

SEASONAL VARIATION IN PRIMARY PRODUCTIVITY OF MUKTAPUR OXBOW LAKE, SAMASTIPUR, BIHAR, INDIA

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ABSTRACT

Primary production refers to the formation rate of organic matter by the phytoplankton, in which the amount of phytoplankton presents at any one time in a unit volume of water. Primary productivity of a large lentic water body named Muktapurmaun (oxbow lake) situated at Samastipur district of Bihar have been studied during the period from July, 2010 to June 2012. The Muktapurmaun is having 60 hectare area with an average water depth one meter. Estimation of gross primary productivity and net primary productivity were made in different seasons viz. pre-monsoon, monsoon, post-monsoon and summer. In the present study, highest productivity was observed during post-monsoon and lowest in summer season. An average production of organic carbon in above maun is about 115.68 tons per year.

Keywords: Primary productivity, Muktapurmaun, Lentic water, Seasonal variation

No. of Figures: 2

No. of References: 17

INTRODUCTION

Oxbow lakes are important attribute of the Earth's landscape by shifting of river courses which are not only the source of precious water, but provide valuable habitats to different flora and fauna, relationship between species richness and productivity, reasonable hydrological cycles, influence microclimate, enhance the aesthetic beauty of the landscape and extend many recreational prospects to humankind. These lakes are often categorized based on the enormity of area, phytoplankton production in the different water column. Generally aquatic ecosystems often have multiple carbon resource at their base. For example, higher trophic level production in small streams is supported by terrestrial carbon inputs and in-stream benthic algal production (Vannote *et al.*, 1980; Wallace *et al.*, 1997; Finley, 2001), lake food-webs are supported by phytoplankton, benthic algae and terrestrial inputs (Cole *et al.*, 2006). During the last century many shallow lakes in the several regions of the world have been subjected to eutrophication (Scheffer, 1998). The idea that ecosystem primary production determines the productivity of higher trophic levels is deeply rooted in efforts to measure ecosystem metabolism (Lindeman 1942).

The primary productivity of an ecosystem is defined as the rate at which radiant energy is stored in photosynthesis by producer organisms into the organic substances, which are used as food material at different trophic levels (Alomand Zaman, 2005). The total amount of organic matter produced is gross production and the amount of organic matter that remains after respiration is the net production. The determination of primary

production in lakes, besides giving information on the magnitude of organic production has its practical consideration. Increasing the production of phytoplankton may reflect the healthiness of ecosystem. Variation in primary productivity among lakes and among years is major consideration linked to fluctuations at higher trophic levels for tropical and subtropical ecosystem of the world (Wetzel, 1983). The present work provides an estimate of primary production in the plankton community of Muktapur oxbow lake and attempts to observe the identify the factors controlling production. Controlling factors are evaluated on the basis of concurrent seasonal variation data and plankton census. There are several works carried in different aquatic habitat related to primary productivity (Khondkerand Kabir, 1995; Goldman *et al.*, 1989; Dodson *et al.*, 2000; Alomand Zaman, 2005).

MATERIAL AND METHODS

Muktapur oxbow lake is located in the Northern India on Samastipur district of Bihar, about 5 km away from Samastipur railway station. There is a possibility of origin of this oxbow lake by shifting of BudhiGandak river course. Locally this oxbow lake is known as Muktapurmaun. The principal features of the maun are horse shoe shaped, maximum depth 4.5 m, mean depth 1m and an area 60 hectare. During current study primary production of maun were estimated in different seasons *viz.* pre-monsoon (April-June), monsoon (July-September), post-monsoon (October-December) and summer (January-

March). The primary production in aquatic environment is measured most accurately by techniques that monitor the flux of metabolically labile molecules, especially oxygen and carbon dioxide. During present course of study primary productivity was measured by following light and dark bottle method (Gaarder and Gran, 1927) with an incubation period of two hours. Random sampling was made fortnightly and midday was fixed for the collection of data. The water samples were collected in two ground stoppered leak proof bottles. One of which was transparent treated as light bottle and the remaining one was dark bottle, which was black painted and waxed to exclude the light for each sampling. The initial dissolved oxygen of water was immediately determined by Winkler's method (Welch, 1948). Much care was taken to ensure that the water should not be agitated much. The light and dark bottles were attached with a metal stand at the same level, so that when the bottles were immersed, they placed in water at the same depth. The metal stand was held firmly in water with its lower end stack in the bottom. The bottles were taken out from water after two hours and their dissolved oxygen was estimated. After estimation of dissolved oxygen the following formula were used for the calculation of primary production i.e. gross

primary productivity (GPP) and net primary productivity (NPP).

$$GPP = \frac{LB-DB}{\text{Time duration}} \times F$$

$$NPP = \frac{LB-DB}{\text{Time duration}} \times F$$

Where,

LB = Dissolved oxygen in light bottle

DB = Dissolved oxygen in dark bottle

F = ratio of molecular carbon and oxygen

All the oxygen value were converted to carbon values by multiplying with factor (F) 0.375 (Lind,1974) and the values were expressed in milligram of carbon per liter per hour (mgC/L/h).

RESULT AND DISCUSSION

Muktapurmaun is shallow lake and therefore, the littoral community does not intrude noticeably upon the plankton community, which is quantitatively of much greater importance in determining the overall primary production of the lake. In the present study, it was observed that the gross primary production was high during post monsoon in the both the year followed by summer, monsoon and premonsoon (Figure 1).

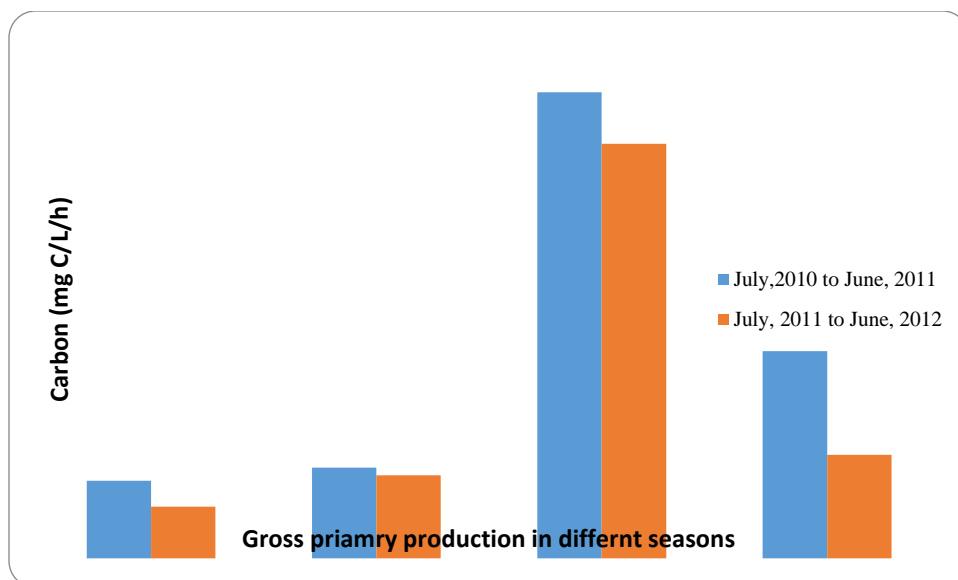


Fig1: Showing the gross primary production in Muktapurmaun

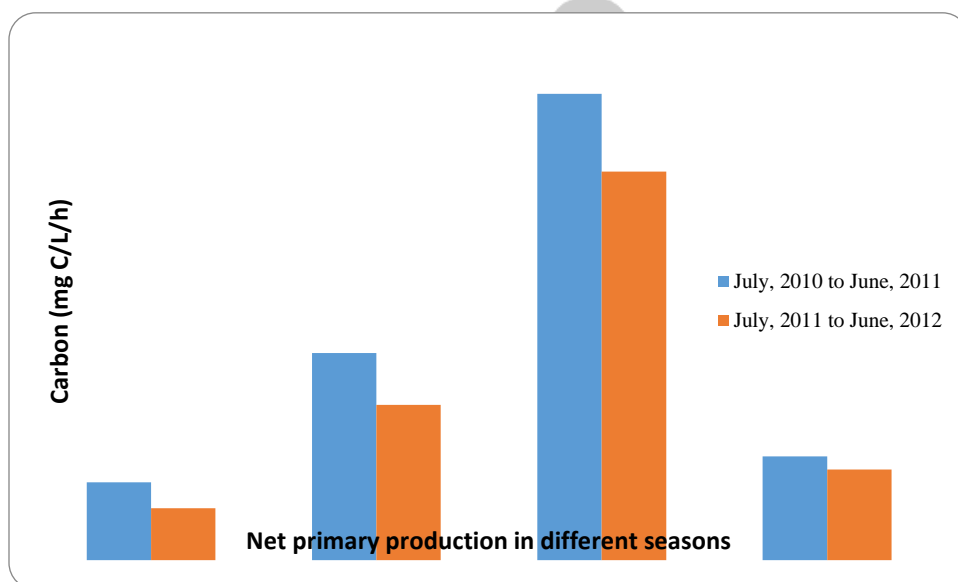


Fig2: Showing the net primary production of Muktapurmaun

The net primary production was also high during post monsoon (Figure 2). The slight decline in primary production was observed during second year, it might be due to climatic and hydrological regimes are likely to affect shallow lake communities differently in warmer regions (Jeppesen *et al.*, 2003). Zooplankton predation also features in the phytoplankton functional model

(Reynolds *et al.*, 2002). The data were analyzed using the MS-excel 2007 and observed that correlation coefficient of gross primary production between all seasons and in the both year were perfect. Similarly the net primary productivity were also analyzed and found that the correlation coefficient between all the seasons in both the years were perfect. Seasonal variation between

gross

primary production (GPP) is shown in figure 1 and net primary productivity is shown in figure 2. The total average gross production was 225.23 tons. During present study 140.16 tons carbon were used for respiration and net production was 115.68 tons organic carbon per year. Similar observation was obtained by Kobia (1982), Kumar(1991).

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CONCLUSION

Primary production refers to the formation rate of organic matter by the phytoplankton, in which the amount of phytoplankton presents at any one time in a unit volume of water. Primary productivity of a large lentic water body named Muktapurmaun (oxbow lake) situated at Samastipur district of Bihar will give the detailed account to help in management of this water body for the fish culture activity.

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