Assessment of water quality status of Chichtola Lake in Gondia District of Maharashtra State, India

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Abstract

Wetlands, the vigorous water filled inland aquatic systems perform variety of functions like provide irrigation, fisheries and recreation resource etc., Assessment of water quality is an important criterion for determining the suitability of water for irrigation, fishing and drinking purpose. The present study deals with the seasonal physicochemical investigation of water of the Chichtola lake, district Gondia of Maharashtra State during the year 2018-20. The physic-chemical parameters such as Temperature, pH, Conductivity, Transparency, Dissolved Oxygen DO, CO_2, Biological Oxygen Demand BOD, Chemical Oxygen Demand COD, Phosphate and Nitrate were studied at three sampling sites of the lake during the study period. The analysis of various parameters carried out by using standard methods (APHA and NEERI). Regular monitoring of water quality parameters can help to conserve freshwater ecosystem.

Keywords: Chichtola lake, Conservation, Freshwater ecosystem

1. Introduction

Water contamination is becoming the most serious threats to human health. It has been estimated that about 80% of all the diseases in mankind are due to one or another unhealthy aspects of water. Contamination of lakes and other reservoirs is seen as one of the commonly occurring phenomenon in almost all developing nation, especially urban ones, due to demographic expansion coupled with lack of civic amenities results in hitting these natural water reservoirs very hard. Majority of the urban and rural lakes have vanished due to this human neglect and the others which could sustain this

pressure, present non-potable water or are not able to meet human requirements [1,2,3].

Conservation of Biodiversity has emerged as key environmental concerns of the day [4]. Water is the most abundant and most useful compound in the world and hence it is called "Jeevan" in Sanskrit or life. Life is not possible without water, the 2/3rdmass of our body is water and 70% surface of the earth is covered by water [5]. Water of good quality is required for living organisms. The quality of water is described according to its physical, chemical and biological parameters. The water quality assessments are used to detect the effects of pollution on the water quality. Changes in the water quality are reflected in the biotic community structure. Biological production in any aquatic body gives direct correlation with its physicochemical status which can be used as tropic status and fisheries resources potential [6]. The physical and chemical parameters exert their influence both, individually and collectively and their interaction creates a biotic environment, which ultimately conditions the origin, development and finally succession of the biotic communities [7].

Present study deals with a Chichtola lake which is situated in Gondia district of Maharashtra State, India. The lake is situated on the periphery of Nagzira Wildlife Sanctuary near Chichtola village at coordinates N 21.202600° and E 80.098697°. In the present study the attempt was made to analyze the physicochemical properties (Temperature, pH, Conductivity, Transparency, DO, CO_2, BOD, COD, Phosphate and Nitrate) from 3 different sites of Chichtola lake to understand the status of water quality from the month of October 2018 to September 2020.

2. Materials and Method

Eastern site of the lake has named as site I (S1) where anthropogenic activities like washed cloths, bullock cart and other vehicles cleaning, dirt from washed cloths, idol immersion and animal washing activities were commonly seen at this site. The western side of the lake has named as site II (S2) of the lake. Minimum human activities and disturbances were seen at S2. Site III (S3) of Chichtola lake is at northern side towards the catchment of the lake. The water samples were collected fortnightly in clean glass bottles of various sizes from the water surface of study sites.

In the present study sampling programme were started in the month of October 2018 to September 2020. Sampling was done in the morning hours from 8.30 am to 10.00 am.

Fig 1- Google Map of Chichtola Lake

Water sample were collected from three sites of the lake in fresh unsullied plastic bottles and brought to the laboratory for analysis of physico-chemical parameters by standard methods.

The parameters like temperature, pH and conductivity were measured on the spot during the study with the help of water analysis kit Systronics model-371 at the sampling sites. For the dissolved oxygen, the water sample was taken in 300 ml. capacity of BOD bottle and fixed the DO on the spot. Measurement of transparency was done by Secchi disc. The results were calculated as per the standard formulas and methods suggested by APHA [8] NEERI [9,10].

3. Results and Discussion

In the present study water quality assessment of Chichtola lake were analyzed. The mean with standard error value of all physico-chemical parameters of water sample collected from all three sampling sites are presented in table 1 and table 2. The temperature at all the sampling sites range between 21.59±0.39 to 28.07±1.10. Similar observations reported by Punam [11] with lowest water temperature 24.66±1.23 during winter season and highest water temperature was 30.99±3.75 during summer in Chandpur lake of district Bhandara, Maharashtra. In the current investigation pH value of all sites under study were slightly alkaline throughout study period which ranges from 7.10±0.05 – 7.78±0.08. Similar observations were reported by Bhaskar [12] with minimum pH value 7.10±0.88 during winter season and maximum 7.84±0.43 during summer season in Shionibandh lake of district Bhandara, Maharashtra. During the present study the conductivity values were differ from 0.18 ± 0.01 during winter season and 0.34 ± 0.01 during summer season. Acharjee *et al.,* [13] also observed the similar observations in Dighali Lake of Assam. In the present investigation minimum transparency was observed during monsoon season however maximum transparency was recorded during summer season at all sites. Average transparency value

fluctuates from 74.26 ± 2.61 during summer season to 39.79 ± 1.63 during Monsoon season. During the study period the minimum mean values of free Carbon dioxide (CO_2) differ from 3.03 ± 0.11 during Monsoon season to 3.93 ± 0.16 during summer season. Koli *et al.,* [14] observed the CO_2 ranged in between 1.89 to 5.98 mg/lit. The minimum CO_2 observed in monsoon and maximum was during summer season in Tulashi tank, Kolhapur district. During the study period, the minimum mean values of BOD differ from 8.20 ± 0.42 during winter season and maximum 12.72 ± 0.24 during summer season. Higher BOD values in summer may be due to organic load from some agricultural activities at the mouth of the lake towards its catchment and reduced water flow. Udayashankara *et al.,* [15] observed the BOD from Lingambudhi lake water ranged in between 5.9 to 25.9 mg/lit. Corroborative results presented by Khiradkar et al. [16] from Labhansarad Dam in Warora Taluka of Chandrapur District, Maharashtra State, India. During the study period the mean values of COD varied from 21.15 ± 0.44 during winter season to 34.72 ± 1.19 during summer season. In the present investigation the maximum value of COD was recorded during the summer season from Site I, it might be due to the domestic and agricultural and other anthropogenic activities from nearby areas. During the study period the mean values of Phosphate was differ from 0.35 ± 0.02 during winter season to 0.92 ± 0.03 during summer season. In the present investigation the lower value were recorded during winter season might be due to rapid utilization by aquatic plants and also due to assimilation by phytoplankton while summer maximum may be due to low water level and inflow of agricultural runoff from summer paddy cultivation in some patches at the catchment area. The lower values of Nitrates were recorded during the winter season at all sites whereas the higher values of Nitrates were recorded during monsoon seasons. During study period the mean values of Nitrate were varied from 0.57 ± 0.05 during winter season to 1.00 ± 0.03 during monsoon season. Analogous findings by Ingale et al[17] from Bhiwapur lake.

Table 1- Seasonal Mean Variations of Physico-chemical Parameters in Chichtola Lake in the Year 2018-2019.

S. N.	Parameters	Winter Season (Oct- Nov-Dec- Jan)	Summer Season (Feb- March- April- May)	Monsoon Season (June- July- Aug- Sept)
1	Temperature	22.00±0.49	28.07±1.10	26.21±0.72
2	pH	7.10±0.05	7.49±0.10	7.67±0.08
3	Conductivity	0.18±0.01	0.32±0.01	0.23±0.01
4	Transparency	52.98±1.01	74.24±2.61	39.79±1.63
5	Dissolved Oxygen (DO)	8.70±0.18	6.52±0.20	5.64±0.13
6	CO_2	3.12±0.13	3.87±0.16	3.03±0.11
7	Biological Oxygen Demand (BOD)	8.20±0.42	11.83±0.30	9.39±0.26
8	Chemical Oxygen Demand (COD)	20.15±0.44	33.89±1.25	23.18±1.37
9	Phosphate	0.35±0.02	0.88±0.02	0.48±0.01
10	Nitrate	0.63±0.05	0.77±0.05	1.00±0.03

Table 2- Seasonal Mean Variations of Physico-chemical Parameters in Chichtola Lake in the Year 2019-2020.

S. N.	Parameters	Winter Season (Oct- Nov-Dec- Jan)	Summer Season (Feb- March- April- May)	Monsoon Season (June- July- Aug- Sept)
1	Temperature	21.59±0.39	27.59±1.12	26.09±0.66
2	pH	7.12±0.05	7.61±0.09	7.78±0.08
3	Conductivity	0.20±0.01	0.34±0.01	0.24±0.01
4	Transparency	53.00±1.01	74.26±2.61	41.84±1.55
5	Dissolved Oxygen (DO)	8.98±0.19	6.88±0.24	6.07±0.14
6	CO_2	3.16±0.13	3.93±0.16	3.08±0.12
7	Biological Oxygen Demand (BOD)	9.37±0.33	12.72±0.24	9.31±0.27
8	Chemical Oxygen Demand (COD)	20.63±0.45	34.72±1.19	24.15±1.40
9	Phosphate	0.37±0.02	0.92±0.03	0.53±0.01
10	Nitrate	0.57±0.05	0.79±0.05	0.96±0.03
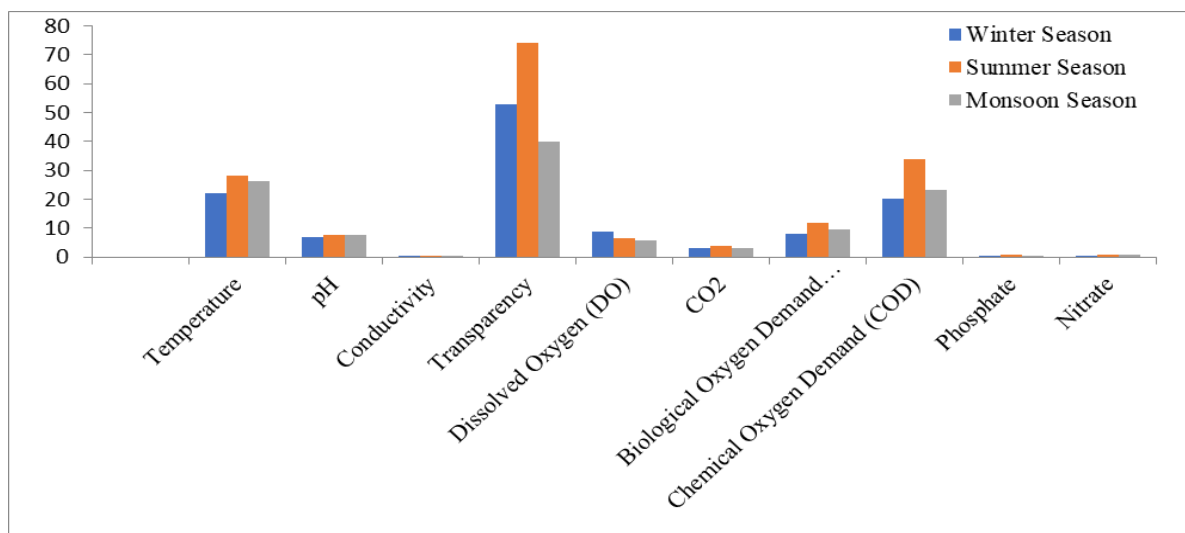
Fig. 1- Graph showing seasonal fluctuation of Physico-chemical Parameters in Chichtola Lake in the Year 2018-2019.
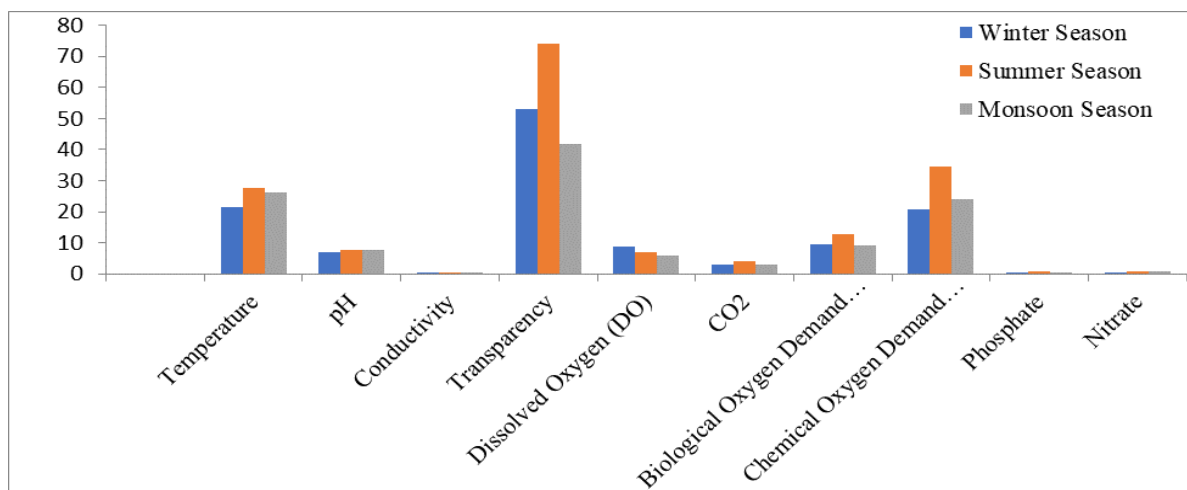
Fig. 2- Graph showing seasonal fluctuation of Physico-chemical Parameters in Chichtola Lake in the Year 2019-2020.

4. Conclusion

The Chichtola lake is most important for migratory birds in winter season and lake ecosystems can affect both fauna and flora. Site I of the lake has little polluted due to contamination by human and animal interventions, religious rituals and all anthropogenic activities. Overall the physico-chemical characteristics of lake show good quality water. Biodiversity contributes both.

Conflict of interest
No conflict of interest influenced in this research.

5. References

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