ratios (stoichiometry), and light are essential for growth indicators. For example, nitrogen-fixing cyanobacteria tend to dominate in systems with N: P ratios <5:1 (Findlay *et al.,* 1994), whereas chlorophytes tend to dominate in systems with higher N: P ratios. The influence of environmental factors on the seasonal abundance and diversity of plankton biotypes varies significantly, with physical factors like temperature and light intensity being the most important and chemical factors like dissolved oxygen, pH, salinity, hardness, electrical conductivity and nutrient level (Sarkar and Basu, 2000; Hassan *et al.,* 2004; Susanne *et al.,* 2005; Nowrouzi and Valavi, 2011; Ogbuagu *et al.,* 2011 and Abujam *et al.*, 2011).

Conclusion

From the above results, it could be conclude that the Bacillariophyceans (diatoms) were identified as mostly seasonally dominated followed by Chlorophyceans and Myxophyceans phytoplankton. All three groups are seasonally significant at 0.01 level. In overall the finding is delineated the wetland is diverse and rich in phytoplankton.

ACKNOWLEDGEMENT

Authors are grateful to the (UGC) for providing financial assistance to carry out the work.

REFERENCES

Abujam SKS, Dakua S, Bakalial B, Saikia AK, Biswas SP and Choudhury P (2011). Diversity of plankton in Maijan beel, upper Assam. *Asian Journal of Experimental Biological Science* **2**(4) 562-568.

Agarwala NK (1996). Limnology and fish productivity of Tamranga wetland in Bangaigaon district of Assam (India) with special reference to some productivity indicator, PhD Thesis, Gauhati University, Assam 200.

Acharjee B (1997). Ecological status and productive potential of some beels in lower Brahmaputra basin, Assam. Unpublished PhD Thesis, Gauhati University, Assam 206.

Bhattacharjya BK, Gupta TRC, Katti RJ and Choudhury M (2001). Phytoplankton population in relation to hydrography in an organically enriched estuary - a multivariate analysis. *Tropical Zoology* **2 & 3** 133-140.

Dey SC (1981). Studies on the hydrobiological conditions of some commercially important lakes (beels) of Kamrup district of Assam and their bearing on fish production, North-Eastern Council, Govt. of India, Shillong.
Das AK (1998). Role of detritus in the beels of West Bengal. *Journal of Inland Fisheries Society of India* **30**(2) 50-54.
Egborge ABM (1994). *Water Pollution in Nigeria 1: Biodiversity and Chemistry of Warri River*. Ben Miller Books Nig. Ltd. 313.
Fee EJ (1976). The vertical and seasonal distribution of chlorophyll in lakes of the Experimental Lakes Area, northwestern Ontario: implications for primary production estimates. *Limnology and Oceanography* **21** 767-783.
Findlay DL, Hecky RE, Hendzel LL, Stainton MP and Regehr GW (1994). The relationship between nitrogen fixation and heterocyst abundance in Lake 227 and its relevance to the nitrogen budget. *Canadian Journal of Fisheries and Aquatic Science* **51** 2254-2266.
Goswami MM (1985). Limnological investigations of a tectonic lake of Assam, India and their bearing on fish production, PhD Thesis, Gauhati University, Assam 395.
Goswami N (1997). Studies on the productivity indicators in three different types of wetlands of Assam, India, PhD Thesis, Gauhati University, Assam **iv** 217.
Hutchinson GE (1967). A treatise on limnology 2. Introduction to lake biology and the limnoplankton. *American Journal of Science* (Wiley & Sons, New York) 1115.
Jeje CY and Fernando CH (1991). An illustrated guide to identification of Nigerian freshwater rotifers. *Nigerian Journal of Science* **25** 77-95.
Kar D (1984). Limnology and fisheries of lake Sone in the Cachar district of Assam, India, PhD Thesis, Gauhati University, Assam 201.
Hassan FM, Kathim FN and Hussein HF (2004). Effect of chemical and physical properties of river water in shatt al-hilla on phytoplankton communities. *E-Journal of Chemistry* **5** 323-330.
Mathew PM (1975). Limnology and productivity of Govindgarh lake. *Journal of Inland Fisheries Society of India* **7** 17-24.
Maosen H (1978). *Illustration of Freshwater Plankton.* Agricultural Press 171.
Misra SD, Bhargava SC, Jakher GR and Dey T (1981). Seasonal study of zooplankton in Balsamand lake. *Proceedings of Symposium on Ecology of Animal Population, Zoological Survey of India* 219-34.
Needham JG and Needham PR (1974). *A Guide to the study of freshwater Biology*. San Francisco, Holde-Day Publishers.
Nowrouzi S and Valavi H (2011). Effects of environmental factors on phytoplankton abundance and diversity in Kaftar Lake. *Journal of Fisheries & Aquatic Science* **6**(2) 130-140.
Ogbuagu DH, Ayoade AA and Chukwuocha NB (2011). Spatial dynamics in physicochemistry and bacterio- and myco-plankton assemblages of Imo River in a Niger Delta community in Nigeria. *African Journal of Microbiology Research* **5**(8) 872-887.
Pant MC, Sharma AP and Chaturvedi OP (1983). Phytoplankton population and diel variation in a subtropical lake. *Journal of Environmental Biol*ogy **4**(1) 15-25.
Sreenivasan A (1964). Limnological studies and fish yield in three upland lakes of Madras, India. *Limnology and Oceanography* **9**(4) 564-575.
Susanne F, Galina K, Lyubov I and Andreas N (2005). Regional, vertical and seasonal distribution of phytoplankton and photosynthetic pigments in Lake Baikal. *Journal of Plankton Research* **27** 793-810.
Sarkar SK and Basu CP (2000). Role of some environmental factors on the fluctuations of plankton in a lentic pond at Calcutta. *In: Limnological research in India* **108** 132.