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Research Article

Studies on the Water Quality of Wetlands and Their Economic Prospects in District Mainpuri (U.P.) India

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Abstract: In view of the significant importance of wetlands in the ecosystem and regional economy of wetland birds, an attempt has been made to analyze the physico-chemical characters of wetland waters in Mainpuri district. Physiochemical studies of wetlands of Mainpuri was conducted six times in an year, during April 2011 to Feb 2012 to estimate the water pollution status of wetlands at Mainpuri .The work has been taken up as a comparative study of the five study sites viz- Site-I(Markandeshwar), Site-II (Bhamwat Canal), Site-III (Saman), Site IV(Sauj) and Site-V(Kirithua). In this paper we discuss temperature, pH, DO, BOD, COD, TDS, TSS and Hardness of water from these wetlands. The results indicate that the water is hard .These wetlands at Mainpuri requires attention and concern for their conservation. They support the rich fauna found there including habitat for many local and migratory birds. Saman and Sauj(Site-III and IV) are IBAs(Important bird areas) under Important Bird Areas Programmes of BNHS and Bird Life International.

KEYWORDS: physiochemical, wetlands, Mainpuri, conservation, fauna, birds.

INTRODUCTION

Wetlands are very productive ecosystems, which help in the regulation of biological cycles, maintenance of water quality, nutrient movement and support for food chains. Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life, wetlands are defined

as “areas of marsh, fen, peat land” or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters[1]. The physical and chemical characters of the wetlands water can be used to assess the ecological nature of the wetlands. Several studies have been conducted to understand the physical and chemical properties of lakes, wetland and reservoir[2]. Wetlands are well known for high diversity in class, composition and four broad categories of functions viz. physical/ hydrological, chemical, biological and socioeconomic[3]. Wetland supports plant species intermediate between true aquatic and terrestrial habitats[4].

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[5-8]. Daily, seasonal and annual variations in water levels and flows drive important ecological processes that maintain a diversity of wetlands and associated biodiversity[9-12].

Over 90 % of globally threatened birds and over 86 % of the other bird species are threatened mainly due to degradation and habitat loss which is attributed to the destruction of huge areas of natural habitats such as wetlands. Human activities such as over-grazing, deforestation, bush fires, mining, and urbanization are amongst the principle causes of habitat destruction[13-15].

In comparison to terrestrial habitats, freshwater habitats and their associated species are more threatened [16-1]. In Pakistan, diversity of wetland dependent flora and fauna, such as water birds, is affected by habitat degradation due to siltation, deforestation and land reclamation[18]. The natural beauty and solitude found in wetland areas provides opportunities for bird watching, wildlife photography, painters, hikers and simply relaxing while appreciating the wonders of nature. For many people, wetlands are a vital part of their lives providing a peaceful place to reflect while escaping from the everyday stress and strains [19].

Wetlands provide fish and wildlife habitat-food, water, and cover-critical to the survival of a wide variety of plants and animals, including a number of threatened and endangered species[20].

India has about 1,228 species of birds (I.U.C.N.) and a large number of quest birds from Europe, central Asia and other neighbouring countries visit every year. The migratory birds from North spend winters in different wetlands and deserts of India, which are distributed almost throughout the country from the high Himalayas to costal mangroves I.U.C.N. listed about 500 bird species as endangered worldwide, while F.W.N.(U.S.) lists more than 75 in U.S .Approximately 82 species of Indian birds have been listed as threatened in the IUCN Red List of Threatened Animals [21] (IUCN 2006).

Cranes are wetland dependent birds, no future of Crane is there without the wetlands(Ichnida ,1994). Survey and conservation strategy of Cranes is essential [22].

Survey and conservation strategy of Cranes is essential[22].Cranes plays a very important role in maintaining ecological balance. They are very important indicator species, indicating at a given point of time, the health of the wetland on which their very existence depends [23]. Sarus is a threatened species and the World Conservation Union (ICUN) and Birdlife International have placed this species under the category `Vulnerable[21] (IUCN, 2004). In India, this species is included in Schedule IV of the Wildlife [24] (Protection) Act, 1972.

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[25].

MATERIAL AND METHODS

1. Geographical location of study site: Mainpuri 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 Distt. 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: 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 Monsoon 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. Markandeshwar(Site-I), Bhamwat Canal(Site-II), Saman(Site-III), Sauj(Site-IV) and Kirithua(Site-V) are the major wetlands in Mainpuri, which are selected for the present study. BNHS and Bird life International has designated Saman bird sanctuary (Site-III) and Sauj (Site-IV) as IBAs(Important bird areas),under IBAs programme.The field based research study was undertaken to analyze the pollution and describe the water quality of wetlands at Mainpuri. It also presents options and opportunities for improving the water quality with respect to physiochemical characteristics of the wetlands, recommending mitigation means for wetland water. This study can help identifying the sources and draw up a plan of action to improve the water quality of wetlands.

3. Collection and Analysis of water samples: 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[26] Temperature, pH and D.O. were measured at study sites and lab with the help of 'water analysis kit'.T.D.S. was also analysed with the help of 'water analysis kit' in lab . After determining D.O.; B.O.D. was determined after keeping the water samples in BOD incubator for 5 days at 250C. For B.O.D. determination, B.O.D. bottles were used. DO. Physiochemical studies were conducted to analyse the condition of water samples from these Sites .Some important conclusions for their management were drawn on the basis of this study.

CALCULATION

D1 = DO of sample immediately after presentation mg/l.

D2 = DO of sample after 5 days incubation at 20□C, mg/l.

P= Decimal volumetric fraction of sample used (APHA).

C.O.D. was determined by reflux titration in laboratory. Unlike BOD; COD can be measured in lab on the same day . Chemical oxygen demand or COD is the measure equivalent to the requirement to oxidizing organic matter content by a strong chemical oxidizing agent. Dichromate is a superior oxidant.

A = mL titrant used for blank

B = mL titrant used for sample

M = molarity of titrant

The amount of organic matter is estimated by their chemical oxidant (potassium dichromate), the constituent carbon and oxygen are oxidized not nitrogen.

Hardness of water was determined in lab by titration method (EDTA), in lab.

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.

RESULTS AND DISCUSSION

Temperature: Temperature is directly harmful as primary pollutant and indirectly it harms the biotic components of water by decreasing dissolved oxygen (D.O) leading to death of fishes also. Most aquatic animals are poikilothermic i.e. they are cold blooded and their body temperature changes with the temperature of the surrounding water. Increase in temperature leads to increase in metabolic rate i.e. animal requires more O2 for respiration. Level of DO in water is reduced by increased temperature. The termperature was recored as °C and it fluctuated from15±0.5-30±0.057 at different sites, which was within tolerance limit. **(Table-1 and Fig.1).**Temperature affects tolerance range of water animals[27]. Temperature has pronounced effect on chemical and biological processes. This parameter is of enormous significance[28]. At all the five sampling sites, it showed a similar trend, being lower in December to February and higher from March to September and comparatively low in October and November.Temperature at different sites differed insignificantly ($p\geq0.05$).

Table- 1 : Showing mean values of some water quality parameters of wetlands of Mainpuri region at five sampling sites during April 2011 to Feb 2012.
Data are presented as mean ± Sem.

MONTHS	IMarkadeswar	IIBhamwat	III Saman	IV Sauz	V Krithua
Temperature					
APRIL	21 ± 1.0	22 ± 0.513	22 ± 0.057	22 ± 1.154	21.9 ± 0.239
JUNE	26 ± 1.0	30 ± 0.057	26 ± 1.0	25 ± 0.5	27 ± 0.577
AUGUST	24 ± 0.577	26 ± 0.818	25 ± 0.1	24.8 ± 0.2	25.4 ± 0.458
OCT	20 ± 0.321	24 ± 0.529	20.2 ± 0.416	22 ± 1.0	21 ± 0.288
DEC	16 ± 0.550	14 ± 1.0	17.7 ± 0.360	15.6 ± 0.115	17 ± 0.577
FEB 12	17 ± 0.577	15 ± 0.5	16 ± 0.577	16 ± 0.351	18 ± 0.305
pH					
APRIL	7.5 ± 0.108	7.3 ± 0.115	7.5 ± 0.207	7.2 ± 0.230	7.3 ± 0.294
JUNE	7.4 ± 0.150	7.2 ± 0.115	7.2 ± 0.196	7.1 ± 0.259	7.2 ± 0.167
AUGUST	7.6 ± 0.219	7.2 ± 0.208	7.3 ± 0.167	7.3 ± 0.259	7.2 ± 0.265
OCT	7.6 ± 0.057	7.4 ± 0.115	7.5 ± 0.173	7.3 ± 0.207	7.3 ± 0.299
DEC	7.9 ± 0.057	7.5 ± 0.207	7.6 ± 0.230	7.7 ± 0.288	7.5 ± 0.150
FEB 12	7.6 ± 0.3	7.3 ± 0.173	7.4 ± 0.115	7.4 ± 0.288	7.5 ± 0.207
Hardness					
APRIL	270 ± 2.64	260 ± 1.62	277 ± 1.73	271 ± 3.60	260 ± 2.30
JUNE	230 ± 2.88	250 ± 2.30	280 ± 0.577	275 ± 1.73	290 ± 1.15

AUGUST	235 ± 1.15	193 ± 1.0	210 ± 2.88	215 ± 0.577	210 ± 2.88
OCT	220 ± 0.0	166 ± 1.62	210 ± 2.51	227 ± 1.15	245 ± 1.15
DEC	224 ± 1.73	140 ± 2.30	225 ± 1.52	230 ± 0.0	255 ± 2.0
FEB 12	240 ± 2.64	170 ± 5.0	275 ± 0.577	270 ± 3.46	270 ± 0.0
Total Suspended Solids					
APRIL	24 ± 1.99	21 ± 1.15	24 ± 1.0	23 ± 0.57	24 ± 1.52
JUNE	30 ± 1.73	21 ± 1.84	30 ± 1.73	28 ± 1.0	32 ± 1.73
AUGUST	25 ± 0.57	24 ± 2.07	24 ± 2.30	25 ± 1.73	25 ± 1.52
OCT	23 ± 1.52	24 ± 1.52	25 ± 1.73	23 ± 1.73	24 ± 1.52
DEC	21 ± 1.0	20 ± 0.57	21 ± 1.52	20 ± 2.07	21 ± 1.46
FEB 12	23 ± 1.73	15 ± 1.15	20 ± 1.52	21 ± 1.46	21 ± 0.814
TDS					
APRIL	610 ± 1.15	470 ±1.732	1190.6±0.877	1150 ± 1.52	650 ± 3.21
JUNE	620.7 ± 1.73	438.3±1.20	1138 ± 2.07	1211 ± 2.30	710.3±2.25
AUGUST	600 ± 2.88	450 ± 2.30	1620.3 ± 1.76	1571±2.11	750 ±0.715
OCT	650.4 ± 0.816	440 ± 2.64	1210 ± 1.15	1500 ± 2.07	870 ±0.588
DEC	488 ± 2.64	350.4±1.43	1508.6 ± 2.72	978 ± 2.90	789 ±0.923
FEB 12	460 ± 6.42	385 ± 2.07	1110 ± 1.62	1009.7±0.565	625 ±0.721
DO					
APRIL	9 ± 1.0	6 ± 1.0	6 ± 0	5 ± 0	5 ± 0
JUNE	6 ± 0.577	6 ± 0.204	5 ± 0.577	7 ± 1.0	5 ± 1.154
AUGUST	6 ± 1.0	5 ± 1.0	6 ± 0.816	5 ± 0	6 ± 0
OCT	8 ± 1.0	5 ± 0.461	7 ± 1.0	8 ± 1.0	6 ± 1.154
DEC	7 ± 0.577	6 ± 0.577	8 ± 0	6 ± 1.0	6 ± 0.577
FEB 12	8 ± 0.577	6 ± 0.577	8 ± 1.154	8 ± 0.577	6 ± 0.577
BOD					
APRIL	22.8 ± 0.296	20 ± 0.173	22 ± 0.270	20 ± 0.196	21 ± 1.0
JUNE	23.3 ± 0.404	20.6 ± 0.461	22.4 ± 0.508	20.9 ± 0.577	23.5 ± 0.577
AUGUST	20 ± 0.577	20 ± 0.152	22 ± 1.15	20 ± 0.351	20 ± 0.981
OCT	17 ± 0.305	15 ± 0.577	18 ± 0.152	16 ± 0.288	16 ± 0.433
DEC	16 ± 0.467	14.3 ± 0.357	18.1 ± 0.294	18.03 ± 0.272	16.8 ± 0.254
FEB 12	17 ± 0.152	14 ± 1.0	17 ± 0.152	18 ± 0.519	16.2 ± 0.981
COD					
APRIL	24 ± 0.577	20 ± 2.88	24 ± 0.577	23 ± 2.3	25 ± 1.03
JUNE	25.26 ± 1.33	22.58 ± 0.66	23 ± 1.73	25 ± 0.529	26 ± 1.15
AUGUST	19 ± 2.3	14.5 ± 0.152	20 ± 0.577	20 ± 1.15	21 ± 0.0
OCT	23 ± 1.15	18 ± 1.15	18 ± 0.288	20 ± 2.3	23 ± 0.55
DEC	20 ± 0.0	19 ± 2.3	20 ± 0.0	21 ± 0.288	23 ± 1.15
FEB 12	20.6 ± 0.057	18 ± 0.0	19 ± 0.404	19 ± 0.503	19.6 ± 1.54

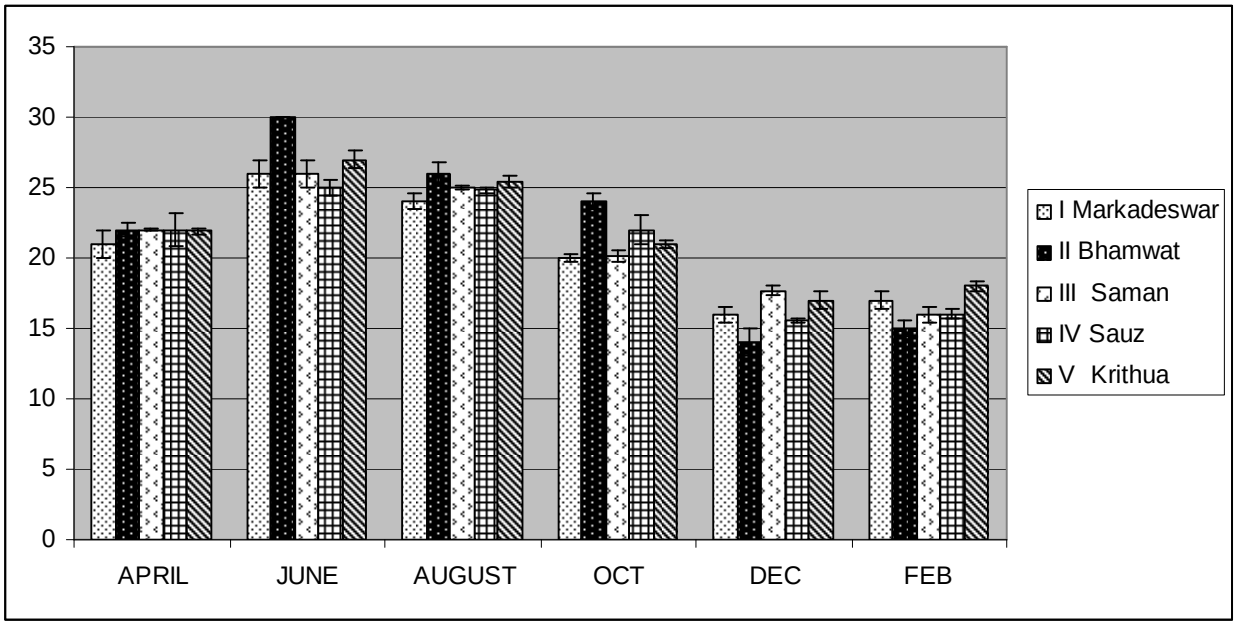

Fig.1: Showing variations in Temperature levels in different sites at Manipuri region between April 2011 and Feb 2012.Data are presented as Mean ± Sem, Error bars indicate standard error

pH: pH is among the most important and commonly studied property of natural waters. It is the measure of the level of hydrogen ion activity. However pH value gives the intensity of acidic or basic character but does not give value of total acidity or total alkalinity. Temperature affects the degree of ionic dissociation and 25□C is the standard temperature for measuring pH. Neutral water at 25°C shows pH 7, but for same water at 0°C gives a pH of 7.5 and at 60°C pH of 6.5 , pH below 4.0 will give sour taste, while above 8.5 will give alkaline taste[29]. pH regulates most of the biological processes and biochemical reactions.pH, CO_2 and NH3 are even more critical factors for the survival of aquatic plants and fishes and water birds than the O_2 supply[30]. O_2 in water supply in fact is affected by these factors indirectly. pH of water is an index of type and intensity of water pollution [31]. It is a factor which can alone decide the biotic fate of the water. High values of pH were observed at Site I and site IV during winter months. The pH value varied from 7.1 ± 0.259 to 7.9 ± 0.057 showing alkaline nature of wetland water samples **(Table-1 and Fig-2).**

Chandraprakash et al.[32] found alkaline nature of the river Yamuna at Agra all around the year (pH being 7.2 to 8.4). As the photosynthesis progresses, it increases O_2 and decrease in CO_2 levels in water. It is accompanied with some rise in pH. Most adult fishes may not suffer but young and juvenile fishes are much susceptible to high pH like 9 or more if exposed for a short period of 1 – 2 hours[33]. At Site I the affluents comes from buffaloes bathing,their dung,urine etc.Dairy effluents are though harmful but not fatal to plants, fishes and birds [34]. pH level at different sites differed insignificantly ($p \geq 0.05$).Hardness: During present investigations, hardness was noticed in water samples from different sites of Manipuri. The low value of hardness in monsoon and post monsoon period is mainly due to the addition of rain water[35] . Results indicate that it is hard water. It was measured maximum 290 ± 1.15 mg/l at site V during June11 and minimum 140 ± 2.30 mg/ltr. at site II during Dec.11. **(Table-1 and Fig-3).**The higher values were obtained in summers, due to increase in temperature and increase in solubility of calcium and magnesium salts [36].The adverse effects of hardness are formation of kidney stones and heart diseases [37]. Levels of hardness at different study sites differed significantly ($p \leq 0.001$).

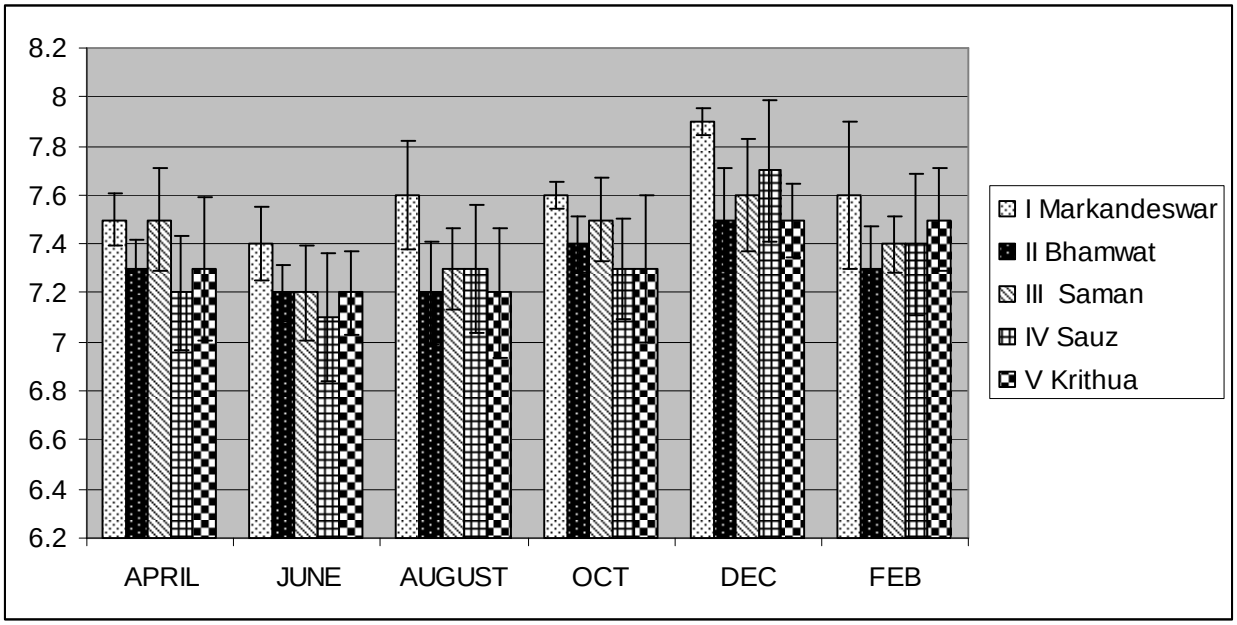

Fig.2: Showing variations in pH levels in different sites at Manipuri region between April 2011 and **Feb 2012**.Data are presented as Mean ± Sem, Error bars indicate standard error

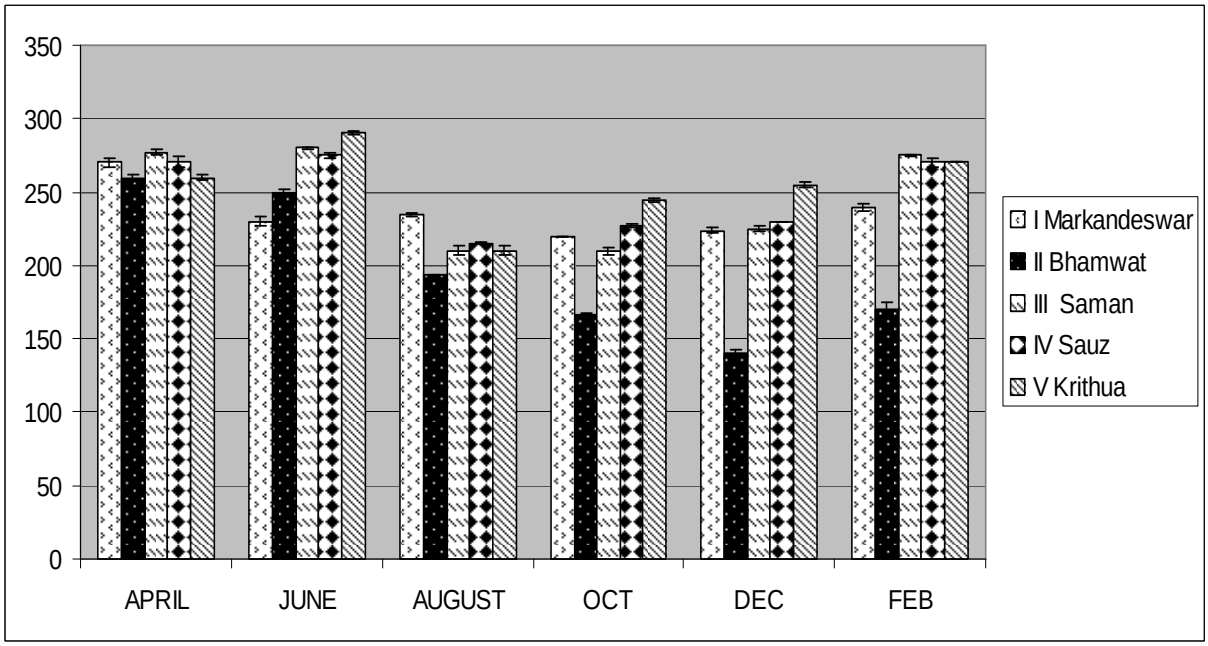

Fig.3: Showing variations in Hardness levels in different sites at Manipuri region between April 2011 and Feb 2012.Data are presented as Mean ± Sem, Error bars indicate standard error

Total Suspended Solids: Maximum values of total suspended solids (TSS) and total solids (TS) were observed at site-IV; this may be due to change in rainfall pattern. Total suspended solids show an increasing affinity with the pollution status of the river[38,39], which in turn affects light penetration resulting in reduced photosynthesis. The present investigations indicate, high amount of suspended solids in the

effluents greatly influences the turbidity of the receiving water. The value varies from 15 ± 1.15- 32 ± 1.73 mg/l. **(Table-1 and Fig.4).**

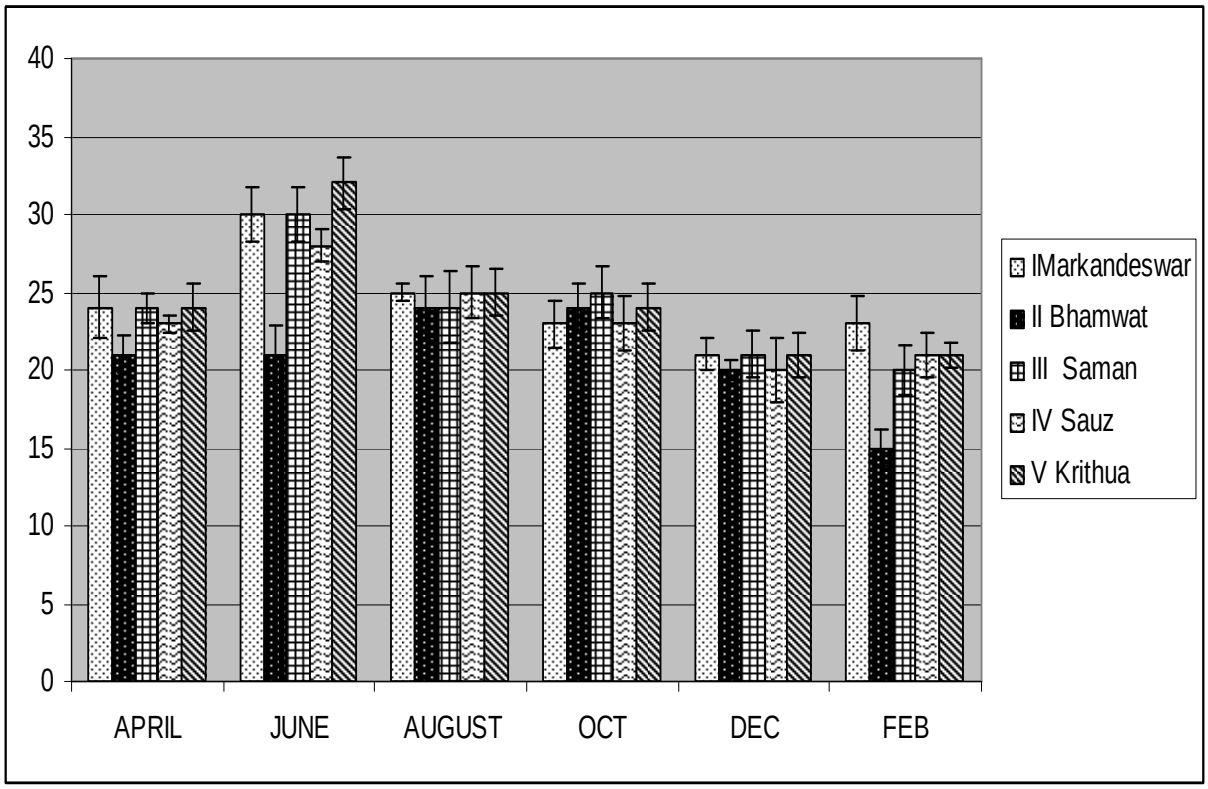

Fig.4: Showing variations in Total Suspended Solids levels in different sites at Manipuri region between April 2011 and Feb 2012.Data are presented as Mean ± Sem, Error bars indicate standard error

Total Dissolved solids (TDS) are necessary for the productivity and do not show any adverse effect on plant, fish and bird life. TDS was maximum 1620.3 ± 1.76 mg/L.during Aug.11 at site III while minimum 350.4±1.43 mg/L at site II area during Dec11. **(Table-1,Fig.5).**The limit for TDS for drinking water is 500mg/L(desirable) to 1000mg/L(permissible) for TDS ,according to BIS. Obviously, TDS is high in wetlands in all seasons. The values are lower in summer season.

The water having high TDS is of bad taste and has laxative or constipation effects [40]. It has been reported that high concentration of TDS in industrial effluents has a toxic effect on life [41, 42].Although, TDS have been noticed in water samples from Mainpuri, their value is not too high ,as to produce toxic effects on water life and birds. Values of TDS at different study sites differed significantly ($p \leq 0.001$).

DO: The average DO level required for aquaculture is 4.0 mg/l to 7.0 mg./l. The DO content showed an inverse relationship with the pollution conditions of the water from wetlands. In water, free O_2 is available from a small stock held in dissolved form, being 8 – 10ppm or mg per litre. The saturation level of DO is 14-15ppm at 0 ^{0}C in fresh, clean water.

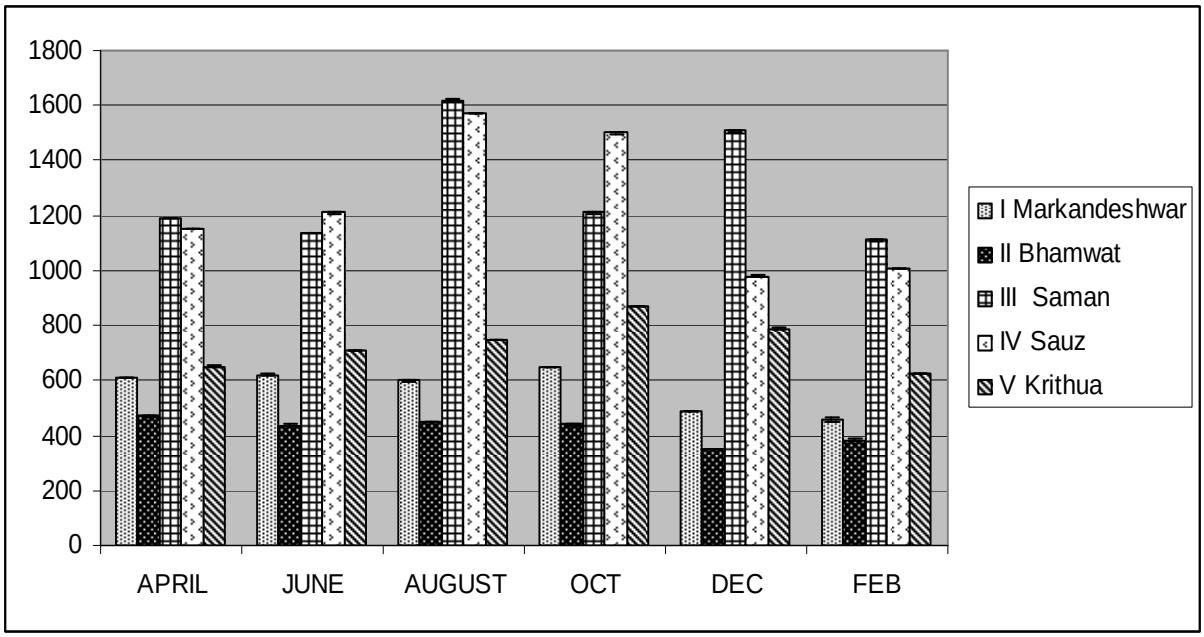

Fig.5: Showing variations in Total dissolved Solids levels in different sites at Mainpuri region between April 2011 and Feb 2012.Data are presented as Mean ± Sem, Error bars indicate standard error

The factors affecting D.O amount in wetland water at Manipuri are:

1. Increase in temperature reduces capacity of dissolving oxygen by water. It reduces up to 0 ppm at 100°C.
2. Photosynthesis and respiratory activities by animals by phytoplanktons and macrophytes releases the O2 leading to increase in pH also.
3. Turbidity reduces light penetration and photosynthesis rate, thus reducing dissolved oxygen (D.O).
4. Salts: When there are more salts in water less O2 is dissolved in water.
5. An excess of elements like Phosphorus and Nitrogen, carried into surface waters can result in eutrophication - an exponential growth or bloom of algae covering. Such elements comes from faecal contamination of water. The rapid growth of algae significantly reduces the amount of oxygen available to other aquatic life, potentially suffocating many of them. (Choudhary,1991;Makaya, 2010)

The dissolved oxygen (DO) content plays a vital role in supporting aquatic life and is susceptible to environmental changes ,it is a critical factor and at times animals like fishes dies in water due to anoxia (oxygen deficiency)[43]. It is essential to the metabolism of all aerobic organisms and it affects the solubility and availability of many nutrients and therefore, productivity of the ecosystem[44]. DO was observed 5 ± 0 mg/ltr.at site IV and V to 9 ± 1.0 mg/l at site-I indicating that site I was almost pollution free. However, considerably low DO content at site-IV and V indicating higher deoxygenating rate due to biological decomposition of organic matter and decay of vegetation as suggested by Jameel[45]. Maximum

concentration of DO was observed during monsoon and winter**.(Table-1 and Fig 6).** DO levels at different sites differed insignificantly (p≥0.05).

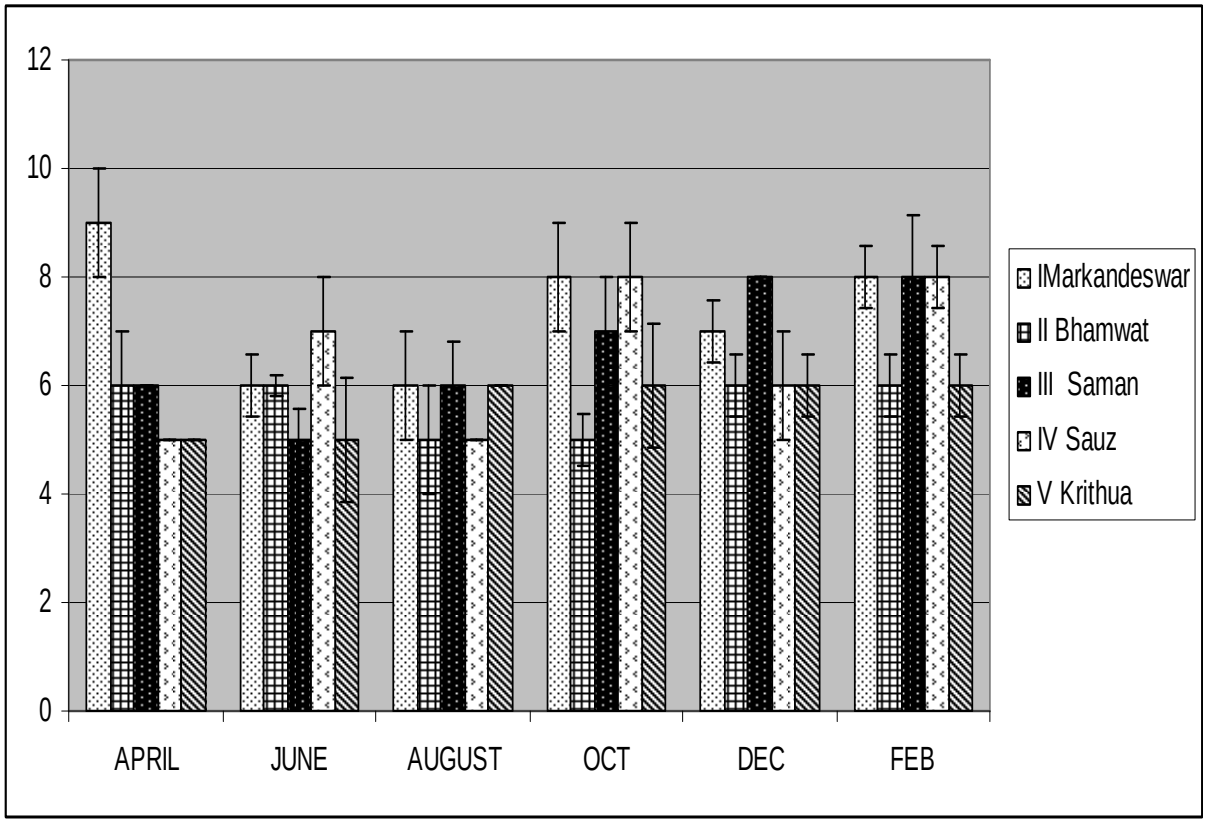

Fig.6: Showing variations in Dissolved oxygen levels in different sites at Manipuri region between April 2011 and Feb 2012.Data are presented as Mean ± Sem, Error bars indicate standard error

B.O.D determination is an empirical test of relative oxygen requirement (by microorganisms) to stabilize biologically degradable organic substances under aerobic conditions over a standard period of time. Since different substances require different period for complete stabilization. In relatively clear waters of Site I,II and III sites BOD values were lower. Some of the samples from Site V were first diluted with buffered dilution water to reduce organic load. BOD (Biochemical Oxygen Demand) is relative oxygen demand. BOD values were 14 ± 1.0 mg/l - 23.5 ± 0.577mg/ltr.

Low BOD values during winter months may be due to the lesser quantity of total solids, dissolved solids and suspended solids in river water as well as to the quantitative number of microbial population . **(Table-1 and Fig.7).** BOD levels at different sites differed insignificantly (p≥0.05).COD: Minimum level was 14.5 ± 0.152 at Site-II in Aug. and Maximum level for Chemical Oxygen Demand was 26±1.15 mg/L at Site-V during June 2011**(Table-1 and Fig.8).**Relatively higher COD values were observed during summer (june). Shardendu et al.[46] have recorded much higher values of COD from their case studies of treated tannery effluents.

The reason for samples showing higher values than the prescribed limit could be attributed to the presence of effluents[1].The oxygen balance of an aquatic environment plays an important role in pollution[47]. Highter values of BOD and COD at site-IV and V indicate more turbidity and pollution in wetland waters. COD levels at different sites differed insignificantly (p≥0.05).

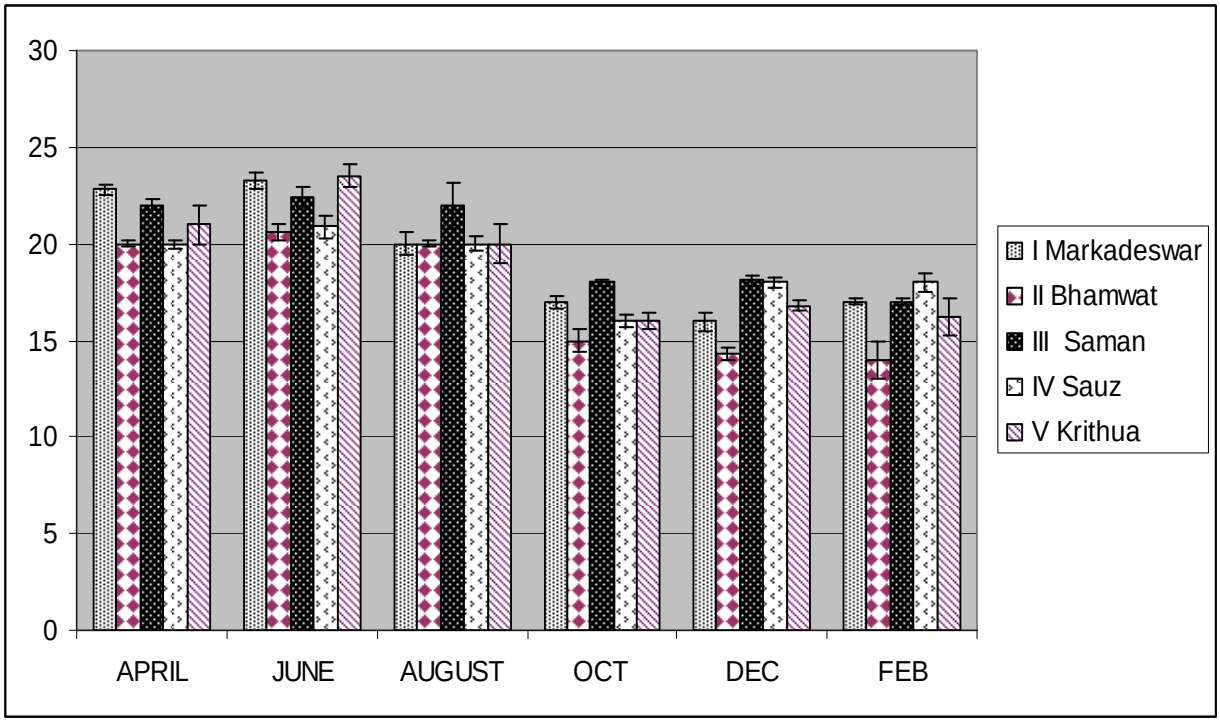

Fig.7: Showing variations in BOD levels in different sites at Mainpuri region between April 2011 and Feb. 2012.Data are presented as Mean ± Sem, Error bars indicate standard error

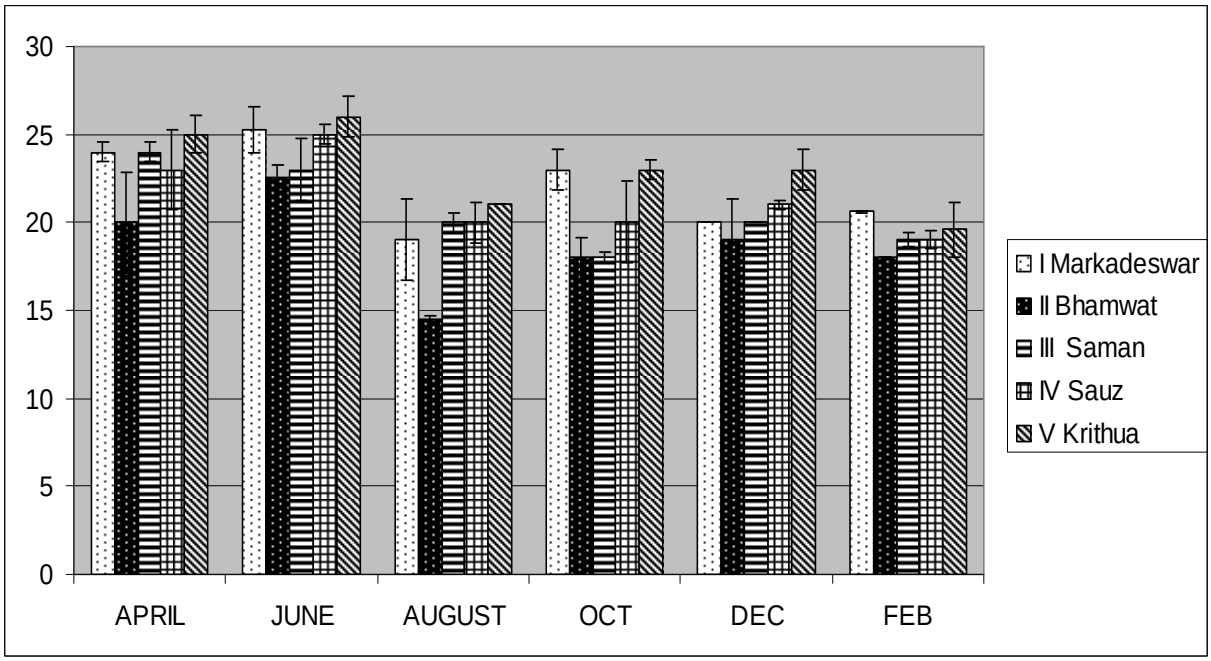

Fig.8: Showing variations in COD levels in different sites at Manipuri region between April 2011 and Feb. 2012.Data are presented as Mean ± Sem, Error bars indicate standard error.

CONCLUSION

The chemical and biological nature of wetlands continually evolves as it moves through the hydrologic cycle and anthropogenic activities change the natural water quality to an extent that it cannot be used for its intended uses. Two kinds of waste, human and animal excreta and agricultural waste normally pollute wetlands at Manipuri. Domestic wastewater discharges also affects the normal life of receiving water courses [48.] These materials have direct and/or indirect impact on the natural water course such as toxicity to aquatic life, hardness, diseases, low dissolved oxygen levels, eutrophication and turbidity.Wastewater effluents have however become a valuable source of water and nutrients in irrigation and can be recycled for this purpose or used as a supplement. 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. Hardness of water is clearly observed, which fluctuates in different seasons. Site-I,III and IV samples show more alkalinity.In samples from different sites, turbidity and muddiness could be observed. Although, Site-II samples showed lesser hardness; Little Cormoronts predominated at this site, not many of birds could be observed here. At Site-IV, the water of the lake is almost completely covered by lotus Nelumbo and bordered with Saccharum on one side, and with a few scattered clumps of Ipomoea carnea, especially after monsoon. It is fresh water swamp and gets agricultural runoffs, a canal to the south takes away excess water to the Saman(Site-III).(Rahmani,1989). Higher values for hardness, TDS and COD have been observed at Saman(Site-III) Sauj (Site-IV)and Krithua (Site-V). It indicates that agricultural water is somehow reaching here in more quantity than the other sites (Site-I, Site-II). Despite of impurities, the DO level was observed to be reasonably high, ie. up to $8\pm1.54(p\leq.05)$,which might be one of the reasons for the birds to stay at Mainpuri. 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).

By loss and deterioration of their habitat by deforestation and cutting of trees, existence of many birds is in threatened. Increasing pollution of atmosphere is also threatening their existence. Human activities such as agricultural,Bathing and laundry should be prohibited at the sites to avoid sewage effluent disposal in the wetland waters, Moreover, there is a possibility of children and infants drinking the water during bathing and swimming thereby posing a health hazard.

Biological monitoring of wetlands receiving sewage effluent should be done. Systematically and consistently and legislation that control the reuse of effluent from wastewater treatment works should be put in place and enforced [49].Microbes are indicator organisms, they can be removed by wastewater treatment efficiently [50]. It is suggested that market oriented systems and mechanisms should be embodied into the wetland water and wastewater systems. However, considering the inertia of the traditional mechanisms of the planned economy, it will take long time for Manipuri to implement the wastewater treatment sector into a market oriented and cost effective system. And as such other options should be incorporated into the wastewater management in order to better manage water quality of wetland waters. Public participation should be encouraged [51]. These are the most critical considerations for Manipuri wetlands. Physicochemical studies of water these reservoirs are essential to get an idea about their status and pollution level. Various ways can be worked on its' basis for conservation of various species. Without a healthy environment, a healthy life is impossible. So when the plight of wildlife draws attention to polluted water, it solves the problem which benefits not only the wildlife, but also the people who share the water.

Obviously, these wetlands at Mainpuri require attention and concern for their conservation. Otherwise, in future they might diminish and disappear, which would result in loss of the rich fauna found here. Although Saman and Sauj(Site-III and IV) are IBAs(Important bird areas) under Important Bird Areas

Programmes of BNHS and Bird Life International. Not only,that the area of Mainpuri be declared as 'Ecologically sensitive area' as per section 3 of the Environmental protection act ,1968. It should be declared as 'site for International importance, under Ramsar[52] Convention of 1971',as has been suggested by Chauhan et al.[52]

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