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ECOLOGY OF DEEPOR BEEL WETLAND, A RAMSAR SITE OF GUWAHATI, ASSAM WITH SPECIAL REFERENCE TO ALGAL COMMUNITY

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ABSTRACT

Present study was carried out to investigate the composition, diversity and distribution of algal community in relation to the physico-chemical properties of the water of Deepor beel wetland. This study reported that the ecological condition of the beel is mainly governed by dissolved oxygen, rainfall, free carbon dioxide and nitrate. Input of continuous discharge of the city's untreated sewage and the dumping of the municipal solid wastes in its close proximity are one of the important reasons for mesotrophic nature of the wetland. Most probable Number (MPN) of organism was recorded in the range of 800-13000 org/100 ml. A total of 27 nos. of algal species belonging to 19 genera of algae has been identified in different stations. From the present research, it is observed that municipal solid waste dumping site should be replaced and sanitary toilet can be build for the local people so that waste are not find their way into the wetland.

KEYWORDS: Algae, beel, physico-chemical properties, trace element, wetland.

INTRODUCTION

Among different ecosystems, wetlands constitute one of the most important ecosystems for man offering numerous regulating services. Water quality assessments of the wetlands are of immense importance in the management of fisheries, water supply and irrigation. Pollution status of water bodies are usually expressed as biological and physico-chemical parameters (Lenat *et al.*, 1980). Several authors have extensively documented the responses of macro-invertebrates to organic and inorganic pollution in aquatic habitat (Thorne and Williams, 1997, Kazanci and Dugel, 2000). Wetlands are the kidneys of nature. It recharges groundwater and serves as storm water deposits. People depend on them for fishing and agricultural activity which again associated with a region's micro-climate (Gogoi, 2013).

The province of Assam is gifted with a myriad of tectonic lake locally called as beel. The Deepor Beel is one of the most important natural, permanent wetlands of lower Assam located between 26°06'N and 26°09'N latitude and 91°36'E and 91°41'E longitude with an average altitude of 50 to 57 m above MSL covering an area of about 700 ha at present. It is the only major storm water storage basin for the Guwahati city. Each wetland has its own local, regional, and global importance in terms of ecological and socioeconomic values because of their unique role in the ecosystem and in the society. Deepor Beel has both biological and environmental importance and richer in floral and faunal diversity. It is of International Importance under the Ramsar Convention been designated as a Ramsar Site (No. 1207) on November, 2002 for provides a framework for national action and international cooperation for the conservation and judicious use of wetlands and their resources. Harboring large number of migratory waterfowl each year this large water body is a great food source and breeding ground for a variety of migratory birds, amphibians, reptiles, insects, micro and macrophytes, phytoplankton terrestrial weeds and important taxa of ecological and economic importance Considering the varieties of bird species found in the Beel, Birdlife International has also been declared Deepor Beel as an Important Bird Area (IBA). Now the Beel is facing problem because the accumulation of municipal solid wastes that are increasingly finding their way into the core area of the wetland. Continuous discharge of the city's untreated sewage through the Bahini and Bharalu Rivers and the dumping of the municipal solid wastes in its close proximity at Boragaon by the Guwahati Municipal Corporation (GMC) have pushed the wetland's pollution to alarming levels. The problem has got aggravated during the monsoon when rainwater sweeping large amounts of garbage from the dumping site to the wetland. If we give a close look it will reveal a blackish, oily substance coating the water over a large stretch. The deleterious impact of pollution of this lifeline wetland of this region is a causing concern. Rich biodiversity of the wetland has been declining and degradation of the water body has reached a critical state. Algae occupy a conspicuous position in wetland ecosystem [Comte, *et al*., 2005, Hassan, *et al*., 2007, Rodríguez, 2011]. They are extremely important group of phototrophs that contribute almost 40% of the total primary production of the freshwater body and play a crucial role in food web regulation. According to Palmer (1959) algae are the reliable indicators of pollution. The algal community which reflects the status of water quality is expected to be the tolerant form. Very less is known about these tolerant algae which are the primary producer in the aquatic body. The main objective of the present work is to study the ecology of the wetland and to investigate the algal species present in the habitat.

MATERIALS AND METHOD

Sampling stations

The present study was conducted in 5 different strategic location of the Deepor Beel wetland of Assam, North-East India. Selection of sampling station was done based on industrial effluents deposition, agricultural field's wash off, garbage dumping location, inlets and outlets of water. Five stations are as follows-

Sample Station 1: Boragaon landfill entrance (West), [26◦ 06.983 N, 091◦ 40.546 E].

Sample Station 2: Connecting Place Bridge (landfill) (North-west), [26◦ 06.852 N, 091◦ 40.349 E].

Sample Station 3: Assam Engineering College, gate no. 2 (East), [26◦ 08.108 N, 092◦ 39.044 E].

Sample Station 4: Airport (East), [26 ◦ 08.114 N, 091◦ 37.520 E].

Sample Station 5: Bird view watch point (North-East), [26◦ 06.779 N, 091◦ 39.387 E].

Collection and analysis of water and algal samples

Sampling of water and algae was done in the monsoon month i.e., May-June, 2015 from both top and bottom layer of water. Simultaneously algal samples were also collected with plankton net from top layer of water. A total of 25 numbers of independent variables of water were analysis by standard method (APHA, 2005). Identification of algae was done by standard protocol as proposed by Prescott (1951), Desikachary (1959). Algal sample were preserved in 4.5% formalin solution and cell counting of algae was done by following Lackey's drop method (Trivedy and Goel, 1986). Pearson correlation analysis was done by SPSS software to study the inter-relationships of the various parameters. All tests were performed three times and data were expressed as mean ± S.D. (n==3).

RESULT AND DISCUSSION

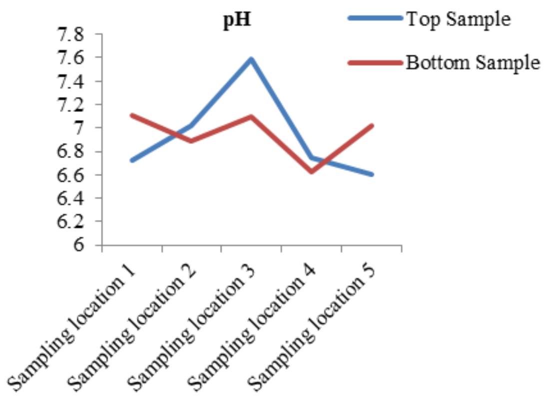
Surface water quality helps us in monitoring the influence of natural or manmade point and nonpoint sources of pollution on ecosystem (Ouyang, 2005). Analysis of different physico-chemical parameters of Deepor beel water was depicted in Fig. 3. The wetland receives dissolved inorganic, organic materials and other substances from various sources. The pH value of water was highest in station 3 of top layer (7.59±0.01) and lower in station 5 (6.60±0.01).The alkaline nature of pH during monsoon indicated the eutrophic condition of the wetland. Similar finding was reported by Das and Baruah (2016). Whitemore *et al*., (2006) reported that alkaline pH during monsoon month is a characteristic feature of eutrophic lakes. Freshwater with a pH range of 6.0-9.0 have been considered as productive ecosystem. The observed pH value was within the optimal range required for the growth and development of algal cell (7.0-9.0), for fungi (5.5-8.0), Deb, *et al*., (2013), Deb and Kalamdhad, (2016). Temperature of water was found more in top as well as in bottom sample of station 1(32◦C). Turbidity of water was more in bottom samples (93.7±0.08 NTU) as compared to top layer samples (9.9±0.08 NTU). Turbidity less than 10 NTU indicate excellent quality of water whereas more than 10 indicate fair quality. Highly turbid water is not considered as harmful (Ayodele and Ajani, 1999) which do not have any detrimental effect on the growth of alga. According to Deshkar *et al*., (2014) high turbidity during runny season could be due to the accumulation of different minerals in water because of runoff from the nearby industrial settlements and agricultural activities. Highest and least concentration of alkalinity i.e.150 mg/L and 95±1 mg/L was found in top layer of water in station 3 and 5. Hardness of water is due to the presence of cations such as Ca, Mg, Sr, Fe and Mn which can be attributed to the inflow of domestic sewage from the adjoining human habitations of the wetland. In present study highest concentration of hardness was found in top layer water (120±2.828 mg/L) of station 2 and least value in station 5 in both top as well as in bottom layer (54±2.828 mg/L). Agrawal and Patil (2014) reported that input of cations in water eventually increase the hardness and on the contrary, calcium, which is considered as an important nutrient for aquatic organisms, attained highest concentration during winter accredited to its higher solubility at low temperature. Solids are found in streams and wetlands mainly in two forms, one is suspended and other one is dissolved. Suspended solids will not pass through a filter but dissolved solids will pass. Total solids (TS) was found in the range of 300 -480 mg/L in present study. Total suspended solids (TSS) concentration was within 300 mg/L whereas Total dissolved solids (TDS) had shown in th range of 220 mg/L. Dissolved solids in freshwater include soluble ions of Na, Ca^2, Mg^2,HCO^3,SO^2. In lakes and streams total dissolved solids levels are found in the range of 50-250 mg/L. The drinking water tends to be containing 25-500 mg/L of total dissolved solids. The maximum content of dissolved oxygen was recorded in top water sample of station 3 (5.6 mg/L) and least value was found in bottom layer of water in station 2 (4.2 mg/L). The finding of Das and Baruah (2016) reports on Deepor beel water also reflect similar result. According to Ahmed and Wanganeo (2015), Bhat *et al*., (2015) low level of dissolved oxygen of water in monsoon month indicated high organic load in the form of sewage waste that are incorporated in the aquatic habitat with runoff. Biological oxygen demands or BOD is a measure of organic pollution of water showed maximum range in station 5 which was10.13±0.3 mg/L while lowest during in station 3 (3.75±0.7mg/L). High BOD value during monsoon indicated increased amount of organic wastes present in Deepor beel wetland during the period (Sharma, 2011). 28.06 mg/L - 60.93mg/L ranged of chemical oxygen demand (COD) was reported in present study. High concentration of COD value is an indication of high concentration of organic material inputs from adjacent industrial settlements. Total Kjeldahal Nitrogen was recorded from 0.56 to 0.84%. The total nitrogen content depends upon the rate of ammonia volatilization and organic matter degradation (Bernal *et al*., 1998). If the ammonia volatilization is more, there will be decrease in the concentration of nitrogen. Again if the organic matter degradation is higher, there will be increase in the concentration of nitrogen due to the net loss in biomass from the release of carbon dioxide (Huang *et al*., 2004). Sodium, potassium and calcium are three of the most essential nutrients to our body. But when any one of them is out of balance it can cause serious effects to your body and the particular habitat where the organism live. Highest concentration of Sodium was found in bottom water of station 1 which was 30.54±0.5 mg/L. Potassium was found in the range of 4.32 mg/L- 13.01±0.04 mg/L accordingly calcium was in the range of 7.9 mg/L- 41.99±0.7 mg/L. The concentration of nitrate and phosphate was found (0.002-0.11 mg/L, 0.012±0.001- 0.288±0.001 respectively). Nitrate and phosphate in freshwater can be traced to percolating sources such as agricultural fertilizers, domestic sewage (Muniyan and Ambedkar, 2011, Vyas and Bhawsar, 2013). The mixing of such sources in the wetland water along with the monsoon rains leaded to the rise in nitrate and phosphate levels. According to Jacobson (1991) slightly high concentration of PO^4 supports algal growth and indicates moderate level of pollution. The major danger associated with drinking-water is the possibility of its contamination by *Escherichia coli* bacteria which are released by human excreta. Total coliforms are indicator organisms used to detect bacterial contamination in drinking water. Their presence indicates the organisms that cause disease may be present, even though total coliforms themselves typically do not cause disease in healthy individuals but they are the pathway of disease-causing organisms in drinking water like nausea, vomiting and diarrhea. The presence of *E.coli* in a drinking water sample is an indication of fecal contamination of the water supply. MPN value was found in the range of 800-13000 org/100 ml of water which indicates that the water is not in a condition for direct use. Trace elements play important role in physiology of aquatic organisms and are essential elements for most species (Watanabe *et al*., 1997). Heavy metals such as Chromium (0.041mg/L-0.055 mg/L), Zinc, Iron, Lead and Arsenic were found in the limit of 0.174 mg/L, 3.42 mg/L,1.69 mg/L and 1.73µg/L respectively. Parameters such as temperature, pH, DO, EC, TA, NO^3, NO^2, NH^4 as well as trace elements like Cr, Fe, Zn, and Pb content of water samples were found within permissible limit (CPCB website, BIS website 1982, Kumar and Puri, 2012). Similar observation was also reported by Purkayastha and Gupta (2015).

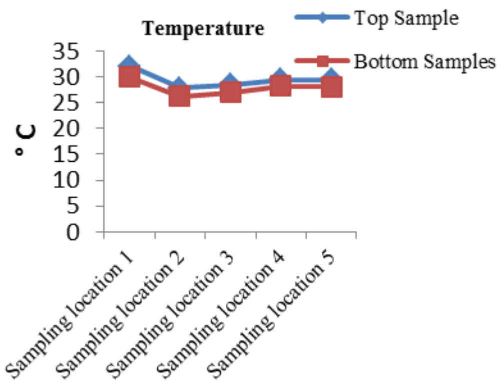
We found significant correlations among different physico-chemical parameters of water [Correlation matrix of top and bottom water samples Table 1 and 2]. Turbidity, alkalinity, TDS value of top water samples were significantly correlates with water pH (0.8638, 0.8115 and 0.6101). COD and total nitrogen established strong positive correlation with ammonia and total phosphorus (0.8055, 0668 and 0.7984, 0.7027). Ammonia was also significantly relates with MPN, Cr, Zn and pb. Again in bottom samples water we found significant positive correlation among pH, turbidity, hardness, total suspended solids, COD, TKN, total phosphorus, sodium, potassium and MPN value.

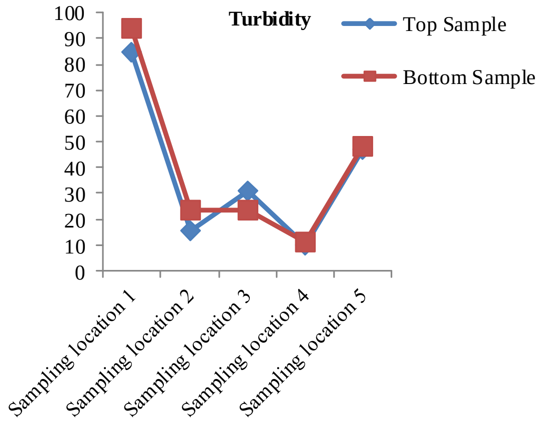
A total of 27 nos. of algal species belonging to 19 genera of algae has been identified in different stations. The list of algae encountered in the present study and their presence and absence at different stations was givn in Table 3.Highest number of species was observed in Bacillariophyceae (14) category followed by Chlorophyceae (8) and Cyanophyceae (4). Similar observation was also made by Deb and Kalamdhad (2016). Again, highest number of species belonged to the genus of *Spirogyra* (4), *Oscillatoria* (3), *Navicula* (2), *Pinnularia* (2) and *Surirella* (2). Single species represented the genera *Merismopedia*, Closterium, Microspora, Scenedesmus, *Ulothrix*, *Amphora*, *Cymbella*, *Eunotia*, *Frustulia*, *Gyrosigma*, *Nitzschia*, *Sendaiensis*, *Synedra* and *Euglena* sp. Table 4 shows the mean values of percent abundance of Algal groups during the study period. The dominant species belongs to Bacillariophyceae in station 1 and station 4 (68.45±8.8 and 59.64±11.7). The area under study harbors rich variety of algal species where abundance of diatoms favoured more than other groups of algae which is an indication of mesotrophic condition of lake. Greater impact of pollution led to lesser diversity of algae and the changes in physicochemical properties of wetland water. However for drawing a concrete conclusion intensive sampling and thorough investigations are necessary.

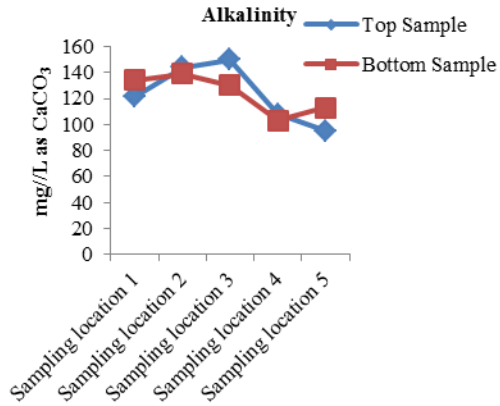
Fig. 1: GPS location of study area.

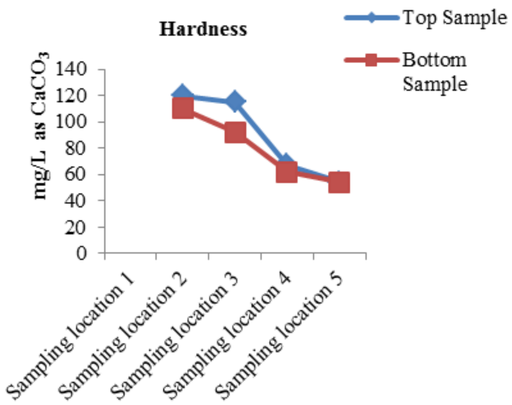
Fig. 2: Shows the photo of sampling location.

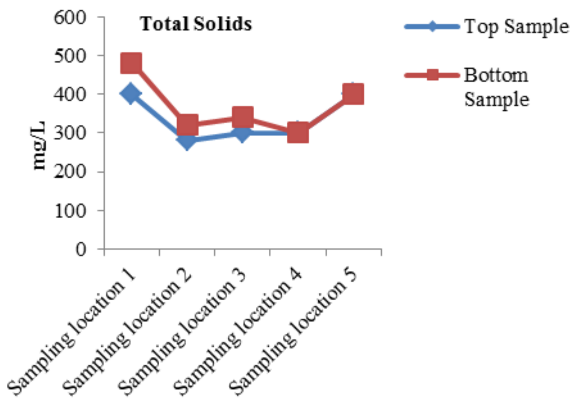

pH
Top Sample
Bottom Sample
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

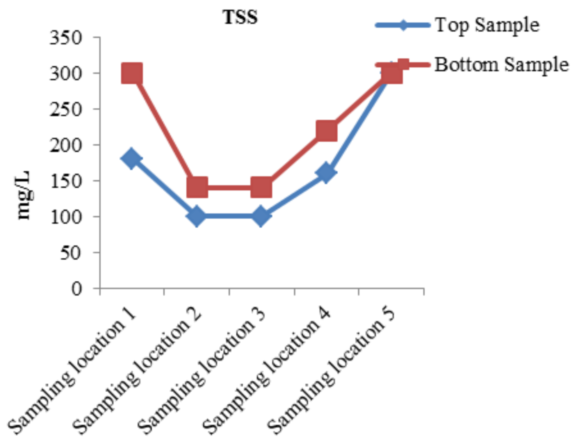

Temperature
Top Sample
Bottom Samples
° C
35
30
25
20
15
10
5
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

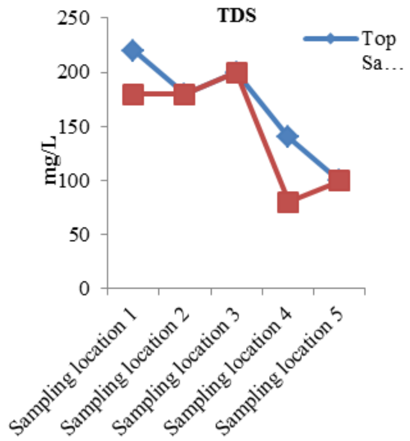

Turbidity
Top Sample
Bottom Sample
100
90
80
70
60
50
40
30
20
10
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

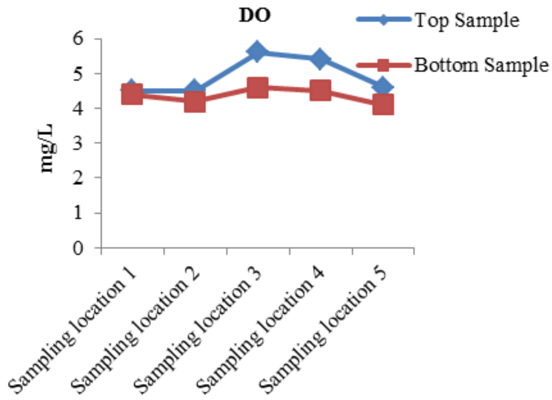

Alkalinity
Top Sample
Bottom Sample
mg/L as $CaCO_3$
160
140
120
100
80
60
40
20
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

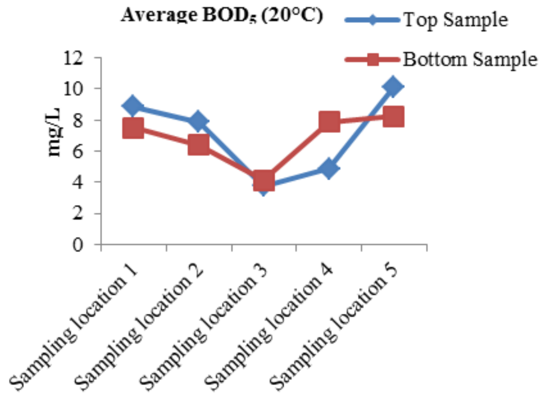

Hardness
Top Sample
Bottom Sample
mg/L as $CaCO_3$
140
120
100
80
60
40
20
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

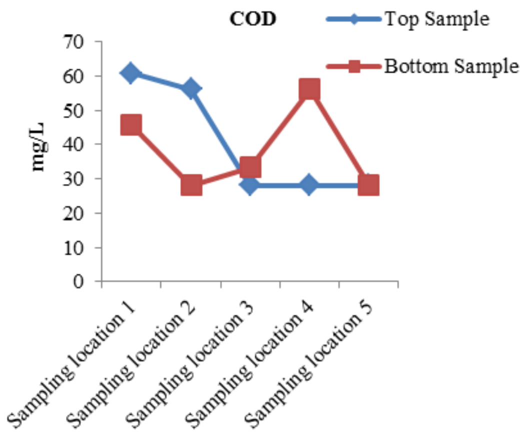

Total Solids
Top Sample
Bottom Sample
mg/L
600
500
400
300
200
100
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

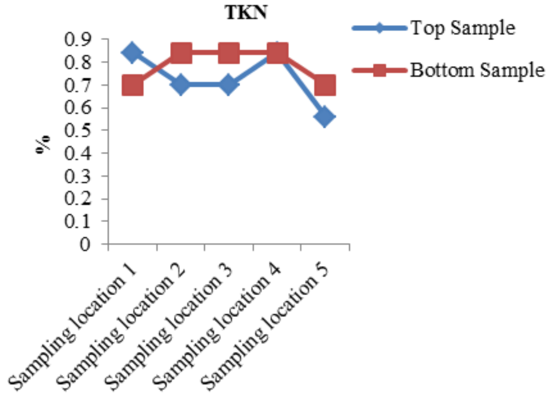

TSS
Top Sample
Bottom Sample
mg/L
350
300
250
200
150
100
50
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

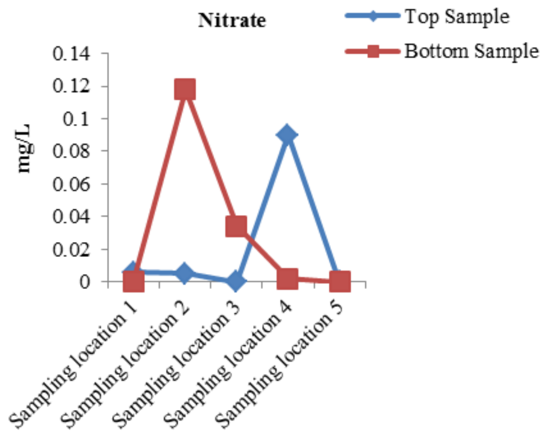

TDS
Top Sa…
mg/L
250
200
150
100
50
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

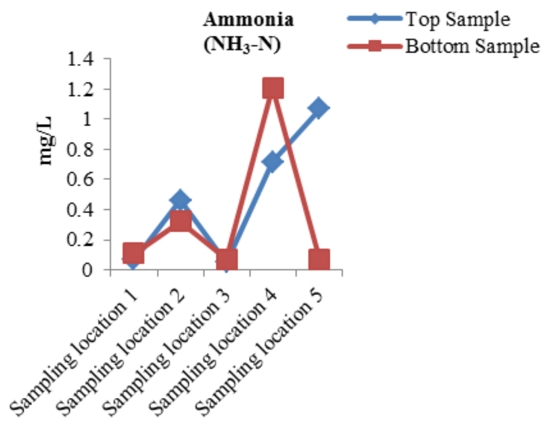

DO
Top Sample
Bottom Sample
mg/L
6
5
4
3
2
1
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

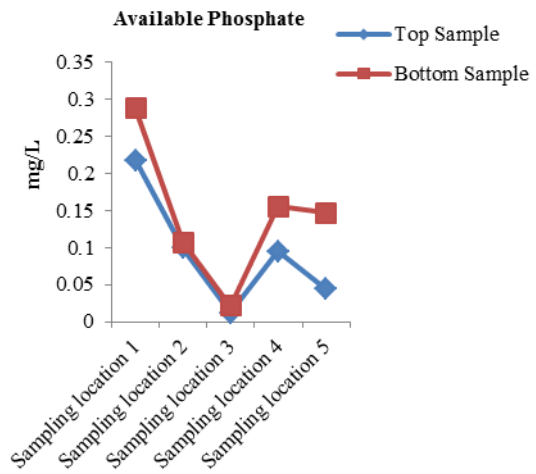

Average BOD5 (20°C)
Top Sample
Bottom Sample
mg/L
12
10
8
6
4
2
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

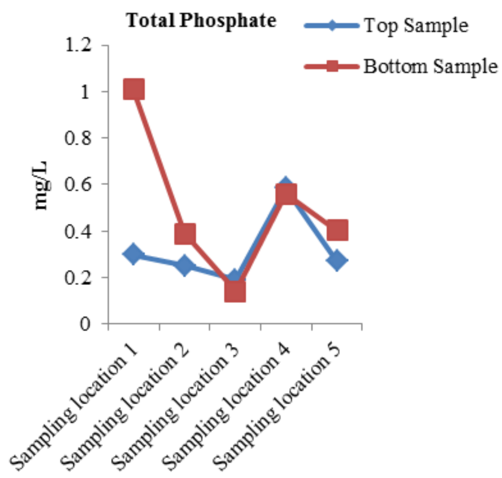

COD
Top Sample
Bottom Sample
mg/L
70
60
50
40
30
20
10
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

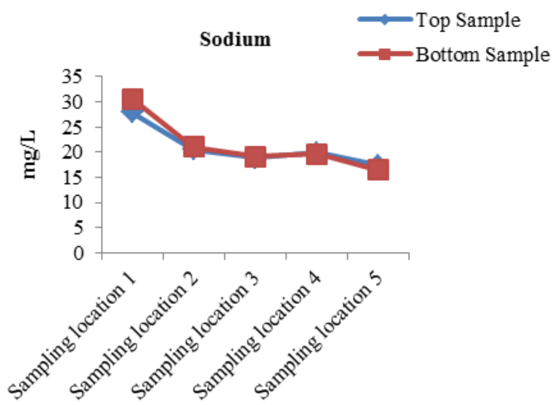

TKN
Top Sample
Bottom Sample
%
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

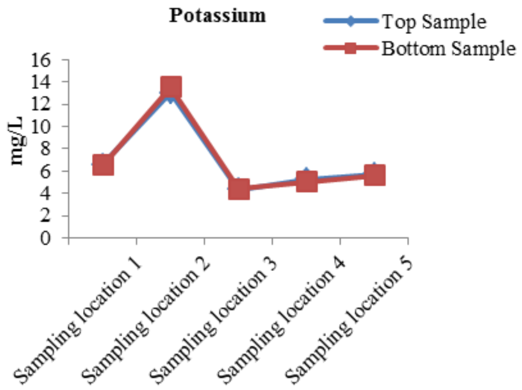

Nitrate
Top Sample
Bottom Sample
mg/L
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

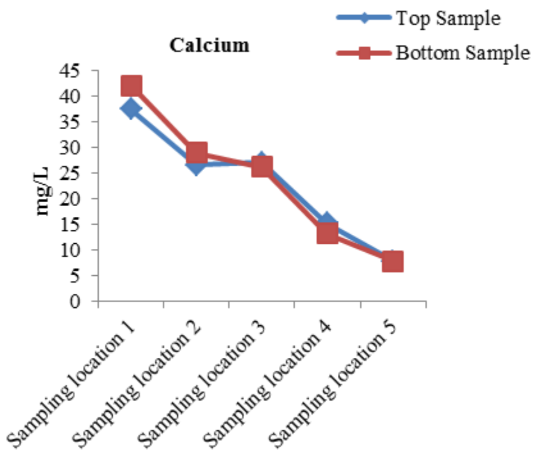

Ammonia
(NH3-N)
Top Sample
Bottom Sample
mg/L
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

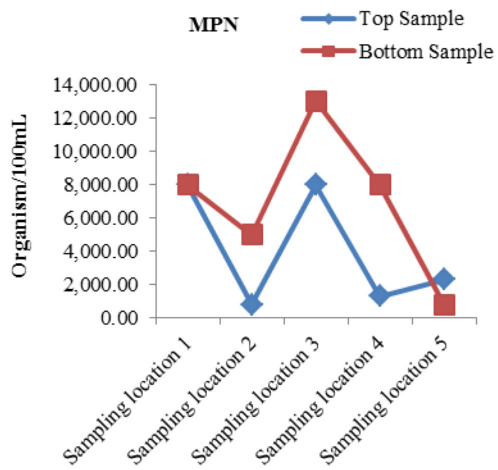

Available Phosphate
Top Sample
Bottom Sample
mg/L
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

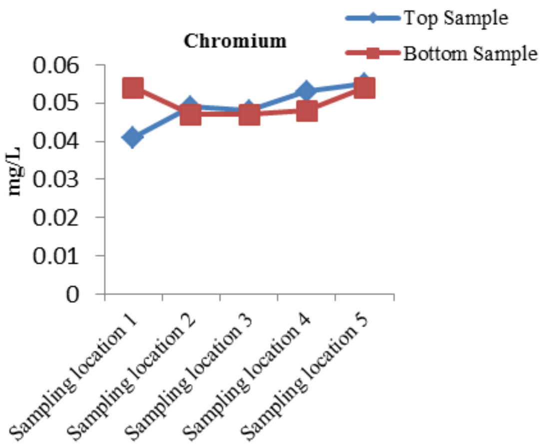

Total Phosphate
Top Sample
Bottom Sample
mg/L
1.2
1
0.8
0.6
0.4
0.2
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

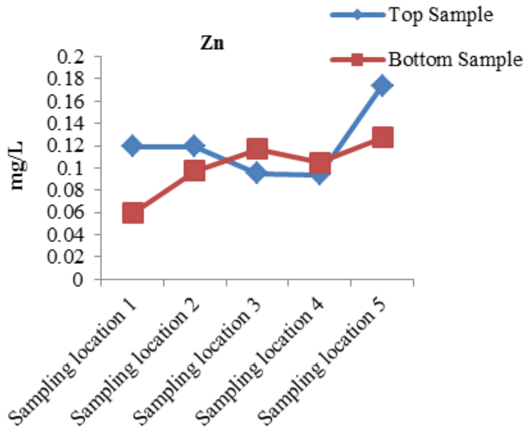

Sodium
Top Sample
Bottom Sample
mg/L
35
30
25
20
15
10
5
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

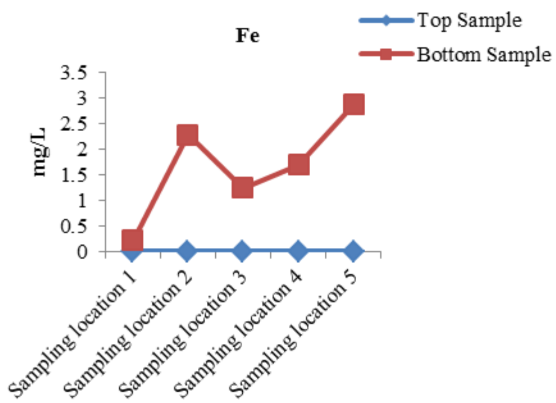

Potassium
Top Sample
Bottom Sample
mg/L
16
14
12
10
8
6
4
2
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

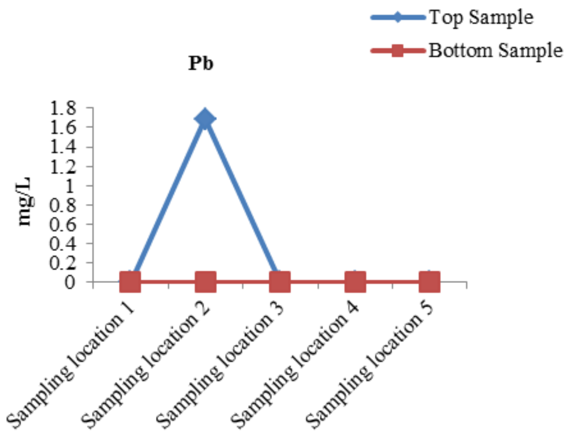

Calcium
Top Sample
Bottom Sample
mg/L
45
40
35
30
25
20
15
10
5
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5


MPN
Top Sample
Bottom Sample
Organism/100mL
14,000.00
12,000.00
10,000.00
8,000.00
6,000.00
4,000.00
2,000.00
0.00
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5


Chromium
Top Sample
Bottom Sample
mg/L
0.06
0.05
0.04
0.03
0.02
0.01
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5


Zn
Top Sample
Bottom Sample
mg/L
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5


Fe
Top Sample
Bottom Sample
mg/L
3.5
3
2.5
2
1.5
1
0.5
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5


Pb
Top Sample
Bottom Sample
mg/L
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Sampling location 1
Sampling location 2
Sampling location 3
Sampling location 4
Sampling location 5

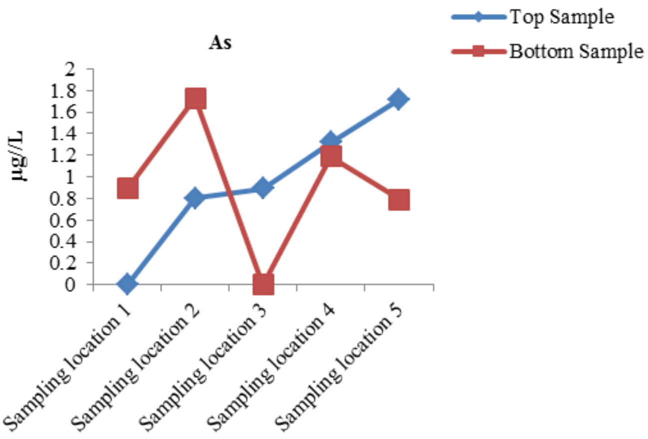


Table 1: Shows the correlation matrix among physico-chemical properties of top samples water in Deepor Beel wetland.

Top Sample	WT	pH	Turbidity	Alkalinity	Hardness	TS	TSS	TDS	DO	BOD	COD	TKN	Nitrate	NH4	AP	TP	Na	K	Ca	MPN	Cr	Zn	Fe	Pb
pH	1	-0.305	0.8638	0.8115	-0.6079	-0.7356	0.5074	0.6101	-0.7278	-0.1782	-0.0497	-0.2839	-0.6313	-0.5093	-0.4856	-0.2224	-0.075	0.3512	0.4454	-0.19672	-0.5732	-0.3736	0.1184	-0.17056
Turbidity		1	-0.207	-0.3524	0.8614	0.4079	0.3609	-0.4873	0.5502	0.4583	0.0983	-0.4927	-0.3256	0.6126	-0.3471	0.6968	-0.2347	0.4649	0.6683	-0.65149	0.3533	-0.1858	-0.4133	-0.56676
Alkalinity			1	0.9877	-0.6367	-0.8962	0.7456	0.2399	-0.5112	0.3154	0.1365	-0.362	-0.7713	-0.1269	-0.5226	0.1129	0.3585	0.6563	0.3609	-0.48024	-0.5992	-0.6576	0.487	-0.50366
Hardness				1	-0.7593	-0.8802	0.9453	0.0951	-0.414	0.6188	0.1589	-0.4118	-0.8745	-0.0592	-0.5422	0.5979	0.4975	0.983	0.3713	-0.97876	-0.5322	-0.8154	0.6188	-0.9719
TS					1	0.8147	-0.1619	-0.5189	0.7283	0.1343	-0.1823	-0.3397	0.1874	0.3982	-0.1532	0.3543	-0.3462	-0.0424	0.3274	-0.18508	0.6895	0.3059	-0.5307	-0.09399
TSS						1	-0.7041	-0.3917	0.6948	-0.2753	-0.4666	-0.077	0.7101	0.0045	0.0919	-0.1691	-0.3373	-0.6072	-0.1763	0.413119	0.8538	0.7713	-0.4637	0.48103
TDS							1	0.031	-0.2905	0.6331	0.5707	-0.285	-0.979	0.48	-0.344	0.7216	0.15	0.9815	0.701	-0.92978	-0.6086	-0.9382	0.1393	-0.93379
DO								1	-0.9317	-0.712	0.212	0.4602	-0.1988	-0.5559	0.2828	-0.3935	-0.621	-0.1507	0.2104	0.231442	-0.6598	-0.0841	-0.4383	0.25541
BOD									1	0.4402	-0.3882	-0.4396	0.4178	0.4045	-0.2391	0.2228	0.3489	-0.1143	-0.2066	-0.02316	0.865	0.3777	0.1623	-0.00964
COD										1	0.3684	-0.3404	-0.4675	0.8055	-0.2527	0.7984	0.6726	0.7601	0.1515	-0.75884	-0.0336	-0.6367	0.5293	-0.81457
TKN											1	0.579	-0.5185	0.668	0.5692	0.7027	-0.0753	0.5699	0.2411	-0.56403	-0.7471	-0.7897	-0.1336	-0.62464
Nitrate												1	0.2873	0.0733	0.975	-0.0759	-0.2363	-0.3237	-0.4293	0.345112	-0.4666	-0.0356	-0.2172	0.27052
NH4													1	-0.3303	0.3742	-0.6146	0.0075	-0.927	-0.7854	0.873353	0.6503	0.889	-0.0154	0.85739
AP														1	0.2124	0.9407	0.2402	0.6158	0.2064	-0.71087	-0.0789	-0.5803	0.0385	-0.75103
TP															1	0.0189	-0.2166	-0.343	-0.4562	0.322357	-0.311	0.0229	-0.248	0.25057
Na																1	0.1179	0.8179	0.5047	-0.89935	-0.2389	-0.7504	-0.0495	-0.91229
K																	1	0.2375	-0.4916	-0.11558	0.0863	-0.2087	0.9713	-0.22153
Ca																		1	0.6572	-0.97204	-0.4921	-0.9239	0.1846	-0.9815
MPN																			1	-0.7297	-0.2605	-0.4944	-0.5067	-0.62939
Cr																				1	0.3601	0.8535	-0.0207	0.98898
Zn																					1	0.76	-0.0207	0.41323
Fe																						1	-0.1916	0.89898
Pb																							1	-0.12676
As																								1

Table 2: Shows the correlation matrix among physico-chemical properties of bottom samples water in Deepor Beel wetland.

Bottom Sample	WT	pH	Turbidity	Alkalinity	Hardness	TS	TSS	TDS	DO	BOD	COD	TKN	Nitrate	NH4	AP	TP	Na	K	Ca	MPN	Cr	Zn	Fe	Pb
pH	1	0.6386	0.6278	0.2451	0.6956	0.1721	0.6842	-0.0735	-0.383	-0.5537	-0.5251	-0.0564	-0.9607	0.0437	0.0264	0.3181	-0.0972	0.4878	0.1139	0.43823	-0.1685	-0.3091	#DIV/0!	-0.5640
Turbidity		1	0.3487	-0.3499	0.9891	0.7256	0.2608	-0.2007	0.3239	0.0324	-0.8613	-0.3855	-0.5408	0.7964	0.7703	0.768	-0.0872	0.576	-0.1622	0.839454	-0.6847	-0.5331	#DIV/0!	-0.0995
Alkalinity			1	0.9276	0.2952	-0.3621	0.9345	-0.0508	-0.5331	-0.4961	0.018	0.6354	-0.656	-0.0197	0.0547	0.5021	0.5963	0.8176	0.2318	-0.11199	-0.4752	-0.3513	#DIV/0!	0.0545
Hardness				1	-0.4257	-0.9139	0.8765	0.1234	-0.6961	-0.4059	0.6514	0.9224	-0.2889	-0.6115	-0.4717	0.7906	0.7055	0.981	0.3846	-0.74367	-0.6337	-0.3217	#DIV/0!	0.2068
TS					1	0.7541	0.2334	-0.205	0.3014	-0.0224	-0.9011	-0.4552	-0.5982	0.7344	0.693	0.6801	-0.1845	0.4932	-0.1731	0.87689	-0.5775	-0.4823	#DIV/0!	-0.2118
TSS						1	-0.4626	-0.3617	0.7874	0.2512	-0.9129	-0.7474	-0.1101	0.7941	0.6846	0.3174	-0.3875	-0.0956	-0.5129	0.952579	-0.268	-0.1057	#DIV/0!	-0.0198
TDS							1	0.2588	-0.7589	-0.4021	0.1351	0.4921	-0.6444	-0.1844	-0.0781	0.4481	0.3247	0.8073	0.5258	-0.22665	-0.3827	-0.4945	#DIV/0!	-0.2565
DO								1	-0.5597	0.5771	0.4842	-0.2475	0.3013	-0.2124	-0.0542	0.2022	-0.5191	0.2802	0.955	-0.45937	-0.157	-0.6756	#DIV/0!	-0.5348
BOD									1	0.3316	-0.5745	-0.4204	0.3401	0.7168	0.6022	0.0986	-0.0105	-0.3367	-0.7507	0.64249	-0.1641	0.2426	#DIV/0!	0.5245
COD										1	0.1018	-0.5327	0.7528	0.4667	0.5537	0.3791	-0.4277	0.0666	0.3589	-0.00751	-0.423	-0.5371	#DIV/0!	0.0710
TKN											1	0.553	0.4994	-0.6981	-0.5818	-0.3645	0.2306	-0.0894	0.5212	-0.99381	0.2796	0.103	#DIV/0!	0.1157
Nitrate												1	-0.1222	-0.431	-0.3845	-0.106	0.8913	0.2497	-0.0261	-0.61558	0.0151	0.2846	#DIV/0!	0.5051
NH4													1	0.0484	0.0972	-0.1639	-0.0938	-0.3732	0.0867	-0.40219	0.0372	0.0644	#DIV/0!	0.4115
AP														1	0.9811	0.7554	-0.0096	0.3791	-0.3036	0.736489	-0.7675	-0.4482	#DIV/0!	0.3330
TP															1	0.8471	0.0006	0.5039	-0.1324	0.619944	-0.8627	-0.5893	#DIV/0!	0.3156
Na																1	0.123	0.8816	0.2578	0.35803	-0.9835	-0.8456	#DIV/0!	0.1230
K																	1	0.3084	-0.3363	-0.27734	-0.2386	0.2661	#DIV/0!	0.7803
Ca																		1	0.4557	0.040609	-0.8532	-0.7993	#DIV/0!	0.0167
MPN																			1	-0.52804	-0.2032	-0.6971	#DIV/0!	-0.5383
Cr																				1	-0.2814	-0.1056	#DIV/0!	-0.0916
Zn																					1	0.7851	#DIV/0!	-0.288
Fe																						1	#DIV/0!	0.3034
Pb																							1	#DIV/0
As																								

Table 3: List of algae encountered in the present study and their presence and absence at different stations.

Algal Group	Name of the Species	Station				
		I	II	III	IV	V
Cyanophyceae	1.*Merismopedia*	A	A	P	A	A
	2. *Oscillatoria tenuis*	P	P	P	P	P
	3. *Oscillatoria princeps*	P	A	P	A	A
	4. *Oscilatoria ornata*	P	P	P	A	A
Chlorophyceae	1. *Closterium* sp.	P	A	A	P	P
	2. *Microspora* sp.	P	A	A	A	A
	3. *Scenedesmus* sp.	P	A	P	P	P
	4. *Spirogyra crassa*	P	P	P	P	P
	5. *Spirogyra aequinoctialis*	P	P	P	A	A
	6.*Spirogyra micropunctata*	P	P	P	P	A
	7.*Spirogyra gratiana*	P	P	P	A	A
	8. *Ulothrix sp.*	A	A	A	P	A
Bacillariophyceae	1. *Amphora ovalis Kuetz.*	P	P	P	P	P
	2. *Cymbella turgida*	P	P	A	P	A
	3.*Eunotia pectinalis* (Kuetz	A	P	P	A	A
	4.*Frustulia jogensis*	P	P	A	P	P
	5.*Gyrosigma*	P	A	A	P	A
	6. *Navicula cuspidata* Kuetz.	P	P	P	A	P
	7. *Navicula cryptocephala*	P	P	P	A	A
	8. *Nitzschia* sp.	P	P	P	A	A
	9. *Pinnularia major*	P	P	P	A	A
	10. *Pinnularia braunii*	P	A	P	A	A
	11.*Sendaiensis Hustedt*	A	P	A	P	P
	12.*Surirella robusta*	P	P	A	P	P
	13. *Surirella* sp.	P	P	P	P	P
	14.*Synedra ulna*	P	A	P	P	P
Euglenophyceae	1.*Euglena* sp.	A	P	P	P	P

Table 4: The mean values of percent abundance of Algal groups during the study period.

Station	Cyanophyceae	Chlorophyceae	Bacillariophyceae	Euglenophyceae
1	40.97±11.84	13.98±9.99	68.45±8.88	2.14±2.18
2	28.07±13.29	17.63±5.86	39.26±10.60	2.79±3.68
3	24.51±14.42	18.61±10.86	44.25±13.30	44.25±13.30
4	17.54±6.42	13.76±7.64	59.64±11.79	4.32±3.56
5	3.54±.41	3.94±2.36	4.51±3.05	7.86±5.32

CONCLUSION

The studied parameters show that the quality of the wetland water is not in a potable condition. Though other variable are in permissible limit but MPN values shows an indication that the conservation measured should be taken to save the wetland from the verge of extinction.

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