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Study of Productivity, Benthos & Fishes of Baya River of District Samastipur, Bihar

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ABSTRACT

Productivity of Baya river water was studied with reference to net primary productivity (NPP), gross primary productivity (GPP) and community respiration (CR) on three ghats namely Bakhoba ghat, Telia ghat and Gopalpur ghat during the year 2008 and 2009. The mean of NPP and GPP was observed 0.108± 0.07 gc/m3/hr and 137±0.083 gc/m3/hr. respectively. Minimum productivity was observed in rain. The variation of productivity may be attributed by many other physico-chemical factors. Community respiration ranged from 0.008 to 0.072 in river during study which also showed bimodal pattern of fluctuation. Benthos of river Baya was examined regularly in three seasons. No abnormalities and uncommon fauna and flora observed during the study period.

Keywords: *Baya river, Productivity, physico-chemical factors.*

INTRODUCTION

In ecology, productivity or production refers to the rate of generation of biomass in an ecosystem. Productivity of autotrophs such as plants is called primary productivity, while that of heterotrophs such as animals is called secondary productivity. Limnological studies without the study of productivity does not make sense. Phytoplanktons constitute major segment of the primary producer in the aquatic ecosystem. Studies on the phytoplankton primary production in the fresh water ecosytems acquire special significance. The phytoplankton population density directly influences primary productivity of the ecosystems. Community respiration which is governed by all living organisms in the water ecosystem is one of the important parameter for productivity study. Effluents from different sources affect primary productivity in general. In the present study 'Gross Primary Productivity' (GPP), 'Net Primary Productivity' (NPP), 'Community Respiration' (CR) and ratio of 'Net and Gross Primary Production' were observed. Considerable works have been recorded on the phytoplanktonic primary production of the ponds and lakes (Khan and Siddiqui,1974; Nasar and Munshi,1975 and Kaul, 1977). However, there is a paucity of literature on the phytoplanktonic primary production of the riverine ecosystems. Some significant contributions in this field are those of Lin (1972), Bilgrami *et al*., (1985); Descy *et al.* (1987).

MATERIALS AND METHODS

For the investigation, productivity was calculated on the collection spot through light and dark bottle method as described by Gardner and Gran (1927).

Reagent used:

As per estimation of dissolved oxygen.

Procedure:

First of all initial oxygen concentration was estimated. Then water sample in two bottles (one covered with black paper and without it) were suspended in the water from where the samples were collected. The above bottle were exposed for one hour and then the oxygen concentration was estimated from both the bottle.

The net primary productivity, gross primary productivity and community respiration were calculated on the basis of the formula given below:

$$\text{(NPP) Net Primary Productivity } (O_2 \text{ mg/1hr}) = \frac{D1 - DL}{h}$$

$$\text{(GPP)Gross Primary Productivity } (O_2 \text{ mg/1hr}) = \frac{D1 - Dd}{h}$$

$$\text{(CR) Community Respiration } (O_2 \text{ mg/1hr}) = \frac{DL - Dd}{h}$$

Where, D1 = Dissolved Oxygen in initial bottle in mg/l
DL = Dissolved Oxygen in light bottle in mg/l
Dd = Dissolved oxygen in dark bottle in mg/l
h = Duration of exposure in hour

Benthos and Fishes:

The collection of organism both attached to or resting on the bottom sediments and burrowed into the sediments re benthos. In terms of size, benthos are generally divided into three categories namely microbenthos $\rightarrow$ the organisms that pass through a 0.5 millimeter sieve, macrobenthos $\rightarrow$ those that are caught by gmbs or dredges but retained on the 0.5 mm. sieve and epibenthos $\rightarrow$ those organisms that live on rater than in the riverbed. Local fishermen were used for calculating data regarding the fishes available in the Baya river at all three selected sites.

Statistical Analysis:

Data collected and tabulated in the tables were statistically analyzed. Such analysis have been made with reference to mean and standard deviation.

RESULTS AND DISCUSSION

The productivity of the river Baya was studied in three seasons of 2008 and 2009. Net primary productivity and gross primary productivity was observed as per the method given in the paper material and methods. Ratio of net productivity and gross productivity was calculated. Similarly community respiration and percentage of gross productivity was also computed. The results have been presented in the Table 1 to Table 3. Details of the observation have been explained under the flowing category. Average values of two years for each ghat have been calculated and used for data presentation.

Net Primary Productivity (NPP):

Average net primary productivity of river Baya was observed 0.108 ±0.07 gm/m3/hr considering all three observed ghat during 2008-09 (Table – 4). Maximum NPP was observed

0.199 gm/m3/hr at Bakhoba ghat in summers (Table – 1) and minimum NP was observed 0.030 gm/m3/hr in rain at Telia ghat. It is also evident from the same table that there is no significant variation among different ghats.

Gross Primary Productivity (GPP):

Average gross productivity of river Baya was observed 0.137±0.08 gm/m3/hr considering all three observed ghats during 2008-09(Table – 4). Maximum GPP was observed 0.267 gm/m3/hr at Bakhoba Ghat in summers (Table 1) and minimum GPP was observed 0.038 gm/m3/hr in rain at Telia ghat. It is also evident from the same table that there is no significant variation among different ghats.

Community Respiration (CR):

Average community respiration of river Baya was observed 0.030±0.02 gm/m3/hr considering all three observed ghats during 2008-09 (Table -4). Maximum CR was observed 0.072 gm/m3/hr at Bakhoba ghat in summer (Table – 1) and minimum GPP was observed 0.008 gm/m3/hr in rain at Telia ghat.

Fishes and Benthos:

Baya is a perennial river. Fish farming is not a common activity of this regions. But fishermen of local area used to capture fishes regularly. There is no standard method of farming/culture of fishes. Fishes observed during the period is given in Table 5. The data is collected from local market and from personal interview with local fishermen.

Benthos of the river was examined regularly in three seasons. No abnormalities and uncommon fauna and flora observed during the period. This is in accordance with the observation made by Kumar (2010).

Table 1
Average Primary Productivity at Bakhoba ghat

	Net Primary Productivity (NPP	Gross Primary Productivity (GPP)	NP/GP	Community Respiration	% of Gross Production
Summer	0.192	0.215	0.893	0.023	10.698
Rain	0.031	0.040	0.775	0.009	22.500
Winter	0.100	0.142	0.704	0.042	29.577

Table 2
Average Primary Productivity at Telia ghat

	Net Primary Productivity (NPP	Gross Primary Productivity (GPP)	NP/GP	Community Respiration	% of Gross Production
Summer	0.189	0.205	0.922	0.016	7.805
Rain	0.030	0.038	0.789	0.008	21.053
Winter	0.090	0.10	0.643	0.050	35.714

Table 3
Average Primary Productivity at Gopalpur ghat

	Net Primary Productivity (NPP	Gross Primary Productivity (GPP)	NP/GP	Community Respiration	% of Gross Production
Summer	0.195	0.267	0.730	0.072	26.966
Rain	0.033	0.044	0.750	0.011	25.000
Winter	0.110	0.145	0.759	0.035	24.138

Table 4
Mean productivity of river Baya during 2008-2009

	Net Primary Productivity (NPP	Gross Primary Productivity (GPP)	NP/GP	Community Respiration	% of Gross Production
Mean	0.108	0.137	0.774	0.030	22.606
Standard Deviation ±	0.070	0.083	0.087	0.022	8.738

Table 5
Common Fishes of river Baya

	Summer	Rainy	Winter
At Bakhoba, Telia and Gopalpur ghats	*Mystus senghaala*	*Mystus seenghala*	*Mystus seenghala*
	Labeo rohita	*Labeo rohita*	*Labeo rohita*
	Basari	*Catla catla*	*Basari*
		Basari	
		Mrigal	
		Wallago attu	

Seasonal variation in the Net Primary Productivity at all three observed ghats was studied (Table 1 to 3). Many workers have observed primary productivity of ponds, lakes and reservoirs (Yadav *et al*., 1987; Valecha and Bhatnagar 1989, Saha and Pandit 1990, and Patralekh, 1990). But less attention was given on riverine system (Bilgrami *et al*, 1979, Patralekh, 1990 and Prasad and Verma, 1988). The annual mean average of NPP and GPP was observed 0.108 and 0.137 gm/m3/h respectively (Table 4). Saha and Pandit (1990) found the NPP varying from 0.29 mgc/l/d to 1.13 mg/l/d and from 0.30 mg/l/d to 1.32 mg/l/d at the Kappa ghat and Barari ghat respectively of river Ganga at Bhagalpur, Prasad *et al.* (1998) estimated the NPP varying from 0.005 – 0.417 gc/m3/hr during 1987 and from 0.018-0.377 gc/m3/hr during 1988 in river Kareh. In the present investigation the NPP was found to vary from 0.030 gc/m3/hr with annual mean value 0.192 gc/m3/hr which is slightly lower than the value reported by Prasad and Verma (1998).

The productivity of the river Baya showed bimodal pattern as reported earlier by Saha and Pandit (1990). The value of NPP showed its primary peak during summer and a secondary peak of lower magnitude in winter. Similarly, the GPP exhibited its primary peak during summer and secondary in winter. Saha and Pandit (1990) found the primary peak in February at Kuppa ghat and in March at Barai ghat of river Ganga while Bilgrami *et al.*, (1979) and Singh and Singh (1985) have recorded the higher value of productivity during summer in river Ganga near Muzaffarpur. Prasad and Verma (1988) observed the maximum value of NPP and GPP in all the three seasons at different sites of river Gandak and Burhi

Gandak. In case of stagnant water system, the production was found maximum in different months/seasons of the year. Sreenivasan (1964) reported the highest production during December in Ayyangulum tank and during April in Amaravati reservoir. While working on three tropical ponds, Vijayraghawan (1971) reported the high production twice during the annual cycle (April and September) in Othakadai pond but only in April in Yanamalai pond. Yadav *et al.*,(1987) recorded the maximum production during April in Deghali Beel, Assam. Valecha and Bhatnagar (1989) reported the productivity peak April in first year and during August in second year of observation in the same eutrophic lake. The variation in the productivity is a common feature as observed by the various workers and similar the case was also observation in the present investigation. Minimum productivity was observed in the rain. The variation of productivity may be attributed to many other physico-chemical factors.

Community respiration in the present study ranged from 0.008 to 0.072 in the river. It also showed bimodal pattern of fluctuation. Saha and Pandit (1990) observed community respiration ranging from 0.30 to 0.95 mgc/l/d and 0.32 to 1.02 mgc/l/d at Kappaghat and Barari ghat respectively in river Ganga. Singh and Singh (1985) observed the variation between 0.10 to gc/m2/d in Ganga river. Prasad *et al*., (1988) found community respiration ranging from 0.10 to 0.082 gc/m3/hr during 1987 and 0.014 to 0.035 gc/m3/hr during 1988 in river Gandak from 0.011 to 0.12 gc/m3/hr during 1987 and 0.01 to 0.042 gc/m3/hr during 1988 in river Burhi Gandak.

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