PHYTOPLANKTONOLOGY OF RIVER GANGA AT BHAGALPUR, INDIA

Phytoplankton Productivity in Relation to Abiotic Spectrum

Aditi Abhilasha Jayaswal And L.C. Saha
University Department of Botany ,
T. M. Bhagalpur University,
Bhagalpur, Bihar.

ABSTRACT

Present communication is an attempt to evaluate phytoplankton productivity of River Ganga in relation to abiotic spectrum at Bhagalpur BIHAR India. The gross and net primary productivity value ranged between 0.87-2.13 gC/m^2/day and 0.340–1.200 gC/m^2/day respectively, maximum being in May and minimum in September. The gross primary productivity showed positive correlation with phytoplankton density, transparency and pH and negative correlation with the nutrients. Key words: Phytoplankton, Standing Crop, Primary productivity, Incubation period.

INTRODUCTION

Green plants have monopoly to convert solar energy into chemical energy in the form of organic assimilates, passed on to higher trophic level. In an aquatic ecosystem, phytoplankton plays a key role in primary productivity and constitutes a major fraction of primary producers. In India, several workers have summed up our knowledge on primary productivity of different ecosystem. (Nasar and Dutta Munshi, 1975; Zutschi and Vass, 1977; Siddiqui e*t al.*, 1980 1981. Saha *et al.* 1985, Singh, 1993). So far as the phytoplankton productivity of River Ganga at Bhagalpur, Bihar, India is concerned, none has attempted to evaluate the potentialities of Ganga at Bhagalpur. In the present communication, productivity of River Ganga at Bhagalpur was studied in detail during June, 2006 to May, 2008.

MATERIALS AND METHODS

Light and dark bottle method was applied to evaluate the phytoplankton productivity with 24 hours incubation period (Gaarder and Gran, 1927). After the completion of incubation period, dissolve oxygen content was estimated and calculation were made (Ellis e*t al.*, 1948; W*o*od; 1975).

By totaling the value of water column, the phytoplankton productivity under one square meter of water surface was determined in mgC/m^2/day. For phytoplankton density, samples were collected at monthly intervals. Eighty liters of water was filtered through bolting silk net (No. XXX) having 173 meshes per linear inch and were fixed and preserved in 4% formalin and Lugol's solution. A micro transect method was used for counting the phytoplankton . (Lackey, 1938; Edmondson, 1974). Subsequently the individuals per liter of the pond water was calculated. (Welch 1948). Physico-chemical characteristics of pond water was estimated regularly at monthly interval by Trivedy and Goel (1986).

RESULTS AND DISCUSSION

The gross primary productivity values of River Ganga ranged between 0.87 to 2.13 gC/m^2/day during the entire period of two years investigation. Its maximum and minimum values were recorded in May, 2007 and in September, 2006 respectively Form June onward, its values started declining and reached minimum values of 0.87 gC/m^2/day in September. Further its value increased gradually, and attained first maxima of lower magnitude in November i.e. 1.41 gC/m^2/day. After a slight decrease in subsequent months again started enhancing and went on increasing until it attained second maxima of greater magnitude i.e. 2.13 gC/m^2/day in May. Bilgrami *et al., (*1979), Siddiqui e*t. al.* (1980). Saha e*t al.*, (1985) and Singh (1993) also observed maximum value of gross primary productivity in May and minimum during rainy season. In the next year, similar pattern of variation was

observed which showed bimodal pattern showing peaks twice in a year. Low values of GPP were noted during monsoon in the pond Rana e*t al., (*1995) also observed low values during rainy season. The net and gross ratio varied from 0.356 to 0.699 and the average value being 0.538. During monsoon season low value of net and gross ratios were noticed. The respiration as percentage of GPP varied from 30.06 to 74.25, average being 46.564%. Higher respiratory values noticed during rainy season along with lower net gross ration may be possibly attributed to the higher demand of oxygen for the decomposition of organic materials added to the system during monsoon which was of allochthonous as well as autochthonous origin, resulting in enhanced respiratory ratio and in turn low net gross ratio. Phytoplankton density varied from 1500-7500 units/litre, maximum being in the month of May and minimum in September. The trend of fluctuation in density was similar to that of gross primary productivity. Simple correlation analysis revealed some significant relationships. The gross primary productivity showed strongly positive correlation with phytoplankton density (r=0.752), transparency of pond water (r=0.804) and hydrogen ion concentration (r=0.499), but it showed positive and insignificant correlation with dissolved oxygen content (r=0.051). The GPP was inversely, correlated with nutrients such as with nitrate-nitrogen(r= -0.778), Phosphate-phosphorus(r= - 0.778) and silicate - silica (r= -0.693). Similar findings were also made by Singh (1980,1993) and Saha e*t al., (*1985).

Annual gross and net primary productivity of River Ganga were computed as 501.145 and 277.035 gC/m*2/yr.* respectively. Net primary productivity value indicated the eutrophic nature of River Ganga.

TABLE 1: PHYTOPLANKTON PRODUCTIVITY OF RIVER GANGA

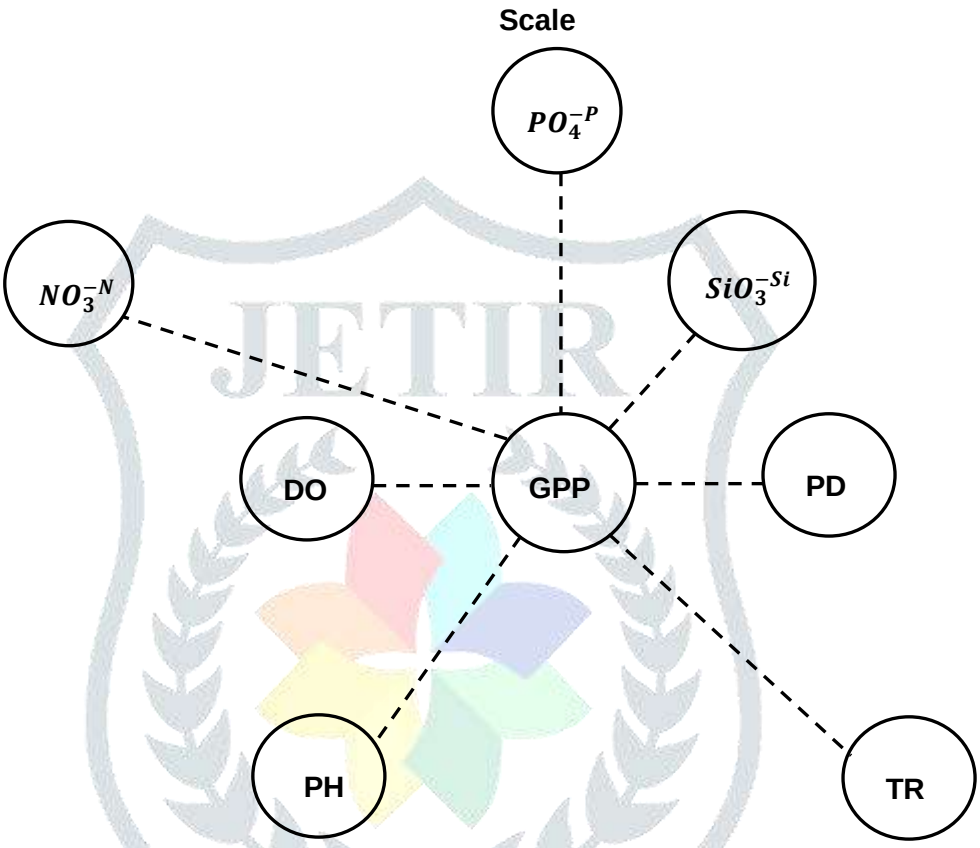
Month's	PHYTOPLANKTON Density (µ/l)	GPP	NPP	NP/GP	RESP	$\frac{Resp}{GPP} \times 100$
June (2006)	2100	1.47	0.93	0.632	0.54	36.75
July	2000	0.97	0.40	0.412	0.57	58.76
August	1857	0.89	0.36	0.404	0.53	59.55
September	1500	0.87	0.34	0.390	0.53	60.91
October	2000	1.01	0.36	0.356	0.75	74.25
November	3891	1.41	0.92	0.652	0.49	34.75
December	3500	1.25	0.87	0.696	0.35	30.40
January (2007)	4200	1.17	0.66	0.564	0.51	43.58
February	5130	1.43	1.00	0.699	0.43	30.06
March	6100	1.67	1.10	0.658	0.57	34.13
April	6700	1.91	1.12	0.586	0.79	41.36
May	7000	2.13	1.20	0.563	0.93	43.66
June	2000	1.93	0.78	0.404	1.15	59.55
July	1500	1.42	0.78	0.549	0.64	45.07
August	1560	1.10	0.65	0.509	0.54	49.09
September	1500	0.93	0.34	0.365	0.59	63.44
October	2000	1.05	0.47	0.447	0.58	55.23
November	4000	1.35	0.91	0.674	0.44	32.59
December	3700	1.20	0.69	0.575	0.51	42.50

January (2008)	3890	1.07	0.47	0.439	0.60	56.07
February	4700	1.25	0.66	0.528	0.59	47.20
March	6000	1.56	1.01	0.647	0.55	35.25
April	7000	1.88	1.09	0.579	0.79	42.02
May	7500	2.03	1.19	0.586	0.84	41.37
Average	3789	1.373	0.759	0.538	0.618	46.564
Maximum	7500	2.13	1.200	0.699	1.15	74.250
Minimum	1500	0.87	0.340	0.356	0.35	30.060

TABLE 2: PHYSICO-CHEMICAL CHARACTERISTIC OF RIVER GANGA

Month's	**Trasp. (cm)**	**Do (mg/l)**	**PH (ppm)**	No_3^{-N}**(mg/l)**	PO_4^{-P}**(mg/l)**	Sio_3^{-Si}**(ppm)**
June (2006)	50.40	5.52	7.00	2.03	0.81	26.10
July	33.00	5.49	6.70	2.47	0.97	28.27
August	32.00	5.53	6.50	2.47	1.00	29.00
September	30.00	5.49	6.20	2.10	1.00	29.13
October	30.00	5.40	6.20	2.10	1.01	29.13
November	36.00	5.81	8.40	1.50	0.27	20.73
December	45.00	5.85	8.50	1.60	0.92	21.64
January (2007)	45.00	5.87	8.60	1.50	0.90	21.20
February	45.00	6.00	8.80	1.20	0.87	21.10
March	46.00	5.89	8.90	1.12	0.72	19.25
April	48.00	5.72	8.90	1.00	0.65	17.36
May	50.30	5.42	8.40	1.00	2.53	16.45
June	49.70	5.60	7.00	1.40	0.92	24.45
July	38.00	5.58	6.48	2.30	1.20	27.90
August	30.00	5.51	6.51	2.41	1.20	28.00
September	29.00	5.00	6.34	2.42	1.20	28.43
October	30.00	5.41	6.31	2.42	1.13	26.00
November	32.00	5.68	8.40	1.89	1.00	21.12
December	38.00	5.89	8.80	1.79	1.00	19.71
January (2008)	43.30	6.71	8.90	1.58	1.00	19.71
February	45.00	6.54	8.60	1.47	0.82	19.00

March	46.20	6.00	8.50	1.30	0.74	18.38
April	50.80	5.93	8.50	1.10	0.61	17.39
May	50.00	5.53	8.40	1.00	0.55	17.04
Average	40.54	5.768	7.756	1.73	0.895	22.709
Maximum	50.80	6.71	8.90	2.47	1.20	29.13
Minimum	29.00	5.40	6.20	1.00	0.55	16.45



N.B.:

GPP	=	Gross Primary Productivity
DO	=	Dissolved Oxygen
PD	=	Phytoplankton Density
TR	=	Transparency
PH	=	Hydrogen Ion Concentration
NO_3^{-N}	=	Nitrate-Nitrogen
PO_4^{-P}	=	Phosphate-Phosphorous
SiO_3^{-si}	=	Silicate-Silica

…….... shows the negative correlation.
_____ shows the positive correlation

*** Figure showing (-) ve and (+) ve correlation with the different factors.**

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