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## Studies on some limnological parameters of a flood plain wetland of West Bengal vis-a-vis avifaunal diversity

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**Abstract :** The present study deals with the limnological investigations relation to anticipated effects of migratory waterbirds in Purbasthali lake, an ox-bow lake of district Burdwan, West Bengal. The meandering nature of river Ganga in its lower course in West Bengal has given rise a large number of floodplain wetlands, mostly open type ox-bow lakes. These floodplain wetlands are rich in biodiversity (both floral and faunal) and are considered among the most productive ecosystems and play a very important role in socio-economic condition of the neighbouring regions as they are used for commercial fisheries (both culture and capture fisheries). This ox-bow lake is famous here for thousands of migratory bird coming here from far off places including Siberia in winter months. In our study period we examined the relation between different physico-chemical parameters and the waterbird population. The addition of bird guano increased the nutrients like sulphate, phosphate, nitrate etc. in the water and was rapidly utilised by higher gross productivity (GPP) as well as by secondary production of the water body. The limnological parameters in different seasons (*viz.* Pre monsoon, monsoon and post monsoon) vary greatly in this ox-bow lake. In our study period the mark changes in the limnological parameters of this waterbody during winter months was observed due to the activities of a large number of migratory avifaunal population.

**Key words :** Purbasthali lake, Floodplain wetland, Ox-bow lake, Limnological parameters, Migratory waterbirds.

### INTRODUCTION

Due to low gradient in the lower deltic region and high discharge during monsoon, the river Ganga and it's tributaries have given rise a large number of flood plain wetlands. The wetlands are locally known as 'beel' or 'bnour'. 'Beel' or 'bheel' is a term for a pond (wetland) with static water (as opposed to moving water in rivers and canals), in the Ganges-Brahmaputra flood plains of the eastern Indian states of West Bengal and Assam and in the country of Bangladesh. The term owes it's origin to the word of the same pronunciation meaning 'pond' in the Bengali and assamese languages. These wetlands harbour rich floral and faunal diversity and support significant fishery in the concerned region. Wetlands *i.e.*

lakes, jheels, beels, bnours are one of the most important and productive ecosystem. They have a variety of linkages for energy and nutrient exchange with surroundings. The oxbow lake of Purbasthali sprawls over an area 3.50 km<sup>2</sup>. in the post monsoon period of winter months. Beyond the lake, this river fed eco-system also forms a cluster of large and small islands comprising Purbasthali Gangetic Isle Complex. Topographic configuration is the typical monotonously low dipping Gangetic plain of West Bengal with an average height of 14 mtrs above mean sea level. During monsoon river gets flooded, with the water level within the wetland getting higher and under heavy rains the enclosed islands get submerged. The area is extremely rich in alluvial soil content. Keeping in view the importance of the waterbody the present study or work is undertaken to assess the general physico-chemical characteristics of water including primary productivity of purbasthali lake in

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three different seasons, viz, pre-monsoon (from March to June), monsoon (from July to October), and post-monsoon (from November to February). The study was carried out from March 2011 to February 2012. During winter months a variety of waterbird species aggregate in the lake. The aggregation of migratory waterbird species in such water body results into significant changes in water qualities due to addition of extra load of nutrients during winter seasons. The impact of these avifaunal population on this waterbody will also be investigated properly.

**MATERIALS AND METHODS**

**Study area:** Purbasthali lies close on the Tropic of Cancer. Purbasthali ox-bow lake is created by the river Ganga, on its Western bank, in Burdwan district of West Bengal. It is 120 km north from Calcutta. On the Eastern bank of the river lays the old and holy town of Nabadwip. The lake is positioned on 23°27'35"N latitude and 88°21'08"E longitude, at an elevation of 7 m.

**Collection of water samples:**

Surface water samples were collected fortnightly in a 500 ml. Glass bottle for analysing different physico-chemical parameters of water. Water samples were collected in 3 replicates from surface, column and bottom of each sampling sites and the mean values of those results were taken for consideration. Preservation of water samples were done at 4° C temperature.

**Analysis of water samples:**

Different limnological parameters of water were taken into consideration. These were- temperature, transparency, pH, DO(dissolved oxygen), BOD(biological oxygen demand), COD (chemical oxygen demand), total alkalinity, hardness, conductivity, chloride, ammonia, nitrate and phosphate etc. of the sample water. Among these parameters water temperature, pH, DO, conductivity and total alkalinity were measured in the field and rest of the parameters were mostly tested within 24 hrs. of collection in the main laboratory. The chemical analysis was done in the field and the laboratory following the standard methods of APHA (1995)<sup>1</sup>, 19<sup>th</sup> edition.

**Relation between limnological parameters and avifaunal diversity:**

The migratory waterbirds usually come to the wetlands in winter months. They start their aggregation in these lakes usually during October and stay there till last week of February or March. During this period the physico-chemical parameters of these wetlands are vastly changed by various activities of the avifaunal population. The organic load of the water body become increased. Our study is to investigate the changes in water quality parameters and the impact of the bird population on this wetland over the total period of time.

**RESULTS AND DISCUSSION**

**Table 1. Seasonal changes in the physico-chemical conditions of Purbasthali ox-bow Lake, Burdwan District, West Bengal, India, for the year (March 2011- February 2012).**

[The values given in the table are average of the three sampling sites].

PARAMETERS	PURBASTHALI LAKE		
	PRE-MONSOON	MONSOON	POST-MONSOON
Water temperature(°C)	34.50	29.60	26.13
pH	7.56	8.36	8.33
Transparency (cm)	111.90	122.70	103.70
DO(mg/l)	5.26	6.33	7.63
BOD (mg/l)	2.25	2.60	3.72
COD (mg/l)	54.96	43.56	51.90
Alkalinity (mg/l)	26.00	42.13	27.20
Hardness (mg/l)	127.96	111.10	141.00
Chloride (mg/l)	14.54	11.60	17.81
Nitrate (mg/l)	16.11	18.45	52.60

Table Continued.....

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Continued table

<b>Phosphate (mg/l)</b>	0.23	0.26	0.29
<b>Calcium (mg/l)</b>	18.36	31.05	52.00
<b>Sulphate (mg/l)</b>	15.72	26.55	51.21
<b>Salinity (ppt.)</b>	1.30	0	0.50
<b>Total dissolved substances (mg/l)</b>	93.54	102.50	124.95
<b>Gross primary production (mg C/m<sup>2</sup>/d)</b>	1859.20	1978.00	3840.43
<b>Net primary production (mg C/m<sup>2</sup>/d)</b>	930.10	1162.31	2215.80

**Table 2. Important wetland floral composition of Purbasthali lake, Burdwan District, West Bengal, India.**

<b>TYPES</b>	<b>COMMON NAME</b>	<b>SCIENTIFIC NAME</b>
Submerged	Hydrilla	<i>Hydrilla verticillata</i>
	Coontail	<i>Ceratophyllum demersum</i>
Floating	Water hyacinth	<i>Eichhornia crassipes</i>
	Water lettuce	<i>Pistia stratiotes</i>
	Water spinach	<i>Ipomea aquatica</i>
Emergent	Cattail	<i>Typha latifolia</i>
	Bulrush	<i>Scirpus longii</i>
	Reed	<i>Phragmites communis</i>

**Table 3. List of some avian fauna observed in Purbasthali lake during study period.**

<b>COMMON NAME</b>	<b>SCIENTIFIC NAME</b>
Lesser Whistling-duck	<i>Dendrocygna javanica</i>
Northern Shoveler	<i>Anas clypeata</i>
Northern Pintail	<i>Anas acuta</i>
Garganey	<i>Anas querquedula</i>
Cotton Pygmy-Goose	<i>Nettapus coromandelianus</i>
Gadwall	<i>Anas strepera</i>
Red-Crested Pochard	<i>Netta rufina</i>
Ferruginous Pochard	<i>Aythya nyroca</i>
Black-rumped Flameback	<i>Dinopium benghalense</i>
Common Kingfisher	<i>Alcedo atthis</i>
Stork-billed Kingfisher	<i>Pelargopsis capensis</i>
White-throated Kingfisher	<i>Halcyon smyrnensis</i>
Pied Kingfisher	<i>Ceryle rudis</i>

<b>COMMON NAME</b>	<b>SCIENTIFIC NAME</b>
Asian Palm Swift	<i>Cypsiurus balasiensis</i>
Spotted Dove	<i>Spilopelia chinensis</i>
Common Moorhen	<i>Gallinula chloropus</i>
Common Coot	<i>Fulica atra</i>
Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>
Small Pratincole	<i>Glareola lactea</i>
Little Grebe	<i>Tachybaptus ruficollis</i>
Little Cormorant	<i>Microcarbo niger</i>
Great Egret	<i>Ardea alba</i>
Cattle Egret	<i>Bubulcus ibis</i>
Indian Pond Heron	<i>Ardeola grayii</i>
Black Drongo	<i>Dicrurus macrocercus</i>
Asian Pied Starling	<i>Gracupica contra</i>

The high diversity of Purbasthali ox-bow lake is due to the availability of all types of macrophytes which provide shelter and various niches to the organisms. The physico-chemical parameters (shown in the table 1) indicate that the water of Purbasthali lake was comparatively clean. The mean pH was found to vary between 7.56 to

8.36, which indicate the alkaline nature of water with its mean peak value during monsoon months. The DO levels of this lake indicate that the lake is not in immediate threat of eutrophication. The nutrients level such as chloride, phosphate, nitrate, sulphate was recorded in high amounts in post-monsoon months (November to February). The

total dissolved substances (TDS) remained higher in the winter months, not only this but the gross and net primary production of the water body was also much higher than the rest of the months. It was probably due to the activities

of migratory water birds in the lake and partly due to the decomposition of water weeds that increased the concentration of these ions in the lake water.

**Table 4. List of some Piscean fauna found in Purbasthali lake during study period.**

LOCAL NAME	SCIENTIFIC NAME
Rohu	<i>Labeo rohita</i>
Catla	<i>Catla catla</i>
Common carp	<i>Cyprinus carpio</i>
Silver carp	<i>Hypophthalmichthys molitrix</i>
Grass carp	<i>Ctenopharyngodon idella</i>
Tilapia	<i>Oreochromis mossambica</i>
Chanda	<i>Chanda ranga</i>
Magur	<i>Clarius batrachus</i>
Koi	<i>Anabas testudineus</i>
Lata	<i>Channa punctatus</i>

As the lake is located in the upper most zone of tidal region, the salinity of the water body was remaining low at all the seasons. Due to the suitability of climatic condition and healthy water quality several avifaunal species gather in the winter months of every year. The Lesser Whistling-duck (*Dendrocygna javanica*) dominated the water body, but several other species were also found. The avifaunal species observed during the study period is shown in the table 3. The lake also contains good variety of vegetation. The floral diversity of Purbasthali lake (during March 2011-February 2012) is shown in the table 2. More over this ox-bow lake is an important site of fresh water fish culture for commercial purpose. Various indigenous and exotic fresh water fish fauna were enlisted during the study period (as shown in the table 4).

#### CONCLUSION

On the basis of our study, it may be concluded that the Purbasthali wetland may be classified as mesotrophic in nutrient status. As the nutrients like sulphate, phosphate, nitrate, chloride etc. were present in comparatively low amount in pre monsoon and monsoon months, whereas in post monsoon months the nutrients level became high mostly due to the addition of bird guano into the lake water. Similar results were observed by CICFRI (2000)<sup>4</sup> during

their survey of flood plain wetlands of West Bengal. The high floral and faunal diversity reflects the suitability of the habitat for the organisms, more over it is correlated with longer food chain and complex food web of the ecosystem.

#### REFERENCES

1. APHA (American Public Health Association ) 1995, 19<sup>th</sup> edition. Standard methods of examination of water and wastewater. APHA, Washington D.C.
- \*2. **Bala G and A Mukherjee, 2010.** Water quality index of some wetlands in Nadia district, W.B, India, International journal of lakes and rivers, ISSN 0973-4570 volume 4, Number 1(2010), pp. 21-26.
- \*3. **Biswas Roy M, N R Samal, P K Roy and A Mazumdar, 2010.** Water-shed management with special emphasis on freshwater wetland: A case study of a floodplain wetland in W.B, India, Global NEST Journal 2010.
4. **CICFRI, 2000.** Ecology and fisheries of beels in West Bengal. Central Inland Capture Fisheries Research Institute, Barrackpore, West Bengal, Bulletin no. 103.
- \*5. **Ganesan L and RA Khan, 2007.** Studies on ecology of zooplankton in a floodplain wetland of West Bengal, India, Proceedings of Taal 2007: The 12<sup>th</sup> World lake conference: 67-73.

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- \*6. **Gibbons, D. W., Hill, D., Sutherland, W. J., 1996.** *In* W J Sutherland, ed. Ecological census techniques: a handbook. Cambridge, U K, Cambridge university press, pp.227-259.
- \*7. **Khan, R.A., 2002.** The ecology and faunal diversity of two floodplain ox-bow lakes of southern West Bengal, Record Zoological Survey Of India, Occasional paper no. 194: 1-104.
- \*8. **Khan, R.A., 2003.** Faunal diversity of zooplankton in freshwater wetlands of south-eastern West Bengal, Record Zoological Survey Of India, Occasional paper no. 204: 1-107.
- \*9. **Krebs, C.J., 1989.** Ecological methodology, Harper Collin S, N. Y. 654p.
- \*10. **Mitra, K., 1989.** Limnological features of beels, Central Inland Capture Fisheries Research Institute, Bulletin no. 63.
- \*11. **Patra, A., Santra, K.B. and Manna, C. K., 2010.** Limnological studies related to physico-chemical characteristics of water of santragachi and joypur jheel, West Bengal, India, Our nature (2010) 8: 185-203.
- \*12. **Prasad, S. N., Ramchandra, T. V., Ahalya, N. , Sengupta, T , Kumar, A. , Tiwari, A. K., Vijayan, V. S. and Lalitha V., 2003.** Tropical ecology 43(1): 173-186.
- \*13. **Roy U S, A R Goswami, A Aich and S K Mukhopadhyay, 2011.** Changes in densities of waterbird species in Santragachi lake, India: Potential effects on limnological variables, Zoological studies 50(1): 76-84.

\* Additional references consulted.

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