



## Seasonal Variation in Primary Productivity of Patil Lake of Tahsil South Solapur, Maharashtra.

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## ABSTRACT

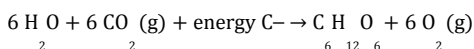
The present study emphasizes to measure Gross productivity, Net productivity and community respiration of Patil lake during May 2015 to April 2016. The aim was to evaluate the productivity and impact of seasonal variation on primary productivity of water. Patil Lake does not showed much variation in between site I and site II throughout the study period. Assessment of gross productivity is necessary for healthy ecosystem which is measure the biomass. Our data were in agreement with previous determinations of a particular season. The higher GPP and NPP was in summer season and post monsoon season but it was very poor in month of April and May due to over evaporation of surface water. Lower GPP and NPP were during winter season. CR was higher in the month of October while it followed similar trend in whole year. Variation in GPP, NPP and CR were clearly noticeable due to environmental changes as well as disturbing in nutrient value and other anthropogenic activity.

## KEYWORDS

Freshwater, primary productivity, eutrophic

## INTRODUCTION

Limnology of aquatic ecosystem is highly focused on study of both biotic and abiotic factor of water body similarly it is important to know about primary productivity. With the help of organic and inorganic components, organism produces energy is nothing but the primary productivity. Oxygen molecule plays a vital role in production of energy by the process of photosynthesis. Autotrophic organisms in water like algae, bacteria, phytoplankton and macrophytes carry the process of photosynthesis or chemosynthesis. The concentration of oxygen in water can be affected by many physical and biological factors. Respiration by plants and animals reduces oxygen concentrations, while the photosynthetic activity of plants increases it. In photosynthesis, carbon is assimilated into the biosphere and oxygen is made available, as follows:



The rate of assimilation of carbon in water depends on the category and quantity of plants inside the water. Primary productivity is determining the rate of carbon assimilation. As the above chemical reaction indicates, the production of oxygen can be used to examine the primary productivity of an aquatic ecosystem. The primary production by phytoplankton in eutrophic zone of aquatic ecosystem refers to maximum utilization of photosynthetically active radiation by the photoautotroph's present in the illuminated water column (Odum, 1971, Dodds, 2006). The difference between phototrophic and heterotrophic activities, performed by organisms which may struggle for common nutrients such as N and P (Currie and Kalf 1984; Laws et al. 1985) may be considered too great to allow inclusion of both within the same tropic level.

Primary productivity of an aquatic ecosystem varies seasonally throughout the year. Nitrogen and phosphate into aquatic environment are drastically affected on production of energy. Human activities, such as use of fertilizers in agriculture fields near water resources and industrial, domestic sewage effluents leads to disturb the aquatic ecosystem or it may lead to eutrophication. Patil lake is situated in South Solapur tahsil region near Boramani village. The water from Patil lake is useful for domestic as well as

agriculture purpose. People in and around the lake are totally depends on this fresh water resource. As the population explosion take place, very fewer efforts have been made for protection and conservation of this lake. Present investigation is applicable for monitor the water quality of lake and in order to collect vital information for future reference.

## MATERIAL AND METHODS

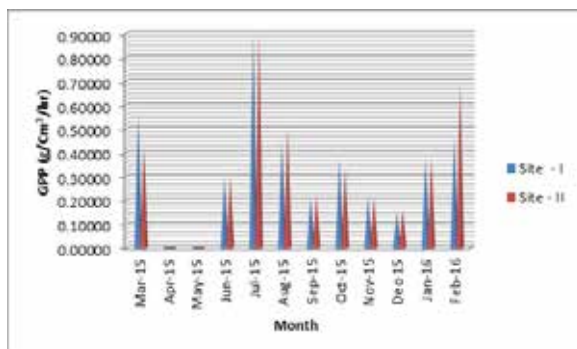
Patil lake is located in the village Boramani in South Solapur tahsil region. The lake is close to Pune - Hyderabad N.H No.09. Their geographical location is 17° 44'51"N- 76° 1'40"E. Water collection for primary productivity investigation from the Patil Lake was done during the year May 2015 – April 2016 from two study site in morning time on fixed day.

Primary productivity was measured by using the oxygen light and dark bottle technique (Gaarder and Gran, 1927). In this method, a sample of water is placed into two bottles. One bottle is stored in the dark and the other in a lighted area. The time exposure (incubation period) in the present study was for the period of 4.00 hours. The initial DO (Dissolved Oxygen) was determined using the sample from third bottle. The DO was determined after incubation in light and dark bottle. GPP and NPP is measured in gm<sup>3</sup>/hr.

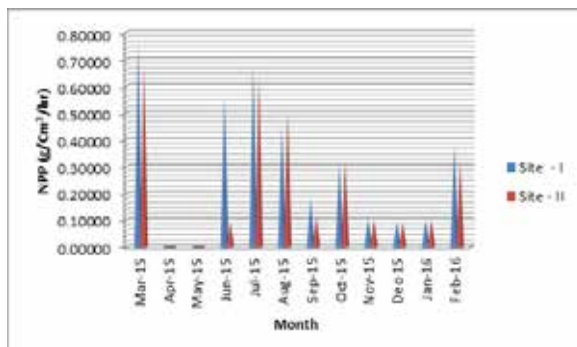
## RESULTS AND DISCUSSION

Gross primary productivity (GPP) is the amount of chemical energy as biomass that primary producer create in given time-span. With the help of produced energy autotrophic organisms do the respiration and maintain their all metabolic process. The remaining fixed energy is referred to as net primary productivity (NPP). Net primary production is useful for the growth of primary producer as well as herbivores animals (<http://en.m.wikipedia.org/wiki/primaryproductivity>). Community respiration (CR) is organic material to CO play a vital role in aquatic ecosystem (Wilson et al., 2014).<sup>2</sup> The following graphs shows variation in GPP, NPP and CR from two different sites during May 2015 to April 2016:

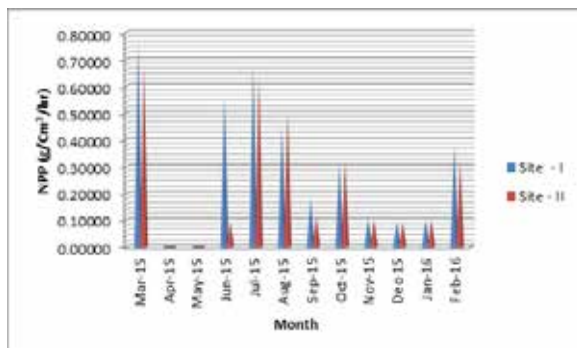
### Graph of GPP during May 2015 to April 2016



### Graph of NPP during May 2015 to April 2016



### Graph of CR during May 2015 to April 2016



In the present study the value's of GPP, NPP and CR are very poor at both the sites of lake in the month of April and May 2015; it may be due to the higher temperature during summer season where surface water evaporates in large amount and eutrophication of lake takes place.. Similar observation was done by Boyce et al. 2010. Higher value of GPP was noticed in the month of July 2015 at both site I and site II. The agriculture runoff from adjacent region of lake ultimately increases the nutrients like nitrate and phosphate. These nutrients are indirectly assist in growth of algae, bacteria, phytoplankton which carries the process of photosynthesis, because of its productivity rate was increases. Shukla and Pawar (2001) found highest productivity value in month of June. During early summer season in month of February 2015 GPP was higher at site II while at site I GPP was relatively higher in month of February and March 2015. Lower GPP was observed in pre monsoon season in month of November and December 2015. Sultan et al., (2003), stated that the temperature, solar radiation and nutrients present in water are the important factors for primary productivity as well as seasonal variation in aquatic ecosystem also contributing the changes in these factors.

Higher NPP was noticed at both sites in month of March 2015 which follow in month of July and August 2015 respectively. At site I more NPP was analyzed in the month of March,

June and July 2015 as in camper with at site II. Similar observation was done by Koli and Ranga (2011). NPP value is not only depends on autotrophic organism in water but also on heterotrophic organisms present in it. According to Gupta and Shaikh (2013) NPP is nothing but the rate of energy which transfer into next trophic level of food chain and they were also observed that minimum value of NPP during pre monsoon season while maximum during post monsoon season. The nutrients in the water body increases may be due to bacterial decomposition during summer season which also leads to increasing the NPP. Jhingran (1991) was reported that phosphate is one of the major nutrients for productivity and it increases in aquatic body due agricultural runoff from surrounding crop field during pre monsoon season.

Overall CR value was lower throughout the study period at both the sites of Patil lake. Higher CR value was noticed in month of October and as compare to site II, site I showed maximum CR value. It was may be due to evaporation of surface water by October heat and water level is lower during post monsoon season. Community Respiration is depends on the value of productivity and organisms which live in water body as well as it was drastically affected by environmental changes like temperature. Chattopadhyay and Banerjee (2008) was analysed that community respiration and water temperature has linear and insignificant relationship which was contrast finding with Talling and Lemalle (1998). According to Gronff and Horne (1975) respiration as percent of gross production may be as a eutropic nature of water body.

### CONCLUSION

The present information can be concluded that Patil Lake showed variation in primary productivity throughout the study period. Primary productivity was integrated not only by seasonal variation but also nutrient content, eutrophication, stratification and agricultural runoff, domestic and industrial effluent similarly anthropogenic activities. In the month of April and May evaporation and precipitation of Patil lake did not produced energy which causes eutrophication of lake during summer season while in month of February and March increased GPP and NPP by peak photosynthetic activity. Seasonal variation in primary productivity indicated that Patil lake was found to be slightly eutrophic in nature. In order to maintain the lake co-ordination effort is required from the people and government and non government organizations. It is necessary to increase the depth of Patil lake to sustain water level in proper manner.

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