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ARTICLE

Water Quality Assessment of Polachira Wetland in Kerala

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Abstract

Polachira, is a wetland located in Kollam district. It is one of the most important wetland in Kerala because of its rich biodiversity especially fishes and wide variety of migratory birds. To evaluate the water quality of the lakes and to identify the pollution sources, random sampling was done during the month of April, 2013 to March, 2014. Five different sampling stations of Polachira wetland were selected(station 1- Thalachira, station 2- Polachira nadappalam, station 3- Mannathipara, station 4- Manalmukku, station 5- near Meenadu bridge) for water quality analysis. Collected samples were analyzed according to APHA (2012) for different waterquality parameters. The analyzed variables are pH, DO, BOD, nitrite, conductivity and chloride. The studies revealed that the certain water quality parameters were satisfactory with exceptions like pH, BOD, nitrite and conductivity.Moreover, the results manifested the importance of conservation of wetland by improving the quality of water.

Keywords: Polachira, wetland ecosystem, pH, DO, BOD, nitrite, conductivity and chloride

Introduction

Water is the most essential and prime necessities of life. Water is the most critical feature that defines a wetland. Wetlands are land-water ecotones or transitional zones that occupy an intermediate position between dry land and open water. Wetlands are often considered as 'hot spots' of biodiversity within a region or a landscape (Gopal *et al.* 1993) and are unique communities which involve a diversity of plants and animals, many of which are adapted to shallow and often dynamic water regimes (Weller 1999). Ecologically wetlands are of great significant for an area as they support different food chain, food webs, regulate hydrological cycle, recharge ground water, trapping of energy and shelter to large numbers of flora and fauna having great ecological and economical value (Bennet 1962, Oglesby 1985)

The indiscriminate exploitation of wetlands beyond its supportive capacity, and input of residues exceeding its assimilative capacity, pollutes the wetland system, the magnitude of which is very alarming. This if continued will cause harm to living resources, hazards to human health, hindrance to aquatic activities, impairment of water quality and reduction of amenities and finally ecological imbalance leading to catastrophic effects (Ajaykumar Varma *et al.* 2007). Conservation of wetlands is very much essential as wetlands are one of the most threatened habitats of the world. The most important step for conservation of wetland is to maintain a proper water quality (Smitha *et al.* 2013). The water quality is to directly relate to the health of the water body. Wetlands improve water quality by acting as sediment sinks or basins. They are especially effective at trapping sediments in slow moving water. Wetland vegetation slows water velocity and particles settle out.

Materials and Methods

Five different sampling stations of Polachira wetland were selected (station 1- Thalachira, station 2- Polachira nadappalam, station 3- Mannathipara, station 4- Manalmukku, station 5- near Meenadu bridge). After selecting the permanent sampling stations, the surface water samples were collected systematically from the sampling sites. The surface water samples were collected from April 2013 to march 2014. The water quality investigations were carried out according to the standard methods (APHA. 2012). The water quality parameters which have taken for analysis are pH, dissolved oxygen (DO), biological oxygen demand (BOD), nitrite ,conductivity and salinity. Of the aforesaid water quality parameters, pH and dissolved oxygen were recorded on-site, whereas rest of the parameters was analyzed in laboratory using standard literatures. pH of samples was determined by pH meter. The DO was determined by using Starch as indicator and (maganoussulphate + alkaline KI) as fixation reagent. The BOD was determined by the 5 day BOD test. The nitrite was determined by using spectrophotometry. The conductivity was determined by using a conductivity meter. The salinity was determined by using argentometric method.

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Results and Discussion

The mean value of different parameters in Polachira wetland in different seasons are shown in table 1.

Hydrogen ion concentration (pH):

pH is the concentrations of hydrogen ions (H^+) present in water and is a measure of acidity or alkalinity. The average pH value of the all studied water samples is recorded between 5.1 (at station 3 in october) to 9 (at station 1 in march). The pH of the Polachira wetland was observed near acidic to alkaline nature. Most of bio-chemical and chemical reactions are influenced by the pH. The higher value of pH during premonsoon (march) was due to the uptake of CO_2 by photosynthesizing organisms (Ananthan 1994). The low values of pH recorded during monsoon period (October) may be influenced by the flooding and mixing up of freshwater (Prabha Devi 1986).

Dissolved oxygen (DO):

Dissolve oxygen (DO) is a very important indicator of a water body's ability to support aquatic life. Dissolved oxygen is necessary to sustain aquatic biota and provides a self purification capacity for water. It is one of the most important factors of the water quality, directly affecting survival and distribution of flora and fauna in an ecosystem (Sahni & Yadav 2012). Higher amount of DO (5.85 mg/L) was observed in the month of November at station 5, whereas lower value (0.2 mg/L) was recorded in March at station5.The maximum dissolve oxygen in postmonsoon(November) may be due to low atmospheric temperature and minimum dissolve oxygen in summer (March) may be due to high metabolic rate of organisms (Hazelwood and Parker 1961).

Table 1. The mean value of different parameters in Polachira wetland in different seasons

	Station 1	Station 2	Station 3	Station 4	Station 5
Mean value of pH					
Premonsoon	7.5	7.4	7.2	7.7	7.3
Monsoon	8.2	7.7	7.8	7.8	7.7
Postmonsoon	5.9	5.8	5.8	6.2	5.8
Mean value of DO					
Premonsoon	2.58	1.64	3.21	2.76	2.34
Monsoon	3.22	1.91	3.13	2.57	2.65
Postmonsoon	3.45	2.7	2.47	4.73	3.88
Mean value of BOD					
Premonsoon	0.41	0.35	2.37	1.11	0.97
Monsoon	1.55	1.19	2.82	0.96	1.55
Postmonsoon	1.14	1.24	3.07	1.63	1.94
Mean value of Nitrite					
Premonsoon	0.02	0.01	0.02	0.02	0.02
Monsoon	0.04	0.1	0.1	0.14	0.1
Postmonsoon	BDL	BDL	BDL	BDL	BDL
Mean value of conductivity					
Premonsoon	ADL	ADL	ADL	ADL	ADL
Monsoon	65.6	ADL	122	129.5	ADL
Postmonsoon	79.5	130.1	131	133.6	ADL
Mean value of chloride					
Premonsoon	12	30.25	16.5	19	30.25
Monsoon	16.75	160	35.5	29.75	208.5
Postmonsoon	39	161.75	118.25	47.5	76.75

Biological oxygen demand (BOD):

Biochemical oxygen demand, or BOD, measures the amount of oxygen consumed by microorganisms in decomposing organic matter in stream water. BOD also measures the chemical oxidation of inorganic matter (i.e., the extraction of oxygen from water via chemical reaction). BOD can also be used to evaluate the efficiency of treatment processes, and is an indirect measure of biodegradable organic compounds in water (Kalff Jacob 2002). Higher amount of BOD (4.84 mg/L) was observed in the month of September at station3, whereas lower value (0.0 mg/L) was recorded in March,may and december at station3. The high BOD in monsoon is due to the consumption of oxygen by the micro organisms for the decomposition of organic matter.

Nitrite (NO_2):

In aerobic conditions, most ammonium is oxidized to nitrite by Nitrosomonas bacteria (Mason 1998).Nitrite is very unstable and is oxidized to nitrate by Nitrobacter bacteria. It has been termed an invisible killer as it has no visible affect on the water column, but is often toxic to fish at low concentrations. Higher amount of nitrite (3.03mg/L) was observed in the month of June at station5, whereas lower value was recorded in all stations as below detectable limit (BDL). The low value of nitrite is due to its oxidation into nitrate. The high value of nitrite reduces the amount of dissolved oxygen as the oxidation of nitrite to nitrate consumes oxygen.

Conductivity:

Conductivity is a good and rapid method to measure the total dissolved ions and is directly related to total solids. Higher the value of dissolved solids, greater the amount of ions in water (Bhatt 1999). High level of conductivity indicates the pollution status as well as trophic level of aquatic body.In the premonsoon, the value of conductivity is above detectable limit (ADL) in all the stations and the lower value (54.6µs/cm) was observed in june at station 1. The higher value of conductivity in premonsoon is due to the evaporation in water bodies which resulted in decrease in the total quantity of water, causing increase in conductivity (Mirza *et al.* 2013). The lower value of conductivity in monsoon is due to dilution effect caused by rain and flood water.

Chloride:

Chloride is one of the important parameter in water. The Chlorides is also one of the important indicators of Pollution. Chlorides are mainly come from inorganic salts like NaCl, KCl and $CaCl_2$ etc. which are generally obtained from soil, natural layers of chloride salts, municipal and industrial sewage and animal wastes (Gopalkrushna, 2011). Higher amount of chloride (323mg/L) was observed in the month of Julyat station 5, whereas lower value (9mg/L) was recorded in May at station1. The high rate of chloride is due to the discharge of animal waste. The higher concentration of chloride in water is an index of pollution of animal origin and there is direct correlation between chloride concentration and pollution levels (Sawant *et al.* 2010).

Conclusion

The studies revealed that the certain water quality parameters were satisfactory with exceptions like pH, BOD, nitrite and conductivity. The results manifested the need and prime necessity to the conservation of Polachira wetland by improving the quality of water. The quality of water body has direct influence on the type and distribution of aquatic community. Therefore the nature and health of aquatic community is an expression of the quality of water. So, to conserve the aquatic life water quality should be properly maintained and monitored regularly.

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