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ASSESSMENT OF PRIMARY PRODUCTIVITY OF PHYTOPLANKTON OF GOGABIL LAKE WETLAND, KATIHAR, BIHAR, INDIA

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ABSTRACT

The Primary Productivity of phytoplankton of Gogabil Lake, Katihar has been assessed for two years from October, 2009 to September, 2011. The net and Gross Primary Productivity (GPP) was recorded with maximum value of 1.69 gC/m³/d and 2.53 gC/m³/d, while the minimum were 0.08 gC/m³/d and 0.42 gC/m³/d respectively. The community respiration ranged between 0.17 gC/m³/d to 1.18 gC/m³/d. The ratio of NPP and GPP fluctuated from 0.11 to 0.91. The P/R ratio was found to vary between 0.12 to 9.96. Net Primary Productivity (NPP) value and P/R ratio indicated eutrophic nature of Gogabil Lake.

KEY WORDS : Gogabil lake, Primary productivity, Phytoplankton.

INTRODUCTION

The photosynthetic fixation of carbon dioxide and its quantitative measurement is considered a vital index of the productive potential of any aquatic system. Productivity in a broad sense refers to a concept of organic matter synthesis potential which measures ability of an area to support a biological population and sustain a level of growth and respiration (Raymount, 1966). Primary Productivity of different lentic water bodies of North Bihar had been studied by Nasar and Dutta Munshi (1975); Saha *et al.*, (1985); Pandey *et al.*, (1995); Mandal (2002); Kumar and Singh (2006); Kumar and Choudhary (2007) and Sinha and Choudhary (2009). The present study was conducted to evaluate phytoplanktonic primary productivity of the Gogabil lake wetland. This wetland is perennial one and quite rich in aquatic biodiversity. We have noticed extensive agricultural practices around the wetland. The agro-chemicals from the crop fields are channelized to the wetland through run off. Fishing is common in the wetland and a large number of people from neighbouring villages depend for their livelihood on the wetland. The anthropogenic pressure in the bil area (nima, surapar, viryahi,

mujwar and haswar) is very high. Local inhabitants practice navigation, irrigation, collect fodders and fishing throughout the year in the bil areas (Kumar and Singh, 2001; Kumar, 2005). In addition, cattle grazing is common in catchment area of the lake. The present study on productivity of phytoplankton will help in formulating the Management plans for the wetland.

STUDY SITE

Gogabil Lake is located in Amadabad block area, 6 km. East of Manihari and about 19 km. South-East to district headquarter of Katihar. It lies in between 25°22.52 63 N and 87°41'21.63 E. The total water spread area of the bil is about 59.32 km². The area of bil which remains submerged throughout the year is about 19.68 km².

MATERIALS AND METHODS

The primary productivity was determined at monthly intervals for the period of two years (October, 2009 to September, 2011), by Light and Dark Bottle' method of Gaarder and Gran (1927). The dissolved oxygen content of the initial bottles

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were determined immediately after collecting the water samples following the modified Winkler's method (APHA, 2005). Two sets of light and dark bottles (250 mL) filled with water were suspended at the depth of 10 cm. below the water surface for 4 hours (8.00 – 12.00 h.). After the incubation period of 4 hours, the suspended bottles were removed and dissolved oxygen content in each bottle was determined. Oxygen values produced due to photosynthesis were converted into carbon by Wood's (1975).

RESULTS AND DISCUSSION

Monthly values of productivity (October, 2009 to September, 2011) in the Gogabil Lake are given in Fig.1. The value of gross primary production (GPP) of phytoplankton ranged in between $0.42 \text{ gC/m}^3/\text{d}$ and $2.02 \text{ gC/m}^3/\text{d}$, during the first year and in between $0.59 \text{ gC/m}^3/\text{d}$ and $2.53 \text{ gC/m}^3/\text{d}$ during the second year of investigation. High gross production was recorded during May (summer) and the value was low in March (late winter). The highest rate of productivity during summer may be due to sunshine with high temperature, high phytoplankton density and algal blooms. The winter lows could be attributed to the reduced photoperiod coupled with low light intensity, temperature and scarce phytoplankton (Chinnaiah and Madhu, 2010). Similar to the observations of Singh (1993), Hari Krishnan and Aziz Abdul (2000) and Kumar

and Singh (2006), the present study revealed distinct seasonal and bimodal pattern of variation in the GPP value, having winter and summer peaks.

The net primary production of phytoplankton varied from $0.08 \text{ gC/m}^3/\text{d}$ to $0.84 \text{ gC/m}^3/\text{d}$ and from $0.17 \text{ gC/m}^3/\text{d}$ to $1.69 \text{ gC/m}^3/\text{d}$ during the first and second year of investigations respectively. NPP value showed the same seasonal and bimodal pattern of variations as shown by GPP values, i.e. maxima attained during May and minima in November-December. The NPP had direct relationship with the temperature in the present study. Similar findings were made by Kumar and Choudhary (2007).

The community respiration of phytoplankton ranged in between $0.17 \text{ gC/m}^3/\text{d}$ and $1.18 \text{ gC/m}^3/\text{d}$ during the first and second year of investigation. The higher values were observed in August and January where as lower values in the months of April, July and October. The community respiration exhibited a significant annual variation in Gogabil Lake and that is in bimodal pattern in conformity (Kund, 1992). So, this investigation reveals that lake is an eutrophic lake.

The value of respiration as per cent of GPP varied from 16.83 to 89.47 during first year and 9.14 to 82.18 during second year. The higher values were observed in November whereas lower values in the month of July. Lower value was recorded during rainy season, whereas higher value of respiration as percent of gross production was recorded in winter season. Higher value of respiration as percent of gross production was possibly because of high microbial population (Sinha and Choudhary, 2009).

The net and gross ratio ranged from 0.11 to 0.83 during the first year while in the second year, it varied from 0.17 to 0.91. The value of net : gross ratio was less than unity in all the months of investigation and that revealed that respiration exceeded production. This suggested that the wetland under study was not healthy. Higher net : gross ratio during summers and early winters were perhaps due to higher net primary productivity during these periods. Similar finding were made by Qasim *et al.*, (1969), Hari Krishnan and Aziz Abdul (2000) and Kumar and Singh (2006).

The ratio of net primary production to respiration (P/R ratio) was found to vary from 0.12 to 4.93 during the first year of investigation while in the second year; it varied from 0.21 to 9.96. It is an important functional index of relative maturity of the system. The P/R ratio shows the wetland may be

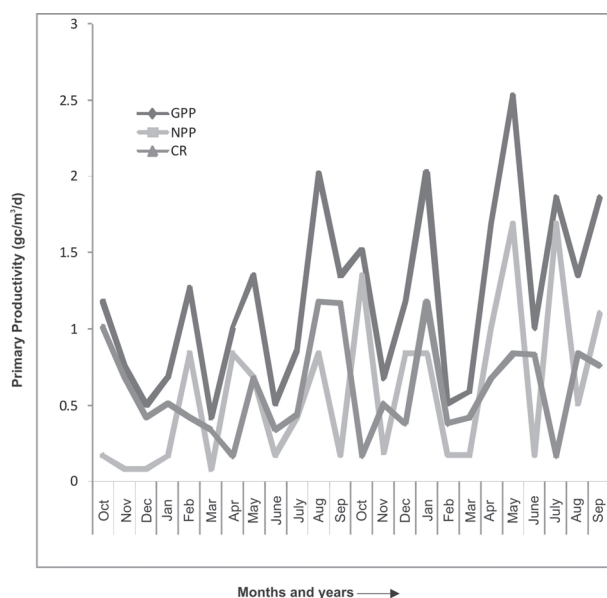


Fig. 1. Productivity of Phytoplankton of Gogabil lake wetland, Katihar (2009-11).

autotrophic in terms of Odum (1969).

From the net primary productivity value, net : gross ratio and P/R ratio obtained in the present study, it may be suggested that the Gogabil lake wetland is progressing towards eutrophication, and it needs immediate remedial measures as the wetland is the source of livelihood for thousands of local people, and is important for floral and faunal diversity.

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