

# DIVERSITY AND SEASONAL VARIATION OF PHYTOPLANKTON IN THE RIVER TORSA, WEST BENGAL, INDIA

Tapan Sarkar<sup>1</sup> and Prof. Joydeb Pal<sup>2</sup>

Asst. Professor, Dept. of Zoology, Raiganj University, Raiganj<sup>1</sup>

Former Professor, Dept. of Zoology, North Bengal University, Siliguri<sup>2</sup>

## ABSTRACT-

A total of 25 phytoplankton genera belonged to five groups were recorded in the river Torsa. Chlorophyceae was the most dominant group with 12 genera, Cyanophyceae with 6 genera, Bacillariophyceae with 5 genera, Dinophyceae and Euglenophyceae with 1 genera each. Average seasonal variations of number of phytoplankton genera, phytoplankton density and diversity indices such as- Margalef's Richness Index and Shannon-Wiener Diversity Index were recorded maximum in winter season and lowest in monsoon seasons. Few pollutant tolerant genera were also recorded.

**Index terms-** Phytoplankton, Torsa, diversity indices

## I. INTRODUCTION-

The river Torsa originated from the Chumbi Valley in Tibet, China and it is a transboundary river and run through China, Bhutan, India and Bangladesh. The term plankton was coined by Hensen (1887) and it's mean all free floating organic particles in the water body those having little or no resistance to water currents. Phytoplanktons are usually occur as unicellular or colonial forms. Phytoplankton have been used as bio-indicator for assessing water quality of an aquatic ecosystem (Palmer, 1963 and Rawson, D.S. 1956, Tiwari and Chauhan, 2006; Hoch et al., 2008). Phytoplanktons, due to the presence of chlorophyll are the primary producers of aquatic ecosystem and are the main source of food directly or indirectly for various aquatic organism (Anitha Devi et al., 2013). The amount of phytoplankton present, influenced the productivity of the water body (Guy, 1992). So far no phytoplankton diversity was studied in the river Torsa. The objective of this study was to assess the phytoplankton diversity and seasonal fluctuation of diversity and density in the river Torsa.

## II. MATERIALS AND METHODS-

### 1. SAMPLING SITES-

Two samplings sites were selected for study, site-I Sona Pur (26°30'22.0''N, 89°19'38.0''E) and site-II Cooch Behar city (26°17'15.8''N, 89°27'37.2''E).

### 2. DURATION OF STUDY-

Duration of the study was two year. The survey was carried out from March 2014 to February 2016.

The sampling was done in the early morning of the day, between 6.0 A.M to 9:0 A.M. Water samples were collected monthly interval with the help of plankton net (mesh size- 60 micron). Ten liter of surface water was

filtered and preserved in Lugol's iodine solution (Trivedy and Goel,1986). In laboratory water sample then concentrated by centrifugation at 15000 rpm for ten minutes. Phytoplanktons were identified up to the species level with the help of standard references such as - Turner (1982); Anand (1998);Presscot,(1962); Turner,(1982) and APHA (2005). Density of phytoplankton were calculated with the help of Lacky drop method(Laky, 1938). Few biodiversity indices like Shannon's diversity index(Shannon,1949), Pielou's evenness index (Pielou, E.C,1966), Simpson's dominance index(Simpson, E.H.,1949) and Margalef's species richness index(Margalef,1968) were calculated with the help of PAST 3 software.

### III.RESULT AND DISCUSSION-

A total of 25 and 24 genera belonged to five groups were recorded in the sites-I and Site-II of the river Torsa. All together 25 phytoplankton genera recorded from the river Torsa during the study period. Chlorophyceae was most dominant group with 12 genera, then followed by Cyanophyceae with 6 genera, Bacillariophyceae with 5 genera, Dinophyceae and Euglenophyceae with 1 genera each(Tab.-1 ). Bhanja(2014) reported a total of 15 phytoplankton from two adjacent ponds in west Bengal. A total of 29 phytoplanktons were recorded by Ghosh(2012) from Santragachi lake, West Bengal. Keshri et. al.(2013) recorded a total of 30 phytoplankton species from the Baishar Beel. So the phytoplankton diversity in the river Torsa corroborates with the above study. The percentage composition of phytoplankton groups contributes 48% of Chlorophyceae, 20% of Bacillariophyceae, 24% Cyanophyceae, Dinophyceae and Euglenophyceae 4% each (Fig.-5).

Table-1. Diversity of Phytoplankton at the Site-I and Site-II in the river Torsa.

Srl. No	Class	Genera	2014-15		2015-16	
			Site-I	Site-II	Site-I	Site-II
1.	Chlorophyceae	<i>Chara sp.</i>	+	+	-	+
2.		<i>Chlorella sp</i>	+	+	+	+
3.		<i>Clamydomonas sp.</i>	+	+	+	+
4.		<i>Closterium sp.</i>	+	+	+	+
5.		<i>Oedogonium sp</i>	+	+	+	+
6.		<i>Coelastrum sp.</i>	+	-	+	-
7.		<i>Pediastrum</i>	+	-	+	+
8.		<i>Spirogyra sp.</i>	+	+	+	+
9.		<i>Cosmarium sp.</i>	+	-	+	+
10		<i>Ulothrix sp.</i>	+	-	+	+
11.		<i>Volvox sp.</i>	+	+	+	+
12		<i>Zygonema sp.</i>	+	+	+	+
13	Cyanophyceae	<i>Anabaena sp.</i>	+	+	+	+
14		<i>Nostoc sp.</i>	+	+	+	+
15		<i>Anacystis sp.</i>	+	+	+	+
16		<i>Oscillatoria sp.</i>	+	+	-	+
17		<i>Spirulina sp.</i>	+	-	+	-
18		<i>Rivularia sp.</i>	+	+	+	+
19	Bacillariophyceae	<i>Diatoma sp.</i>	+	+	+	+
20		<i>Navicula sp.</i>	+	+	+	+

21		<i>Cymbella sp.</i>	+	+	-	+
22		<i>Pinularia sp.</i>	-	+	+	+
23		<i>Tabellaria sp.</i>	+	+	+	+
24	Dinophyceae	<i>Ceratium sp</i>	+	+	+	+
25	Euglenophyceae	<i>Euglena sp.</i>	+	+	+	+

The maximum density of phytoplankton was recorded 34 org./L in the month of January (site-II) and minimum was found 7 org./L in the month of August (site-I) during the study period. The maximum number of phytoplankton genera was recorded 19 in the month of January (site-II) and minimum 6 in the month of August (Site-I & II). The maximum Shannon-Wiener Diversity Index ( $H'$ ) was recorded 2.84 (site-I) in the month of January and minimum was observed 1.74 (site-I&II) in the month of August. Highest value of Evenness Index was observed (0.989) in the month of October (site- II) and lowest value (0.958) in the month of November. Highest value of Margalef's Richness index was observed 4.98(site-I) in the month of January and lowest value 2.56(site-I&II) in August. Highest and lowest value of Species Dominance index was recorded 0.183 and 0.064 in the month of August(site-I &II) and January(site-I)(fig.1-4).

Seasonal variations of number of phytoplankton genera, phytoplankton density, Margalef's Richness Index and Shannon-Wiener Diversity Index were observed maximum in winter season and lowest value in monsoon seasons. Phytoplankton genera, density and diversity indices were maximum in winter season due to low volume of river water and high nutrient content. Similar finding was suggested by Keshri *et. al.*,2013; Patel (2014). On the contrary, highest seasonal variation of species dominance index and species evenness index was found in monsoon season followed by summer and winter during the two year study period (tab.-2). Mishra *et.al.* (2010) proposed that the Shannon-Wiener Diversity Index ( $H'$ ) above the 4 is an indication of the very good quality of water.

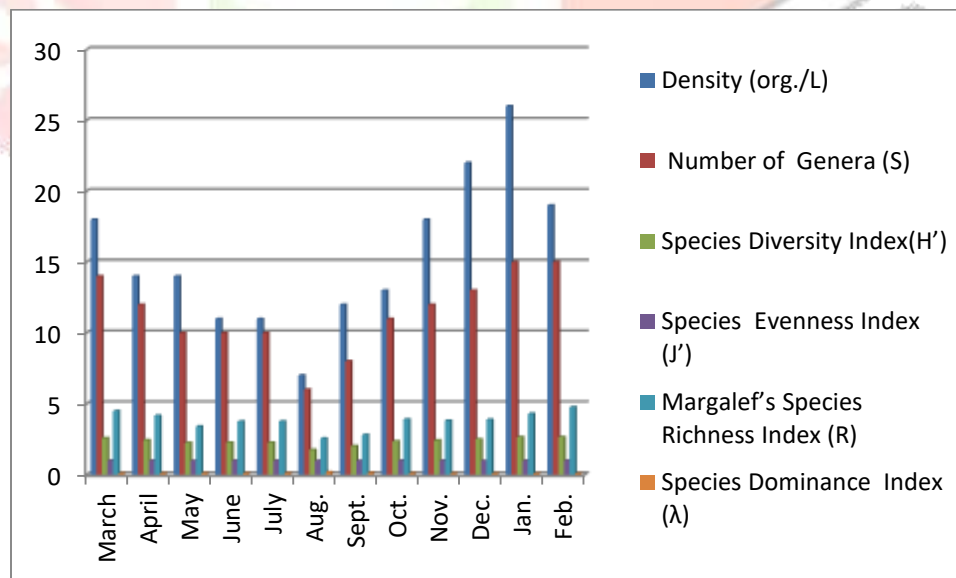


Figure-1. Monthly variation of number, density and diversity indices of Phytoplankton at the site-I from March 2014 to February 2015

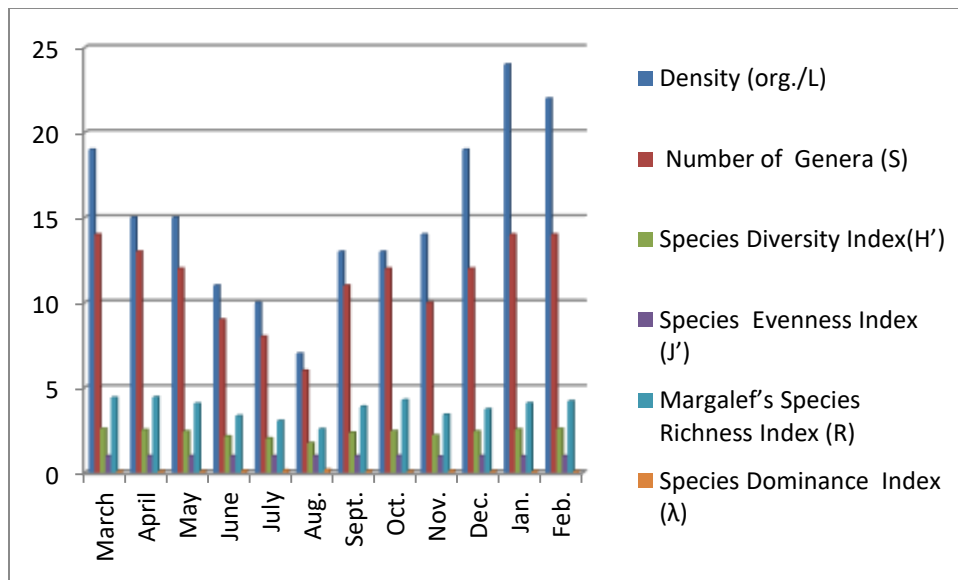


Figure-2.Monthly variation of number, density and diversity indices of Phytoplankton at the site-II from March 2014 to February 2015

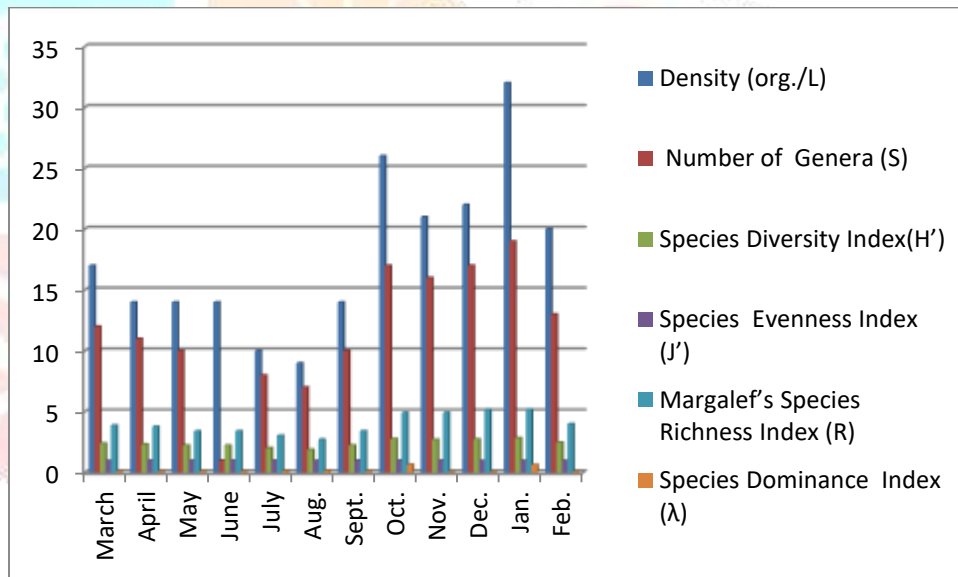


Figure-3.Monthly variation of number, density and diversity indices of Phytoplankton at the site-I from March 2015 to February 2016.

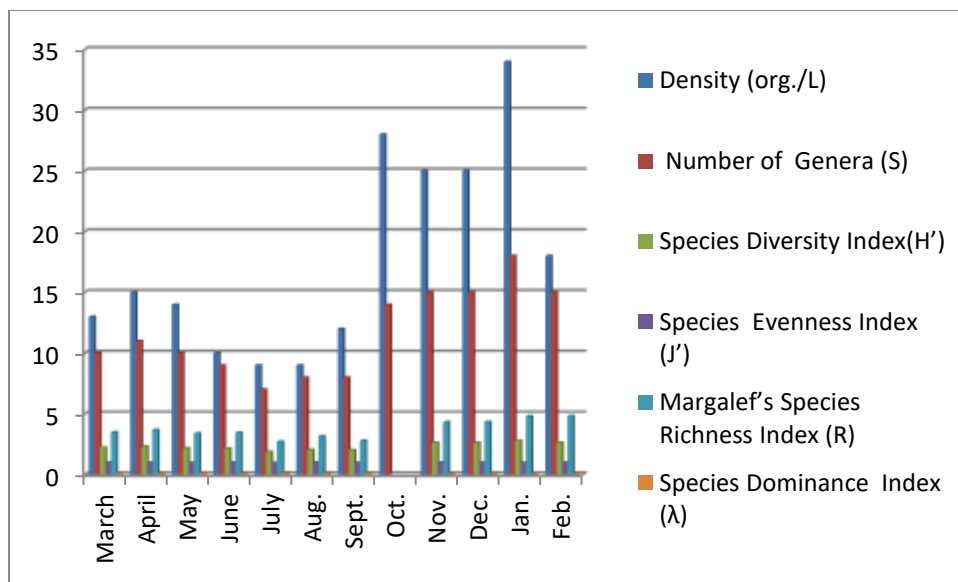


Figure-4. Monthly variation of number, density and diversity indices of Phytoplankton at the site-II from March 2015 to February 2016.

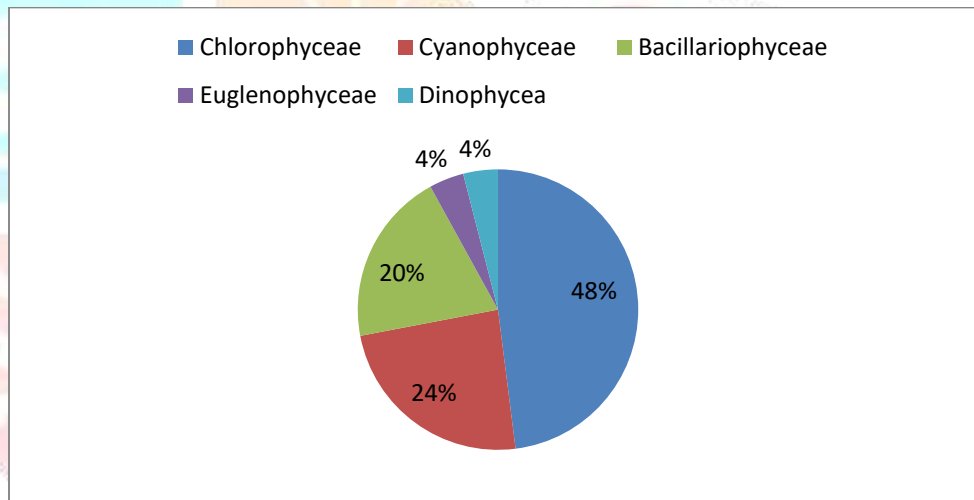


Figure-5. Percent composition of Phytoplankton group.

Table – 2. Average Seasonal number, Density and Diversity Indices of Phytoplankton at site -I and Site-II of the river Torsa from march 2014 – February 2016.

Study period	March 2014 – Feb. 2016			March 2014 – Feb. 2016		
	Site-I			Site-II		
Diversity Indices	Summer	Monsoon	Winter	Summer	Monsoon	Winter
Density (org./L)	14.5	13	22.62	13.87	11.87	22.5
Number of Genera (S)	21	17	23.5	19	15	23.5
Species Diversity Index(H')	2.875	2.71	3.035	2.79	2.63	2.98
Species Evenness Index (J')	0.946	0.962	0.906	0.953	0.973	0.947

<b>Margalef's Species Richness Index (R)</b>	4.92	4.05	4.99	4.47	3.62	5.0
<b>Species Dominance Index (<math>\lambda</math>)</b>	0.0605	0.071	0.0515	0.065	0.075	0.057

Presence of *Anabaena*, *Oscillatoria*, *Chlorella*, *Navicula* and *Spirogyra* indicated the low level of organic and sewage pollution in this river (Gupta and Shukla,1990;Shekhar *et.al.*,2008). Higher value of Shannon's diversity index in the river Torsa indicated the rich diversity of species and longer food chain. According to Wilham and Dorris (1966) species diversity value greater than 3 indicates clean water .

#### IV.CONCLUSSION-

Moderate number of phytoplankton genera was recorded in the river Torsa. Chlorophyceae was the dominant group indicated a high nutrient content. A high diversity indices in the river Torsa suggests a healthy river ecosystem. In this investigation it has been found that the water of river Torsa exhibits very low pollution load but few organic and sewage pollutant genera were found in this river.

#### V.REFERENCES-

- [1] Anitha Devi U, Ugandhar T and Masingara Sharya,2013.Dynamic of productivity in Lower Manaie dam (Lmd) and Kakatiya canal (KC) Karimnagar, Andhra Pradesh, India.Bioscience Discovery,4(1): 111-116.
- [2] Guy, D. 1992.The ecology of the fish pond ecosystem with special reference to Africa. Pergamon Press. pp. 220.-230
- [3] Hoch MP, Dilon KS, Coffin RB and Cifuentes LA, 2008. Sensitivity of bacterioplankton nitrogen metabolism to eutrophication in sub-tropical coastal water of Key West.Florida. Mar.Pollut Bull.,56:913-926.
- [4] Keshri, J.P ; Ghosh ,S and Bhattacharyya,S. Int J CurResRev, Oct 2013 /Vol05 (19):8-13.
- [5] Krebs, C.J.1999. Ecological Methodology- 2<sup>nd</sup> Edition.Addison Wesley Longman.
- [6] Lacky,J. B.1938. The manipulation and counting of river plankton and changes of some organism due to formalin solution. *Pub.Hlth.Rep.* 53:2080-2093.
- [7] Margalef, D.R.Information Theory in Ecology. General Systems3: 36–71.
- [8] Mishra, A., S.K. Chakraborty, A.K. Jaiswar, A.P. Sharma, G. Deshmukhe & M.Mohan.2010 .Plankton diversity in Dhaura and Baigul reservoirs of Uttarakhand.Indian Journal Fisheries. 57(3): 1927.
- [9] Palmer, C.M. 1963. The effect of pollution on river algae. Bull. N.Y. Acad. Sci
- [10] Pielou, E.C. The measurement of diversity in different types of biological collections. Journal of Theoretical Biology.1966;13: 131–144. [http://dx.doi.org/10.1016/0022-5193\(66\)90013-0](http://dx.doi.org/10.1016/0022-5193(66)90013-0).

- [11] Prescott G.W.1982. Algae of the Western Great Lakes Area, Otto Koeltz Science Pub., Koengstein, pp. 977.
- [12] Rawson, D.S. 1956. Algal indicators of trophic lake types. *Limnol. Oceanogr.*1:18
- [13] Shannon, C.E. and W. Weaver 1949. *The mathematical theory of communication.*Urban . University of Illinois Press, Urbana.
- [14] Shekhar RT, Kiran BR, Puttaiah ET,Shibraj X and Mahadevan KM, 2008. Phytoplankton as index of water quality with reference to industrial Pollution. *J Environ Biol.*, 29:233-236.
- [15] Simpson,E.H.Measurement of diversity. *Nature* 1949;163:688; <http://dx.doi.org/10.1038/163688a0>.
- [16] Tiwari, A and SVChauhan,2006.Seasonal phytoplanktonic diversity of lake, Agra. *J.Environ.Biol.* ,27:35-38,
- [17] Trivedy, R.K. and Goel,P.K1986.Chemical and biological method for water pollution studies. Environmental publication, Karad, India.
- [18] Turner W.B. 1982.The Freshwater Algae of East India, Kongl. Sv. Vet. Akademiens Handlingar, pp.187.
- [19] Wilhm J.L., Dorris T.C. 1968.Biological parameters for water quality criteria. *Bioscience*, 18: 447-481

