Seasonal Variation in Primary Productivity and Macrophytes of Semara Taal, A Wetland of Siddharth Nagar District of U.P.

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Abstract- ***Seasonal variations in primary productivity, respiration rate, chlorophyll content and macrophytes biomass were carried out during July, 2017 to June, 2018. The primary productivity rate was maximum in summer season denote the peak of phytoplankton, macrophytes, higher values of light intensity, temperature and chlorophyll concentration. The minimum rate of primary productivity was observed during monsoon season.***

Indexed Terms- Wetland, Primary productivity, Respiration, macrophytes, Semara taal.

I. INTRODUCTION

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.

Wetlands support vast biodiversity of flora and fauna, provide food and shelter to organisms that thrive in. They occur where the water table is at or near the surface of the land, or where the land is covered by water. Wetlands are among the world's most productive environments (Verma and Prakash,2018). Wetlands like lake etc. are of utmost importance for several reasons. They represent only a part of our land bases but they provide shelter to a great number of plant and animal species including birds, mammals, reptiles, amphibians, fish and invertebrate species. Now-a-days wetlands and other deep-water habitats is globally a subject of great ecological interest due to their socio-economic values and ecosystem services which has necessitated the need for reliable broad-based information on their ecological status. The ecological functioning of these ecosystems has been greatly affected by the growing anthropogenic activities

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. Primary productivity of an ecosystem is the radiation energy stored by photosynthetic activity of phytoplankton (Odum, 1977). The entire diverse life depends on this phenomenon either directly or indirectly. Thus, primary productivity is a mass of new organic matter synthesized through carbon assimilation by chlorophyll bearing aquatic plants which serve as primary producers in an aquatic food chain and thus act as keystone species in the ecosystem. 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 and Saxena (1987) and Deka (2017).

The Semara taal, a wetland is situated near the Shohratgarh of Siddharthnagar district of Uttar Pradesh. The total area of this taal is 466.66 acre. The maximum depth of water in the pond is 15 feet during monsoon and minimum in summer. It has good biodiversity as it is rich both in flora and fauna and the occurrence of good bio-diversity is an index of healthy, growing, dynamic and economically efficient water body. Due to urbanization and anthropogenic pressure most of the wetlands are succumbed to greater degree of biologically active nutrient accumulation.

II. MATERIAL AND METHODS

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 site 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.

III. RESULTS AND DISCUSSION

The seasonal values of productivity, respiration rate, Chlorophyll contents and biomass of macrophytes of Semara Taal are given in the Table 1.

Table 1. Seasonal variations in Primary GPP, NPP, Respiration rate, Chlorophyll and Macrophytes Biomass of Semara Taal

Location	Season	GPP (mgC/m^3/3hr)	NPP (mgC/m^3/3hr)	Respiration (mgC/m^3/3hr)	Chlorophyll (mg pig. /m^3)	Macrophytes biomass (kg / m^2)
S-1	Monsoon	55.26	33.96	14.34	0.0046	3.115
	Winter	86.53	60.15	23.32	0.0057	1.866
	Summer	90.36	57.27	37.13	0.124	1.193
S-2	Monsoon	65.44	41.56	26.91	0.0044	2.796
	Winter	90.15	54.27	36.02	0.0087	2.143
	Summer	91.54	57.37	33.14	0.139	1.494
S-3	Monsoon	62.64	48.29	18.54	0.0056	2.917
	Winter	82.75	56.58	32.55	0.0090	1.882
	Summer	91.36	58.51	33.76	0.147	1.519

GPP= Gross Primary Productivity; NPP= Net Primary Productivity

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 55.26 to 65.44 mgC/m^3/3hr in monsoon, 82.75 to 91.36 mgC/m^3/3hr in winter and 90.36 to 91.54 mgC/m^3/3hr in summer seasons. NPP varied from 33.96 to 48.29 mgC/m^3/3hr in monsoon, 54.28 to 59.14 mgC/m^3/3hr in winter and 57.27 to 58.51 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 14.34 to 26.91mgC/m^3/3hr in monsoon, 28.35 to 33.96 mgC/m^3/3hr in winter and 33.14 to 37.13 mgC/m^3/3hr in summer seasons. In the present study, the chlorophyll concentration varied from 0.0044 to 0.0058 mg pig/m^{3}in monsoon, 0.0057 to 0.090 mg pig/m^{3}in winter and 0.124 to 0.147 mg pig/m^{3}in summer seasons.

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. 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).

- Macrophytes: The present study reveled that the presence of 15 aquatic macrophytes belonging to four groups namely free floating (*Eichhornia* sp., *Salvinia* sp., *Wolfia* sp.and *Lemna* sp.), emergent (*Ipomoea* sp., *Polygonum* sp., and *Typha* sp.), submerged(*Hydrilla*, *Vallisneria*, *Creatophyllum* and *Najas* sp.) and rooted with floating leaves (*Potamogaton*, *Nelumbo*, *Nymphaea* and *Najas*), The *Salvinia* sp., *Lemna* sp., *Ipomoea* sp., *Hydrilla*, *Vallisneria*, and *Potamogaton* species have been recorded as prominent species of macrophytes and found all the sampling sites. The average biomass varied from 2.796 to 3.115 kg/m^2 in monsoon, 1.866 to 2.143 kg/m^2 in winter and 1.193 to 1.519 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. Thus, aquatic vascular plants are an important indicator of water pollution.

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