SEASONAL VARIATION IN PRIMARY PRODUCTIVITY OF HARSI RESERVOIR IN DABRA, DISTRICT OF GWALIOR, MADHYA PRADESH

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Abstract : Seasonal Variation in Primary Productivity of Harsi Reservoir in Dabra, District of Gwalior, Madhya Pradesh was carried out during January 2011 to December 2012. Primary productivity estimated by conducting light and dark bottle method. In the year 2011 GPP lowest was 92.03±2.22 ($mgcm^3h^{-1}$) in the monsoon season and highest was 120.71±6.09 ($mgcm^3h^{-1}$) in the summer season. NPP lowest was 57.32±3.79 ($mgcm^3h^{-1}$) in the monsoon season and highest was 83.54±5.84 ($mgcm^3h^{-1}$) in the summer season. RR lowest was 34.71±1.61 ($mgcm^3h^{-1}$) in the monsoon season and highest was 37.17±3.31 ($mgcm^3h^{-1}$) in the summer season. In the year 2012 GPP lowest was 87.68±2.9 ($mgcm^3h^{-1}$) in the monsoon season and highest was 121.46±7.18 ($mgcm^3h^{-1}$) in the summer season. NPP lowest was 62.22±4.41 ($mgcm^3h^{-1}$) in the monsoon season and highest was 94.86±5.63 ($mgcm^3h^{-1}$) in the summer season. RR lowest was 22.47 ±1.95 ($mgcm^3h^{-1}$) in the winter season and highest was 26.6±3.69 ($mgcm^3h^{-1}$) in the summer season. The result indicates that productivity is greater than respiration it shows positive relationship. High productivity of Harsi reservoir showed their food chain and food web is in good condition and it favours better growth of zooplanktons and fishes.

Index Terms - Seasonal variation, Primary productivity, Harsi Reservoir

I. INTRODUCTION

Primary production defines as organic compound (carbohydrate) made from inorganic compound, solar energy by photosynthesis. Primary producer are organism which use inorganic material for photosynthesis to build organic material. Producer organisms performs photosynthetic activity and stores radiant energy of Sun, this is known as Primary productivity In fresh waters several factors, include solar light, nutrient content, water transparency, high flushing rate etc. are known to influence the rate of primary production. The conspicuously lower productivity values observed during monsoon might be due to increased turbidity and suspended silt content of water from soil erosion from surrounding areas. As a consequence penetration of light in to the water, the most essential factor for photosynthesis dropped sharply.

In aquatic ecosystem Primary productivity mostly depends upon nutrient input, algae, and temperature. The study of primary productivity of any water body is preferably used to know about the tropic structure. In reservoir ecosystem the primary producers are aquatic flora and phytoplankton, primary consumers are zooplankton, secondary consumers are small fishes and tertiary consumers are big fishes. GPP is the amount of biomass or energy that primary producers produce in a given time. Net primary productivity is the rate of storage of organic compound by the primary producers during time.

II. STUDY AREA

The study area Harsi reservoir is built up on Parwati River near village Harsi in tehsil Dabra of district Gwalior (M.P). It belongs to Gwalior Division. The Harsi reservoir is a composite earth dam, located at Latitude $25'47^0$ North and longitude to $77'58^0$ East. Three sides of the reservoir covered by hills and small hillocks. The maximum height of reservoir is 29.26 m, length is 21,333 m, total catchment area is 777.5 m^2 and total area cover by reservoir is 308,252 Km^3.Gross storage capacity 238.09 Mcm, Live storage capacity 224.45 Mcm. This fresh water reservoir is primarily constructed to supply water in Dabra. Mainly its water used for irrigation in nearby agriculture land and fisheries purpose. Other than the stored water of the dam, its feeder canal of Mohini pick-up weir of Sindh project also supplies water for irrigation system of dam. The canal follows the contour which is taken off from Harsi dam. The length of canal is about 65 km. Its entire command is on the right hand side.

Fig. 2.1 : Location Map of Harsi Reservoir

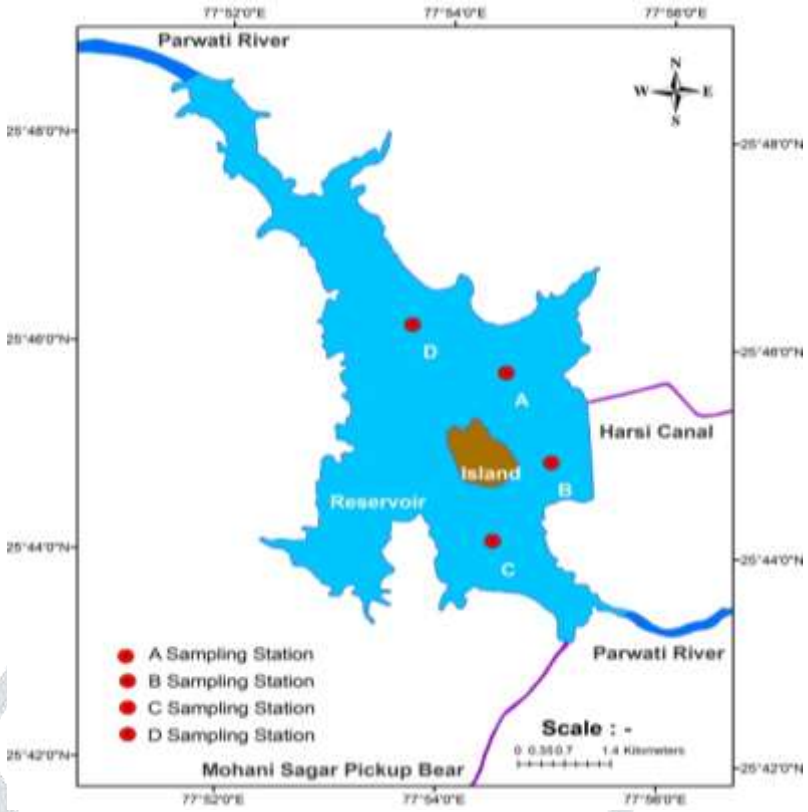

Fig. 2.2 : Map of Sampling Stations A, B, C & D at Harsi Reservoir

III. METHODOLOGY

Primary productivity estimated by conducting light and dark bottle method. Light dark bottle method use in the measurement of amount of oxygen evolved. The water from desire depth taken in two bottles and their initial oxygen concentration measurement by oxygen electrode then both bottles is sub merged at desired depth. Cover one bottle with black polythene to prevent light penetration (dark bottle). The experiment so set up was terminated after 6 hours and bottle were taken out of the reservoir and the dissolved oxygen content was estimated in both light and dark bottles. In dark bottle respiration occur, not photosynthesis but light bottle respiration and photosynthesis are both occur. NPP was given by light bottle change in oxygen concentration. Decrease in oxygen concentration of dark bottle gives the estimate of respiration.

IV. RESULT AND DISCUSSION

4.1 Analysis of Primary Productivity

In the present study primary productivity of Harsi reservoir has been calculated. Seasonal record of primary productivity recorded as GPP (Gross Primary Productivity), NPP (Net Primary Productivity) and RR (Respiration Rate) during Jan 2011-Dec 2011 and Jan 2012 - Dec 2012 is depicted in Table 4.1 and 4.2. The result indicates that productivity is greater than respiration it shows positive relationship.

In the year 2011 GPP lowest was 92.03±2.22 ($mgcm^3h^{-1}$) in the monsoon season and highest was 120.71±6.0 ($mgcm^3h^{-1}$) in the summer season. NPP lowest was 57.32±3.79 ($mgcm^3h^{-1}$) in the monsoon season and highest was 83.54±5.84 ($mgcm^3h^{-1}$) in the summer season. RR lowest was 34.71±1.61 ($mgcm^3h^{-1}$) in the monsoon season and highest was 37.17±3.31 ($mgcm^3h^{-1}$) in the summer season. (table no. 4.1 and fig no. 4.1)

Table 4.1: Seasonal Variation of Primary Productivity ($Mgcm^3h^{-1}$) Jan 2011 to Dec 2011

Seasons	GPP	NPP	RR
	Mean ± SE	Mean ± SE	Mean ± SE
Summer	120.71 ± 6.09	83.54 ± 5.84	37.17 ± 3.31
Monsoon	92.03 ± 2.22	57.32 ± 3.79	34.71 ± 1.61
Winter	98.36 ± 1.68	62.75 ± 2.25	35.2 ± 2.34

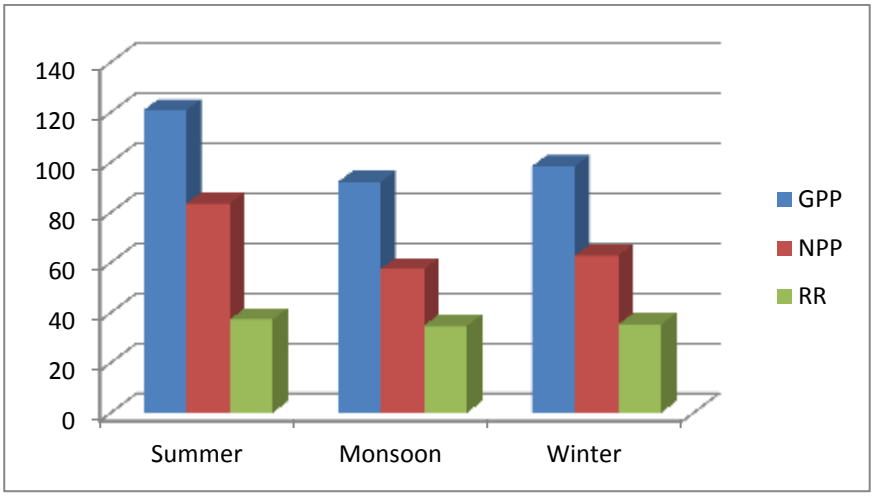

Fig. 4.1 : Seasonal Variation of GPP, NPP & RR in year 2011

In the year 2012 GPP lowest was 87.68±2.9 ($mgcm^3h^{-1}$) in the monsoon season and highest was 121.46±7.18 ($mgcm^3h^{-1}$) in the summer season. NPP lowest was 62.22±4.41 ($mgcm^3h^{-1}$) in the monsoon season and highest was 94.86±5.63 ($mgcm^3h^{-1}$) in the summer season. RR lowest was 22.47 ±1.95 ($mgcm^3h^{-1}$) in the winter season and highest was 26.6±3.69 ($mgcm^3h^{-1}$) in the summer season. (table no. 4.2 and fig no. 4.2)

Table 4.2 : Seasonal Variation of Primary Productivity ($Mgcm^3h^{-1}$) Jan 2012 to Dec 2012

Seasons	GPP	NPP	RR
	Mean ± SE	Mean ± SE	Mean ± SE
Summer	121.46± 7.18	94.86 ± 5.63	26.6 ± 3.69
Monsoon	87.68 ± 2.9	62.22 ± 4.41	25.46 ± 1.63
Winter	94.04 ± 3.42	71.57 ± 4.61	22.47 ± 1.95

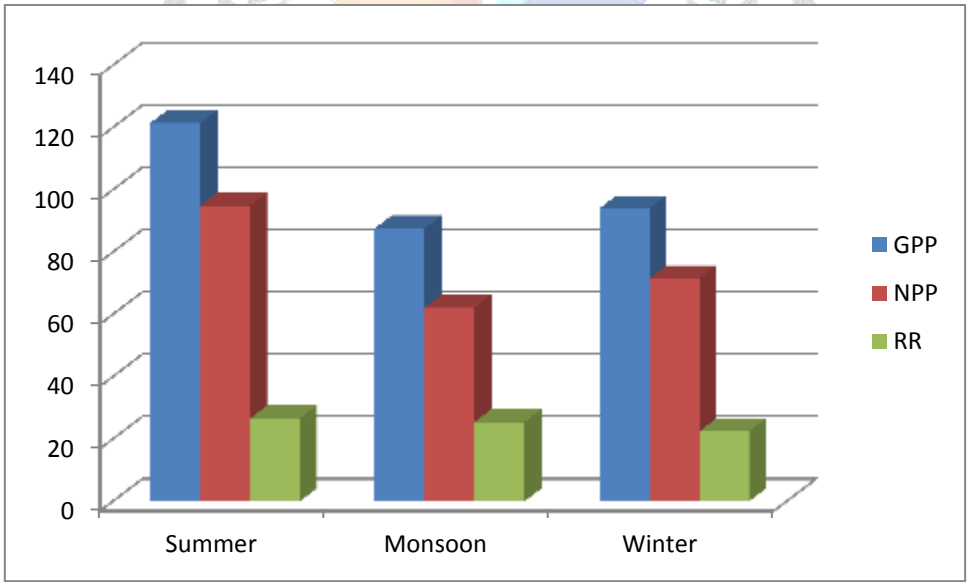

Fig. 4.2 : Seasonal Variation of GPP, NPP & RR in year 2012

4.2 Correlation of Primary Productivity with Physico-Chemical Characteristics

GPP shown the positive correlation with many physico-chemical characteristics like dissolved oxygen, sodium, potassium, phosphate, ammonia, nitrate, and nitrite and shown the negative correlation with solids. NPP showed the positive correlation with free CO_2, calcium, sodium, potassium, phosphate, silicate, nitrate, nitrite and negative correlation with solids. Respiratory Rate shown the positive correlation with calcium, ammonia, solids and negative correlation with total alkalinity, pH, sodium, potassium, sulphate, silicate and magnesium.

4.3 Discussion

Nazi et al. (2006), Sharma (2007) and Malaria (2008) reported seasonal variation of productivity in tropical freshwater bodies. High primary productivity reported in winter comparison to summer. Gross Primary Production showed positive correlation with phosphates, depth of visibility, dissolved oxygen, pH, silicates and nitrates. In 2008 Banerjee and Chattopadhyay reported maximum productivity in summer season in Tropical Shallow Freshwater lake Euphotic Zone. P. C. Verma and L. L. Sharma (2008) reported the seasonal variation of

primary productivity in Rana Pratap Lake. Seasonal average value of GPP was 0.362 $mgcm^3h^{-1}$ (winter), 0.449 $mgcm^3h^{-1}$ (summer), 0.282 $mgcm^3h^{-1}$ (monsoon).

Meera and Nandan (2010) reported maximum gross primary productivity and net primary productivity was in November and nil in September. The chlorophyll pigment showed higher value in monsoon season. Sharma Riddhi et al. (2011) reported minimum value of Community Respiration in monsoon and maximum value in summer months (2006-07). V. V. Bhoyar and H. L. Tamloorkar (2012) reported the high rate productivity during summer months was due to increase in temperature and high transparency. G. K. Sontakke and S. S. Mokashe (2014) reported GPP and NPP were minimum in monsoon season in two freshwater lakes of Aurangabad district, Maharashtra.

In aquatic system several factors were responsible for primary productivity variation. Observation shows that high turbidity is mainly responsible for lower production (Shreenivasan 1965, and Yeragi 2003). As high correlation exists between pH and productivity, the pH is very useful in predicting the magnitude of productivity (Flemer 1970). In natural water, phosphates, nitrogen, are important factor for increase the rate of productivity (Jhingran 1982). High temperature during summer season shows positive correlation with primary productivity (Dwivedi et al. 1986). Light penetration and nutrient content are mainly responsible for higher primary production (Kolekar and Singh 1999). The positive increase in the dissolved oxygen level indicated that the reservoir is moderately productive having adequate density of phytoplankton and adequate penetration of light.

V. CONCLUSION

In Harsi Reservoir the primary productivity show positive correlation with pH, temperature, phosphates, nitrates, sodium, potassium, calcium and free CO_2. On the basis of above observation and discussion, it may be concluded that Harsi Reservoir is good productive water body. High productivity of Harsi reservoir showed their food chain and food web is in good condition and it favours better growth of zooplanktons and fishes.

VI. ACKNOWLEDGEMENT

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