



LIMNOLOGICAL STUDY OF A CLOSED WETLAND-POTIASOLA FROM JORHAT DISTRICT, ASSAM

R. Bordoloi¹, S. K. S. Abujam^{2*} and G. Paswan³

¹Dept. of Zoology, D. R. College, Golaghat, Assam 785621, India

²Dept. of Life Sciences, Dibrugarh University, Assam-786004, India

³Dept. of Ecology & Environmental Science, Assam University, India

Email Id: santosh.abujam@gmail.com

(Received on Date : 29th June 2012

Date of Acceptance: 23rd July 2012)

ABSTRACT

Certain physico-chemical parameters of Potiasolabeel (wetland) in Jorhat District, Assam showed that the maximum water and atmospheric temperature is 25.5^oC and 27^oC while the minimum is 17^oC and 16^oC respectively. The pH varied between 5.6 and 7.2; turbidity between 15.3 and 50 NTU; DO between 6.49 and 10.03 mg/l; FCO₂ between 0.5 and 3.2 mg/l; hardness between 15 and 35 mg/l. The soil of the beels is of the alluvial type. The range of sand in soil was varied 29 and 35% while range of clay between 20 and 23 %. The pH of soil was found between 4.4 and 5.9. Nitrite content was trace amount only in the beels, it was ranged from 0.01 to 0.05 mg/l; nitrate 0.1 to 0.6 mg/l; phosphate 0.11 to 0.8 mg/l; organic carbon 0.3 to 2.33%. Meteorological data was also discussed in this paper. The results reveal that a slight variation occurs in certain physico-chemical parameters due to the surface run-off and other excessive human activities.

Keywords:Physico-chemical parameters, Potiasola, Beel, Wetland, Jorhat.

Number of Tables : 3

Number of Figures: 6

Number of References:30

INTRODUCTION

Potiasola is a closed type wetlands and located in the Jorhat District ($26^{\circ}48' - 26^{\circ}49''$ N and $94^{\circ}08' - 94^{\circ}10''$ E). The wetland is situated in the North east of Jorhat town and there is no connection with Brahmaputra River. However, in the earlier the beel was connected through a feeding channel known as Bejjian but the channel is now completely lost due to embankment of Brahmaputra River. The embankment of the Brahmaputra River is just located on the eastern side of the beel. The catchments area of the beel is fairly large and is surrounded by paddy fields and different types of marginal plants. During the winter season the catchment area of the beel is utilized for the cultivation of vegetation and as well as it is also utilized for feeding ground of buffalo and cattle.

Studies of wetlands in Assam are restricted to Day (1981) who estimated the presence of 1,392 wetlands in the state of Assam. Deuri and Lahon (1987) studied the effect of embankments, slice gates and similar structure in the fisheries of Nagaon and Kamrup districts. Again, Different wetlands of Barak valley of Assam were studied by Nath (1987) and Kar & Dey (2000). Most significant contributions on *beel* ecology are those of Agarwala (1996) in Tamrange wetland; Biswas and Boruah (2000) in lentic and lotic water bodies of upper Brahmaputra basin; Dutta (2002) in "closed" and "open" *beels* in upper Assam; Bera *et al.* (2008) in Deepor beel; Singh *et al.*, (2009); Dakua *et al.*, (2009); Abujam *et al.* (2011) in Maijan beel; Hussain & Biswas (2011) in wetland of Dhemaji; Paswan *et al.*

(2012) in Borsalabeel of Jorhat.

To increase fish production one needs to have knowledge of physical, chemical and biological properties of the natural beel ecosystem. Over the years, particularly winter seasons the water quality of the wetland has been changed due to influx of the untreated waste water from paddy field and at the same time, the wetland is converting to shallow swampy area due deposition of silt and heavy growth of vegetation. Considering the above view, the present study has taken up the water quality, soil and meteorological parameters of the Potiasola beel.

MATERIAL AND METHODS

The experiment was undertaken in Potiasola beel of Jorhat district during January to December 2010. It is about 15 km. from North east of Jorhat town, lies between $26^{\circ}48' - 26^{\circ}49''$ N latitudes and $94^{\circ}08' - 94^{\circ}10''$ E longitudes. The study period was divided into four seasons: viz., winter season (December-February), pre-monsoon (March-May), monsoon (June-August) and post monsoon (September-November). The physico-chemical parameters and soil quality of the wetlands were recorded as per standard procedure of Trivedy & Goel (1986) and APHA (1998). Meteorological data obtained from Meteorological laboratory, Assam Agriculture University, Jorhat. Rainfall data were collected from the Central Water Commission (W.B.W.T.) station located at Neamatighat about 1 km away from the beels.

RESULT AND DISCUSSION

Physico-chemical parameters of water: Physico-chemical parameters of Potiasola beel have been conducted during January' 2010 to December' 2010 (Table-1). Surface water temperature fluctuated from 17 to 25.5°C with an average value of 21.3°C. Similarly, atmospheric temperature was varied between 16 and 27°C with an average of 21.5. Both the temperature is similar in trend and lowest and highest values were recorded during winter and monsoon season respectively (**Fig.1**). Temperature of the water has profound effects on the chemistry and biochemical reactions in the organisms present in water. pH was found to be lowest (5.6) and that of highest (7.2) during November and May respectively with an average value of 6.4. The minimum pH was observed in post-monsoon and that of maximum in pre-monsoon (**Fig.1**). Water bodies were slightly acidic features and not found within the permissible limit of 6.5 to 8.5 (BIS-1982). Similar results were reported in different wetlands of Assam (Jhingran & Pathak, 1987; Acharjee et al., 1999; Kar, 2000 & Sharma, 2000).

Turbidity of water was varied between 15.3 (December) and 50 NTU (July) with an average value of 32.7 (NTU). Higher rate of turbidity was recorded in monsoon and minimum value was observed

in December (Fig. 2). Turbidity reduced light penetration in the water that affected photosynthesis process of Phytoplankton as well as reduced productivity of the beels.

Dissolved oxygen was ranged from 6.49 (July) to 10.03 mg/l (January) with an average value of 8.26 mg/l. Seasonal variation of dissolved oxygen has been observed throughout the entire study period. Dissolved oxygen was above the tolerance limit (5 mg/l) as prescribed by BIS (1982). Again maximum dissolved oxygen was recorded in winter and pre monsoon and gradually decreased from monsoon onwards (Fig. 2). A seasonal fluctuation of DO is also reported earlier from Indian lentic water (Dey, 1981; Lahon, 1983; Goswami, 1985; Yadava, 1987; Agarwala, 1996; Kalita and Goswami, 2006; Jhingran and Pathak, 1987). Several workers have reported variable dissolved oxygen level in the beels of Assam. For instance Yadava *et al.*, (1987) recorded 2.6 to 10.9 mg/l, Jhingran and Pathak (1987) 4.27 to 11.2 mg/l; Acharjee *et al.* (1999) 5.4 to 8.18 mg/l. The FCO_2 is necessary to retain calcium in water in the form of calcium bicarbonate. The free CO_2 was ranged from 0.83 (March) to 2.72 mg/l (August). The FCO_2 was drop down from pre-monsoon onwards and slowly increased from Monsoon (Fig. 3) The variation of CO_2 was due to the absorption by plants for photosynthesis.

Table 1: Physicochemical parameters of Potiasolabeel

Characteristics of water	Range	Mean
Water temperature °C	17 - 25.5	21.3
Air temperature °C	16 - 27	21.5
Turbidity (NTU)	15.3 - 50	32.7
pH	5.6 - 7.2	6.4
DO mg/l	6.49 - 10.03	8.26
Hardness mg/l	15 - 35	25.0
FCO ₂ mg/l	0.83 - 2.72	1.76

Table 2: The characteristics of soil from Potiasola

Characteristics of soil	Range	Mean
Alluvial	29 -35 (sand) & 20-23 (clay)	32.0% (sand) & 2 1.5 % (clay)
Nitrite (mg/l)	0.01- 0.05	0.03
Nitrate (mg/l)	0.1- 0.6	0.35
Moisture content (%) (summer)	45 - 99	72.0
Phosphate (mg/l)	0.11 - 0.8	0.46
pH	4.4 - 5.9	5.2
Organic carbon (%)	0.3 – 2.33	1.32

Table 3: Meteorological parameter (2010)

Period	Temperature °C		Humidity in percentage		Rain falls (mm)	Intensity (Lux)
	Max	Min.	Morning	Evening		
2010						
Jan	22.7	9.8	98	96	4.2	71074.06
Feb	22.7	12.3	96	74	57.7	59533.66
Mar	27.7	15.8	93	68	17.1	93446.66
Apr	27.4	19.9	91	73	323.4	62469.99
May	31.5	24	90	72	194.7	66266.67

Jun	30.9	24.8	93	81	310.1	94736.67
Jul	32.1	25.8	92	77	327.8	73673.33
Aug	32.3	25.5	92	76	337.8	63759.99
Sep	31.1	24.4	95	77	357.7	74076.67
Oct	31	21.7	93	80	24.1	78056.66
Nov	26.5	16.7	96	78	9.2	57760
Dec	22	10.1	96	76	0	195506
Aver	28.16	19.23	93.75	77.33	173.28	82530.03

Fig. 1: Monthly mean variation of pH/Water/Atmospheric temperature

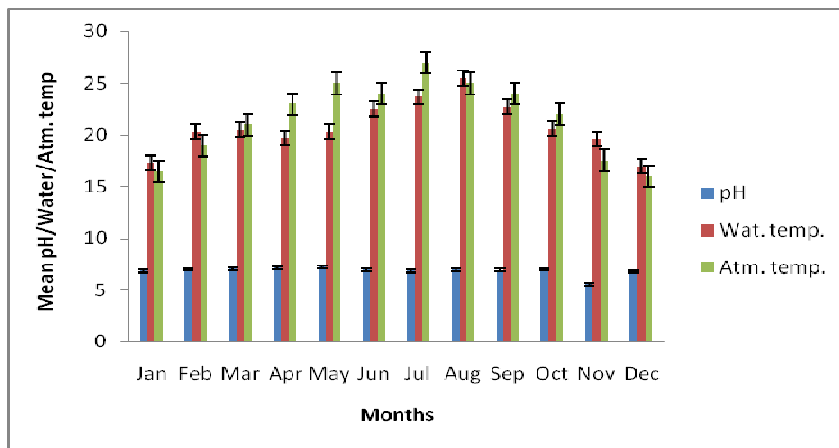


Fig. 2: Monthly mean variation of DO/Hardness/Turbidity

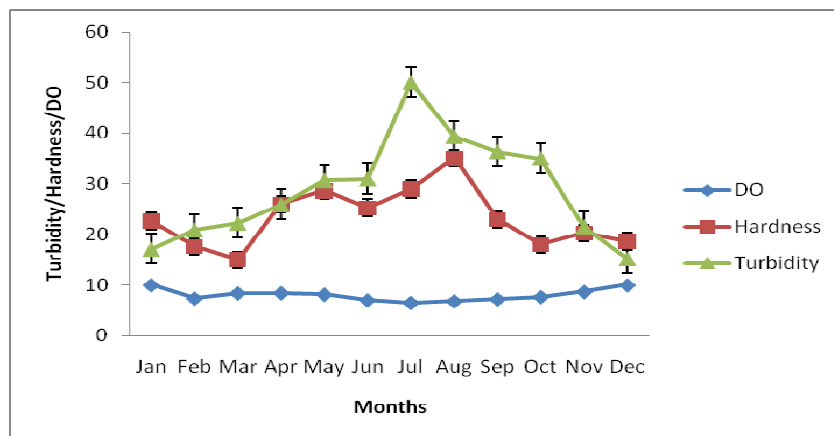


Fig. 3: Monthly mean variation of FCO₂

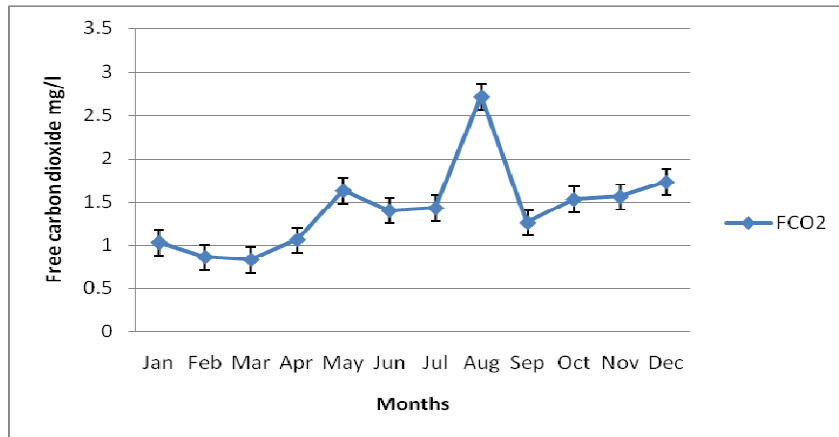


Fig. 4: Monthly mean variation of pH and organic carbon of soil

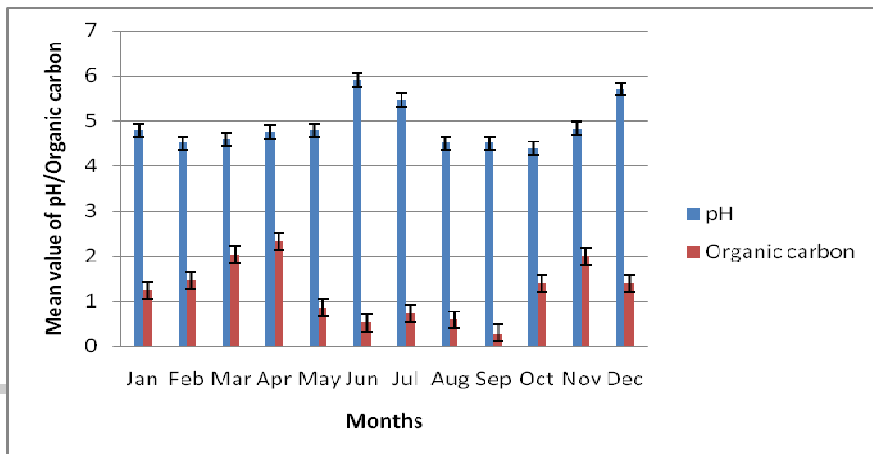


Fig.5: Monthly mean variation of moisture content of soil

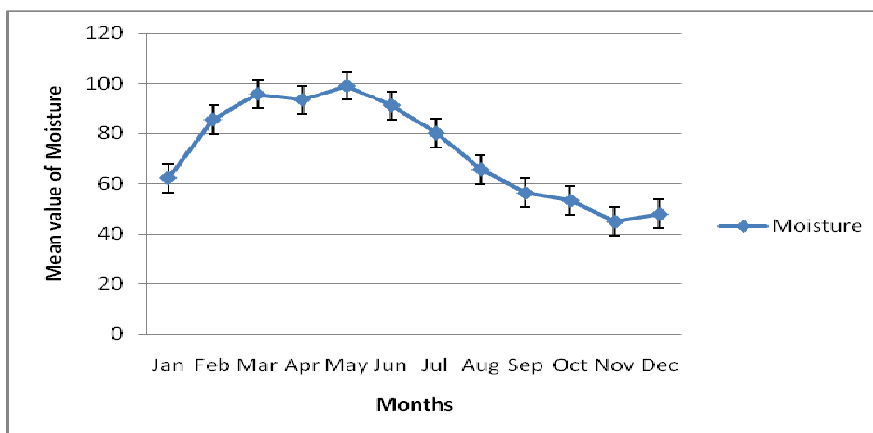
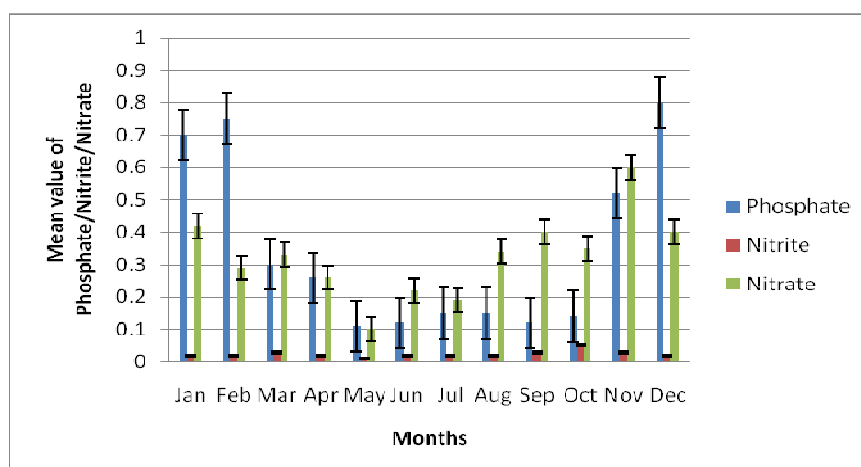


Fig. 6: Monthly mean variation of phosphate, nitrite, nitrate of soil

Variation of Free CO₂ in different fresh water bodies of Assam were reported by Jhingran&Pathak (1997), Lahon (1983), Kar (2000) and Dutta, (2002). Sreenivasan (1964) reported level of free CO₂ from Kodaikanal Lake and its values fluctuated from 2.76 to 6.2 ppm and from 0.8 to 1.32 ppm at the bottom as well as surface layers, respectively.

Hardness of water in the beel ranged from 15 (March) to 35 mg/l (August) with an average value of 25 mg/l. The maximum hardness was recorded in monsoon and that of minimum was recorded in pre-monsoon (Fig. 2). Similar observations were also recorded in Dhirbeel and Maijanbeel of Assam (Thingram and Pathak, 1987; Abujam et al. 2011).

Characteristics of soil: The soil of beel is of the alluvial type. The range of sand in soil ranged from 29 to 35 % with mean value 32.0% and range of clay from 20 to 23 % with the mean value 21.5% (Table 2). pH of the soil of the beels was slightly acidic and it ranged from 4.4 to 5.9 with an average value

of 5.2. The lowest pH value of soil was observed in October and that of highest was in June (Fig. 4). Similar results were also made by several authors in different wetlands of Assam (Lahon 1983; Goswami 1997; Acharjee *et al.* 1998). An organic carbon value was found between 0.3 (September) and 2.33% (April) with mean value 1.32 (Fig. 4). The organic carbon recorded in the wetlands can be considered as a normal feature of the wetlands (Agarwala, 1996; Acharjee, 1997; Goswami, 1985; Kalita and Goswami, 2006). Moisture content was recorded as 45 to 99% during November and May with mean 72.0 (Fig. 5). Nitrite content of soil was trace amount only in the beels. Nitrite content of the soil ranged from 0.01 to 0.05 with mean 0.03 mg/l. Nitrate content was recorded as 0.1 and 0.6 ppm with mean 0.35 mg/l. Both the nitrite and nitrate was found to be minimum in pre-monsoon and that of maximum in post monsoon (Fig. 6). Phosphate content in closed beel ranged from 0.11 (May) to 0.8 (December) with mean 0.46 ppm (Fig. 6). Similar observation was also recorded in

other wetlands of Assam (Goswami, 1985; Yadava, 1987; Jhingran&Pathak, 1987; Kar, 2000). This indicates the wetlands of Assam are the non-polluting nature.

Meteorological parameters: As per meteorological data (Table 3), average maximum atmospheric temperature was 28.16 °C and that of minimum 19.23 °C; average value of humidity was 93.75 (for morning) and 77.33 (for evening); average rainfall was 174.1 mm and average light intensity was 71722.63 lux, were observed in the beel during 2010.

From the above findings, it is clear that a distinct monthly variation in selected physico-chemical parameters of the wetland. However, parameters of soil data reveal that no significant seasonal variations in major physico-chemical parameters occur in beel. There is further investigation on the fish diversity and other water quality of this wetland. Because of there is always chance to dilute the wetland water with the overflowing water from paddy field and as well as thick covering water hyacinth over the wetland during the monsoon seasons.

ACKNOWLEDGEMENTS

The authors are grateful to the UGC for providing financial assistance to carry out the work.

REFERENCES

Abujam, S. K. S., Dakua, S., Bakalial, B., Saikia, A. K., Biswas, S. P. and Choudhury, P., Diversity of Plankton in MaijanBeel, Upper Assam. *Asian J. Exp. Biol. Sci.*, 2(4): 562-568., (2011)

Acharjee, B., Comparative study of limnology and fisheries of three beels of lower Assam. Unpublished Ph.D. thesis, Gauhati University., (1997)

Acharjee, B., Choudhury, M., Dutta, A.&Goswami, U. C., Productivity and fish yield in the beels of lower Brahmaputra. Basin. *Indian J. Fish.*, 45(4): 419-427., (1998)

Acharjee, B., Dutta, A. &Choudhury, M., Role of physico-chemical parameters in the evaluation of productivity of Dighalibeel, Assam. *Environ. &Ecology*, 17(2): 274-279., (1999)

Agarwala N. K., Limnology and fish productivity of Tamranga wetland in Bangaigaon district of Assam (India) with special reference to some productivity indicator, PhD Thesis, Gauhati University, Assam, pp. x+200., (1996)

APHA., Standard Methods for Examination of Water and Wastewater. 20th Edition, AM Public Health Assoc, Washington D.C., (1998)

Bera, S. K., Dixit, S., Basumatary, S. K. &Gogoi, R., Evidence of biological degradation in sediments of Deeporbeel Ramsar site, Assam as inferred by degraded Palynomorphs and fungal remains. *Current Science*, 95(2): 178-180., (2008)

BIS., Tolerance limits for inland surface waters subject to pollution. 2296 p., (1982)

Biswas, S. P. and Boruah, S., Fisheries ecology of the North-Eastern Himalaya with special reference to the Brahmaputra River. *Ecol. Eng.*, 16: 39-50., (2000)

Dakua, S., Singh, A. S. K., Choudhury, P. and Biswas, S. P., A preliminary investigation on the fish and fisheries of Maijanbeel in upper Assam. *Indian J. Environ. & Ecoplan.*, 16 (1): 263-270., (2009)

Deuri, P. C. and Lahon, B., Flood control measures in Assam: Impact on beel fisheries. In: Workshop on Development of Beel Fishery in Assam. 21st and 22nd April, 1987, Assam Agricultural University., (1987)

Dey, S. C., Studies on the hydrobiological conditions of some commercially important lakes (beels) of Kamrup district of Assam and their bearing on fish production, North-Eastern Council, Govt. of India, Shillong., (1981)

Dutta, P. K., A comparative study of the hydrobiology and fisheries of open and closed beels in Jorhat district of Assam. Ph. D. Thesis (unpublished), Dibrugarh University, India., (2002)

Goswami, M. M., Limnological investigation of a tectonic lake of Assam, India and their bearing on fish production. Unpublished Ph.D. Thesis, Gauhati University, Assam., (1985)

Goswami, N., Studies on the productivity indicators in three different types of

wetlands of Assam, India, PhD Thesis, Gauhati University, Assam, pp. iv+217., (1997)

Hussian, Md. and Biswas, S. P., Physico-chemical characteristics of a floodplain lake of Dhemaji in upper Assam. *Bull. Life. Sci.*, 16: 81-91., (2011)

Jhingran, A. G. and Pathak, V., Ecology and management of *beels* in Assam- A case study of three *beels*, p. 16-36 In: *Compendium Proc. Workshop on Development of Beel Fisheries in Assam.* Assam Agricultural University, Khanapara, Guwahati., (1987)

Kalita, T. C. and Goswami, M. M., Microhabitat of *Monopteruscuchia* (Hamilton and Buchanan, 1822): A case study in wetlands of Goalpara District of Assam. *Aquacult.*, 7(1): 43-52 p., (2006)

Kar, D., An account of physico-chemical characteristics of twenty lentic systems in relation to Eutroiphica status in Barak valley region of Assam. In: National Symposium on Current Trends and Wetlands and Fisheries Research in the New Millennium, 8-9 Nov. 2000 at Assam University, Silchar., (2000)

Kar, D. and Dey, S. C., Yield and conservation of Indian major carps of lake Sone in Assam. *Env.&Ecology*, 18(4): 1036-1038., (2000)

Lahon, B., Limnology and fisheries of some commercial beels of Assam, India. Unpublished Ph.D. Thesis, Gauhati

*J.Bio.Innov*1(5),pp:132-141,2012

University, Assam, 349 p., (1983)

Nath, P., Systematics, Distribution and Ecology of Ichthyofauna of Arunachal Pradesh with particular reference to the Limno-biology of Itanagar Lake, PhD Thesis, Gauhati University, pp. xvii+362, Assam, INDIA., (1987)

Paswan, G., Singh, A. S. K., Biswas, S. P. and Dey, M., A Study of Certain Physico-Chemical Parameters of BorsolaBeel (Wetland) of Jorhat. (Ed.) Proc. National seminar on 'Current Issues of Conservation and Wise Use of Wetlands in North Eastern Region of India', 291-297 p., (2012)

Sharma, P. K., Systematic distribution and ecology of Zooplankton in some floodplain wetlands of Assam, India, Ph. D. thesis, Gauhati University, pp. 236., (2000)

Singh, A. S. K., Dakua, S. and Biswas, S. P., Physico-chemical parameters and fish enumeration of Maijanbeel (wetland) of upper Assam. *Geobios*, 36: 184-188., (2009)

Sreenivasan, A., Limnological studies and fish yield in three upland lakes of Madras, India. *Limnol. Ocenogr.*, 9(4):564-575., (1964)

Trivedy, R. K. and Goel, P. K., Chemical and Biological Methods for Water Pollution Studies. Environmental Publication Karad (India), (1986)

Yadava, Y. S., Studies on the limnology and productivity on an ox-bow lake in Dhubri district of Assam, India. Unpublished PhD

Thesis, Gauhati University, Assam., (1987)

Yadava, Y. S. and Chaudhury, M., 'Banas' fishing in beels of Assam. *Bombay Nat. Hist. Soc.*, 82(2):452-456., (1986)

Yadava, Y. S., Singh, R. K., Choudhury, M. and Kolekar, V., Limnology and productivity of Dighalibeel (Assam). *Trop. Ecol.*, 28:137-146., (1987)