Seasonal Variation in Primary Productivity and Macrophytes of Baghel Taal

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Abstract- ***Seasonal variations in primary productivity and macrophytes were carried out during July, 2018 to June, 2019. Grass primary productivity (GPP) and net primary productivity (NPP) ranged from 52.25 to 95.65 mgC/m^3/3hr and 35.94 to 60.85 mgC/m^3/3hr, respectively. The respiration(R) values varied between 16.31 to 34.80 mgC/m^3/3hr. The maximum rates of production in summer months denote the peak of phytoplankton, macrophytes, and higher values of light intensity, temperature and chlorophyll concentration. The minimum rates of primary production were observed during monsoon months.***

Indexed Terms- ***Wetland, Primary productivity, Respiration, macrophytes, Baghel taal.***

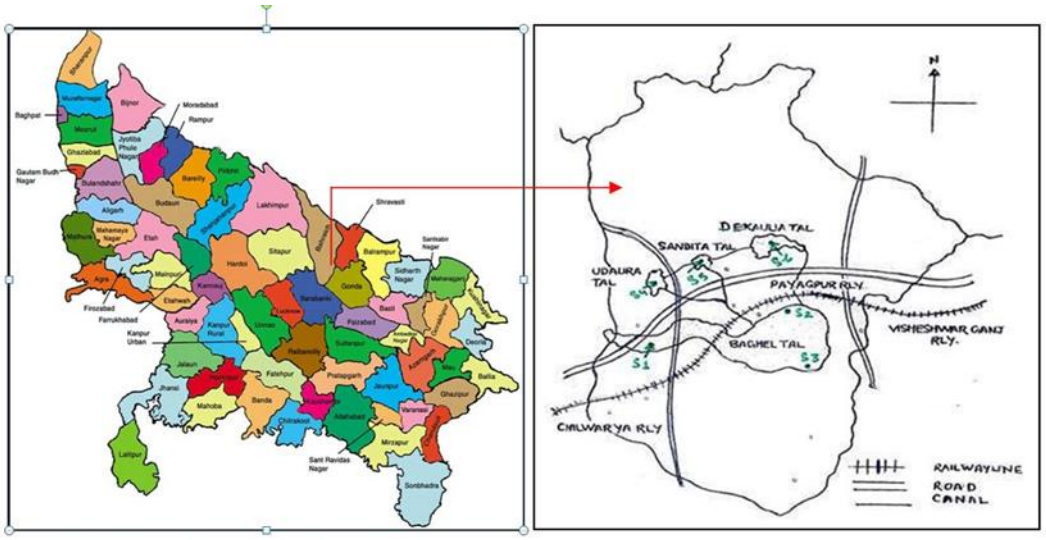
I. INTRODUCTION

According to Cowardin *et al*. (1979) wetlands are defined as lands transitional between terrestrial and aquatic ecosystem, where the water label is usually at or near the surface or the land is covered by shallow water. They are rich source of primary producers. Wetlands are very productive ecosystems, which help in the regulation of biological cycles, maintenance of water quality, nutrient movement and support for food chains. Wetlands are areas where water is the primary factor controlling the environment and the associated plants and animal life (Kumar *et al*., 2015). Wetlands are important components of watersheds and provide many valuable functions to the environment and society. The water resource is being used for various purposes such as domestic use, agriculture and fish culture etc. by local community. Now wetlands are shrinking rapidly because of urbanization and industrialization. Due to urbanization and anthropogenic pressure most of the wetlands are succumbed to greater degree of biologically active nutrient accumulation (Verma and Prakash, 2018; Prakash and Singh, 2019).

Primary productivity is defined as the rate at which organic matter is created dry producer in an ecosystem whereby low energy inorganic carbon is converted to high energy organic carbon form. The chlorophyll bearing aquatic plants serve as primary producers in an aquatic food chain and thus act as keystone species in the ecosystem. Primary productivity has been used as potential index of productivity for many diverse ecosystems of the world (Wetzel, 1966). Primary productivity of a particular water body gives quantitative information about the amount of energy available to support bioactivity of the system. In India contributions to the productivity were made by Sreenivasan (1965), Pandey & Singh (1978), Khatri (1980), Bhargava & Saxena (1987) and Deka (2017).

II. STUDY AREA

Baghel Taal is a large shallow perennial lentic waterbody with irregular margin and dense growth of macrophytes. It is situated in village Baghel, Payagpur block of district Bahraich at a distance of about 1.60 km. To the south - east of Payagpur Railway station. It is about 31 km, away from Gonda, 30 km, from Baahraich and 45 km from Balrampur.



Map of U.P. Showing District Bahraich

Location of Baghel Taal in Payagpur Block of Bahraich District

Satellite view of Baghel Taal, Wetland in Bahraich District U.P.

It is half oval in shape with maximum diameter of 3800m and connected with three small waterbodies namely Udavra Tal, Sandita Tal and Dekaulia Tal. It receives water from three main streams, Babia nallah from north-west side, Jamvar nallah from north and Sakarpatti nallah from north-east side during rainy season. It is also a Bird sanctuary extending around 32 km with total catchment area of wetland 441.5575 acre. Out of this only 121.22 acre is water body in rainy season but in summer its area becomes reduced with maximum depth 3.6m. It is habitat of rich micro- and macro living organisms including *Nymphaea, Nelumbo*, Narkul, Tinna rice, vegetation as well as various annelids, molluscans, fishes and amphibians. The abundant food attracts hundreds of resident and migratory birds including Siberian crane during winter season.

Image of Baghel Taal, a Wetland

III. MATERIAL AND METHODS

Investigation were carried out for a period of one year from June, 2018 to July, 2019. Three sampling sites were selected at Baghel taal. The primary productivity was measured with well-known light and dark bottle method of Gaarder & Gran (1927). Initial dissolved oxygen values were recorded from each sites by Winkler method. Light and Dark Bottles were submerged for three hours, after which they were withdrawn and the final dissolved oxygen in each was measured on spot. The oxygen production values were converted into its carbon equivalents using a factor of 0.375.

IV. RESULTS AND DISCUSSION

The results of the present investigation are given in table1 & 2.

The primary productivity of an aquatic system is the rate of radiation energy, which is stored by photosynthetic activities of phytoplankton (Odum, 1971). The primary productivity of a water body is a function of autotrophs associated with utilization of radiant energy. The solar energy that required for biological activities is finally converted to chemical energy by the process of photosynthesis primarily executed by phytoplankton and macrophytes. In the present study, the GPP varied from 52.25 to 68.45 mgC/m^3/3hr in monsoon, 85.55 to 91.25 mgC/m^3/3hr in winter and 88.35 to 92.35 mgC/m^3/3hr in summer seasons. NPP varied from 35.94 to 48.20 mgC/m^3/3hr in monsoon, 54.25 to 57.17 mgC/m^3/3hr in winter and 55.21 to 59.51 mgC/m^3/3hr in summer seasons. The respiration (R) which is a heterotrophic activity of phytoplankton, zooplankton, bacteria and fungi etc. inhabiting the pond water (Community respiration) ranged from 16.31 to 23.89 mgC/m^3/3hr in monsoon, 28.38 to 34.16 mgC/m^3/3hr in winter and 32.85 to 33.85 mgC/m^3/3hr in summer seasons. In the present study, the chlorophyll concentration varied from 0.0048 to 0.0054 mg pig/m^3in monsoon, 0.0058 to 0.098 mg pig/m^3in winter and 0.131 to 0.152 mg pig/m^3in summer seasons.

Table 1.Seasonal variations in Primary GPP, NPP and Respiration rate of Baghel Taal

Location	Season	GPP (mgC/m^3/3hr)	NPP (mgC/m^3/3hr)	Respiration (mgC/m^3/3hr)	Chlorophyll (mg pig./m^3)
S-1	Monsoon	52.25	35.94	16.31	0.0045
	Winter	85.55	57.17	28.38	0.0058
	Summer	88.35	55.21	33.14	0.0143
S-2	Monsoon	68.45	44.56	23.89	0.0048
	Winter	90.10	54.25	33.85	0.087
	Summer	91.53	57.38	34.15	0.131
S-3	Monsoon	66.80	48.20	18.60	0.0054
	Winter	91.25	57.09	34.16	0.0098
	Summer	92.36	59.51	32.85	0.152

GPP= Gross Primary Productivity; NPP= Net Primary Productivity

The GPP and NPP were maximum in summer season, moderate in winter season and minimum in monsoon season in all the three sites. During the present study, the maximum value of GPP and NPP was observed during summer season and subsequently the lower values during monsoon season which corresponds to the intensity of light energy. Lower rate of primary production during monsoon season is the result of limitation of sunshine period and low light energy due to interruption of clouds. Subsequently, the dilution

effect of rain on phytoplankton density and as well as the increased in allochthonous turbidity from nearby area are prime causes of lowering the primary productivity in monsoon season. Thus in the present study high productivity was due to high temperature (Shukla and Pawar, 2001) and low in spite of high concentration of nutrients in monsoon season (Saijo and Kawashima, 1964). Similar observations were made by Bhargava & Saxena (1987), Singh *et al*.(1996) and Shukla and Pawar (2001). The maximum rate of production in summer months coincided with the peak of phytoplankton and macrophytes, higher values of light intensity, higher temperature, and high value of chlorophyll concentration. The steep fall of phytoplankton population, biomass, low values of transparency and light intensity during monsoon months were reflected in the minimum rate of primary production (Shukla and Pawar,2001). Higher respiration values(R) were observed during the summer season and low values were recorded in the monsoon season. The maximum chlorophyll concentration was observed in summer season and minimum in rainy season. Similar observation was reported by Ranjan and Singh (2019). After monsoon, with the increase in phytoplankton concentration the rate of production also increased. Higher growth of algal biomass results in higher primary productivity (Deka, 2017).On the basis primary productivity it can be concluded that Baghel Taal shows the mesosaprobic status.

The present study reveled that the presence of 20 aquatic macrophytes belonging to four groups namely submerged, rooted with floating leaves, free floating and emergent. The *Eichhornia, Hydrilla, Vallisneria, Potamogaton, Creatophyllum, Ipomoea, Nelumbo, Nymphaea, Salvinia, Utricularia* and *Najas minor* have been recorded as prominent species of macrophytes and found all the three sites (S1, S2 & S3). The average biomass varied from 2.667 to 2.880 kg/m^2 in monsoon, 1.628 to 1.98 kg/m^2 in winter and 1.179 to 1.432 kg/m^2 in summer seasons. In general average biomass found to be in declined trend as the season changes from monsoon to winter to summer. Aquatic vascular plants are an important indicator of water pollution. Aquatic plants are important as they serve as a substratum to different micro and macro fauna (Ramesh and Kiran, 2015).

Table 2. Seasonal variation in Macrophytes biomass (kg / m^2) of Baghel Taal

Location	Season	Macrophytes species	Biomass
S-1	Monsoon	*Eichhornia, Hydrilla, Vallisneria, Potamogaton, Creatophyllum, Ipomoea, Nelumbo, Nymphaea, Salvinia, Utricularia, Najas minor*.	2.880
	Winter	*Eichhornia, Hydrilla, Vallisneria, Potamogaton, Creatophyllum, Ipomoea, Nelumbo, Salvinia,*	1.628
	Summer	*Hydrilla, Vallisneria, Potamogaton, Creatophyllum*	1.179
S-2	Monsoon	*Hydrilla, Vallisneria, Potamogaton, Creatophyllum, Nymphaea, Salvinia, Utricularia, Najas minor*.	2.667
	Winter	*Hydrilla, Vallisneria, Potamogaton, Ipomoea, Nymphaea, Salvinia, Utricularia, Najas minor*.	1.958
	Summer	*Hydrilla, Vallisneria, Potamogaton, Ipomoea, Nelumbo, Nymphaea, Salvinia, Utricularia,*	1.387
	Monsoon	*Eichhornia, Hydrilla, Vallisneria,*	2.701

S-3		*Potamogaton, Creatophyllum Nelumbo, Nymphaea, Utricularia,*	
	Winter	*Eichhornia, Hydrilla, Vallisneria, Creatophyllum, Nelumbo, Nymphaea, Utricularia,*	1.765
	Summer	*Hydrilla, Vallisneria, Potamogaton, , Salvinia, Ipomoea,Creatophyllum, NelumboUtricularia ,*	1.432

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