E-ISSN: 2278–179X

JECET; September-November, 2012; Vol.1.No.3, 442-450.

Journal of Environmental Science, Computer Science and Engineering & Technology

Available online at www.jecet.org

Environmental Science

Research Article

Analysis of the Water Quality of Wetlands in Mainpuri District (U.P.) India

Amita Sarkar and Bhavna Upadhyay

Department Of Zoology, Agra College, Agra (India)-282002

Received: 28 September 2012**; Revised:** 31 October 2012**; Accepted:** 11 November 2012

ABSTRACT: Wetlands are probably the earth's most important fresh water resource and are also the most threatened .They having intrinsic ecological and environmental values**.** The present investigation was carried out to analyse the physico-chemical parameters of wetlands, viz- Site-I (Markandeshwar), Site-II (Bhamwat Canal), Site-III (Saman), Site IV(Sauj) and Site-V(Kirithua) in Mainpuri District. The survey of these wetlands was done between April 2011 to February 2012.Here, we discuss-O.R.P. Sodium,Potassium ,Magnesium,Nitrite Nitrogen, Nitrate Nitrogen,CO_2,Chromium,Cadmium,Copper and Lead.The results of the present investigations were compared with literature values and investigation reveals that, there is fluctuation in the physico-chemical characters of the water due to the various biotic and abiotic factors. Saman and Sauj(Site-III and IV) are **IBAs**(Important bird areas) under Important Bird Areas Programmes of BNHS and Bird Life International.

Keyword: Wetland, reveals, physic-chemical, threatened etc.

INTRODUCTION

In district Mainpuri wetlands and agricultered fields contributes to the healthy population of Sarus and other wetland birds. A large number of wetlands are situated in Mainpuri and many others emerge in Mansoon season. In winter season (from the month of October to march) a large number of birds of different species can be seen around these wetlands. Due to no more urbanization; Mainpuri is favourite place of local and migratory birds.

The wetland's ecological diversity depends on the crucial balance of complexly interactive forces of physical, chemical and biological processes[1]. Wetlands are world's most productive environment with stunning biological diversity. Around 4-6% of earth's surface is covered by wetlands. In addition, they provide refuge for endangered species of plants and animals and economic benefits in aquatic fauna. Wetlands reduce the impact of floods by acting as storage areas[2].

The wetland offers beautiful sites for recreational and tourism activities. It is also an excellent ground for research and education related to conservation and natural balance of various ecosystems. It is also the powerhouse to study the biogeochemical cycles of nature[3]. The wetland provides important values of i) biological diversities in terms of both floral and faunal assemblages, ii) cultural and historic values to be designated as a heritage site, iii) aesthetic values in form of its excellence in natural beauty, variable landscapes and habitat types and iv) a large number of attractive wildlife [4].

Wetlands play a unique role to stabilization of climate which interalia, controls the life cycles of species and maintenance of ecosystems[5]. Their role is complex and varied. Apart from being highly productive as the habitat of birds, fishes and a variety of other aquatic life forms, including microorganisms, wetlands provide other ecosystem services, from maintaining the natural balance to sustaining human livelihoods[6]. Changes in the hydrologic regime due to management or climate change can result in changes in the distribution and abundance of different wetland types. This can adversely affect many wetland bird populations that frequent freshwater habitats, particularly during the breeding season[7-10]. Daily, seasonal and annual variations in water levels and flows drive important ecological processes that maintain a diversity of wetlands and associated biodiversity [11-14].

MATERIAL AND METHODS

1. Geographical location of study site: Manipuri is a District of Agra Division, U.P., India, is bounded on the north by Etah District, on the East by District Farrukhabad and Kannauj on the South by District Etawah and on West by District Firozabad. It lies between north latitude 26º 53' to 27º 31' and East Longitude 78º 27' to 79º 26'. The area of the District is 2745 Sq. km and population 13, 11, 492 in 2001.Out of 1,228 bird species found in India(I.U.C.N.); Uttar Pradesh has 25-30% of birds species out of total species found in India, and of all Sarus counted in U. P. were 73.04 percent encountered in the districts of Mainpuri, Etawah, Etah, and Aligarh. (Plate-I).

2. Study area: Markandeshwar (Site-I), Bhamwat Canal (Site-II), Saman (Site-III), Sauj (Site-IV) and Kirithua (Site-V) are the major wetlands in Mainpuri, which were selected for the present study.

3.Collection and Analysis of water samples: The five study sites of mainpuri are : ***Markandeshwar (site-I), Bhamwat canal (site-II), Saman(site-III), Sauz (site-IV)*** *and* ***Krithua (site-V).****Following* ***Physiochemical characteristics of water of wetlands*** *a*re studied- O.R.P. Sodium, Potassium ,Magnesium, Nitrite Nitrogen, Nitrate Nitrogen,CO_2,Chromium,Cadmium,Copper and Lead.

For the analysis of water, water samples were collected at random basis from each site, in plastic bottles previously rinsed with distilled water. The water samples were collected at seasonal intervals from five wetlands to conduct physico chemical study. The methods of analysis was in accordance to *Standard Methods for the Examination of water and waste water (Eatson AD, Clesceri, L.S.& Greenberg, AE Eds) 20th ed. Ameri. Pub. Hlth. Assoc.*, Washington D.C. APHA, AWWA & WEF[15.] **O.R.P.** was analysed with the help of 'water analysis kit' in lab. Heavy metal ions (Cu, Cd, Cr,Pb) detection was done by **spectrophotometer (Systronics; PC based double beam spectrophotometer,2202)** and ***atomic absorption (A Analyst 100, Germany).*** Determination of NO3 was made by kit method in lab, though conventional methods were also used for the comparison of the data. According to the requirement samples were preserved in the refrigerator after treatment.

STASTICAL ANALYSIS

Data were analyzed by one-way analysis of variance (ANOVA). Significant difference among groups was determined by Duncan's Multiple Range Tests. Data are presented as mean ± Sem. The values of $p<0.05$ were considered significantly different.

OBSERVATION AND DISCUSSION

Physiochemical Studies: ORP (Oxidation reduction potential) or "redox", indicates the relative capacity of a solution to oxidize or reduce. Results for the oxido -reduction potential parameter were as expressed highly variable trend, and it is well correlated with DO concentrations. The ORP values during the testing period fluctuated from 250±0.577 to 540 ± 4.04.**(Table-1, Fig-1)**Study indicates that water of Site-III(Saman) was filled with slimy algae, at Site-IV , water was covered with algae, giving reddish colour and lots of lotus were present all over. While Site-V study indicates that this was the most damaged site. It requires filtration and cleaning. The widely ranging ORP values could also be explained by the differences in collection times. Low ORP values may be a result of the samples being collected during the early hours of the day with low photosynthesis rates. During the late afternoon photosynthesis rates increases and the subsequently, algae growth shows impact on the water quality[16]. Favorable ORP conditions for nitrification and denitrification processes can occur from +200 to +400 mV and -50 to +225 mV, respectively. Levels of O.R.P at different sites differed significantly ($p\leq0.001$).

Table 1: **Showing mean values of parameters of water from five sampling sites of Mainpuri, during April 2011 to Febuary 2012.Data are presented as mean ± Sem.**

MONTHS	IMarkadeswar	IIBhamwat	III Saman	IV Sauz	V Krithua
O.R.P					
April-2011	340 ± 0.577	302 ± 0.577	315 ± 2.88	305 ± 2.88	512 ± 0.0
June	312 ± 1.15	289 ± 1.15	341 ± 0.577	350 ± 1.15	540 ± 4.04
August-	310 ± 0.0	288 ± 1.0	268 ± 2.3	250 ± 0.577	458 ± 1.0
October	320 ± 1.73	295 ± 3.46	290 ± 1.73	275 ± 2.3	494 ± 0.0
December	325 ± 2.88	304 ± 0.577	272 ± 4.04	285 ± 0.0	482 ± 1.73
February 12	330 ± 2.30	309 ± 0.0	255 ± 0.0	270 ± 3.46	472 ± 0.577
Sodium					
April-2011	68 ± 0.577	59 ± 2.08	73 ± 1.15	65 ± 1.73	68 ± 0.577
June	70 ± 1.15	61 ± 1.73	75 ± 2.30	68 ± 4.04	70 ± 2.88
August	65 ± 2.88	54 ± 0.0	70 ± 0.0	60 ± 1.15	63 ± 1.73
October	66 ± 1.73	58 ± 4.04	70 ± 1.15	62 ± 1.82	65 ± 1.82
December	63 ± 1.15	55 ± 2.88	68 ± 3.46	59 ± 0.0	66 ± 3.46
February 12	64 ± 2.30	57 ± 3.46	65 ± 2.88	61 ± 2.30	60 ± 0.0
Potassium					
April-2011	17 ± 0.577	12.9 ± 0.152	19 ± 0.360	32 ± 0.763	18.4 ± 0.3
June	14.5 ± 0.1	11.6 ± 0.173	19.4 ± 0.199	20.5 ± 0.577	17.5 ± 0.399
August-	18.9 ± 0.577	13.3 ± 0.173	28 ± 2.516	32.5 ± 1.154	20.6 ± 0.556
October	18 ± 0.574	13.13 ± 0.145	25 ± 0.351	36 ± 0.512	19.5 ± 0.577
December	17.5 ± 0.346	13 ± 0.115	20 ± 0.519	32 ± 1.10	18 ± 0.305
February 12	18 ± 1.00	13.4 ± 0.115	22 ± 1.154	34 ± 0.720	18.2 ± 0.399
Magnesium					
April-2011	35 ± 0.673	16 ± 0.351	37 ± 0.493	48 ± 0.808	45 ± 0.607
June	33.6 ± 0.577	15 ± 1.15	28 ± 0.642	26.4 ± 0.812	41 ± 1.72
August-	35 ± 1.154	18 ± 0.294	38.4 ± 0.635	47.4 ± 0.556	48 ± 1.22
October	36 ± 0.592	16.5 ± 0.150	34.7 ± 0.698	42 ± 0.456	44 ± 1.04
December	38 ± 0.404	19 ± 1.15	35 ± 0.548	42 ± 0.360	46 ± 0.756

February 12	38.5 ± 0.173	17 ± 0.435	36 ± 0.305	44 ± 0.953	46 ± 2.08
Nitrate nitrogen					
April-2011	10 ± 1.154	5.6 ± 0.346	15 ± 0.115	16 ± 0.173	9.5 ± 0.150
June	11.25 ± 0.250	7.4 ± 0.230	16.8 ± 0.086	15.3 ± 0.606	11.8 ± 0.346
August-	11 ± 0.144	12 ± 0.040	15.76±.0.266	15 ± 0.577	12 ± 0.577
October	9.8 ± 0.305	3 ± 0.132	12 ± 0.173	9.5 ± 0.115	9.6 ± 0.152
December	6 ± 0.404	2 ± 0.028	10 ± 0.577	9 ± 0.305	8 ± 0.144
February 12	6 ± 0.577	2 ± 0.144	12 ± 0.132	9 ± 0.472	9 ± 0.017
Carbon-dioxide					
April-2011	3.6 ± 0.115	2.5 ± 0.360	2.0 ± 0.135	3.4 ± 0.251	3.2 ± 0.1
June	4.2 ± 0.152	6.0 ± 0.346	1.9 ± 0.057	7.2 ± 0.173	4.2 ± 0.288
August-	6.0 ± 0.215	7.0 ± 0.230	4.2 ± 0.173	5.0 ± 0.577	6.4 ± 0.175
October	6.2 ± 0.057	2.9 ± 0.208	4.2 ± 0.208	4.0 ± 0.115	2.5 ± 0.078
December	1.2 ± 0.057	0.9 ± 0.1	2.4 ± 0.152	3.0 ± 0.057	1.6 ± 0.046
February 12	1.4 ± 0.057	1.9 ± 0.152	1.9 ± 0.057	2.8 ± 0.208	2.0 ± 0.152
Copper					
April-2011	0.027 ± 0.001	0.018±0.0028	0.027±0.008	0.04 ± 0.005	0.012 ± 0.002
June	0.03 ± 0.012	0.015 ± 0.002	0.03 ± 0.005	0.04 ± 0.011	0.01 ± 0.001
August-	0.02 ± 0.0049	_	0.019±0.001	0.03 ± 0.002	0.011 ± 0.002
October	0.017 ± 0.0053	0.013 ± 0	0.016±0.001	0.032 ± 0.001	0.011 ± 0
December	0.016 ± 0.001	0.015±0.0017	0.022±0.001	0.02 ± 0.002	0.01 ± 0.001
February 12	0.03 ± 0.009	0.014 0.0015	0.02 ± 0.013	0.024 ± 0.002	0.016 ± 0.008

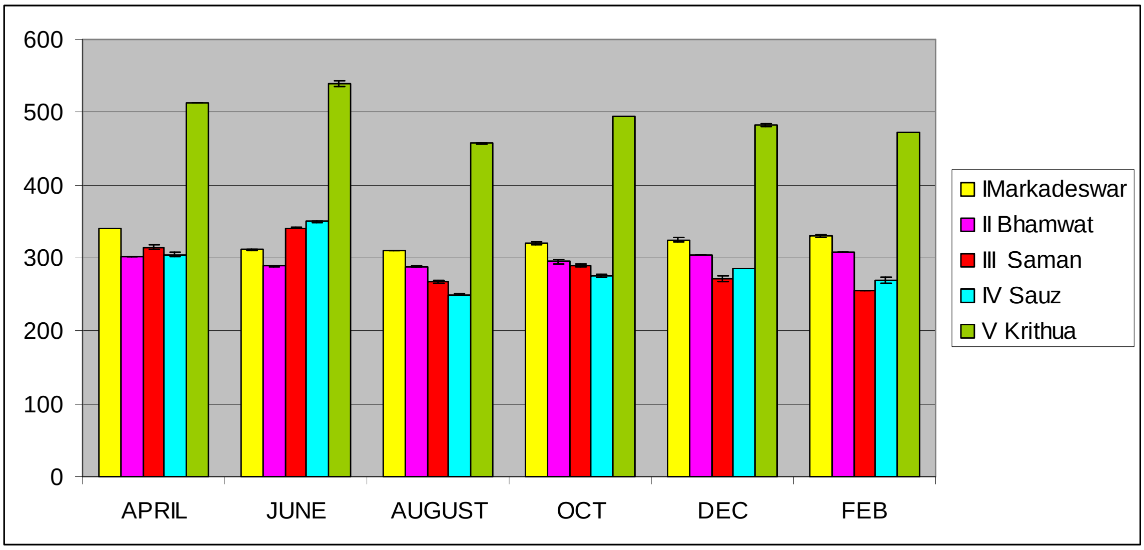

Fig.1: Showing variations in O.R.P. levels at different sites of Manipuri region between April 2011 and Feb. 2012.Data are presented as Mean ± SEM, Error bars indicate standard error.

Sodium was 54 ± 0.0 at Site-II in Aug to 75 ± 2.30 at Site-III during June mg/l. **(Table-1, Fig.2).** The sodium level indicates salinity in water but very high levels of sodium requires concern. Dietary intakes of sodium, potassium and water have substantial health effects. Excessive sodium intake, especially when accompanied by inadequate potassium intake, raises blood pressure (BP), a well-accepted and extraordinarily common risk factor for stroke, coronary heart disease (CHD) and kidney disease. The salt glands of marine birds (and some falconiform and desert birds) secrete excess NaCl via the salt glands using less water than is consumed, which generates free water[17].

Potassium was 14.5 ± 0.1mg/l to 36 ± 0.512 mg/l. **(Table-1, Fig.3).** A number of potassium compounds, mainly potassium nitrate, are popular synthetic fertilizers 95% of commercially applied potassium is added to synthetic fertilizers. Potassium salts and mixtures of magnesium and calcium compounds are also applied regularly. Regeneration releases wastewater that is hazardous when discharged on surface water, and that is difficult to purify. Potassium occurs in various minerals, from which it may be dissolved through weathering processes. Eg.feldspars (orthoclase and microcline) and chlorine minerals carnalite and sylvite. Potassium from dead plant and animal material is often bound to clay minerals in soils, before it dissolves in water. Consequently, it is readily taken up by plants again[18]. Levels of Potassium at different sites differed significantly ($p \leq 0.05$).

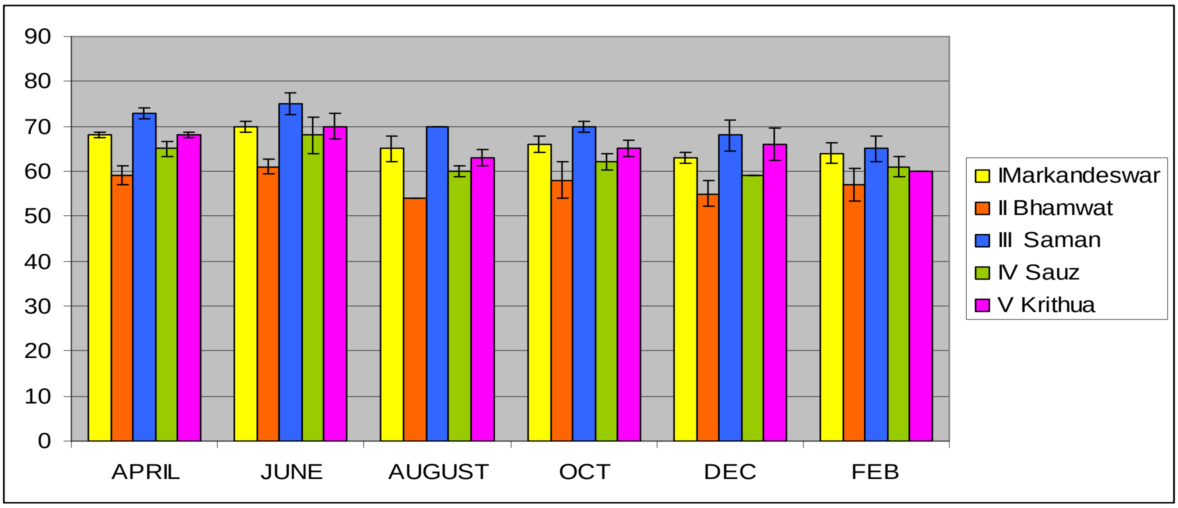

Fig. 2: Showing variations in Sodium levels at different sites of Mainpuri region between April 2011 and Feb. 2012.Data are presented as Mean ± SEM, Error bars indicate standard error.

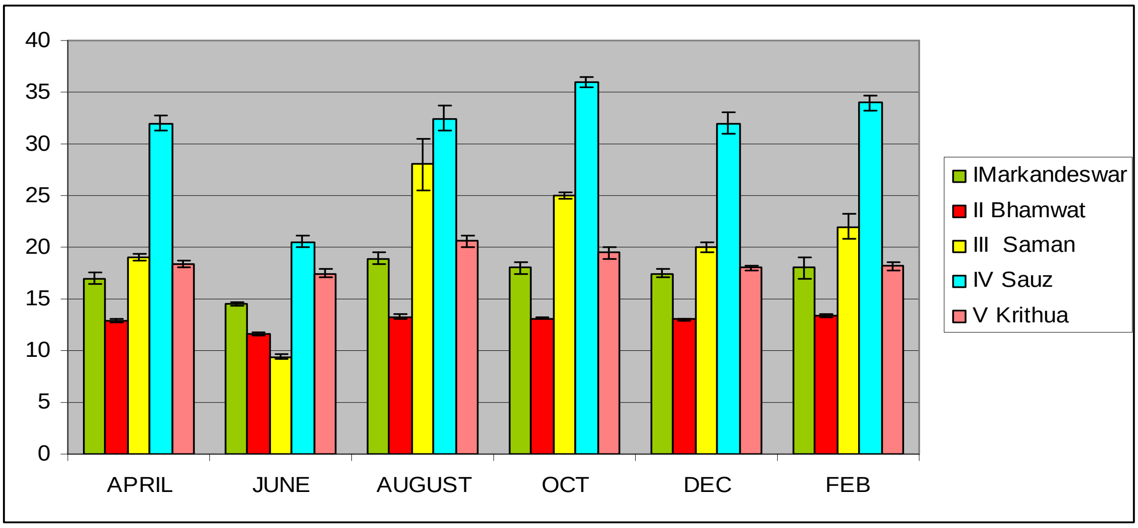

Fig. 3: Showing variations in Potassium level at different sites of Mainpuri region between April 2011 and Feb. 2012.Data are presented as Mean ± SEM, Error bars indicate standard error.

Magnesium was 15 ± 1.15 mg/l - 48 ± 1.22 mg/l **(Table-1, Fig-4).**Migrating waterfowl and shorebirds visits the wetland annually/regularly. Wetlands supply magnesium and the unique salinity in these wetlands also provides a supply of food for the migrating birds in the form of flies and shrimp. There are times during the year when large populations of birds are present in Mainpuri ponds,like, sandpipers, little grebes, gulls,pond heron,grey heron,purple heron,open bill,egrets etc. For birds salt metabolism is very important. Desirable limit for magnesium in drinking water according to WHO is 30mg/L.(WHO,1993)[19]. Increased level of Calcium and Magnesium enhances hardness of water[20]. . Levels of Magnesium at different sites differed significantly ($p \leq 0.05$).

Nitrite Nitrogen was not present.

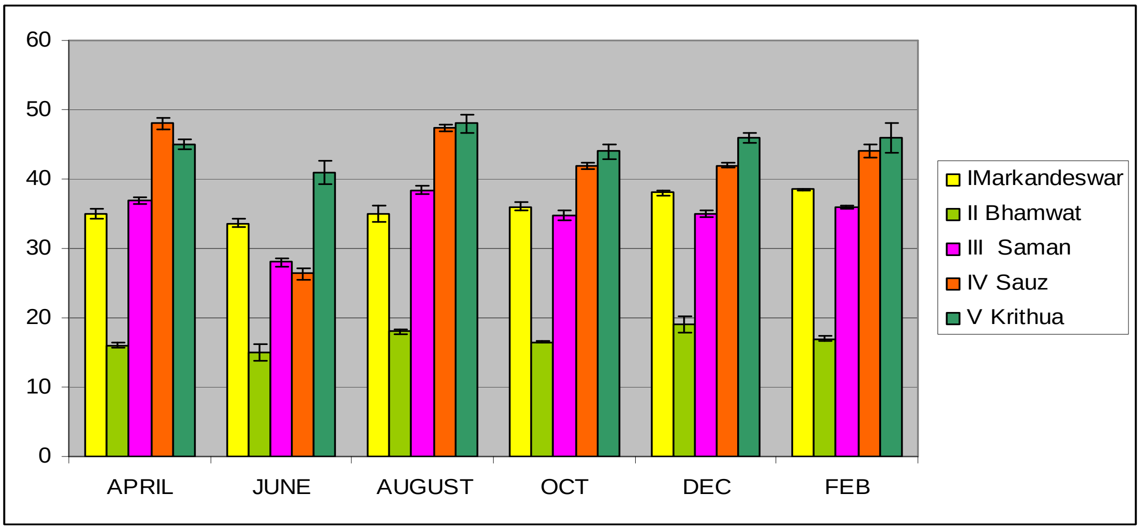

Fig. 4: Showing variations in Magnesium levels at different sites of Mainpuri region between April 2011 and Feb. 2012.Data are presented as Mean ± Sem, Error bars indicate standard error.

Nitrate Nitrogen was 2 ± 0.028 mg/l- 15 ± 0.577 mg/l **(Table-1, Fig.5).** The nitrate load was safe in the water. Low effluent nitrates could be attributed to a highly efficient denitrification process in which more nitrates are converted to molecular nitrogen[21]. Nitrate is highly mobile and can very easily leach to ground waters and may concentrate there, making ground water unsafe for drinking. Nitrates are considered acutely toxic because they can be reduced in the stomach or by saliva to nitrites hence induce methemoglobinemia in infants[22].Concentrations above 0.1 mg /L are considered to be sufficient to trigger algal growth in fresh water systems .

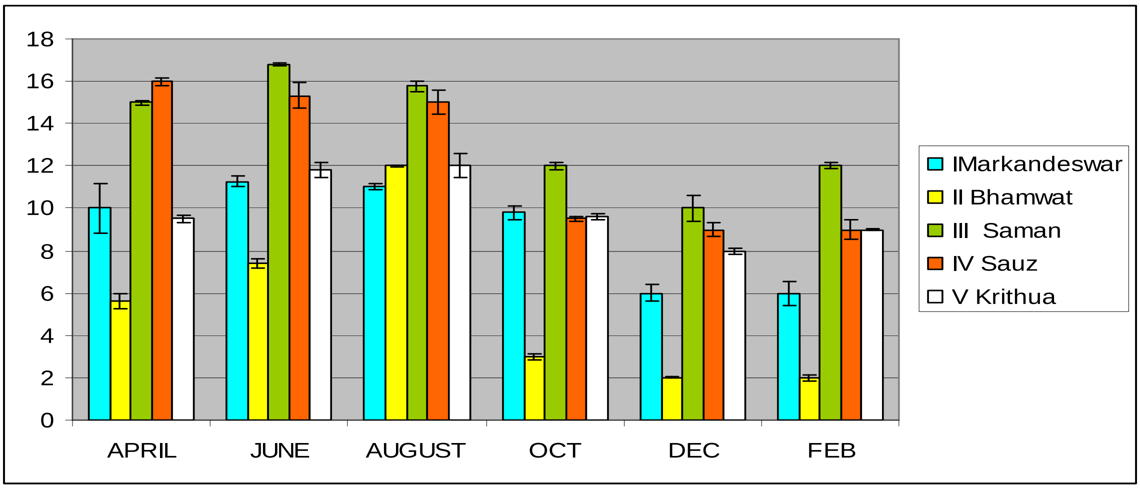

Fig. 5: Showing variations in Nitrate levels in different sites at Mainpuri region between April 2011 and Feb. 2012.Data are presented as Mean ± SEM, Error bar indicates standard error.

On the other hand, condensed and organically bound phosphorus in the activated sludge will be converted to orthophosphate[23]. Thus, total phosphorus in the effluent will be primarily orthophosphate, although there will be some organic phosphorus contained in suspended solids. However, effluent containing Total nitrogen (TN) of 3-10 mgN/L and Total Phosphorus (TP) of 0.3-1.0 mg /L is allowed to be discharged to Sensitive River and estuarine environments[24].The nitrogen fixation by plants, soil and rainwater leaching process could be the source of present concentration. Moreover,during rainy season ,it might come from agricultural fields[1,23]. Levels of Nitrate at different sites differed significantly (p≤0.05).

Carbon dioxide was 1.2 ± 0.057 mg/l-7.2 ± 0.173mg/l.**(Table-1,Fig.6).**The levels of CO_2 at different sites differed significantly (P≤0.05). Carbonated water is usually not palatable to birds, and while the carbonation is harmless, this type of water is not suitable for daily consumption for birds.

Chromium was absent.

Cadmium was absent. It is established that Cd affects the respiration of fishes adversely[25].

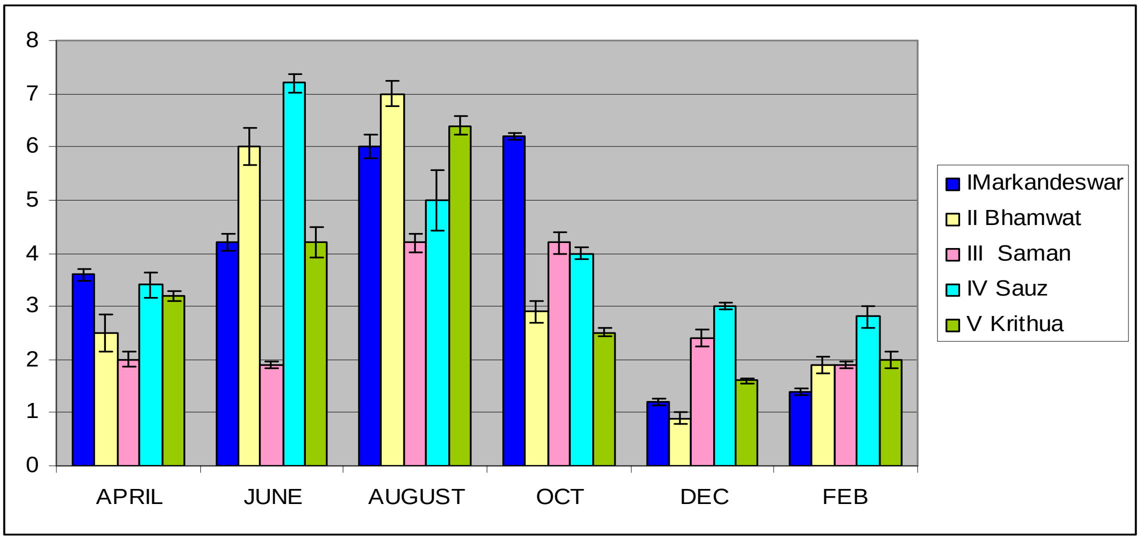

Fig. 6: Showing variations in Carbon-di-oxide levels in different sites at Mainpuri region between April 2011 and Feb. 2012.Data are presented as Mean ± Sem,Error bars indicate standard error.

Copper The present study shows Copper , 0.01 ± 0.001 mg/L - 0.03 ± 0.012 mg/L.**(Table-1,fig-7).** Copper is one of a relatively small group of metallic elements which are essential to bird health, along with amino, fatty acids and vitamins, for normal metabolic processes. WHO and BIS limit for copper in drinking water is .05mg/L to 1mg/L.

Lead was absent.

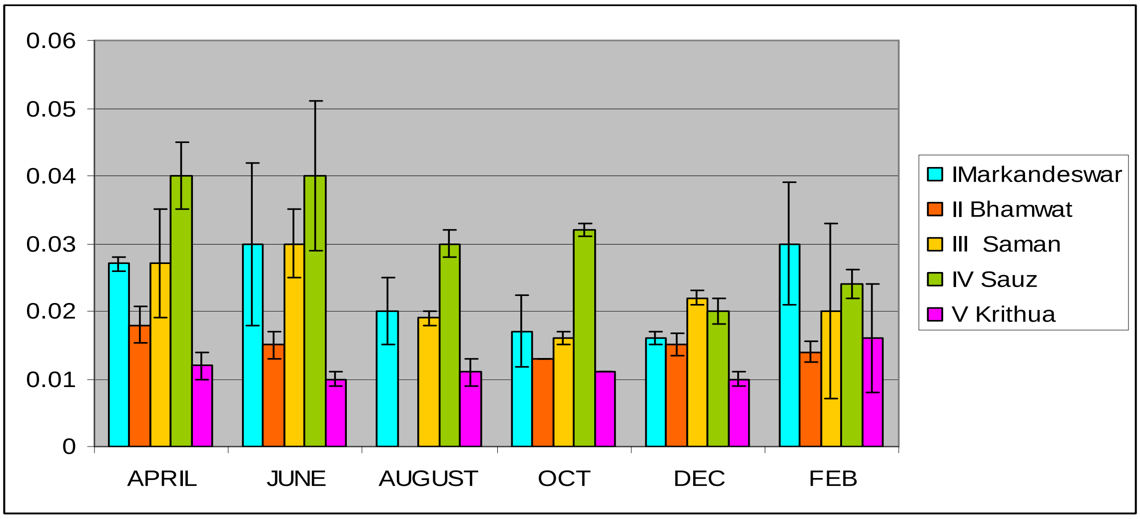

Fig. 7: Showing variations in Copper levels at different sites of Mainpuri region between April 2011 and Feb. 2012.Data are presented as Mean ± SEM, Error bars indicate standard error.

CONCLUSION

Wetlands are very diverse, but they all share one fundamental feature: the complex interaction of their basic components — soil, water, animals and plants - that fulfil many functions and provide many products that have sustained humans over the centuries[26].Wetlands provides essential habitat for a wide variety of species - birds, mammals, reptiles, amphibians, fish, and insects - up to 45% of which are rare and endangered. The high rate of wetland loss has contributed to the endangered status of many species. Different species spend most of their life within wetlands and depends on them for food, water, or shelter. Those species that require wetland habitat to complete at least a portion of their life cycle are called obligate species.

Wetlands attract wild life for a number of reasons 1) their vegetative cover provides shelter from predators. 2) They provide ideal nesting conditions for many water birds and cranes. 3) They provide migratory birds with a safe stop-over location to rest during long migrations. 4) they provide essential spawning and nursery habitat for commercially important fish and shellfish; 5)many have an extensive, complex food chain that supports numerous species, including man .When salt marsh plants die, their tissues are broken down by bacteria and fungi into detritus, nutrient-rich fragments that are flushed out with the tides and made available to fish, shellfish, and invertebrates.

The sodium level indicates salinity in water but very high levels of sodium requires concern .The present study indicates that the studied sites has fluctuation in different nutrients during different parts of the year. The water is open surface water. Results indicate that it is hard water**.** Heavy metals could not be observed in the present study, this might be due to absence of industries in this area. Although agricultural practices imparts nutrients to the water bodies. Amongst the five study sites, Site-V appears to be most damaged**,** much eutrification and dryness has been observed here, due to anthropological activities. Therefore, these wetlands require more attention and more care is required for the two IBAs (Site-III and Site-IV). The conservation of wetlands will help in conservation of the ***State bird*** of U.P. (Sarus Crane) and other local and migratory **birds** inhabiting the wetlands and maintaining the ecological balance. The future of Indian Sarus crane. *Grus antigone antigone* and other migratory and resident water birds is closely tied to the quality of these wetlands in Manipuri which serves of their habitat.

ACKNOWLEDGEMENT

Financial assistance from the U.G.C.,New Delhi (India) is gratefully acknowledged. The authors are also thankful to the authorities of Agra College, Agra for providing the necessary facilities.

REFERENCES

1. A.Bhattacharya, Animal –Sediment interaction to assess coastal pollution,1994. forsustainablemanagement of deltaic Sunderbans, Northeast India. Proceedings of Coastal Zone Canada, Conference .Bedford Institute of Oceanography, Nova Scotia, Canada, 1994, 1288-1301.
2. S.Jindal and Gusain, corelation between water quality parameters and phytoplankton of Bicherli pond, Beawar, 2007.
3. S.K.Mukhopadhyay, H.Biswas, T.K. De, B.K. Sen, S. Sen, T.K. Jana. Impacts of Sundarban mangrove biosphere on the carbon dioxide and methane mixing ratios at the NE Coast of Bay of Bengal, India. *Atmospheric Environment*, 2002. 629-638.
4. H. Biswas,A. Chatterjee., S.K.Mukhopadhya,T.K.,Dey., S.Sen, T.K.Jana, Estimation of ammonia exchange at the land-ocean boundary condition of Sundarban mangrove, northeast coast of Bay of Bengal, India. Atmospheric Environment, 2005, **39,** 4489-4499.
5. A.Bhattacharya and S.K.Sarkar, Impact of overexploitation of shellfish: Northeastern coast of India. Ambio, 2003, **32,** 70-75.
6. R. Sisodiya and C.Mounditoiya , Assesment of the water Quality index of wetland kalakho lake ,Rajasthan India *Journal of Environmental Hydrology* 2006, **14,**1-11.

7. G.E.Craigie., S.T.Timmermans, and J.W.Ingram,.: 2003, 'Interactions Between Marsh Bird Population Indices and Great Lakes Water Levels: A Case Study of Lake Ontario Hydrology', *Unpublishe Report Prepared for the International Joint Commission*, Bird studies Canada and CWS-Ontario Region, Downsview, ON, 2003,40.
8. H.J.Griese, R.A.Ryder and C.E.Braun, 'Spatial and temporal distribution of rails in Colorado', *Wilson Bull*.1980, **92**, 96–102.
9. R.Greenberg, 'Water as a habitat due for breeding Swamp and Song Sparrows', *Condor, 1988,* **90**, 420–427.
10. A.T.Gilbert, 'the Foraging and Habitat Ecology of Black Terns in Maine', *M.Sc. Thesis*, The University of Maine, Orono, Maine, USA, 2001,126.
11. J.R. Keough, T.A. Thompson,G.R. Guntenspergen, and D.A.Wilcox, 'Hydrogeomorphic factors and ecosystem responses in coastal wetlands of the Great Lakes', *Wetlands,1999,* **19**, 821–834
12. M.W.Weller, *Wetland Birds: Habitat Resources and Conservation Implications*, Cambridge, 1999.
13. P.A.Keddy, *Wetland Ecology: Principles and Conservation*, Cambridge University Press, Great Britain, 2002.
14. K.Turgeon, O. Champoux, S.Martin, and J.Morin : 2004, 'Mod´elisation des milieux humides de la Univ. Press, Great Britain, 2004,271.
15. APHA, AWWA & WEF Standard *Method for the Examination of water and waste water (Eatson AD, Clesceri, L.S.& Greenberg, AE Eds) 20th ed. Ameri. Pub. Hlth. Assoc.*, Washington D.C.1998.
16. H.J.Easton, Melinda Lalor, and Robert Pitt. 1998. The use of a multi-parameter sonde for in-situ photosynthesis/ respiration in sewage contaminated waters. *WEFTEC '98*. Orlando, Fla., pp. 181–197.
17. M.R.Hughes, Regulation of salt gland, gut and kidney interactions. *Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology, 2003,* **136:** 507-524.
18. A.Krishnamoorthy and S.Selvakumar Seasonal variation in physiochemical characteristics of water bodies in and around Cuddalore District, Tamil Nadu. *Nature Environment and Pollution Technology. 2010*,**9** (1):89-92.
19. WHO,Guidelines for drinking water quality,World health organization,Geneva,1993.
20. Goldman, The role of major nutrients in limiting the productivity of aquatic ecosystems.*Am. Soc.Limnol. and Oceanogr. 1972,* ***1b:21***-23.
21. E.Makaya, Water quality management for upper Chinyika River in Zimbabwe. *EJEAFChe*,,Electric journal of environmental,agricultural and food chemistry.,2010,9 (3),. [493-502].
22. D.Barnes, and P.J.Bliss, 1983. Biological Control of Nitrogen in Wastewater Treatment,London Enad F.N. Spon LTD.
23. J.K.Park, J.Wang, and G.Novortny, Wastewater characterization for evaluation of biological phosphorus removal. Wisconsin department of Natural Resources. Research report, 1997, 174-27.
24. T.K.Biswas, F.R.Higginson and I.Shannon, Effluent Nutrient management and Recovery in Intensive rural industries for the protection of Natural Waters, *Water Science and Technology* 1999, 40,.2, 19-27.
25. Y.Samuel and A.J.Thatheyno effect of cadmium on the respination of Orea Chromis mossambiaus *J. Exp, 2004,* India a7 (i) 113 – 116.
26. Wetlands International, *Waterbird Population Estimates – Third Edition.* Wetlands International Global Series No. 12. Wageningen,The Netherlan,2002.

***Correspondence Author: Amita Sarkar;** Department Of Zoology, Agra College, Agra (India)-282002