



RESEARCH ARTICLE

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### Studies on the Primary Productivity of a Tropical Pond

Vinay Kumar

Deptt. of Zoology, D.S. College, Aligarh- 202001 (U.P.)

Email: vinay\_join@yahoo.com

#### ABSTRACT

*Present study has been carried out to study the status of primary productivity of a pond. This pond receives domestic sewage and effluents from local industries. Productivity was determined by using standard 'Light and Dark bottle' method of Garden and Gran (1927). Primary productivity values were found high indicating its eutrophic nature.*

**Key words:** Primary productivity, GPP, NPP, CR.

#### INTRODUCTION:

Plants and autotrophic organisms synthesize their own food by means of photosynthetic activities in presence of sunlight. Primary productivity is the rate at which the sun's radiant energy is stored by photosynthetic activities of producers in the form of organic substances (Odum, 1971). Primary production studies are very important to understand the effect of pollution on system's efficiency. Estimation of primary productivity is essential to understand food chain and food web, water quality and pollution study. The primary productivity of a water body is adversely affected by anthropogenic activities. Several workers have studied the primary productivity of fresh water bodies. Kaur et al., (1996), Jain et al., 1997; Sharma et al., (2001); Sultan et al., (2003); Rani et al., (2004); Umavathi et al., (2007), Fatima et al., (2011); Koli et al., (2011).

Present study has been undertaken to study the primary productivity of a pond in Aligarh city. This pond receives water from domestic discharges and rain water which accumulates during rainy season. City sewage and effluents from some small industries also accumulate in this water body.

#### MATERIAL AND METHODS:

The pond under study, Kalidah is a small (1.5-2.0 hectare) perennial water body located in Aligarh city. The study was carried out during Nov. 2005 to Oct. 2006. Water samples were collected from a selected station during morning time every month and brought to the laboratory for analysis. The initial dissolved oxygen and the dissolved oxygen in light and dark bottles were determined by using modified Winkler's method (Trivedi, *et al.* 1998). The observed Gross primary productivity (GPP), Net primary productivity (NPP) and Community Respiration (CR) in mg/l/hr were converted into gC/m<sup>3</sup>/h by multiplying these values with a factor of 0.375 as suggested by Benton A.H. et al (1972).

#### RESULTS AND DISCUSSION:

Results of primary productivity (GPP, NPP and C R) are given in Table-1. The gross primary productivity (GPP) varied from 0.132 gC/m<sup>3</sup>/h to 0.145 gC/m<sup>3</sup>/h. Maximum (0.145 gC/m<sup>3</sup>/h) GPP was recorded in May, 06 and minimum (0.132 gC/m<sup>3</sup>/h) in Feb, 06. The gross primary productivity showed two peaks; the first in April and second in May. This shows a definite trend of variation in productivity values.

Gross primary productivity is the total rate of photosynthesis including the organic matter utilizes in respiration during the period of measurement. Net primary productivity

is the rate of storage of organic matter in plant tissues in the excess of the respiratory use by plants during the measurement period. High productivity indicates the pollution and eutrophication of water bodies. Net primary productivity (NPP) values ranged from 0.064 gC/m<sup>3</sup>/h to 0.190 gC/m<sup>3</sup>/h. NPP values follows similar pattern as GPP. Community respiration means deducting the net primary productivity from gross primary productivity and converted into carbon dioxide release. Community respiration (CR) values ranged from 0.063 gC/m<sup>3</sup>/h to 0.145 gC/m<sup>3</sup>/h. CR values also follows similar pattern as GPP and NPP. Higher values of planktonic community respiration in summer months may be due to the effect of sewage water and effluents from local industries coming into pond that enhance the biological activities of microbes especially in summer due to decomposition of organic matter.

**Table 1:** Productivity and Planktonic Community Respiration in Pond

Months	GPP*	NPP*	CR*
Nov.05	0.243	0.160	0.083
Dec.	0.236	0.143	0.093
Jan.06	0.162	0.098	0.063
Feb.	0.145	0.064	0.081
Mar.	0.174	0.092	0.082
Apr.	0.295	0.168	0.126
May	0.312	0.190	0.122
Jun.	0.245	0.097	0.145
July	0.244	0.110	0.134
Aug.	0.274	0.142	0.132
Sept.	0.246	0.175	0.071
Oct.	0.248	0.164	0.081

\*gC/m<sup>3</sup>/h.

The important factors affecting primary productivity besides producer population are light, temperature, and concentration of essential nutrients. In a fresh water body, decline in the productivity in rainy months could be because of dilution of water and subsequent reduction in the phytoplankton population and cloudy weather. Sultan, *et al.*, (2003) reported that temperature, solar radiation and available nutrients may be important limiting factors for primary production and contributing to seasonal variation in any aquatic ecosystem.

Hujare and Mule 2007 have reported lower productivity in rainy season and higher in summer, of two perennial tanks near Kohlapur. The higher productivity was observed in summer, indicating no direct relationship between temperature and productivity. Baburao, *et al.*, (1981) reported winter break in the Wagholi pond, Pune. Hujare and Mule (2001) reported summer and winter peaks in Vadegon reservoir. Koli, *et al.*, (2011) reported three peaks in GPP in Ana sagar lake, Ajmer.

Present study indicates highly polluted state of this water body. Due to accumulation of sewage and effluents, water quality has become very poor and not fit for human consumption.

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