



Studies on some physico-chemical properties of sediment and their role in productivity of two floodplain wetlands in West Bengal, India

KEYWORDS

wetland, sediment, nutrient status, primary productivity.

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ABSTRACT The state West Bengal comprises a good number of floodplain wetlands. These wetlands possess a unique type of ecosystem and play a vital role in maintenance of socio economic condition of concerned area. A yearlong study was conducted in two wetlands of the state West Bengal viz., Hansadangabeel of district Nadia and Purbasthalibeel of district Burdwan to analyse the nutrient status of sediment and their role in Net and Gross primary productivity. The present study recorded comparatively high primary productivity in Hansadangabeel (L1) than Purbasthalibeel (L2) due to its high range of nutrient status. Furthermore, due to rapid urbanisation and various anthropogenic entries the overall nutrient status of these wetlands is being disturbed. So a proper management approach is needed to conserve these unique ecosystems through their rich nutrient status

INTRODUCTION

In the state West Bengal, district Nadia and Burdwan contain a large number of floodplain wetlands. These wetlands are usually formed due to meandering nature of the holy river Ganga and its tributaries in its lower course. These wetlands are locally named as 'beel' in those districts. These wetlands possess unique and complex ecosystem due to several geomorphological factors. Primary productivity is one of the most important sources of energy input in aquatic ecosystem (Paul et.al 2007). It is of two types, first one is the Net primary productivity (NPP) which is the rate at which all the plants in an aquatic ecosystem produce net useful chemical energy and the second one is the Gross primary productivity, which is greater than the net primary production as the respiratory energy by the ecosystem's producers is concerned. Phytoplankton, periphyton and various aquatic macrophytes etc. play a major role in primary productivity of an aquatic ecosystem. The primary productivity of an aquatic ecosystem is directly related to the temperature and others physico-chemical characteristics of water and soil (Moss et.al, 1980). The basin sediments of these wetlands serve as the main source of productivity of this ecosystem as it release nutrients to the water; moreover it acts as a niche for benthic floral and faunal population.

Now a day these natural resources of these water bodies are very much neglected. The objective of the present study was to determine the nutrient status of soil of two wetlands of the state West Bengal with primary productivity and monitor the changes of these nutrients over time.

MATERIALS & METHODS

Location and description of study area: The entire districts of Nadia and Burdwan are located in the lower "Bhagirathi sub-basin". There are a large number of floodplain wetlands throughout these districts. Two different water bodies of those districts were selected for the study. One is the 'Purbasthalibeel', an ox-bow lake of the holy river Ganga of Burdwan district of West Bengal. The lake is positioned on 23°27'35"N latitude and 88°21'08"E longitude, at an elevation of 7 m. and other one is 'Hansadangabeel' which is situated by the side of National Highway no. 34 in Krishnanagar-II block near the Bahadurpur forest of dis-

trict Nadia, West Bengal. It is positioned on 23°27'26" N latitude and 88°27'29" E longitude at an elevation of 8 m.

Methodology: The study was conducted for three seasons- viz., pre monsoon, monsoon and post monsoon period of one year (2011) to assess the nutrients level in soil of both lakes namely, Hansadangabeel (L1) and Purbasthalibeel (L2). The primary productivity (Both Gross and Net primary productivity) of the lakes was also being considered. Samples of soil were collected from four different sampling sites of each water body and the mean values were taken into consideration. Soil samples were collected from each sampling site with the help of Ekman's dredge and then composite samples were prepared for respective water body for the analysis of pH, available Phosphate (AP), available Nitrogen (AN), available Potassium (AK) and organic carbon percentage (OC%) of the water body. These analyses were done following the methods prescribed by Piper (1966) and Nathet.al (1994). The Gross and Net primary productivity were estimated by the light and dark bottle method (APHA, 19th edition, 1995).

RESULTS & DISCUSSION

The pH values of soil, recorded during the study period showed alkaline nature in both the water bodies. The mean peak pH value (8.05) was recorded during the post monsoon months in L¹. On the other hand the mean lowest pH value (7.20) was seen during monsoon in L². The pH value below 4.0 and above 9.0 was found detrimental on overall productivity of the water body (Bala and Mukherjee, 2011).

Mean highest value of organic carbon (2.01%) was found in L¹ during winter months. On the other hand its mean lowest value (1.09%) was recorded from L² during the rainy season.

Available Nitrogen (AN) content in soil was greatly influenced by the organic Carbon content (Saha, 1991), but there are many occasions in beel ecosystem where this relation is not established. This might be due to the low nutritive values of organic matter with their slower rate of decomposition and also due to the siltation over organic layer hindering the rate of decomposition (Bala and

Mukherjee, 2011). However AN was found its mean peak value (25.92 mg/100g) in L¹ during the pre monsoon and its mean lowest value (16.90 mg/100g) was recorded in monsoon from L². A range of AN from 25 to 50 mg/100g of soil resulted in moderate production of fish (Banerjea, 1967).

Phosphorus is the first limiting nutrient for plants in freshwater (Stickney, 2005) which regulates the phytoplankton production in presence of nitrogen. According to Banerjea (1967) less than 3 mg/100gm of soil phosphorus is considered as poor, 3-6 mg/100gm is considered average and more than 6 mg/100gm is considered highly productive. In this study the mean peak AP value (9.07 mg/100g) was found in L¹ during winter months and its mean lowest value (3.01 mg/100g) was recorded monsoon months from L².

Table 1: Seasonal changes (mean ± S.D) of soil parameters of Hansadangabeel (L1), Nadia District, West Bengal, India, in the study period.

Parameters	Pre monsoon	Monsoon	Post monsoon
Soil Ph	7.60±0.03	7.21±0.01	8.05±0.03
Soil organic Carbon (%)	1.81±0.10	1.25±0.16	2.01±0.09
Available Nitrogen (mg/ 100gm soil)	25.92±0.13	20.09±0.06	22.73±0.10
Available Potassium (mg/ 100gm soil)	13.27±0.06	9.65±0.11	11.89±0.03
Available Phosphorus (mg/ 100gm soil)	7.48±0.05	5.32±0.11	9.07±0.18

Table 2: Seasonal changes (mean ± S.D) of soil parameters of Purbasthalibeel (L2), Burdwan District, West Bengal, India, in the study period.

Parameters	Pre monsoon	Monsoon	Post monsoon
Soil pH	7.31±0.01	7.20±0.09	7.85±0.02
Soil organic Carbon (%)	1.28±0.19	1.09±0.20	1.50±0.16
Available Nitrogen (mg/ 100gm soil)	19.73±0.05	16.90±0.10	18.45±0.08
Available Potassium (mg/ 100gm soil)	10.89±0.09	8.24±0.14	10.71±0.12
Available Phosphorus (mg/ 100gm soil)	5.33±0.15	3.01±0.21	3.87±0.12

Although Potassium is one of the major nutrients for terrestrial primary producer, but its impact as fish pond fertilizer is not much known (Saha, 1985). It is not a limiting factor in beel ecosystem but it is required in all cells as an enzyme activator. The optimum range of Potassium is 4.7 to 6.2 mg/100g for aquatic production (Bala and Mukherjee, 2011). The mean maximum value of available Potassium (AK) (13.27 mg/100g) was found in L¹ during summer months; whereas the mean lowest value (8.24 mg/100g) was recorded from L² during rainy season. Higher range of AK content is probably due to the periodic application of fertilizers and manures in these water bodies for better fish production.

The Net primary production (NPP) achieved its mean

maximum value (2148.54mgC/m²/day) during pre monsoon in L¹ and the mean minimum value (791.02mgC/m²/day) was seen during post monsoon months in L². On the other hand, the mean highest value (3952.08mgC/m²/day) of Gross primary productivity (GPP) was recorded during summer months in L¹ and the mean lowest value (1128.78mgC/m²/day) was seen during winter months in L².

Figure1: seasonal fluctuation of NPP of Hansadangabeel (L¹) and Purbasthalibeel (L²) during study period. [PRM: pre monsoon, MON: monsoon. POM: post monsoon]

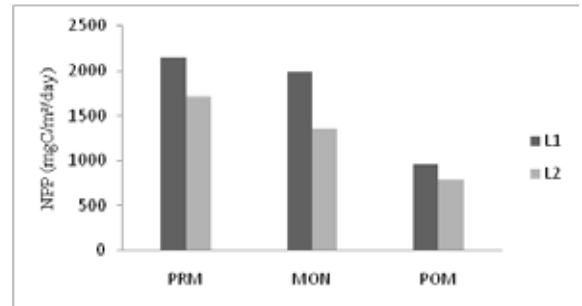
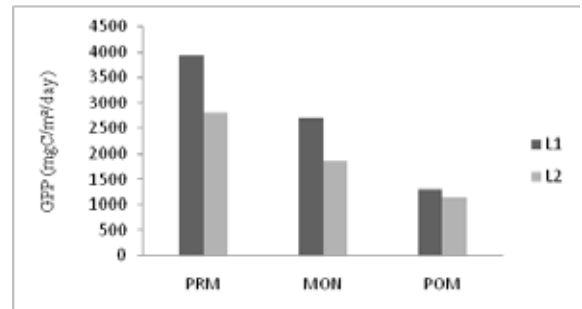


Figure2: seasonal fluctuation of GPP of Hansadangabeel (L¹) and Purbasthalibeel (L²) during study period. [PRM: pre monsoon, MON: monsoon. POM: post monsoon]



CONCLUSION

From the above study it is revealed that both lakes are slightly alkaline in nature as the soil pH ranges between 7.21 to 8.05 in L¹ and 7.20 to 7.85 in L². The study reveals that the overall nutrient status is higher in Hansadangabeel (L1) than Purbasthalibeel (L2). Hence the production potential of Hansadangabeel is much higher. Higher temperature during summer months strongly influences the autotrophic and heterotrophic biomass for their metabolic activities and nutrient demands (Munster et.al. 1992). This accelerates nutrient release from sediment which in turn favours the production of phytoplankton, resulting in higher Net and Gross primary production in summer months. Besides regular application of different Nitrogenous fertilizers and manures also increase the nutrient level in these wetlands. Apart from other hydrobiological parameters now a days the productivity of these water bodies are also influenced by various factors like eutrophication, pollution and different anthropogenic activities. So proper management strategies are urgently needed to upgrade the nutritional status of the sediments of these beels which on the contrary also enhance the quality of limnological parameters resulting better production of fish and as well as fish food organisms.

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