



**ASSESSMENT OF WATER POLLUTION IN MALAKA-HARHAR
WETLAND OF ALLAHABAD**

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ABSTRACT

The assessment in pollution parameters of Malaka-Harhar wetland in Allahabad, like Temperature, pH, D.O., B.O.D. and electrical conductivity was analyzed from (Sep. 2008-Aug. 2009). All these parameters were found to be higher in cool season compare to other season may be due to the temperature change which shows a inverse relationship with water temperature. The water was alkaline during entire study period and alkalinity was found highest in the month of June and lowest in the month of August. This study reveals the changes in physico-chemical characteristics of this wet land, which will be a beneficial study to monitor the environmental changes of such water bodies.

KEY WORDS: Wetland, Allahabad, Electrical conductivity, D.O.



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INTRODUCTION

The combination of aquatic and terrestrial conditions that produce what we describe as 'wet-land' makes these ecosystems among the most complex in the world. In wetland ecosystem, the environmental parameters are determined by surrounded climate as well as hydrological cycle too. According to Ramsar Convention (1971): "Wetland are areas of marsh, for 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." Wetlands of India are estimated to be covering an area of 58.2 million hectares (Prasad et al 2002), of which Uttar Pradesh has 12832 ha (MOEF-India 1990). Wetlands are important in many ways, such as flood control, recharge and discharge of ground water, shoreline stabilization climate stabilization and carbon sequestrations (Day JW Jr, Piieczynska E, Ulehlova B, 1998). The driving forces and mechanism of seasonal changes are acknowledged to be related to variations in physical, chemical and biotic environment of any ecosystem (Muhammad et al., 2005). Different causal influences, which determine the quality of water, show a characteristic variation from season to season (Islam, 2007). Wetland ecosystem is a nutritional sink that deposits organic matters (Cungi et.al, 2007). Therefore, there is a pressing need to gain knowledge about tropical lentic ecosystem from properly recorded water quality data. The aim of the present study was to assess physico-chemical properties of Malaka-Harhar Wetland and to understand, its pollution variations.

MATERIALS AND METHODS

Geographical Status

The district of Allahabad lies in the southern part of the state of Uttar Pradesh in the Gangetic plain and it lies between 24°47' and 25°N latitude and 81°9' and 82°21'E longitude. Malaka-Harhar wetland situated nearly 11 km from the city, in Allahabad - Lucknow highway nearly National Highway

No.24 B (See map-1). A shallow freshwater pond and meandering water courses with associated marshes, subject to monsoon flooding and often dry by the end of the dry season (See Fig-1). The floating hydrophytes are dominant in this wetland. This is open agriculture surrounded wetland. The villagers of the surrounding villages depend on the wetland for their livelihood in the form of fishing, agricultural activities and bathing.

Topography and Micrometry

The landscape and terrain of the wetland is almost in S-shape having an average height of 98 m mean sea level (MSL), representing a typical old pond landscape. Maximum area of wetlands is 6500m² however the maximum depth of wetlands was found 1.4meter. For the present study the water was sampled on a monthly basis, between 10.00AM to 4.00P.M., from September 08 to August, 2009. The physico-chemical parameter such as temperature, pH, measured on the site. Dissolved oxygen was measured by the Winkler's method (Fevre, 1999). The surface water was sampled in two liter water sampler (300ml). The parameters like, total alkalinity, electrical conductivity chloride content, B.O.D. was analyzed in the laboratory, following the methods of APHA (2000).

RESULTS AND DISCUSSION

PHYSICO-CHEMICAL PARAMETERS

1. Temperature

Water temperature has played a pivotal role in all aquatic ecosystem studies. So this parameter is very important as it always has a direct or indirect effect on the biochemical reactions of the aquatic organisms. Changes in water temperature lead to the acceleration or retardation of chemical reactions in water. Moreover, temperature is important for the determination of various other physico-chemical parameters such as pH, conductivity, saturation level of gases, various forms of alkalinity, acidity etc. In contrast with river, Wetlands show a great degree of stratification due to their lack of flow. Consequently, the entire water mass

behaves more or less as a heterogeneous unit. In the present study the values of temperature ranged from a minimum of 23.7°C in the month of January 2009 to a maximum of 31.1°C in the month of May 2009 (See table 1). Higher values of temperature were recorded during the summer months, e.g., May (31.1°C) and lower values were measured during the winter months like in January (23.7°C). It is also played an important role onset of plant and animal life.

2. Transparency

Water is transparent which allows light to filter into the wetlands. This allows for aquatic plants to absorb light and perform photosynthesis. Since the ancestor of all plants originated in the wetlands, the transparency of water has had an immeasurable influence on life of wetlands. Most photoreceptors and photosynthetic pigments utilize the portion of the light spectrum that is transmitted well through water then transparency of wetland water is major factor for its productivity. Solar radiation is the major energy source driving the productivity of aquatic systems and thus controls all life processes going on inside the lakes, ponds, pools and the rivers. It is therefore very important to know the intensity of light penetration and its quality in the natural waters. Transparency is inversely proportional to the turbidity of water, which is in turn is directly proportional to the amount of suspended organic and inorganic particles. In the present study it was recorded that the highest transparency values were noted in the post monsoon season and lowest during the summer season. There was a general decrease in transparency values from January onwards because of low level of water and more anthropogenic activity in the wetlands. During the months of March, April and May, the wetlands water level was found reciting. With the influx of rain water during monsoon season, the wetlands got high turbidity because of highly waste discharged water, which is mix with the rain water in the wetlands water. With the onset of winter season, the wetland water again showed a tendency to become clearer. During the twelve consecutive months of study, the values of transparency of wetlands range

from a minimum of 18 cm to a maximum of 25.9 cm (See table 1). The minimum value of transparency (18 cm) was recorded in the month of May 2009 and the maximum values of transparency (25.9 cm) were recorded in month of August 2009.

3. Hydrogen ion concentration (pH)

The pH is a measure of the intensity of acidity or alkalinity and it shows the concentration of hydrogen ions in the water. The pH of a solution is defined as the negative logarithm of the hydrogen ion concentration in gm. mole per litre. During the twelve consecutive months of study the pH of water of the wetland was found to be basically in the alkaline range from 7.8 to 8.7 in pH scale. (See table 1). The pH of wetlands was found to fluctuate with a narrow range of 7.8 to 8.7. Minimum value of pH (7.8) was recorded in month of March 2009 and the maximum value of pH (8.7) was recorded in month of September 2008. Alkaline nature of wetlands, water during all twelve months of study because of highly agriculture runoff and high rate of evaporation of water in the wetlands.

4. Dissolved Oxygen (DO)

During the twelve consecutive months of study, the values of dissolved oxygen range from a minimum of 4.6 mg/l to a maximum of 6.8 mg/l (See table 1). The minimum value of DO (4.6 mg/l) was recorded in month of May 2009 and the maximum value of DO (6.8 mg/l) was recorded in month of January 2009. The present observations support these in so far as the maximum DO values have been recorded during winters, due to increased aeration because of low water temperature and low rainfall. DO values at selected sites declined during the summer months. They reached their lowest level during the rainy seasons and again show a rise during the onset of the winter season. During winter season, the wetlands showed a perceptible change due to the clearing of water as the turbidity decreases after monsoon season. It was during winter that the maximum DO values were recorded. D.O. shows inverse relationship with water temperature (Boyd, 1981). The average DO concentration in this wetland was slightly high primarily due to open the water surface and

thereby due to high atmospheric O₂ diffusion into the water and low O₂ demands by the microorganisms during the oxidation of dead leaves and roots, which are less in quantity (Mohan, 2013).

5. Conductivity

Conductance is defined as the reciprocal of the resistance involved and expressed as mho or Siemen (s). As such, conductivity does not have any great significance. However, it is an important criterion in determining the suitability of water and wastewater for irrigation. During the twelve consecutive months of study the values of conductivity were found to be in the range of 1.2mho to 1.5mho (See table 1). The minimum value of conductivity (1.2mho) was recorded in the month of July 2009 and the maximum value of conductivity (1.5mho) was recorded in the month of October 2008. In the present study, more or less similar patterns were recorded with the values of conductivity during different seasons. Conductivity values were found lower during the early winter months. It increased gradually during the late winter season and reached its maximum during summer season. A sharp fall in the conductivity values was noticed during the onset of monsoon every year.

6. Biological Oxygen Demand

Biological Oxygen Demand (BOD) is the amount of oxygen required by microorganisms for stabilizing biologically decomposable organic matter (Carbonaceous) in water under aerobic conditions. The test is used to determine the pollution load of wastewater, the degree of pollution and the efficiency of wastewater treatment methods. It is good index of the organic pollution and therefore helps in deciding the suitability of water for consumption. During the twelve consecutive month of study the values of BOD of the wetland range from a minimum of 3.9 mg/l to a maximum of 4.52 mg/l (See table 1). The minimum value of BOD (3.9 mg/l) was recorded in the month of May 2009. The maximum value of BOD (4.52 mg/l) was recorded in the month of August 2009. Higher values of BOD were observed during the summer and monsoon months while the

winter months recorded low BOD values because high temperature favors the oxidation reaction of water.

7. Total alkalinity

Nearly in all natural water bodies, bicarbonates and sometimes carbonates are present in appreciable amounts. The total alkalinity is mainly due to the carbonates and bicarbonates of calcium and magnesium. Total alkalinity of the wetland ranges from a minimum of 110 mg/l to a maximum of 144 mg/l. The wetland recorded the lowest value of total alkalinity (110mg/l) in month of September 2008. The highest recorded value of alkalinity was found (144 mg/l) in month of June 2009. Without exception, the total alkalinity values were higher during the summer months in the wetlands. A sharp dip in the alkalinity values was noticed during the monsoon months of July and September. With the onset of the winter season, the alkalinity values again increased and reached their maximum during the summer.

ENVIRONMENTAL PARAMETERS

Allahabad is located on the confluence of the holy Ganges and Yamuna. The city is based in the Gangetic plains and is close to the Tropic of Cancer. Due to its proximity to the Tropic of Cancer, the city experiences sub-tropical climate. During summers, weather can be as hot as 45° C and humid too.

(a) Atmospheric Temperature

Atmospheric temperature is a measure of temperature at different levels of the Earth's atmosphere. It is governed by many factors, including incoming solar radiation, humidity and altitude. When discussing surface temperature, the annual atmospheric temperature range at any geographical location depends largely upon the type of biome. During the twelve consecutive month of study the Atmospheric Temperature of the district wetlands range from a minimum of 16.7 ° C in month of December 2009 to a maximum of 35.5° C in June 2010. The rise in temperature could be due to the fact that in winter photoperiod was shorter and less intense than summer. (Salam et al., 2000). (See table 1)

(b) Rain falls

During the twelve consecutive month of study the rainfall of the district wetlands range from a minimum of 0 mm to a maximum of 3.05 mm .(See table 1)

(c) Wind

Wind speed is now commonly measured with an anemometer but can also be classified using the older Beaufort scale which is based on people's observation of specifically defined wind effects . Wind speed is also affected by wind direction and climatic condition.In the present study it was maximum wind speed was recorded 4.6 km/h in month of April 2009 and minimum of 0 km/h in the month of October 2008(See table 1)

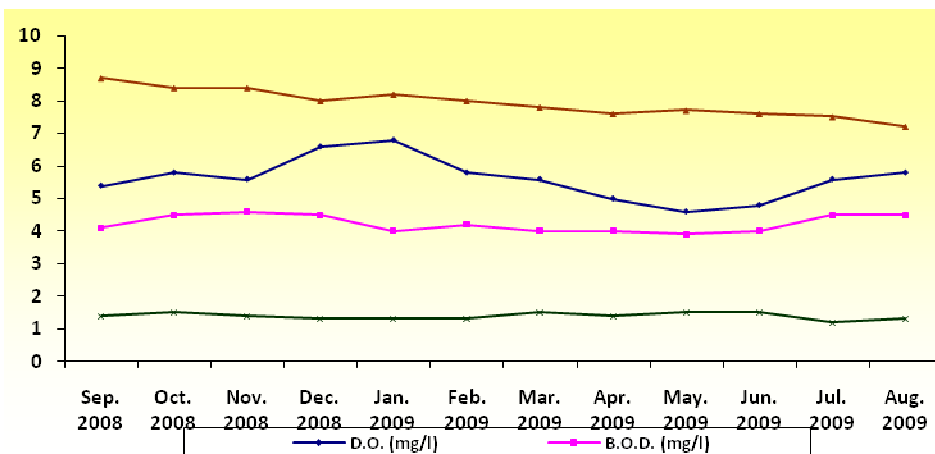
(d) Humidity

Humidity is essentially the number of water vapour molecules in the air, but there are many and varied ways of expressing it. In the present study the values of humidity range from a minimum of 44% in March to a maximum of 79%in month of August. (See table 1). Higher values of humidity were recorded during the summer months and

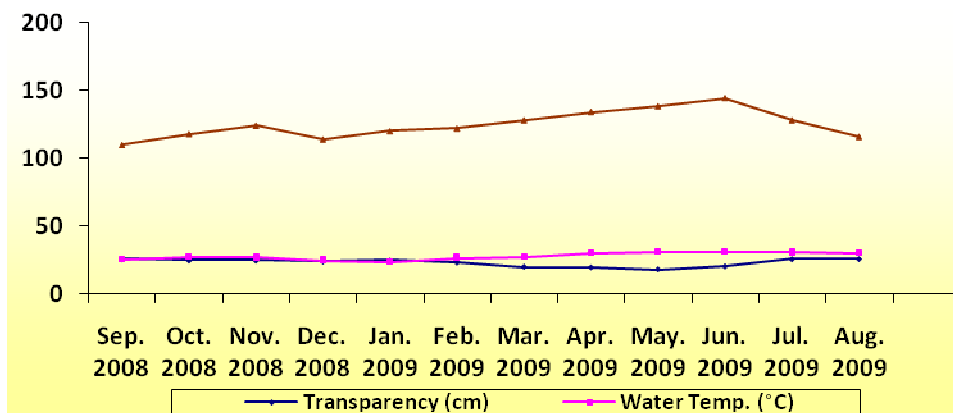
lower values during the winter months. The water profile of study site is well developed with distinct physico-chemical parameters .the physical analysis of water reveals high range water temperature(13.7-31.1^{0c}) and transparency range of water are also high (18 -25.9 cm). The B.O.D. range of wetland water (3.9 - 4.52 mg/l).however the alkanity range of water is (110- 144 mg/l). The chemical parameters of water indicate good health of wetland water in terms of B.O.D and alkanity. Although Malaka-Harhar wetlands exhibited luxiernt biodiversity it is under heavy anthropogenic pressure due to its encroachment and for agricultural activities and also its use for animal husbandry around the wetlands, which has led to the constant habitat loss as well as its degradation. Some parts of wetlands have been drained off and are being converted into rice fields or in barren land as well as wasteland. The over exploitations of this wetlands need to be checked in order to preserve and conserve the fragile wetland ecosystem. However the pollution levels of the wetlands are minimum and their uses are also safe for the domestic and agriculture purposes.

TABLE-1
Showing Physico-chemical properties of Malaka- Harhar wetland (from September 2008 to August 2009)

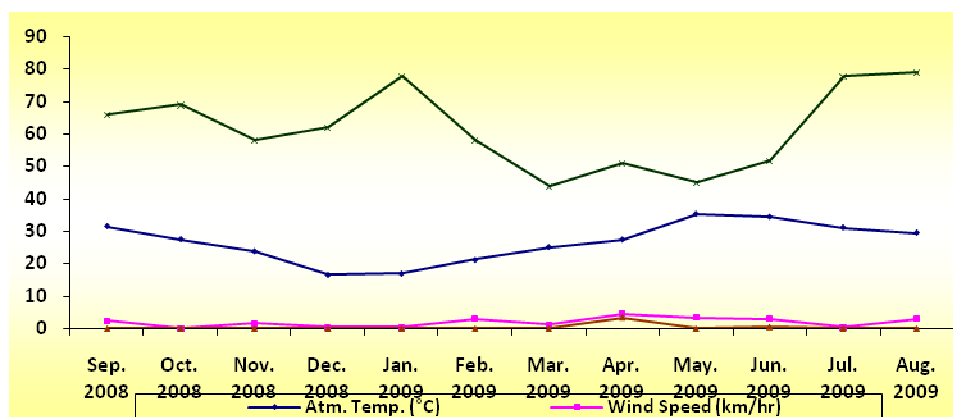
Month	D.O. (mg/l)	B.O.D. (mg/l)	pH	ELEC. CONDUCTIVITY (mho)	Transparency (unit)	WATER. TEMPERATURE (°c)	Total alkalinity (mg/l)	Atm. Temperature (°c)	Wind speed (km/hr)	Rainfall (mm)	HUMIDITY (%)
Sep.2008	5.4	4.1	8.7	1.4	25.75	25.6	110	31.7	2.4	0	66
Oct. 08	5.8	4.05	8.4	1.5	24.75	27.1	118	27.7	0	0	69
Nov. 08	5.6	4.06	8.4	1.4	24.7	27	124	24	1.5	0	58
Dec. 08	6.6	4.05	8.00	1.3	24	25	114	16.7	.4	0	62
Jan.09	6.8	4	8.2	1.3	24.75	23.7	120	17.1	.4	0	78
Feb. 09	5.8	4.02	8.0	1.3	23.25	26.9	122	21.3	3.1	0	58
March 09	5.6	4	7.8	1.5	20	27.5	128	25.3	1.1	0	44
Apr.09	5	4	7.6	1.4	19.5	30.2	134	27.6	4.6	3.05	51
May-09	4.6	3.9	7.7	1.5	18	31	138	35.5	3.5	0	45
June-09	4.8	4	7.6	1.5	20.25	31.1	144	34.6	3	.51	52
July-09	5.6	4.5	7.5	1.2	25.8	30.7	128	31.3	.4	0	78
Aug-09	5.8	4.52	7.2	1.3	25.9	30	116	29.7	3	0	79



GRAPH-1
D.O, B.O.D., pH and Conductivity of Malaka Harhar Wetland



GRAPH-2
Transperency, Water Temp. and Alkanity of Malaka Harhar Wetland



GRAPH-3
Environmental Parameters of Malaka Harhar Wetland

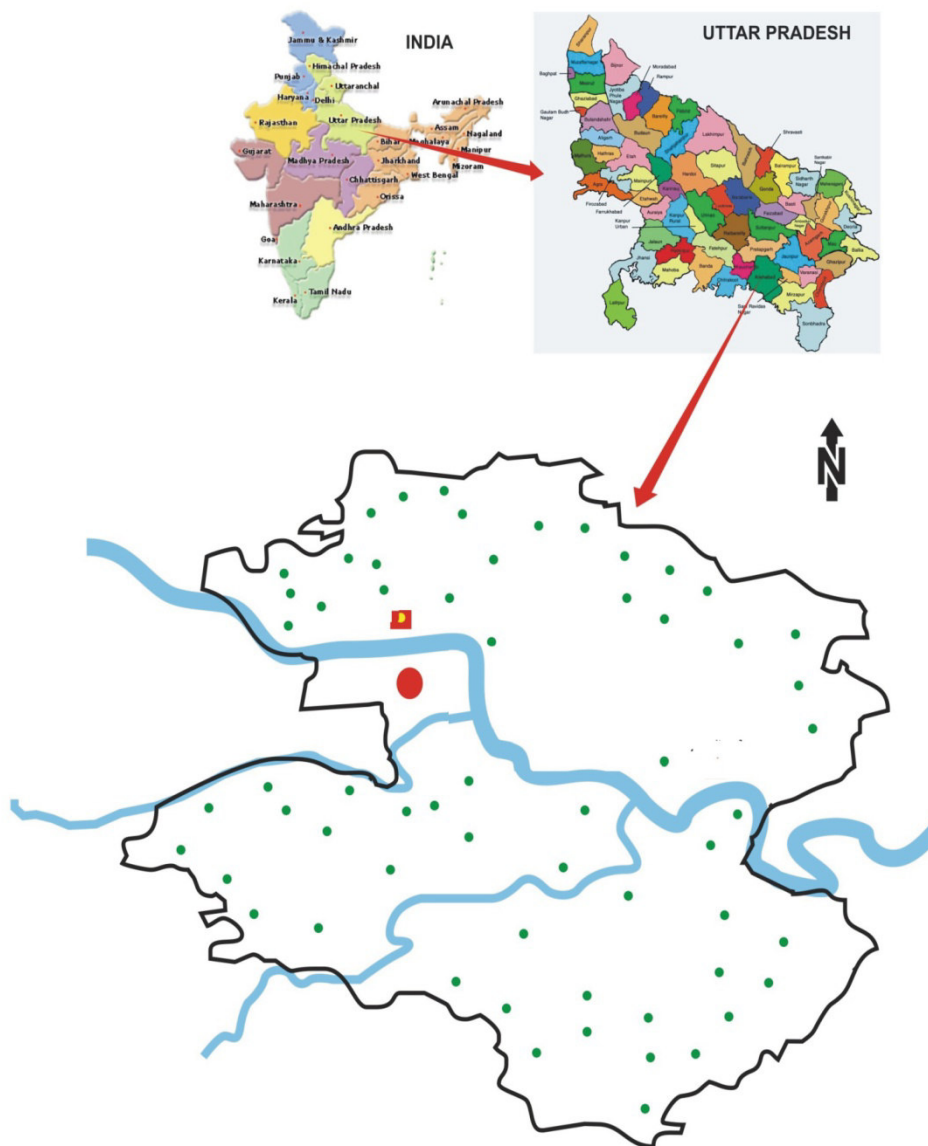


Fig. (1) Map of Allahabad showing Wetlands of the districts and the study site, of Malaka- Harhar

Figure 1
Map of Allahabad showing Wetland of the districts and study site,of Malaka-Harhar



Figure 2
Study Site (Photograph by -Anand Mohan)

CONCLUSION

The present assessment of pollution in Malaka –Harhar wetland shows high range of temperature of water and alkaline pH . while DO and BOD is in normal range. During the study it is found that the physico-chemical parameters of the water of the wetland is showing much pollution into it but high monthly variations are of concern and so anthropogenic disturbances must be reduced such as encroachment and agricultural waste. If necessary steps are not taken at the right earnest it may be sooner converted into a commercial and agricultural land.

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