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Evaluation of Physico-Chemical Parameters of Alania and Lakhawa Natural Wetlands of Kota, India with regard to Aquatic Organisms and Wildlife Species

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***Abstract*— Since time immemorial, natural wetlands have been providing us with many products and services. Most of the human civilizations have developed around the wetlands. They provide economic, social and cultural benefits. With rapid increase in population and industrialization, wetlands are steadily disappearing. Now wetlands are under threat as people assume them as 'wasted lands'. In the present study, two natural wetlands of Kota, *Alania* and *Lakhawa* have been studied to evaluate their status with regard to aquatic organisms and wildlife species. The physico-chemical parameters of these wetlands have been analysed continuously for six months and compared with the standard limits prescribed by the Bureau of Indian Standards (BIS, 1982 and 1994). It has been found that water quality of *Lakhawa* wetland is not fit for aquatic organisms and wildlife species due to higher concentrations of pH and turbidity. However, the water quality parameters of *Alania* wetland are within permissible limits but it is also under threat in terms of encroachment. Hence, there is a need for proper management, conservation and monitoring of water quality of natural wetlands to maintain healthy ecosystem.**

***Keywords*— Aquatic organisms, natural wetlands, physico-chemical parameters, water quality, wildlife species**

I. Introduction

Traditionally, wetlands have been used for many purposes like agriculture, fishery and recreation. They have served as source of fuel, wood and construction material and as purification of surface and groundwater resources and flood control. They have provided shelter to many endangered plants and animals.

The wetlands possess various kinds of flora and fauna species in a rich amount and maintain several food chains and complex food web. The wetlands are also important to reduce natural calamities like typhoon, cyclone and floods. But unfortunately wetlands are going to vanish due to human disturbance. This disturbance is also harmful for avian diversity. These days the major threats to the wetlands are that they are being destroyed for commercial development, extraction of mineral resources, tourism and discharge of domestic and industrial wastes into them.

II. Study Area

The study was conducted for a period of six months from July 2015 to December 2015 at two important wetlands namely, Alania and Lakhawa wetlands of Kota city.

Alania Wetland

Alania is located across the Alania River near Simapura village in Kota district. Its maximum height is 14.54 metre from the deepest level. It is a masonry dam built with Surkhi mortar. It was constructed in 1961-1962. It is an irrigation tank rich in fish and avian diversity. The ancient paintings portraying animal figures, hunting scenes and geometrical designs are the places of attraction at Alania dam. The water of Alaia dam is used for irrigation purposes.

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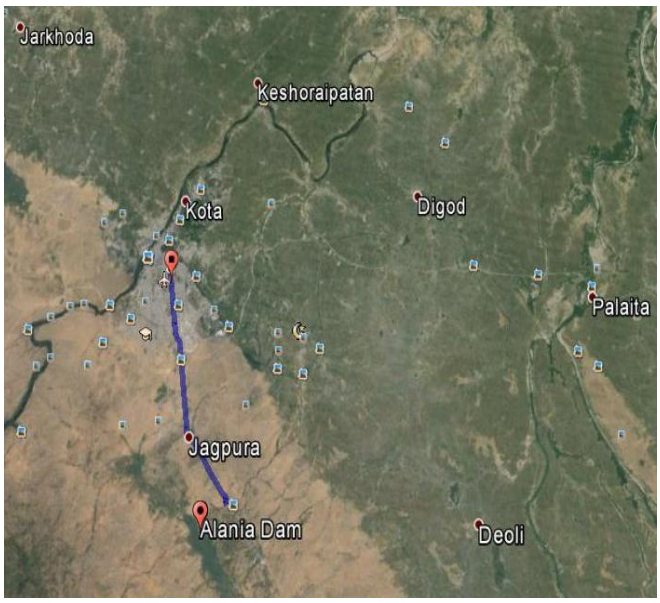

Figure 1: Google Map showing Alania Wetland

Figure 2: Alania Wetland

Lakhawa Wetland

Lakhawa is a village located in Ladpura tehsil of the Kota district. It is about 3 km from Ranpur village. It has a beautiful pond having length of 1330 metres.

Its catchment area is about 6.5 square kilometres. It was surveyed in 2011 by the National Lake Conservation Plan for conservation and management of polluted and degraded lakes.

Figure 3: Google Map showing Lakhawa Wetland

Figure 4: Lakhawa Wetland

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III. METHODOLOGY

Sample collection

The water samples were collected from Lakhawa and Alania wetlands during July to December 2015. To analyze the water quality, 5 litres of water samples were collected in plastic containers. Samples were collected at an interval of ten days. Before sampling, the containers were cleaned and washed properly. After sampling, the containers were marked carefully with their respective identification marks. Proper preservation of collected water samples was also ensured so as to get actual and accurate results during experiments.

Sample Analysis

The water quality parameters were measured according to the "Standard Methods for Examination of Waters and Waste Waters, American Publication Health Association", 21st Edition, 2005. The water parameters crucial from the wetlands point of view were found out which included pH, temperature, alkalinity, turbidity, ammonical nitrogen, electrical conductivity and dissolved oxygen.

IV. RESULTS AND DISCUSSION

In India, the tolerance limits of parameters have been specified for fresh water/inland surface water for fish culture and wildlife propagation as per the BIS – IS 13891:1994 and IS 22926:1982), which are represented in table I and II respectively.

Table I
Tolerance Limits For Fresh Water For Fish Culture

S. No.	Parameter	Tolerance Limit
1	pH	6.5 – 8.5
2	Dissolved Oxygen (mg/l)	4
3	Turbidity (NTU)	10
4	Water temperature (0C)	2 – 35
5	Alkalinity as CaCO3 (mg/l)	100 – 300
6	Nitrate Nitrogen as N (mg/l)	2

(Source: BIS 13891:1994)

Table II
Tolerance Limits Of Inland Surface Water For Fish Culture And Wildlife (Class 'D')

S. No.	Parameter	Tolerance Limit
1	pH	6.5 – 8.5
2	Ammonical Nitrogen (Free Ammonia) (mg/l)	1.2
3	Electrical Conductivity (mS/cm)	1000
4	Dissolved Oxygen (mg/l)	4

(Source: BIS 2296- 1982)

Major physico-chemical parameters were analysed during the study period to determine the effect of water quality on the aquatic organism and wildlife species of the wetlands. Physico-chemical parameters are effective for change in life processes of aquatic biodiversity like change in water temperature because aquatic biodiversity is sensitive to change in water temperature. Water temperature varied from 18 to 30^0C, conductivity varied from 140 to 480 µS/cm, pH value ranged from 8.09 to 8.5, turbidity ranged from 2.3 to 8.5 NTU, total alkalinity ranged from 80 to 200 mg/l, dissolved oxygen in Alania wetland ranged from 4.06 to 7.1 mg/l, and ammonical nitrogen ranged from 0.4 to 1 mg/l. The results show that the physico-chemical parameters during July to December 2015 are within the tolerance limits of IS 2296:1982 of class 'D' and IS 13891:1994. Hence water quality of this wetland during July to December months is found suitable for the survival of aquatic organism and wildlife species.

Similarly, for Lakhawa wetland, the water temperature varied from 17 to 30^0C, conductivity from 150 to 250µS/cm, pH value from 7.89 to 9.72, turbidity from 1.6 to 16 NTU, total alkalinity from 44 to 92 mg/l, dissolved oxygen from 4.8 to 6.6 mg/l and ammonical nitrogen from 0.4 to 1.3 mg/l. After the assessment of various water parameters of this wetland, the results show that the value of pH of is very high and lies between 7.89 to 9.82 during post monsoon and winter season and the value of turbidity is very high during monsoon season which is not within the tolerance limit of class 'D' of IS 2296:1982 and IS 13891:1994 given by Indian standards for fish culture and wild life. Electrical conductivity, water temperature, dissolved oxygen; total alkalinity and ammonical nitrogen are within the limits. Hence, water quality of this wetland during September to December 2015 is highly deteriorating and not suitable for aquatic organism and wild life species due to higher concentration of pH because of sewage discharged by surrounding Lakhawa village, agricultural waste and high organic matter. In Lakhawa wetland high turbidity was observed during July month due to the presence of silt, clay, muddy water and high suspended particles in water.

The results of various physicochemical parameters of water samples of both the wetlands are represented in graphical form in graphs I to VI and in tabular form in table III and IV.

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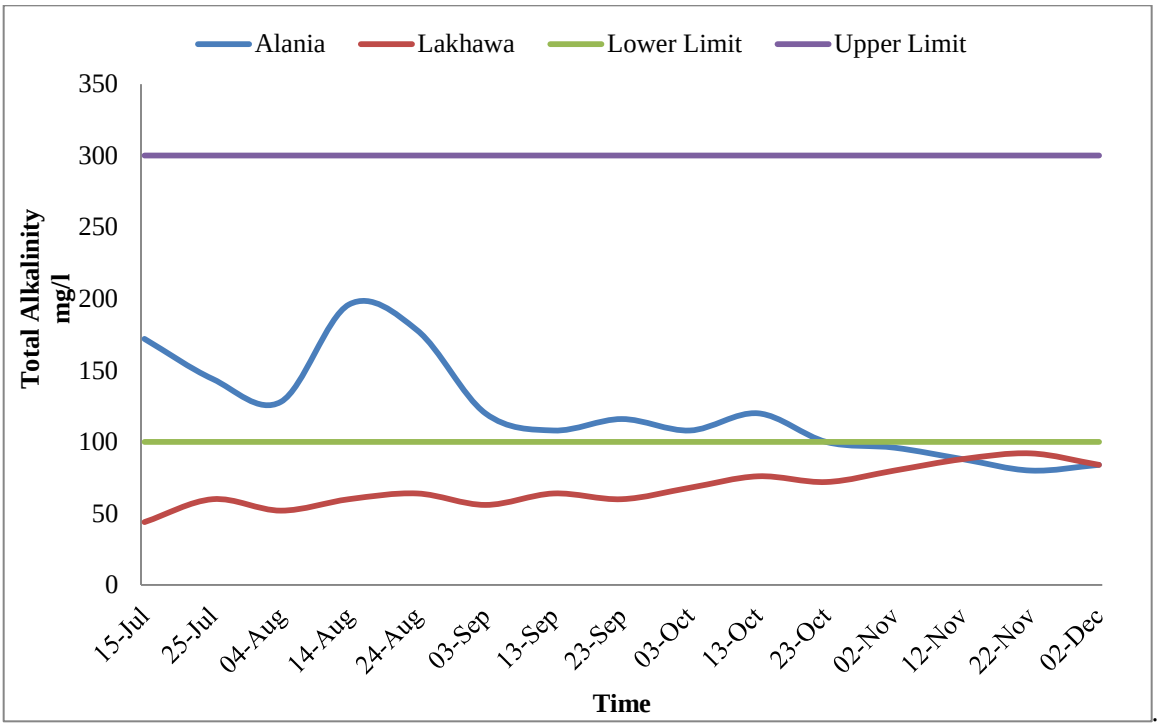
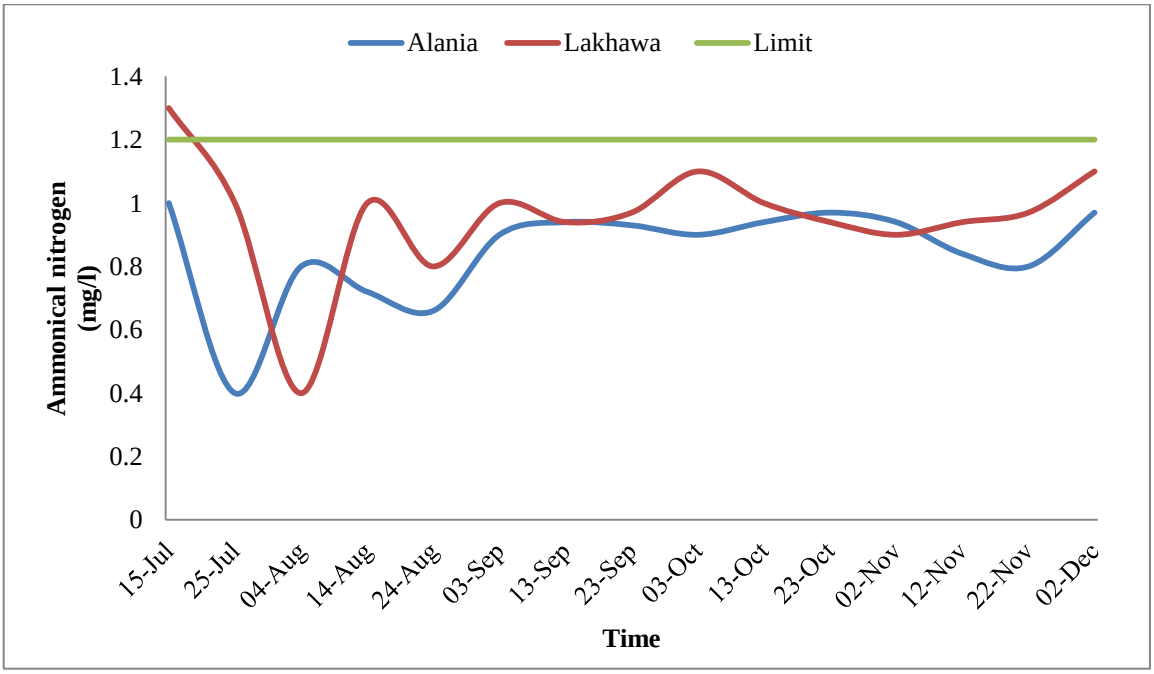


Graph I: Variation of Total Alkalinity in Wetlands



Graph II: Variation of Ammonical Nitrogen in Wetlands

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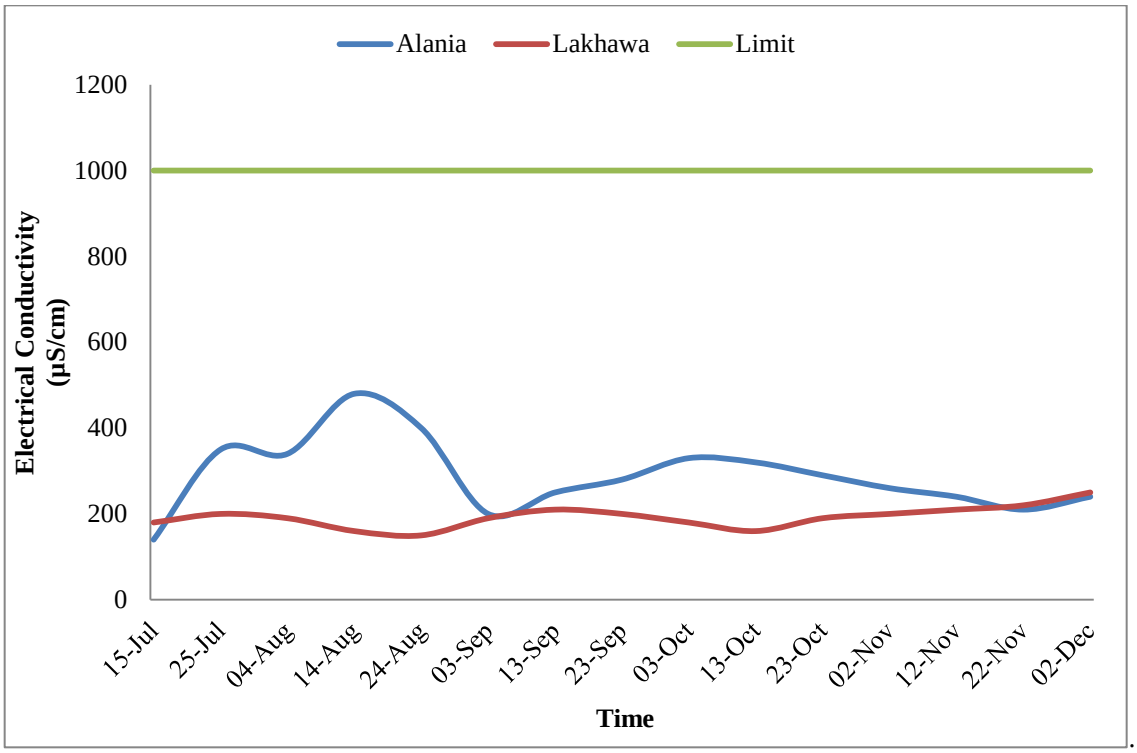
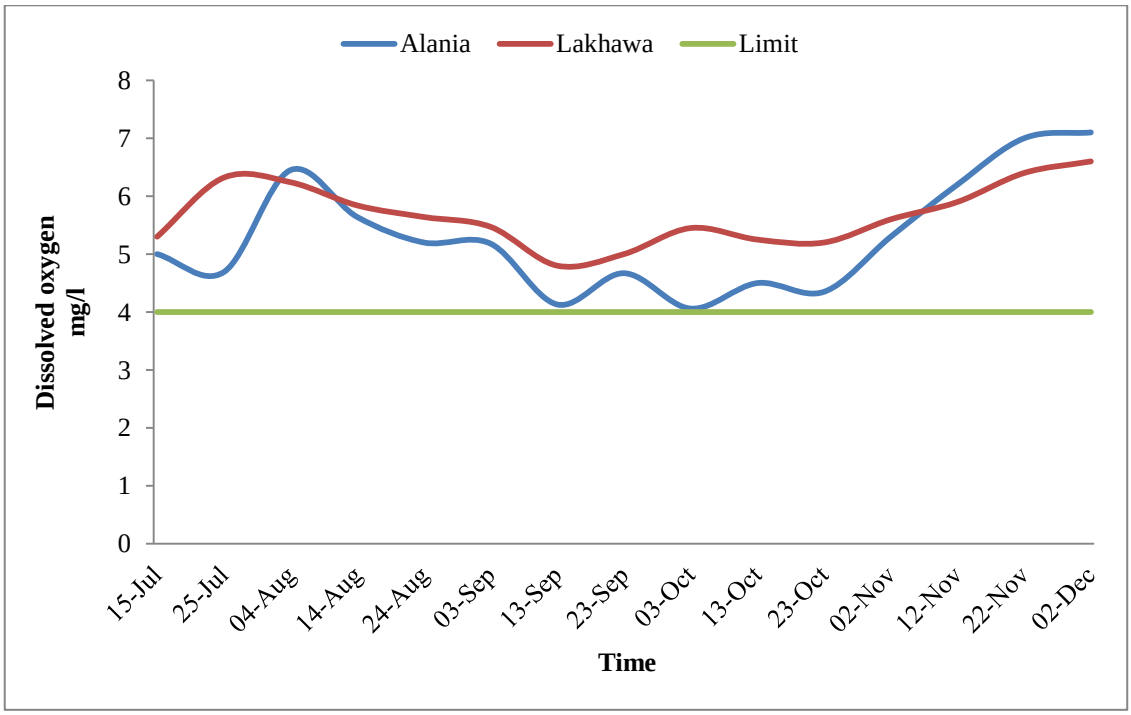


Graph III: Variation of Electrical Conductivity in Wetlands



Graph IV: Variation of Dissolved Oxygen in Wetlands

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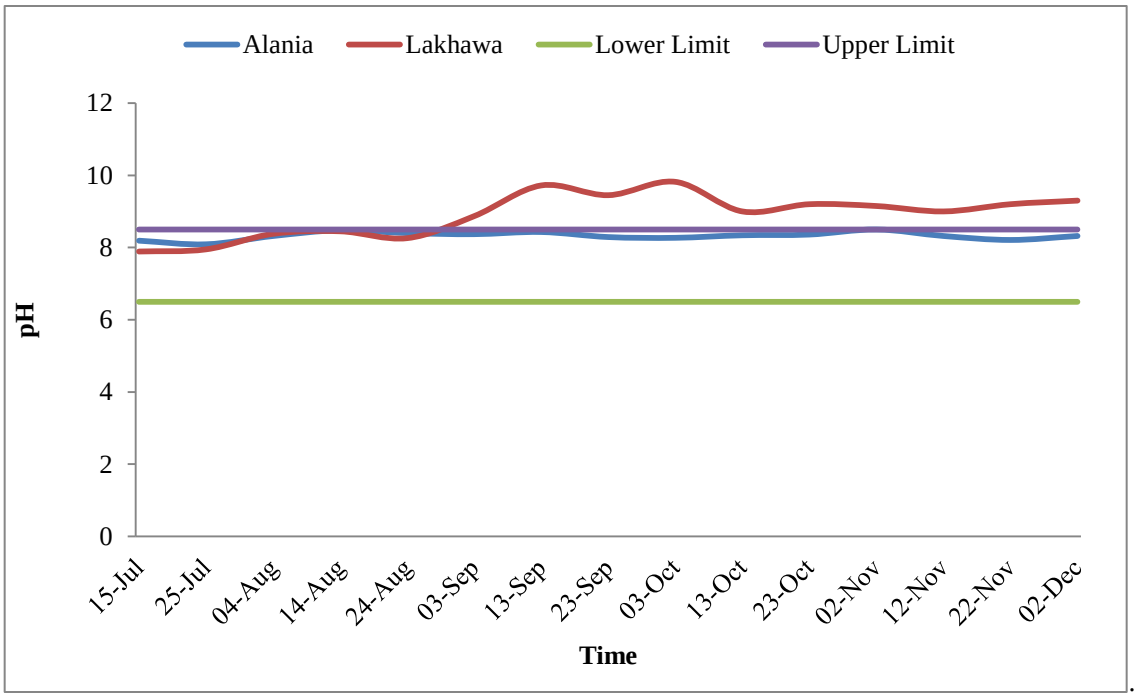
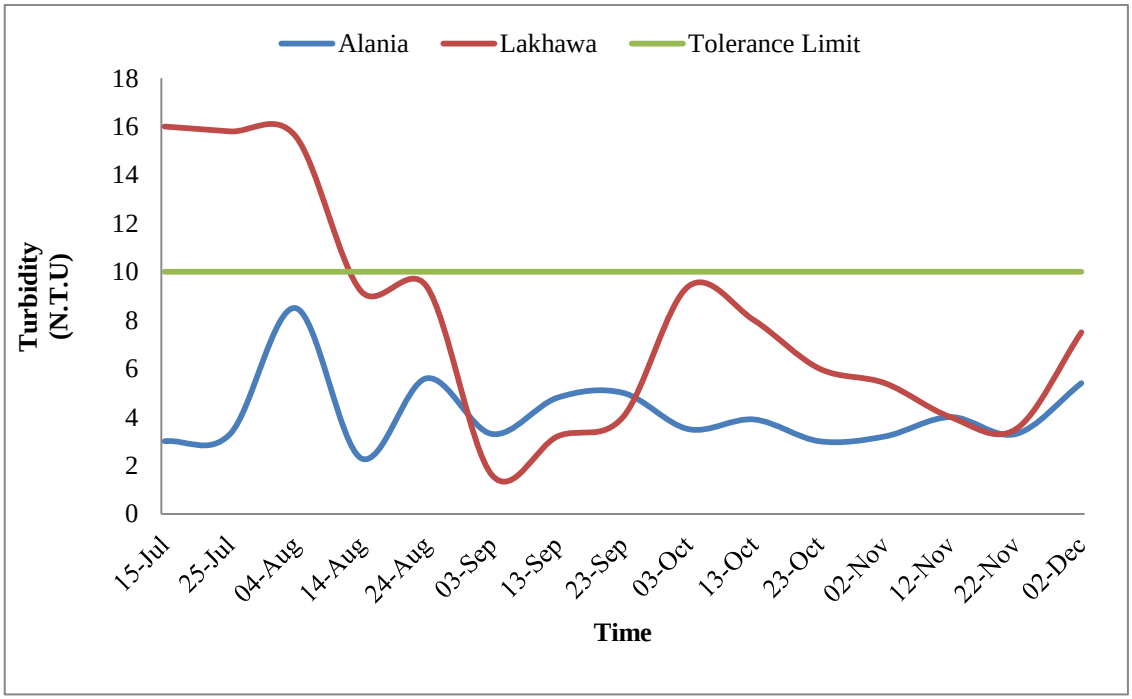


Graph 5: Variation of pH in Wetlands



Graph 6: Variation of turbidity in Wetlands

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TABLE III
RESULTS OF ALANIA WETLAND FOR DIFFERENT PARAMETERS

Date (2015)	pH	Water Temperature (°C)	Turbidity (N.T.U.)	Conductivity (µS/cm)	D.O. (mg/l)	Ammonical Nitrogen (mg/l)	Total Alkalinity (mg/l)
15 July	8.19	29	3	140	5	1	172
25 July	8.09	28	3.3	350	4.69	0.4	144
4 Aug	8.32	24	8.5	340	6.45	0.8	128
14 Aug	8.48	25	2.3	480	5.64	0.72	200
24 Aug	8.40	26	5.6	400	5.2	0.66	178
3 Sept.	8.37	30	3.3	200	5.18	0.9	120
13 Sept	8.43	28	4.8	250	4.13	0.94	108
23 Sept	8.29	29	5	280	4.67	0.93	116
3 Oct	8.27	30	3.5	330	4.06	0.9	108
13 Oct	8.34	27	3.9	320	4.5	0.94	120
23 Oct	8.36	29	3	290	4.35	0.97	100
2 Nov	8.50	26	3.2	260	5.3	0.94	96
12 Nov	8.32	25	4	240	6.2	0.84	88
22 Nov	8.21	21	3.3	210	7	0.8	80
2 Dec	8.32	18	5.4	240	7.1	0.97	84

TABLE IV
RESULTS OF LAKHAWA WETLAND FOR DIFFERENT PARAMETERS

Date (2015)	pH	Water Temperature (°C)	Turbidity (N.T.U.)	Conductivity (µS/cm)	D.O. (mg/l)	Ammonical Nitrogen (mg/l)	Total Alkalinity (mg/l)
15 July	7.89	28	16	180	5.30	1.30	44
25 July	7.95	27	15.8	200	6.32	1.00	60
4 Aug	8.38	25	15.6	190	6.24	0.04	52
14 Aug	8.45	25	9.2	160	5.84	1.00	60
24 Aug	8.26	28	9.4	150	5.64	0.80	64
3 Sept.	8.87	29	1.6	190	5.47	1.00	56
13 Sept	9.72	30	3.2	210	4.80	0.94	64
23 Sept	9.45	29	4.0	200	5.00	0.97	60
3 Oct	9.82	30	9.4	180	5.45	1.10	68
13 Oct	9.00	27	8.0	160	5.25	1.00	76
23 Oct	9.20	28	6.0	190	5.20	0.94	72
2 Nov	9.15	29	5.4	200	5.60	0.90	80
12 Nov	9.00	24	4.0	210	5.90	0.94	88
22 Nov	9.20	20	3.5	220	6.40	0.97	92
2 Dec	9.30	17	7.5	250	6.60	1.10	84

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V. CONCLUSIONS

As far as the water quality is concerned, different physicochemical parameters like turbidity, pH, D.O, conductivity, water temperature and total alkalinity were analysed for Alania and Lakhawa wetlands of Kota during the study period. The results show that the physico-chemical parameters during September to December 2015 are within the tolerance limit of IS 2296:1982 of class 'D' and IS 13891:1994 prescribed by the Indian standards for fish culture and wildlife. Hence water quality of Alania wetland during July to December 2015 is less deteriorating and found suitable for the survival of aquatic organism and wildlife species, whereas Lakhawa wetland is not suitable for the survival of aquatic organism and wildlife species during September to December 2015 due to higher concentration of pH and high turbidity which is beyond tolerance limits of both standards IS 2296:1982 of class 'D' and IS 13891:1994 prescribed by the Bureau of Indian Standards.

VI. RECOMMENDATIONS

1) Effective training programs can be rendered to the farmers of Lakhawa village to create awareness for bird conservation and habitat protection.
2) Unrestricted use of chemicals and pesticides should be stopped to maintain the sustainability and health of the ecosystem of Lakhawa wetland.
3) Stoppage of dumping sewage and garbage may help in conserving the Lakhawa wetland in the Kota district.
4) A continuous monitoring of both wetlands of Kota should be done in order to assess the changes in quality and quantity of water.

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