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POLLUTION STRESS ASSESSMENT OF OXBOW LAKE IN KERALA

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ABSTRACT

An oxbow lake is a U-shaped body of water that forms when a wide meander from the main stem of a river is cut off, creating a free- standing body of water. Oxbow lakes are Shallow open waters. They are small bodies of standing or gently flowing water that represent a transitional stage between lakes and marshes. "Kanichan thura" at Vynthala is considered to be the only one naturally formed "Ox-bow" lake in Kerala. Now the pollution load of this lake is high due to anthropogenic activities. Physical and chemical properties of water are the most important factors responsible in shaping the biotic communities. A shift in the desired level of physio chemical properties affect the productivity chain adversely and as a result the entire aquatic productivity equilibrium is disturbed. The present study identify the water and sediment pollution level by analysisng the different water and sediment quality parameters. The different water parameters analysed are pH, TDS, conductivity, alkalinity, acidity, BOD, COD etc. During the present study realized that the oxbow lake at Kanichamthura is a precious natural resource. It holds The ox-bow lakes are very potent biologically and thus are capable to generate better economic environment, provided certain management practices are employed. At the present, as the lakes are poorly managed. The lake is under threat. It needs urgent care and protection as it is a part of our natural heritage and should remain as specimen for the generations to come.

KEYWORDS: Oxbow Lake, Pollution, Kanichamthura, Natural Resource

INTRODUCTION

The origin of ox-bow lake is a complex phenomenon and in this process many natural and human forces are involved. The genesis of the formation of lake basins has been identified as constructive, destructive or obstructive by geomorphologists and they have attributed seven main reasons for their origin, such as.(i)Tectonic activities (ii) land slides (iii) glacial activity (iv) drifting activity (v)volcanic activity (vi) solution activity and (vii) fluviatile activity. Thus nomenclature for such lakes has originated from United States and is derived from resemblance In shape to the wooden U-shaped collar placed around the neck of a draft-ox and attached to the yoke (Hutchinson 1957) Oxbow-lakes belong to semi-natural wetlands(Zsofia Molnar.2013), which are rare in South India as well. Oxbow lakes are Shallow open waters. They are small bodies of standing or gently flowing water that represent a transitional stage between lakes and marshes. They vary greatly in physical and chemical composition. Its surface is free of vegetation except for aquatic macrophytes. Unlike lakes, the water temperature in shallow open waters is uniform, without any stratification. Shallow open waters are usually connected to sources of groundwater and receive additional inputs from runoff, precipitation and other water bodies. Their depth is usually less than 2metres. Shallow open waters are characteristic of intermittently flooded, permanently flooded or seasonally stable water regimes. They may dry out due to water losses from seepage or evaporation (Foote Lee *et al.* 1996). Wetlands are one of the most threatened habitats of the world. Wetlands in India, as elsewhere are increasingly facing several anthropogenic pressures. Thus, the rapidly expanding human population, large scale changes in

land use/landcover, burgeoning development projects and improper use of watersheds has all caused a substantial decline of wetland resources of the country. Significant losses have resulted from its conversion threats from industrial, agricultural and various urban developments. These have led to hydrological perturbations, pollution and their effects. Unsustainable levels of grazing and fishing activities have also resulted in degradation of wetlands. Hydrologic conditions can directly modify or change chemical and physical properties such as nutrient availability, degree of substrate anoxia, soil salinity, sediment properties and pH. These modifications of the physiochemical environment, in turn, have a direct impact on the biotic response in the wetland (Gosselink and Turner 1978). During last decade, this is observed that ground water get polluted drastically because of increased human activities consequently number of cases of water born diseases has been seen which is a cause of health hazard (Thakare Choudhari and Jadhav, 2015).

The main problem faced by water is “pollution ”.It has become a growing threat to human society and natural ecosystem in day today life.Clean water access is a basic human right.The land disposal of solid wastes has been identified as a source of ground water pollution.With high density of population, the problem of pollution is very much higher in the absence of scientific waste disposal system (Graig Eisen and Andersan,1979).Urban settlements and growing industrial development,combined with rapidly increasing demand for water,are causing more and more water problems. Ninety six percent of water pollution problems in India are due to indiscriminate discharge of municipal wastes (Chaudhary,1981).

Bioindicators are organisms, such as lichens, birds and bacteria, that are used to monitor the health of the environment. Bioindicators are used to: detect changes in the natural environment, monitor for the presence of pollution and its effect on the ecosystem in which the organism lives, monitor the progress of environmental cleanup and test substances, like drinking water, for the presence of contaminants.

MATERIALS AND METHODS

Quality of an aquatic ecosystemis dependent on the physico- chemical charecteristics of water and also on the biological diversity on the system. Physico chemical properties of water are the most important factors responsible in shaping the biotic communities. A shift in the desired level of physic chemical properties affect the productivity chain adversely and as a result the entire aquatic productivity equilibrium is disturbed. As mentioned in the earlier chapters the oxbow lakes are very complex biotope due to so many geo-morphological factors. The oxbow lake in Kanichamthura is highly infested with aquatic weeds and are subjected to many indiscriminate interferences of human being resulting in substantial variation in their physic chemical properties. Surface water samples were collected from different sites of the lake between 9 am to 11 am on March 2015.The samples were collected in1 litre bottles for analysis and soon carried to laboratory without delay. The parameters like temperature of water sample and pH was determined at the time of collection. The samples for the determination of DO were collected separately and fixed on the spot in stoppered BOD bottles. The other water quality parameters were analysed on the same day itself using standard methods.(APHA,1998;Trivedi et al,1998;Maiti 2001;Radojevic and Bashkin,1999). In aquatic ecosystems the sediments are often analysed for their physic-chemical characteristics in order to judge the effects of pollution on these properties (Trivedi &Goel,1986). The soil parameters such as soil pH,temperature, organic carbon are determined.

The sediment samples were collected in polythene bags and soon transported to the laboratory from the sites studied. The sediment is then dried. After drying, the stones and other similar objects are picked up and the soil is ground in a mortar, to break up the lumps. The soil is then passed through 2mm sieve. Then the soil is subjected to different types

of analysis. The physical and chemical characteristics of water affect the abundance,species composition,stability and productivity of the indigenous populations of aquatic organisms. Planktons are microscopic community of plants (phytoplankton) and animals(zooplankton)found usually free floating, swimming with little or no resistance to water currents, suspended in water, on motile or insufficiently motile to overcome transport by current. Phytoplankton's occurred as unicellular colonial or filamentous form. The phytoplankton's has long been used as indicators of water quality. Because of their short lifespan, plankton responds quickly to environmental changes Some species flourished in highly euphotic water while others are very sensitive to organic and or chemical wastes. Zooplanktons principally comprise of microscopic protozoans, rotifers, cladocerans and copepods. The species assemblage of zooplankton also may be useful in assessing water quality. The biological methods used for assessing water quality includes collection, counting and identification of aquatic organisms. (APHA, 1998)

Water samples were collected from different sites of the study area on 5/2015.1litre sample water collected from the sites in a well labeled and tightly capped bottles. The bottles were washed thoroughly and rinsed within water sample before collecting it. Care was take not to contaminate the water sample during the collection and transportation. The collected samples were preserved in 4% formaldehyde brought to the laboratory.1 litre water sample was concentrated to 100ml for observing the algae in live condition.

RESULT AND DISCUSSIONS

Temperature is a physical factor that alters the water characteristics and considered as an important factor in controlling the fluctuation of plantation and functioning of aquatic ecosystem. In the present investigation shows that the surface water temperature of oxbow lake is uniform in all parts of the lake studied. The average surface water temperature of the lake is about 29°C. There is no notable variation in the turbidity of water. The sample water from site2 and site7 are more turbid compared to other samples. The average turbidity of the lake is about0.06 NTU. Suspended and colloidal matters such as clay, silt, finely divided organic and inorganic matter; plankton and other microscopic organisms cause turbidity in water. Turbidity affects light scattering, absorption properties and aesthetic appearance in a water body. In the present investigation shows that the pH of the lake ranged from 5.98 to 8.44.The maximum pH value obtained from site 10 and minimum in site 5.The average pH of the lake is about 6.836. Out of the 10 sites studied 4 sites of the lake water shows pH less than 6.5. The lake showed slightly acidic trend with a few variations. It reveals that the pH range below 6.5 will affects the organisms ability to maintain its salt balance. The range of electrical conductivity in the present study was between 29 mScm-1 and 138.3 mScm-1.The electrical conductivity is maximum at site 7 and minimum at site 10.The average conductivity of the lake is about 64.91 mg/l. In the present study high values of conductivity, could be due to high ionic concentration, pollution status, trophic levels, some domestic effluents and other organic matter in water (Ahluwalia, 1999; Fokmare and Musaddique, 2001). Unusual conductivity and salinity levels are usually indicative of pollution.

The high value of TDS in sight 7 may be due to addition of domestic waste water, garbage and sewage etc in the natural surface water body (Verma *et al.*, 2012). Increased high concentration of TDS increases the nutrient status of water body which was resulted into eutrophication of aquatic bodies (Swarnlata and Narsigharao, 1998; Singh and Mathur, 2005). The lake water shows acidic nature. the value ranged from 36 to 104mg/L. The average alkalinity of the lake is about 61.4 mg/l. In the present study the total alkalinity ranged between 3 to40 mgl-1.And the average alkalinity of the lake water is about 21 mg/l. The lake water shows acidic nature. Hardness of water is principally due to salts of Ca++ and

Mg++ mainly the carbonates and sulphates (Wadia, 1961). In the present study the total hardness of water ranged from 20mgl-1 to 47.5 mgl. The hardness of water is high in site 6 compared to other sites. Kiran (2010) reported that water can be categorised according to degree of hardness as soft (0-75 mgl-1) moderately (75-150 mgl-1) hard, hard (150- 300 mgl-1) and above 300 mgl-1 as very hard. On the basis of the observation, the water of the present pond appears to be soft.

The surface water salinity during the period of study ranged from 18 to40.37.The site 1,9 and 10 shows comparatively higher salinity. The results of the Dissolved oxygen content of the lake water ranged between 4.2 to 6mg/L. The average DO of the lake is about 5.15 mg/l. The optimum value of DO for good water quality is 4-6mg/L (Rao,2005).This would ensure healthy aquatic life in a water body. When the level of D.O falls below the minimum critical value required to ensure healthy aquatic life,it indicates pollution of water. The present study shows that Biological Oxygen Demand of the samples ranged from 1.2-3.2.It shows that the BOD of lake water is maximum at site 1.The average BOD of the lake is about 2.11 mg/l. Water may consider fairly pure if the BOD is only 1-3 mg/L. Higher BOD's indicate pollution. It shows that the lake facing pollution problems. Like the discharge of untreated sewage, barnyard run off water, disposal of domestic wastes, discharge of wastes from industries etc. The BOD of unpolluted water is less than 1.00 mgl-1 moderately polluted water 2.00-9.00 mgl-1 while heavily polluted water have BOD more than 10.00 mgl-1 (Adakola, 2000). The BOD in different season in the present study fluctuated between 1.55 and 3.26 mgl-1 indicating pond status as moderately polluted. The COD value of water sample is less than 250 ppm.COD value of higher than 250ppm is regarded as indicative of pollution. In the present studies the COD of the lake in between 4-142 mg/l. And the minimum COD is at site 3 and maximum at site 10.The average COD of the lake is about 46.26.

The present study shows that that the pH of the sediment collected from the lake is about 7.43.And shows slightly alkaline nature. During the present study 14 algal genera were identified from the study area. That belongs to 4 taxonamic groups.3 genera comes under Cyanophyceae or Blue green algae,4 genera comes under Chlorophyceae or Green algae.4 to Bacillariophyceae or Diatoms,2 to Euglenineae.

CONCLUSIONS

During the present study it is observed that the oxbow lake at kanichamthura facing several anthropogenic pressures. A good portion of this Oxbow lake- like structure has been either encroached upon or degraded this lake by the local people..Mining and reclamation by the ceramic and clay industries are the important threat faced by the lake. And The waste loading by domesticated animals, and impacts from adjacent property owners, mowing, landscaping, solid waste dumping, and domesticated animal activity. Increased sediment, nutrient, organic matter, metals, pathogen and other water pollutant loadings from storm water runoff and wastewater discharges. The surface run off from agriculture fields increase the nutrient content of lake and cause algal bloom and eutrophication. Introduction of the exotic plants are other important problem faced by the lake.

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APPENDIX

Analysis of Water

Table 1

Sl.No	Parameter	Sites										Min	Max.	Average	S.D
		1	2	3	4	5	6	7	8	9	10				
1	Temperature(°C)	29	29	29	29	29	29	29	29	29	29	29	29	29	0
2	Turbidity (NTU)	0.07	0.1	0.05	0.04	0.04	0.05	0.1	0.04	0.04	0.07	0.04	0.1	0.06	0.0224
3	pH	8.08	6.16	6.12	6.3	6	6.63	6.6	6.4	7.7	8.44	6	8.44	6.836	0.9
4	Conductivity (µm)	40.4	63	77.6	73	60	55.3	138	77	36	29	29	138.3	64.91	30.936
5	TDS(ppm)	26.2	40.6	50.4	47	39	36	90	50	23	19	19	89.6	44.1	20.045
6	Acidity (mg/l)	48	28	56	84	104	60	80	100	48	36	28	104	61.4	26.3
7	Alkalinity (mg/l)	5	40	22	5	5	6	10	19	5	3	3	40	12	11.78
8	Total hardness (mg/l)	22.5	35	22.5	23	23	25	48	33	25	20	20	47.5	27.5	8.5
9	Chloride (mg/l)	19	10	10	10	10	10	10	10	22	16	10	22	12.7	4.58
10	Salinity (mg/l)	34.9	18.4	18.4	18.4	18.4	18.4	18.4	18.4	40	29.4	18	40.37	23.30	8.39
11	DO	4.2	5.8	6	5.8	5.5	4.4	5.8	4.6	4.8	4.6	4.2	6	5.15	0.7
12	BOD	3.2	1.6	1.2	1.6	2	3	1.3	2.4	2.2	2.6	1.2	1.2	2.11	0.7
13	COD	5.6	20	4	40	6	9	46	140	50	142	4	142	46.26	52.85

Analysis of Sediments

Table 2

Sl. No	Parameters	Result
1	Temperature	30.5 °C
2	pH	7.43
3	Conductivity	0.09 µs
4	Organic carbon	14.31 mg

Analysis of Phytoplankton

Table 3

Cyanophyceae	Chlorophyceae	Bacillariophyceae	Euglenenea
Spirulina Oscillatoria Anabaena	Spirogyra Closterium Cosmarium Micrasterias	Coscinodiscus Synedra Navicula Pinnularia	Trachelomonas Phacus