

Seasonal Variation in Primary Productivity of Freshwater Reservoirs of Yadgir District, Karnataka, India

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Abstract— Primary productivity provides information regarding to the amount of energy available to support biological component of aquatic ecosystem. The present investigation is aimed to understand the status of primary productivity of freshwater reservoir namely, Mailapur reservoir of Yadgir district. The primary productivity has been determined by using standard 'Light and Dark bottle' method of Garden and Gran (1927) at an interval of fortnight in every month a period of one year i.e 2014-15. The study results reveals that Primary productivity of Mailapur reservoir high and it support better growth biotic components like zooplanktons etc.

Keywords— Gross primary productivity, Net primary productivity Mailapur reservoir.

I. INTRODUCTION

The flow of energy in any kind of ecosystem must begin by the complex biological process of trapping of solar energy by primary producers and other creatures so called autotrophic organisms. Through photosynthetic process the primary producers are able to store the food material which is known as primary production and the rate of this energy accumulates is known to be primary productivity. Among the accumulate energy, the producers are utilize the some part of energy therefore the total energy is not available for the food web (Mitsch and Gosselink, 1993).

The understanding of food web and food chain can be possible by the estimation of primary productivity (Chinnaiah et al., 2010), physico-chemical characteristics of water (Wetzel, 2000) and level of pollution by natural and manmade (Prabhakar et al., 2000). The interference of anthropogenic activity is major cause for decreases or affects the production of primary productivity of the aquatic ecosystem. According to Odum and Barrett (Odum and Barrett, 2008) explained the primary productivity is rate of

conversion of solar energy into the organic matter by the process of photosynthetic activity and chemosynthetic activity by the biological component of the ecosystem. The major organic producers of the earth are fragile aquatic ecosystems. Several environmental biologist and particularly ecologists from across the globe have laid emphasis on the role and significance of the primary productivity as a vital functional attribute of the biosphere (Westlake, 1963). Studies on Primary productivity of many aquatic ecosystems have been reported by earlier workers from world (Chinnaiah et al., 2010; Joseph K, Shanthi 2010; Patil A, Chavan 2010; Vasanthkumar and Kumar(2011)). The present study has been undertaken to analyze the seasonal variations of Primary productivity in Mailapur reservoir.

II. MATERIALS AND METHODS

2.1 Study area: - Mailapur is located in Yadgir the reservoir was extensively used for irrigation and aquaculture purposes. The primary productivity is determined by using standard "light and dark bottle" method of (Gardner T, Gran (1923) at an interval of fortnight in every month for a period of one year i.e October 2014 to September 2015. The method of (Gardner T, Gran (1923) is slightly modified by Vollenweider (1974) and Wetzel and Linkens (2000) to make it more suitable. The time of exposure (incubation period) in the present study was for the period of 2 hours. The dissolved oxygen is estimated by initial bottle and light and dark bottle method of Winkler (Wetzel and Linkens, 2000). The observed Gross Primary Productivity (GPP), Net Primary Productivity (NPP) and Community Respiration (CR) in mg/l/hr were converted into gC/m³/hr by multiplying these values with a factor of 0.375 as by Benton AH [3] et al. The Gross Primary Productivity (GPP), Net Primary Productivity (NPE) and Community

Respiration (CR) were estimated by using following formulae of 9(Westlake, 1963). NPE and Respiration (% of GPP) were calculated by using formulae of Chattopadhyay and Banerjee (2008) with the help of GPP, NPP and CR.

III. RESULTS

In the present study primary productivity of Mailapur reservoir has been determined. Seasonal record of Primary productivity recorded as Gross primary productivity, Net primary productivity, Community respiration, Net production efficiency and respiration (% of GPP) in Mailapur during October 2014 to September 2015 is depicted in Table 1.

Table.1: Seasonal record of Primary Productivity of Mailapur reservoir during October 2014 to September 2015.

Parameters	Northeast monsoon	Summer season	Southwest monsoon
GPP (gCm ³ /hr)	2.12±1.02	2.35±0.95	0.69±0.12
NPP (gCm ³ /hr)	1.98±1.02	1.88±0.91	0.64±0.10
CR (gCm ³ /hr)	0.14±0.04	0.30±0.11	0.06±0.02
NPE (%)	99.38±0.63	91.26±2.36	94.23±2.14
RESP (% of GPP)	1.05±0.76	1.87±0.20	2.98±1.02

GPP= Gross Primary Productivity, NPP= Net Primary Productivity, CR= Community Respiration, NPE= Net Production Efficiency, RESP = Respiration.

Gross Primary Productivity (gC/m³/hr): Seasonal variation of Gross primary productivity in Mailapur reservoir showed lower in southwest monsoon (0.69±0.12) and higher in summer season (2.35±0.95) respectively.

Net Primary Productivity (gC/m³/hr): Seasonal fluctuation at Mailapur reservoir showed low rate of production in southwest monsoon season (0.64±0.10) and higher in northeast monsoon season (1.88±0.91) respectively.

Community Respiration (gC/m³/hr): Seasonal variation at Mailapur reservoir showed lower values were in monsoon (0.06±0.02) and higher values in winter season (0.30±0.11) respectively.

Net Production Efficiency (%): Seasonal changes at Mailapur reservoir exhibited minimum values in summer season (91.26±2.36) and higher in northeast monsoon season (99.38±0.63) respectively.

Respiration (% of GPP): Seasonal record in Mailapur reservoir showed minimum in northeast monsoon (1.05±0.79) and maximum values in monsoon season (2.98±1.02) respectively.

IV. DISCUSSION

Gross and Net primary productivity:

Gross primary productivity is considered to be total photosynthetic activity or total assimilation of the any ecosystem. Net primary productivity or net assimilation is measurement of the rate of storage of organic material in the tissues of primary producers of the ecosystem after utilization of respiratory activity of the primary producers. or net assimilation. Seasonal variations of GPP is minimized during monsoon in the reservoir and increased during the summer season of the study period. Mitsch and Gosselink (1993) were reported that, the increase trend in the GPP of the aquatic ecosystem from northeast monsoon season to summer seasons and the GPP rate will be decreased during monsoon season. The higher values of GPP during the summer season may be availability and utilization of solar radiation leads to the high biomass of phytoplankton and algal blooms. The lower values of GPP in monsoon season may be due to the minimum photoperiod of the seasons with low solar radiation, temperature coupled with less abundance of number phytoplankton. Mitsch and Gosselink (1993) were studied on different aquatic ecosystems and reported that, high values of GPP during summer season may be due to high assimilation of solar energy, while minimum production of GPP during monsoon season because of the inflow of more rainwater with high amount of turbidity in to the reservoir. Prabhakar *et al.*, (2009) were worked on reservoir at Pune and reported that, the GPP higher in northeast monsoon season and lower in southwest monsoon season. Clean water may permit more light to penetrate which in turn promote the higher values of GPP during northeast monsoon season. In other hand adding of more amounts of nutrients along with runoff water during monsoon season and later phase of northeast monsoon the water will be more clear water responsible for high production of GPP. The minimum rates of GPP production during the southwest monsoon season may be due to high amount of suspended particles present in the water.

Radwan (2005), also reported similar results while working with lakes of Uttarakhand state that, more abundance of phytoplankton are responsible for more production of GPP and lower density of phytoplankton showed less GPP production. Similar observations were made in the present study, that low phytoplankton density, nutrient status and are responsible for low primary productivity in the southwest monsoon season and high GPP production during summer season could be coupled with high population of phytoplankton, maximum nutrient budget due to inflow of runoff water from the surrounding area resulting in high GPP productivity. Similar results are also observed by Anjinappa (2002) and Das (2002).

Community respiration (CR): community respiration is defined as reduction of NPP from GPP and later converted into releasing of CO₂. The study results indicate that, Community respiration of the reservoir is low during the southwest monsoon, while high values were obtained during northeast monsoon season and in summer season respectively. The high community respiration of all biotic and abiotic components organic matter reduces the content of dissolved oxygen [13]. This examination supports the present investigation as values of content of dissolved oxygen was found low in concentration during the summer season.

According to Prabhakar VM [13] *et al.* the rate of community respiration was high in summer season due to the effect of sewage water discharged from the diverse drains of surrounding area and this activity enhances the activities of various biological components particularly during the summer season by the utilization of decomposition of organic matter. Similar results are also found in the present reservoir. During these seasons, the abundance of phytoplankton is low and high density of zooplankton might be accountable for high values of community respiration in the reservoir.

Net production efficiency: Net production efficiency is the determination of ratio of the efficiency with which an organism converts assimilated energy into GPP or NPP production. Seasonal variations of NPE minimum in summer season and high during northeast monsoon season. Chattopadhyay and Banerjee (2008) reported that, high NPE values during monsoon season and northeast monsoon season. Chinnaiah and Madhu (2010) were also studied NPE of various aquatic habitats of Andhra Pradesh state and reported that, high values during northeast monsoon and southwest monsoon season, while low values during

summer. Similar results are also observed in the present study.

Respiration (% of GPP): Seasonal variations of respiration were minimum in northeast monsoon season in the reservoir and high values were recorded during summer and southwest monsoon season respectively. Chinnaiah and Madhu (2010) studied respiration of status of the various aquatic ecosystems and reported that, the high values were noticed in the northeast monsoon season followed by summer and southwest monsoon seasons. Such findings are in support of the present study.

V. CONCLUSION

The above study results indicate that, the Mailapur reservoir is exhibited high productivity during the study period and established a good food chain and food web. The high productivity of the reservoir supports the high abundance of zooplanktons and higher organisms of the reservoirs.

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