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A COMPARATIVE STUDY AND CORRELATION ANALYSIS OF PRIMARY PRODUCTIVITY IN JHAROKH AND URMAAL WETLANDS OF HAJO, IN KAMRUP DISTRICT, ASSAM, INDIA

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ABSTRACT: Primary productivity is the rate of production of organic matter per unit area through the photosynthesis process in an ecosystem.The solar energy is transformed into chemical energy in green plants by the process of photosynthesis which is called gross productivity.During the process of respiration in green plants some of the organic matter is utilized and metabolized .The organic matter which remained after the respiration process by the green plants is called net primary productivity.Primary productivity is very useful tool to know about the ecological health of any aquatic ecosystem.The present study is on the estimation of primary productivity in two wetlands of Hajo area i.e Jharokh, and Urmaal .The research was carried from the year 2015 -2016 for four seasons namely pre monsoon, monsoon,post monsoon and winter for 2015 and the same for 2016 by dark and light oxygen bottle method.. Correlation analysis was done among the primary productivity between the two wetlands.Primary productivity is an important phenomena in an aquatic ecosystem in which phytoplankton acts as primary producers.
Key words: Wetland, Primary Productivity, Correlation, Solar energy Photosynthesis.

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INTRODUCTION

The green plants synthesize their own food by the process of photosynthesis in the presence of sunlight by utilizing the inorganic substances in the environment..In any water system, organic carbon fixed by chlorophyll producing phytoplankton acts as an important indicator of productive function of the system [1]. Primary productivity is an important tool for the determination of trophic level status and fish production potential of any aquatic ecosystem [2,3,4]. Primary productivity or its major important components, gross and net primary productivity plays important role during photosynthesis [5].

The rate of production of the organic food materials per unit time is called productivity.Solar penetration, temperature acts as limiting factor for primay production [6].The primary productivity of any water body is the manipulation of its biological production.Primary productivity is an important biological phenomenon in the aquatic environment in which phytoplanktons acts as primary producers.Primary productivity is the basis of metabolic cycle in the in natural aquatic ecosystem. The primary productivity of any water body is the manipulation of its biological production.Primary productivity is affected by many abiotic factors such as solar penetration,nutrient abundant, water transperancy,water level content in fresh water ecosystems [7,8,9,10,11].The relationship between oxygen evolution and carbon fixation is prime important for primary productivity.

In this investigation two wetlands namely- Jharokh, and Urmaal, were selected.From the ecological point of view, all the two wetlands are inundated with water almost throughout the year.The harvesting area around the beels are increasing day by day.Cultivation of Bodo rice during pre monsoon season around the beels results decrease of wetland depth. Fishing activity is also very high in the wetlands.From the study it is clear that the wetlands are healthy in terms of water quality mostly and phytoplankton abundance is also moderate.Low phytoplankton in the wetlands indicate water quality problems and high phytoplanktons indicates eutrophication on the other hand.

METHODOLOGY

For the analysis of primary productivity, the water samples were collected from the wetlands in different seasons from pre monsoon 2015 to post monsoon 2016.Pre monsoon (PRM),Monsoon (M), Post monsoon (POM),Winter (W).The light and dark bottle oxygen method was adopted for analysis of primary productivity.In this investigation water samples were collected in three bottles i.e one dark and two light bottles .The sample in the first light bottle was used for measuring the initial concentration of dissolved oxygen by Wrinkler's volumetric method [12].The resultant oxygen values were converted into carbon values by multiplying the conversion factor .536 .The other two light and dark bottles were suspended vertically under water for for six hours for incubation(13).After incubation period the bottles were taken out and immediately fixed the dissolved oxygen concentration**.**

Calculation:

Primary productivity is expressed in terms of Gross primary productivity, Net primary productivity and Community Respiration

Initial DO = z mg/L

Light bottle DO after incubation period (6 hours): x mg/L

Dark bottle DO after incubation period (6 hours): y mg/L

1.Gross photosynthesis :x-y mg/L

2. Net photosynthesis: x-z mg/L

3. Respiration: z-y mg/L

i) **Gross primary productivity (GPP) (mgC/L/hr)**= (x-y)×.536 /PQ × N

Where, PQ = 1.2 (Photosynthetic Quotient)

N= Incubation Period

.536 = Factor to convert mg O_2 to mg of C

ii) **Net Primary Productivity (NPP) (mgC/L/hr)** = (x-z)× .536/PQ ×N

iii) **Community Respiration (CR)** = (z-y)×.536/PQ ×N

Study Area: Jharokhand Urmaal wetland are situated at the global position 26^0 $13^/$ $5^{//}$ N to 26^0 $18^/$ $5^{//}$ N latitude and 91^0 $30^/$ $41^{//}$ E to 91^0 $35^/$ $40^{//}$ E longitude, covering an area of 162.74 ha and 34.85 ha, in Hajo, Kamrup district, Assam

RESULTS AND DISCUSSION

Table-1. Primary productivity values of Jharokh wetland

	PRM	M	POM	W
GPP	6.4	5.2	6.8	9.2
NPP	2.1	2.6	2.1	3
CR	4.25	2.5	4.2	6

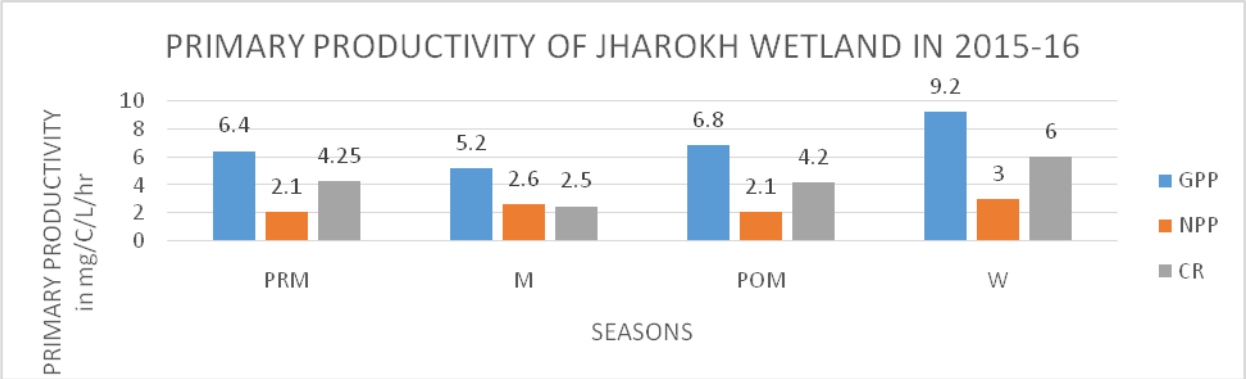

Figure 1.Graph of Primary Productivity of Jharokh Wetland.

Table 2. Correlation Matrix of primary productivity of Jharokh Wetland

	GPP	*NPP*	*CR*
GPP	1		
NPP	0.501161	1	
CR	0.902344	0.07927	1

Table-3. Primary Productivity of Urmaal wetland

	PRM	M	POM	W
GPP	5	4.8	7.9	5.6
NPP	2	2	3.1	2.1
CR	3.5	2.7	4.5	3.1

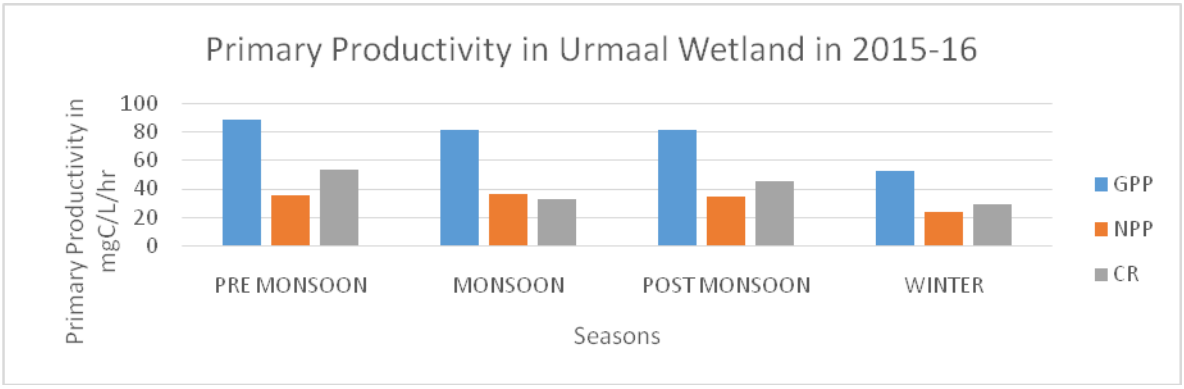

Figure-2. Graph Showing Primary Productivity of Urmaal Wetland

Table 4. Table showing Correlation Matrix of Primary Productivity of Urmaal Wetland

	GPP	*NPP*	*CR*
GPP	1		
NPP	0.974319	1	
CR	0.771462	0.61964	1

Gross Primary Production

The analysis was done based on seasonal variation for 2015 of pre monsoon,monsoon, post monsoon and winter seasons and same for 2016 The study indicated that the GPP of Jharokh wetland showed value 9.2mgC/L/hr in winter season whereas GPP of Urmaal wetland showed high value during post monsoons i.e 7.9 mgC/L/hr .During monsoon the results were found to be low in both the wetlands (Table 1, Figure 1).

Net Primary Productivity

The maximum values of NPP were obtained during winter season i.e 3mg/C/L/hr in Jharokh wetland and in Urmaal wetland the maximum value showed 3.1mg/C/L/hr during post monsoon season and minimum values were obtained during monsoon season i.e 2 mgC/L/hr in Urmaal wetland.The relationship is shown in correlation matrix table (Table 1 and Figure 1)

Maximum values of GPP and NPP were recorded during winter seasons in Jharokh wetland.High rainfall caused suspension of loads in the wetland but in post monsoon the particles settled down consequently water on the surface of the wetland becomes more clear.As a result abundant sunlight penetration happens inside the water leading to high values of GPP and NPP in winter in Jharokh wetland.Penetration of more sunlight during the pre monsoons and post monsoons into the water body results high temperature which increases the photosynthetic activities which ultimately increase the primary productivity of the aquatic ecosystem. This pattern is observed in Urmaal wetland.On the contrarary in monsoon season due to flood higher total dissolved solids and suspended particles make the water body highly turbid which restricts the penetration of light and thereby less photosynthetic activities take place .During monsoon due to cloudy weather ,organic effluent in water, low transparency and high water current lower production values were obtained.An intermediate value of GPP and NPP were obtained during winter due to low water temperature and reduced light.

Community Respiration

The CR values were high during winter season i.e 6mgC/L/hr in Jharokh wetland and in Urmaal wetland during post monsoon the high value showed i.e 4.5 mgC/L/hr minimum values were obtained during monsoon seasons i.e 2.5 mgC/L/hr in Jharokh wetland and 2.5 mgC/L/hr in Urmaal wetland (Table 1, Figure 1). Higher values during winter were due to higher sunlight penetration which facilitates growth of microbial population for which more oxygen was used for their metabolic activities and low values during monsoon because of low temperature and reduced light.

In Jharokh wetlandthe correlation between GPP and NPP is r =.501161, NPP and CR, r = .07927 and GPP and CR , r = .902344. The relationship of GPP and CR indicates strong correlation. Correlation matrix within the parameters is shown in table 2 of Jharokh wetland for the year 2015-16.

In Urmaal wetland the correlation between GPP and NPP is r =.974319, NPP and CR , r = .61964 and GPP and CR , r = .771462.The relationship of GPP and CR shows a strong relationship between them.Correlation matrix within the parameters is shown in table 4of Urmaal wetland for the year 2015-16.

CONCLUSION

Increased nutrient content, high temperature might have enhanced the growth of aquatic macrophytes, resulting high primary productivity (14).As primary productivity depends upon the amount of sunlight, temparture in waterbodies, high rate of photosynthesis results higher density of phytoplanktons and aquatic macrophytes. High rate of primary productivity during premonsoon due to high sunlight penetration was reported by many researchers [15,16,17]. In this investigation it was noticed that the productivity is governed by various factors such as sunlight, weather conditions temperature, rainfall, phytoplanktons etc .The anthropogenic factors which influenced the primary productivity were agricultural runoff, monsoon flood, human activities etc.

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