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Limnological Status of Maligre Freshwater Reservoir of Ajara Tahsil, Kolhapur District (MS), India

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Abstract:
Present study deals with physico-chemical investigation of freshwater reservoir from Maligre, Ajara Tahsil of Kolhapur district. The study has been carried out to investigate the monthly physico-chemical parameters like, temperature, transparency, pH, electric conductivity, free CO_2, total hardness, calcium, magnesium, chlorides and dissolved oxygen. The results revealed that all the parameters are within the permissible limit and monthly variation was noticed throughout the study period. The values of total hardness are near to cross permissible limit which is alarming for future management strategies. As all parameters are within the acceptable limit, it can be concluded that water from this reservoir can be used for drinking and irrigation purpose. However, on the basis of total hardness, management strategies should be framed out to use water, especially for future domestic purposes.

Keywords: *Freshwater, reservoir, maligre, physico-chemical, management strategies*

1. Introduction

Aquatic ecosystem is revolving around the water. Along with aquatic animals, water plays an important role in the life of other animals including human. It is most important natural resource and continuous supply of clean water is mandatory for the survival of all living organisms (Patil *et al.* 2013). Due to tremendous development of industry and agriculture, the water ecosystem has become perceptibly altered in several respects in recent years and as such they are exposed to all local disturbances regardless of where they occur (Vencatesan, 2007). The demographic pressure or the anthropogenic disturbances on our water resources and its ecosystems will irrevocably damage and destroy the rich biodiversity supported by it (Deviprasad *et al., 2009*).

2. Materials and Methods

2.1. Study Area

Ajara is one of the important tahsil of Kolhapur district, located at southern region with N 16^0 12' and E 74^0 2'. Total population of the tahsil is about 1,21, 430 residing in 74 villages. The total area of the tahsil is about 54, 853 ha. The climate is moderate subtropical with an average annual rainfall of 2000 mm. The people residing here depend on two important rivers for their domestic, agricultural and drinking water needs, viz. Hiranyakeshi River and Chitri River. On the other hand, villages away from these rivers depend on bore-wells, dug-wells, small and large freshwater water bodies for their daily use (Jadhav *et al.,* 2012). Maligre is one of the villages situated 12 km from Ajara city at its south east region. A manmade freshwater reservoir (Figure 1 and 2) is located N 16^0 07' 352" and E 74^0 16' 985" at Maligre with total submergence area of 4.30 ha during monsoon season and 2.12 ha during summer season (Patil *et al.,* 2014). Reservoir area is partially covered with forest, grassland and cropland area. The population of this village is about 4500, people of this village depend on this reservoir for drinking, irrigation and domestic purpose. Domestic purpose includes, cloth washing, animal washing, bathing, etc. The annual rainfall at this region is about 1600 mm annually. Although the limnological studies and water quality status was exclusively studied over the last few decade, this area of Kolhapur district from Maharashtra have been neglected (Patil *et al.,* 2013) so the present study is carried out to reveal the physico-chemical characteristics and accordingly the suggestions were given to enhance the sustainability of people around the reservoir.

2.2. Collection of Samples

The samples of surface water were collected monthly from Maligre reservoir during July 2011 to June 2012. The samples were collected in plastic container in the morning hours and brought to the laboratory for further analysis.

2.3. Analysis of Physico-Chemical Properties

For the analysis, standard methods were used. Some parameters like temperature, pH, and transparency were done at the investigation sites. The sample for DO was fixed in the BOD bottle at the site and then brought to the laboratory for analysis. Winkler's method was followed for this analysis, while remaining analysis was made by the standard methods of APHA (2005) and Trivedy and Goel (1984).

3. Results and Discussion

3.1. Temperature

Temperature plays main role in the physico-chemical and physiological characters of biotic components of aquatic ecosystem. The atmospheric temperature and water temperature values lies between 18^0C to 30^0C and 15^0C to 25^0C respectively.

3.2. Transparency

The transparency is important to determine the productivity of the water body. It also depends on color and turbidity of water. The transparency values ranges from 20 cm to 44 cm. The lower values were recorded in the month of June while higher in December. Lower transparency during Monsoon season is due to the silt brought from adjoining area. Due to dissolved and un-dissolved inorganic and organic material water get turbid and results in lowest transparency (Sawant *et. al.,* 2011). Higher transparency recorded during winter season due to settlement of suspended particles.

3.3. pH

pH is main factor which shows acidic and alkaline nature of water. It also depends upon carbonates, bicarbonates present in water. The pH value varies from 6.7 to 8.41. The minimum values were recorded in the month of August and maximum in May. The pH remains alkaline throughout the year. Ohal *et al*. (2011) has given similar values for Ganesh tank. Jagadeeshappa and Vijayakumara (2013) have given similar pattern.

3.4. Electric Conductivity

Electrical conductivity shows the nutrient status of water bodies. It also determines the TDS. The level of E.C. ranges between 0.12 mho/cm to 0.35 mho/cm. E.C. were increased in the month of October while decreased in May. It is increased in the summer season due to increase in concentration of salts. Similar range has recorded by Devi et. al. (2009) for Madhavara lake. Similar trend was given by Krishnamoorthi *et al*. (2010).

3.5. Free CO_2

Free CO_2 is essential for growth and development of flora and fauna. It depends on respiration of living organisms. The free CO_2 value varies from 4.4 mg/l to 8.8 mg/l. There is no much variation throughout the year. Similar kind of trend and results were obtained by Patil *et al.* (2013) from Gajargaon pond.

3.6. Total Hardness

The total hardness is due to the presence of Ca and Mg ions. It is an important parameter to access the quality of water and classify it (Reid, 1966). The total hardness values ranges from 72 mg/l to 276 mg/l. It was declined in the month of July and inclined in the month of May. Lower values of total hardness were obtained during Monsoon season due to dilution. The values of total hardness increased during summer season are due to large scale human use. Parallel results were given by Bath and Kaur (1998) from Harike reservoir. Same kind of trend was given by Sawant et. al.(2011). As per Kanan (1991) the values of this reservoir shows water is very hard. Hardness below 300 mg/l is considered as potable (WHO, 1993) but beyond this limit cause Gastrointestinal irritation (ICMR, 1975).

3.7. Calcium

The presence of the Ca in water is due to the detergents and anthropogenic activities. The Calcium value varies from 13.63 mg/l to 88.22 mg/l. The Calcium level was inclined in the month of May and declined in the month of July. The similar range was given by Verma *et al*. (2011) from Kankaria lake. As per Ohle (1934) the water body is rich in Calcium. The desirable limit of Calcium in drinking water is 75 mg/l and maximum permissible limit is 200 mg/l (WHO, 1993). So, present values lies between desirable ranges, the water body is suitable for domestic use.

3.8. Magnesium

Magnesium is another important cation present in water which causes the total hardness. Generally it remains lower than the Ca in water. The level of magnesium ranges between 14.18 mg/l to 47.09 mg/l. It was minimum in the month of July while maximum in April. Similar range was given by Ramesh and Sardhamani (2009). Permissible limit of Magnesium values for drinking purpose is 50 mg/l but higher limit is 150 mg/l so, the values are below the desirable limit.

3.9. Alkalinity

Total alkalinity is determination of salts from water. The total alkalinity values lies between 20 mg/l to 44 mg/l. Minimum values were obtained during the month of July and maximum in August. Total alkalinity value shows no definite pattern during the investigation period. Parallel range and similar trends were recorded by Patil *et al.* (2013). According to Spence (1967) the water of this reservoir is moderately nutrient rich.

3.10. Chlorides

Chloride is the measure factor for accessing the water quality. Chloride acts as nutrient source for living organisms. The chloride value fluctuates from 26.40 mg/l to 59.64 mg/l. It was lower in the month of October and higher in the month of May. The lower values observed during monsoon season might be due to dilution by the rain water, low amount of organic wastes from animal origin. The increased values of chloride during summer season may be due to evaporation of water due to high temperature and decreased water level. Similar kind of trend was given by Sawant *et al*. (2013). Present results are on similar lines of Subhashini *et al.* (2005) from Aliyar reservoir. The desirable limit of chloride concentration in drinking water is 250 mg/l (WHO, 1993). As per Goel (2006), water is excellent for irrigation because of values were recorded below 142 mg/l.

3.11. Dissolved Oxygen

Dissolved oxygen is the central biological parameter which balances the aquatic life. The presence of D.O. in water ecosystem is due to the atmosphere, assimilation rate of plants and solubility of the oxygen. It presence is essential in aquatic ecosystems to keep the organisms in balance. It also affects the solubility and availability of many nutrients hence affecting the productivity of aquatic ecosystems (Wetzel, 1983).The dissolved oxygen values fluctuate from 3.6 mg/l to 15.2 mg/l. A fall in dissolved oxygen is observed in the month of September while dissolved oxygen rose in the month of December. According to Patil *et al.*, (2013), the monthly variations in dissolved oxygen values range from 6.4 mg/l to 15.2 mg/l at Khanapur reservoir.

3.12. Conclusions

The values of total hardness are near to cross permissible limit which is alarming for future management strategies. As all parameters are within the acceptable limit, it can be concluded that water from this reservoir can be used for drinking and irrigation purpose. However, on the basis of total hardness, management strategies should be framed out to use water, especially for future domestic purposes.

4. References

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Annexure

Months/ Parameter	Air Temp.	Water Temp.	Trans.	Free CO_2	pH	E.C.	Alkalinity	Hardness	Calcium	Magnesium	Chloride	D.O.
Jan.	18	15	42.5	8.8	7.70	0.32	24	112	16.84	23.12	56.80	11.6
Feb.	22	20	41.5	4.4	7.33	0.29	22	88	16.04	17.48	51.12	10.0
March	24	21	38.0	8.8	7.40	0.31	24	92	17.64	18.06	53.96	10.8
April	27	24	38.5	4.4	8.39	0.33	30	266	72.18	47.09	56.80	05.2
May	30	25	30.0	4.4	8.41	0.35	32	276	88.22	45.63	59.64	05.6
June	22	20	20.0	4.4	6.90	0.22	24	200	80.20	29.11	26.40	05.0
July	19	17	33.0	8.8	7.10	0.18	20	72	13.63	14.18	28.40	04.0
August	20	18	34.0	8.8	6.70	0.25	44	100	24.86	18.25	28.40	04.4
Sept.	21	19	39.5	8.8	7.02	0.22	30	80	20.85	14.37	28.40	03.6
Oct.	21	19	40.5	8.8	7.90	0.12	36	82	17.64	15.63	34.08	08.4
Nov.	21	19	43.5	8.8	8.04	0.13	24	92	20.85	17.28	34.08	07.6
Dec.	21	20	44.0	8.8	7.74	0.24	26	126	24.86	24.57	34.08	15.2

Table 1: Physico-chemical parameters of freshwater reservoir from Maligre

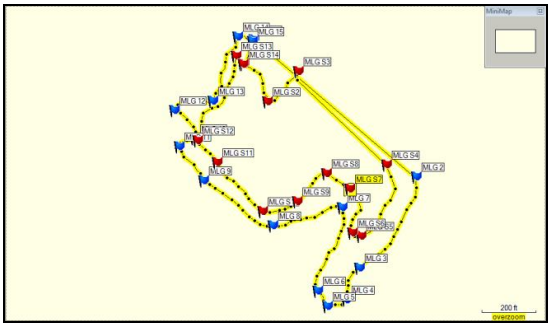

Figure 1: GPS map of Maligre freshwater reservoir

Figure 2: Google map of Maligre freshwater reservoir

Note: Indicates boundry line of water during summer season Indicates boundry line of water during monsoon season

Figure 3: Photograph of Maligre water reservoir