Biolife 2(3):1014-1021
AN INTERNATIONAL QUARTERLY JOURNAL OF BIOLOGY & LIFE SCIENCES
ISSN (online): 2320-4257
www.biolifejournal.com
BIOLIFE RESEARCH ARTICLE

ASSESSMENT OF WATER QUALITY PARAMETERS OF SELECTED BLOCKS IN KEOLADEO NATIONAL PARK, BHARATPUR, RAJASTHAN WITH REFERENCE TO WILDLIFE FEASILIBILITY

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ABSTRACT

The physic-chemical and biological parameters of six blocks of Keoladeo National Park or Ghana Bird Sanctuary were studied during the period Dec. 2013 to Feb. 2014. During investigation period the water temperature ranged between 22.11°C to 22.92 °C. The colour of the water samples varies from light yellowish to black during study. The Hydrogen-ion concentration (pH) was found to be in slightly alkaline range i.e. 7.6-7.9. DO concentration ranged from 3.3 mg/lt to 4.8 mg/lt, electrical conductance varied between 867 mg/lt to 1358 mg/lt, turbidity varied from 2.15 NTU to 38.4 NTU. Salinity ranged between 160 mg/lt to 205 mg/lt, TSS varied from 27.5 mg/lt to 49.16 mg/lt, TDS ranged between 492 mg/lt to 674.66 mg/lt. BOD ranged between 0.24 g/lt to 3.48 mg/lt, whereas COD varied between 7.5 mg/lt to 34.16 mg/lt. Ammonical nitrogen ranged from 0.45 mg/lt to 2.25 mg/lt and Nitrate nitrogen varied from 2.16 mg/lt to 11.33 mg/lt. Number of coliform bacteria was also very high in all the studied samples. Water quality indicates that water of Block L1 is better than all the studied blocks than any other block. Based on the observations made during the study period it can be concluded that water quality of Ghana bird Sanctuary is deteriorating and it needs proper conservation strategies for healthy wildlife.

Keywords: Physico-chemical, Biological, Deteriorating, Wildlife.

INTRODUCTION

Wetlands are among the world's most productive environments which provide a wide variety of benefits. They are cradles of biological diversity, providing the water and primary productivity upon which countless species of plants and animals depend for survival. Keoladeo National Park is one of the best waterfowl reserves in the world. In 1982 it has been recognized as the "National Park". Now the park is recognized as UNESCO Heritage (1985) and in Ramsar Convention as Wetland. KNP include wetlands, woodlands, scrub forests and grasslands which supports both plant and animal species diversity. The park contains around 375 species of angiosperms of which 90 species are wetland species (Perennou and Ramesh 1987). The fauna includes more than 350 species of birds, 27 species of mammals, 13 species of reptiles, 7 amphibians and 43 fishes (Vijayan 1991). Water is the most important component in structuring ecological characteristics of any wetland. Changes in water quality can alter the whole ecosystem affecting all dependent floral and faunal species in the wetlands. High quantities of nutrients entering the systems results in high productivity and may result in 'choking' of

wetlands whereas too little nutrients might result in very low growth, thus, affecting herbivores both birds and animals. Similarly, high amount of pesticides in the water entering the wetlands may result in mortality of birds and animals. Previously, the water inside the Park, drawn through a canal from Ajan dam (Gambhir river) during monsoon, gradually water recedes and the Park dries up in May-June, leaving only some pools in the deeper areas. A large number of fish die in the drying pools and on which scavengers feast. Turtles become vulnerable to predation during this period, although many aestivate and some take refuge in deeper pools. But now water is supplied from Chambal River (Dholpur) through Govardhan Dam, so there will be continues supply of water throughout the year in the Park. But it may be possible that the quality of Chambal water is different from the water of Gambhir river.

Present investigation focus on water quality analysis including physical, chemical and biological parameters to demonstrate the quality of water and to conclude its safety incidence for wildlife of the Park.

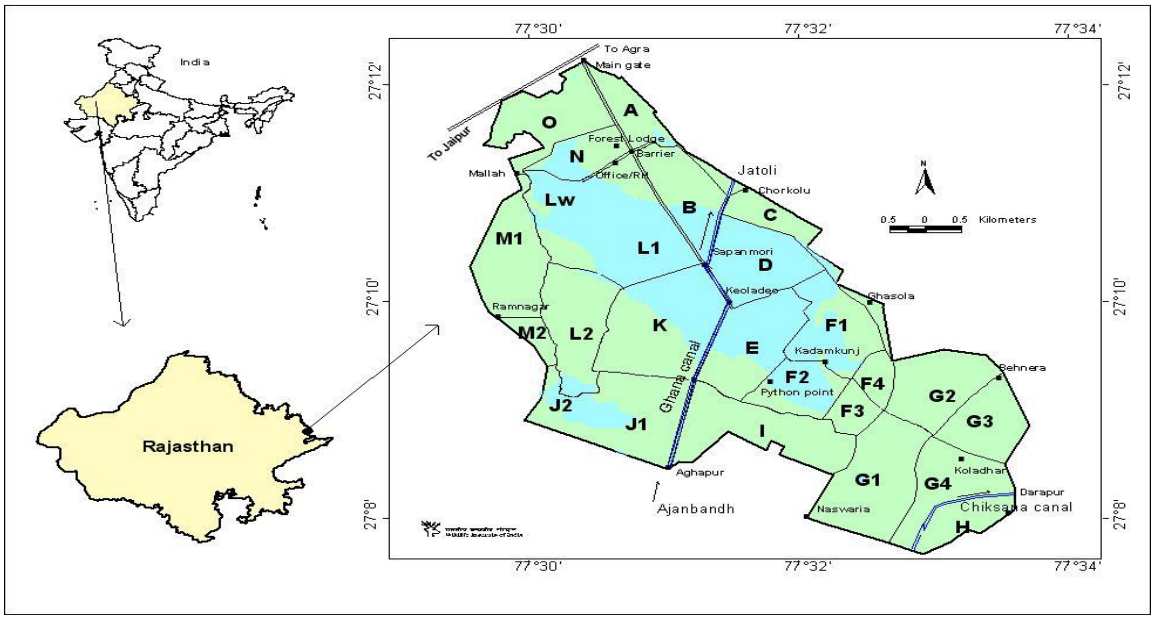
Study Area:

KNP is situated between 27°7'6"N 27°12'2"N and 77°29'5" E 77°33'9"E co-ordinates. It is 2 kms. in southeast from Bharatpur city (Rajasthan), 38 kms. southwest from Mathura and 50 kms. west from Agra of state Uttar Pradesh. The total area of the Park is about 29 sq. km. It is flat with a gentle slope towards the centre, forming a depression, the total area of which is about 8.5 sq. km. This is the main submersible area of the Park. The average elevation of the area is about 174 meters. The submersible area has divided into various unequal compartments by means of dykes (Map 1). Present study was conducted in 6 blocks of the park viz. N, K, L-1, E, B and D.

BLOCK N	N-26°11'12.94"	E-77°30'14.52"
BLOCK L1	N-27°10'23.51"	E-77°31'06.47"
BLOCK B	N-27°10'33.52"	E-77°31'15.96"
BLOCK K	N-27°10'01.64"	E-77°31'14.84"

Figure-1: Panoramic view of Wetland

Figure-2: Block-wise view of Keoladeo National Park



BLOCK D N-27°10'11.12" E-77°31'35.81"
BLOCK E N-27°09'50.87" E-77°31'45.26"

MATERIALS AND METHODS

In present research, water quality parameters like physico-chemical and biological character of above mentioned six blocks of the Park were assessed. Analysis of selected physico-chemical parameters were determined by following methods devised by APHA, (1976), Adoni, (1985), Trivedy and Goel, (1986) and Gupta, (2006).

Sampling for chemical analysis:
Raw water sample for determine chemical parameters were taken twice in a month of study period (1st Dec. 2012 to 28th Feb. 2013). For collection purpose, it is best to take samples for routine analytical purpose, from the raw water inlet channel at a point at where flow is maximum.

Sampling procedure:
Samples were collected from at least 2 to 3 meter away from the boundaries of water body. For this purpose a pre-sterilized bottles were tied at one end of a long bamboo pole and collect the sample after displaying surface water which might contain organic floating over it. After filling, the bottle the cap was placed tightly. Information regarding to samples was tagged on the bottle. Water samples from all six blocks of KNP, Bharatpur (Raj.) were collected through the same procedure and analyzed for various parameter viz. physical- Temperature, pH value, Colour; Chemical viz. Dissolved Oxygen, Conductivity, Turbidity, Salinity, Total Suspended Solids, Total Dissolved Solids, Biological Oxygen Demand, Chemical Oxygen Demand, Ammonical Nitrogen, Nitrate Nitrogen; and Biological like total coliforms.

RESULTS

The main source of water quality criteria is the "Guidelines for Drinking Water Quality" vol. 2, WHO 1998, 2004 (Saravnakumar *et al.*, 2011) which unambiguously allows the individual country to fix its own maximum permissible limits. In India, ICMR (Indian Council of Medical Research) (Pandey *et al*, 2009) have laid down the permissible limits for water quality.
The physico-chemical parameters analyzed during December 2012-Feburary-2013 are shown in Table- 1.

Block-B- A pH value of 7.6 indicates alkaline nature of water, with a less (3.98 mg/lt) DO and very high conductivity of 1224.5 μmhos/cm then permissible limit. Acids, bases and salts in water make it relatively good conductor of electricity. Rawson (1960) categorized eutrophic water having electrical conductance above 0.20 mS. Turbidity (38.4 NTU) was higher than ICMR standards. Amount or salinity was 176.66 mg/lt which is very low than WHO limits. TSS was 49.166 mg/lt and TDS was 612 mg/lt which is very high than permissible limits. BOD of the water was very low (1.766 mg/lt) than WHO standards. Whereas COD was also very high (34 mg/lt) than WHO standards. On the other hand amount of ammonical nitrogen (0.45 mg/lt) and Nitrate nitrogen (2.16 mg/lt) was very low than ICMR values.

Block-D- Average pH of this block was 7.9 during the survey, which is in permissible amount according to all wildlife standards. But amount of D.O. was very less (3.4 mg/lt) than standard water quality which causes stress to aquatic life. Conductivity (1259 mg/lt.) was lower and turbidity was higher than ICMR standards which indicate intermittent pollution. Total suspended solids and total dissolved solids were very less than the standards. BOD was less and COD was high then the permissible limits. Amount of BOD, COD and Nitrate Nitrogen indicates that water is not so good for aquatic life. Ammonical and Nitrate nitrogen was less than the standards. Amount of total coliforms is very high then water quality standards.

Block-E- Water of this block was somewhat alkaline. DO is the most important water quality parameter which shows the amount of oxygen present in water. In the water of Block E, D.O. was very less 3.75 mg/lt. which may be stressful for wildlife. Conductivity (1209.67 μmhos/cm)

and salinity (205 mg/lt) represents that water is slightly polluted. Turbidity (5.33 NTU) is approximately similar to the WHO standards. TSS (42.5 mg/lt) and TDS (600 mg/lt) were very less than the aquatic life standards. Amount of BOD (0.24 mg/lt) was very less whereas COD was very high. Amount of nitrogen and total coliforms were also not so good for wildlife.

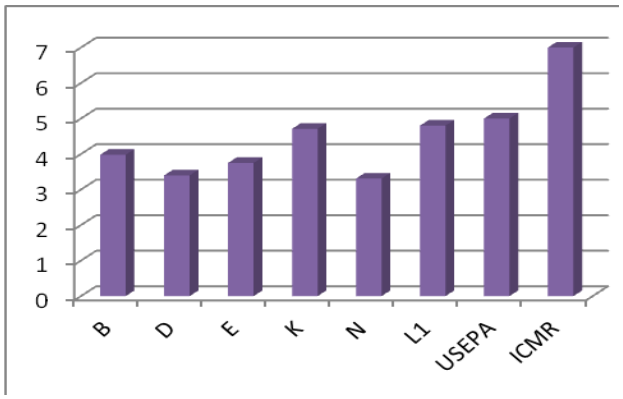
Block-K- A 7.8 pH vlue indicates that water is slightly alkaline. DO is less (4.7) than USEPA and ICMR standards. Conductivity is very high (1358 μmhos/cm) which should be 600 mg/lt as ICMR standards. Pure water has zero conductivity but amount of acids, base and salts make water a good conductor of electricity. It means water is organically polluted. Amount of Turbidity and Salinity indicated that water had fewer amounts of salts. TSS (31.66 mg/lt) and TDS (674.66) were less than the aquatic life standards. B.O.D. was slightly low (2.76 mg/lt) and COD (7.5 mg/lt) was slightly high than portable standards. Amount of Nitrate Nitrogen (6.83 mg/lt) and Ammonical nitrogen (1.5 mg/lt) was also very less which were not sufficient for a healthy wildlife.

Block-N- A pH range between the 6.5 and 8.5 is generally suitable. Average pH of this block was 7.8 during the survey, which is in permissible amount according to all wildlife standards. But amount of Dissolved Oxygen (DO) was very less (3.31 mg/lt) than standard water quality which causes stress to aquatic life. Conductivity and

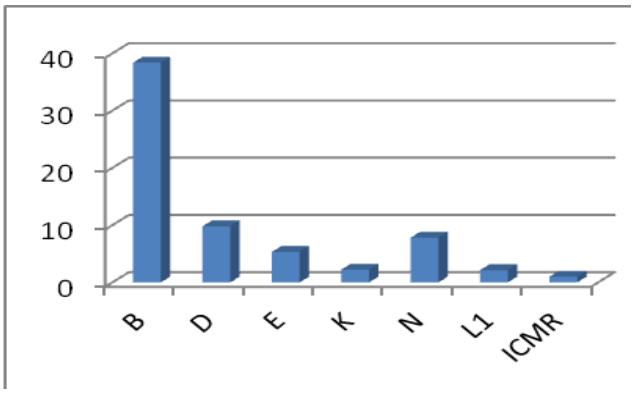
Table-1: Physico-Chemical and Biological Parameters of Selected Blocks of Keoladeo National Park during Dec. 2012- Feb. 2013.

Physico-chem. Parameter	Block B	Block D	Block E	Block K	Block N	Block L1	WHO Stand.	USEPA Stand.	ICMR Stand.
pH	7.6	7.9	7.7	7.8	7.8	7.85	±2	±2	-
DO (mg/lt)	3.98	3.4	3.75	4.71	3.31	4.8	40%	⍰5 mg/lt	7 mg/lt
Conduct.	1224	1259	1209	1358	954	867	-	-	600 mg/lt
Turbidity (NTU)	38.4	9.8	5.33	2.24	7.83	2.15	5 NTU	-	⍰1 NTU
Salinity (mg/lt)	176.66	198.33	205	200	171.66	160	600 mg/lt	-	600 mg/lt
TSS (mg/lt)	49.16	43.33	42.5	31.66	28.33	27.5	-	-	-
TDS (mg/lt)	612	630	616.83	674.66	513.16	492	⍰1000 mg/lt	⍰1200 mg/lt	1500 mg/lt
BOD (mg/lt)	1.766	0.35	3.48	2.76	2.42	0.24	3 mg/lt	-	-
COD (mg/lt)	34	34.16	33.66	7.5	24	14.4	4 mg/lt	-	-
Amm. N_2 (mg/lt)	0.45	0.75	1.4	1.5	2.15	2.25	-	-	-
Nitrate N_2 (mg/lt)	2.16	4.5	6.83	6.83	11.33	11.2	≈90 mg/lt	-	50 mg/lt
Total Coliform	2400	2400	1100	2400	2400	1100	-	126/100 ml	-

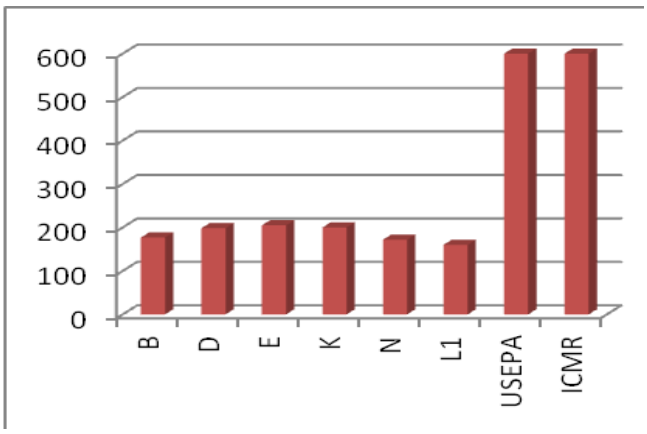
Graph 1. Comperative DO (mg/lt.) values in selected Blocks



Graph 2. Comperative Turbidity (NTU) values in selected Blocks

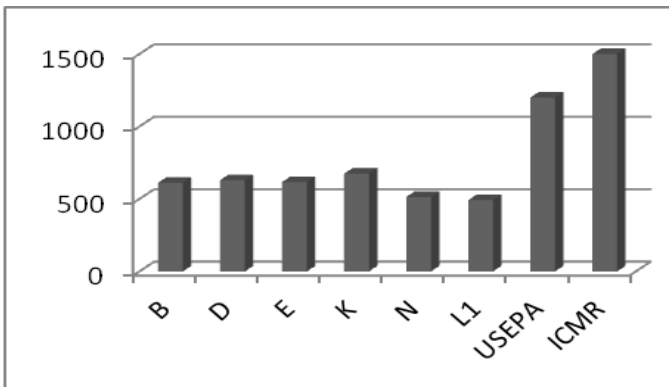


Graph 3. Comperative Salinity (mg/lt.) values in selected Blocks

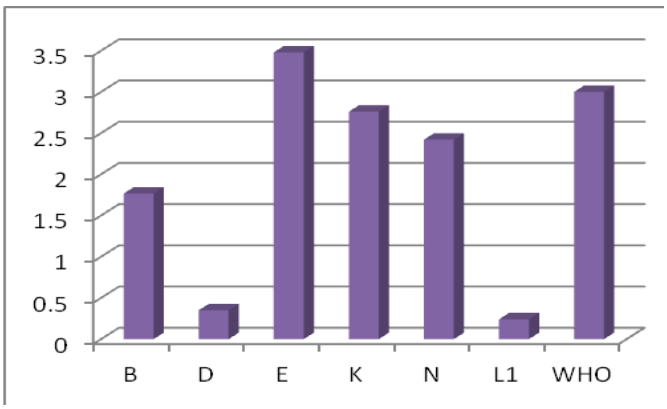


Turbidity were higher than ICMR standards which indicate intermittent pollution. Salinity (171.6 mg/lt) of the water was very less. Total suspended solids and TDS were lower than WHO and ICMR standards. Biological Oxygen Demand (BOD) of the water was very low (2.42 mg/lt). Similarly amount of ammonical nitrogen (2.15 mg/lt) was also less than the standards. On the other hand Chemical Oxygen Demand (COD) was very high (24 mg/lt) than permissible limits. Amount of BOD, COD and Nitrate Nitrogen indicates that water is not good for the health of wildlife. Nitrate stimulates the growth of plankton and waterweeds that provide food for fish. Amount of total coliforms is very high then water quality standards.

Graph 4. Comperative TDS (mg/lt.) values in selected Blocks



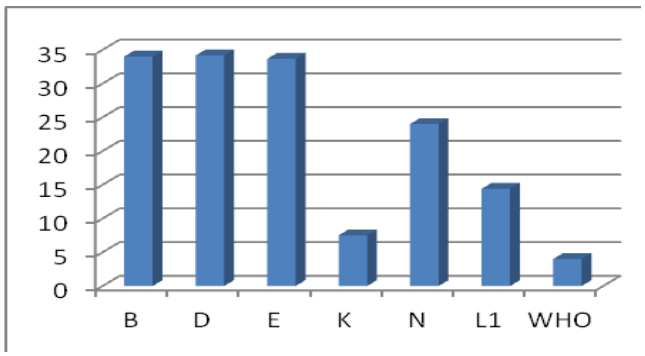
Graph 5. Comperative BOD (mg/lt.) values in selected Blocks



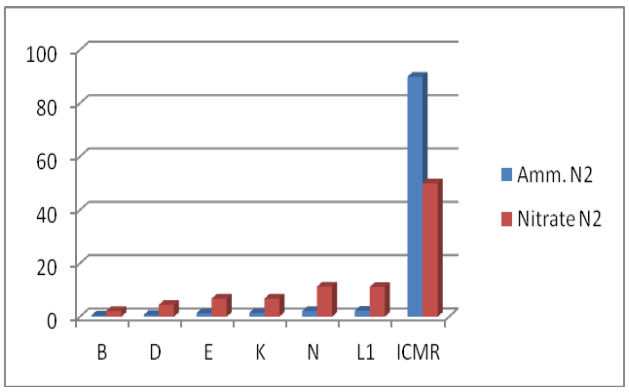
Block-L1- pH is somewhat alkaline (7.85). Amount of DO is less (4.83 mg/lt.) but approximately similar to USEPA standards. Conductivity (867 mg/lt), Turbidity (2.15 NTU) and Salinity (160 mg/lt) of the block water were not in permissible limits of wildlife. TSS (27.5 mg/lt) and TDS (492 mg/lt) were low than the standard limits. BOD (3.48 mg/lt.) was in accordance with the WHO standards and COD (14.4 mg/lt) was very high than wildlife water

quality standards which indicate that is not much harmful for bird and fish life. Ammonical and Nitrate nitrogen was also very less (11.2 mg/lt.) so availability of food for aquatic life was less. Amount of total coliforms is very high then water quality standards.

Graph 6. Comperative COD (mg/lt.) values in selected Blocks



Graph 7. Comperative Ammonical Nitrogen and Nitate Nitrogen (mg/lt.) values in selected Blocks



DISCUSSION

Temperature:
Temperature affects the ability of water to hold oxygen, rate of photosynthesis and metabolic rate of organisms in water (Garg et al, 2008). The temperature ranges between 22.11 to 22.92 °C in all the studied blocks during the studied period.

Color:
Color of the water is caused by both dissolved and particulate materials. It may be caused by the presence of natural iron and manganese ions, humus and planktons etc. in the water. The presence of colour in water does not indicate that the water is harmful for the health. The colour of the water samples varies from light yellowish to black during study.

pH:
The balance of positive hydrogen ions (H^+ and negative hydroxide ions (OH^-) in water determines the acidic or basic nature of water. In pure water, the concentration of positive hydrogen ions is in equilibrium with the concentration of negative hydroxide ions, and the pH measures 7. The pH of water determines the solubility and availability of nutrients and heavy metals. The maximum pH was calculated in Block-D, whereas minimum in Block-B which was slightly alkaline.

Dissolved Oxygen (D.O.):
The amount of oxygen present in water is known as dissolved oxygen. It is a critical water quality parameter which indicates the health of an aquatic system. It gets there by diffusion from the surrounding air, and as a waste product of photosynthesis. In general, rapidly moving water contains more dissolved oxygen than slow or stagnant water and colder water contains more dissolved oxygen than warmer water. Due to the contamination and pollution (like sewage) average concentration of DO decreases. The amount of DO was relatively less in all the studied blocks in comparison to standard values (Graph.1). It was minimum in Block-N and maximum in Block-L1. It suggests that water of Block-L1 is comparatively better for wildlife than water of other blocks.

Electrical Conductivity:
It estimates the amount of total dissolved salts, or the total amount of dissolved ions in the water. Pure water is a poor conductor of electricity. Acids, bases and salts in water make it relatively good conductor of electricity. High levels of mineral salts in fresh waters can affect animal and plant survival and reproduction. The conductivity can be used for the measurement of contamination from human and animal wastes. It was maximum in Block-K and minimum in Block-L1.

Turbidity:
It was maximum in Block-B and minimum in Block-L1 (Graph 2).

Salinity or Alkalinity:
Alkalinity is not a pollutant. It is caused by carbonate, bicarbonate, hydroxide compounds, borates, silicates and phosphates etc. In large quantity, alkalinity causes bitter taste to water. The salinity of water can affect plants and wildlife. It was maximum in Block-E and minimum in Block-L1 (Graph 3).

Total suspended Solids (TSS) and Total Dissolved Solids (TDS):
It describes all solids that are suspended and dissolved in water mainly mineral salts are involved. It imparts a peculiar taste to water and reduce its potability. The concentration of TDS and the relative amounts of different ions influence the organisms that can best survive in the waterbody. TSS was maximum in Block-B and minimum in Block-L1. TDS was maximum in Block-K and minimum in Block-L1 (Graph 4).

Biological Oxygen Demand (BOD):
It was maximum in Block-E and minimum in Block-L1 (Graph 5).

Chemical Oxygen Demand (COD):
It was maximum in Block-D and minimum in Block-K (Graph 6).

Nitrogen:
Nitrogen can be present in the form of nitrate ions (NO3-) and ammonium ions (NH4+). Unpolluted water contains fewer amounts of nitrate ions. Ammonical and Nitrate nitrogen stimulates the growth of production of planktons and waterweeds that provide food for aquatic wildlife. Both ammonical and nitrate nitrogen was maximum in Block-L1 and minimum in Block-B (Graph 7).

CONCLUSION

Main objective of estimation of water quality criteria is to protect wild life health in the wetlands. The results of present investigation show that the water of the study area is highly contaminated. Water is slightly polluted with acids, bases and salts which are responsible for the increased conductivity and turbidity. Water of almost all study points have low BOD and high COD which indicates the less solubility of oxygen in water. The water quality of all the blocks has deteriorated and is potential threat to aquatic flora and fauna. On the basis of various physic chemical parameters the blocks needs more attention towards its management and conservation.

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