J. Exp. Zool. India Vol. 19, No. 2, pp. 821-824, 2016 | www.connectjournals.com/jez | *ISSN 0972-0030*

STUDIES ON WATER QUALITY OF ADHALA LAKE IN RELATION TO FISH CULTURE, AHMEDNAGAR DISTRICT, MAHARASHTRA

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(Accepted 21 April 2016)

ABSTRACT : The present study deals with the water quality of Adhala lake to assess its suitability for fish culture. Several parameters viz., temperature, dissolved oxygen (DO), pH, total alkalinity, chloride, TDS, hardness, calcium, magnesium, nitrite and phosphate have been studied for a period of one year beginning from December 2012 to November 2013. All the physico-chemical parameters determined, revealed that the fluctuations in water temperature, pH, dissolved oxygen, total alkalinity, TDS, hardness and nitrite were within the desirable limits for fish and fisheries practices. However, low level of chloride, calcium and magnesium and high level of phosphate were recorded. These parameters need to be modifying in order to favour fish culture.

Key words : Adhala Lake, water quality, fish culture.

INTRODUCTION

In India, not much progress has been made in the last few decades, though freshwater bodies and the potential to culture fish species are plenty. The freshwater sources in India are mainly contributing for augmenting the crop productivity in agriculture. Their proper utilization for aquaculture and management has not been given due consideration and attention (Usha *et al*, 2006).

Lakes are important natural resources, utilized by the population around them as a source of natural beauty, serene environment and economic return (from tourism). From an economic point of view, lakes serve as drinking water resource, irrigation, fisheries, tourism, etc. (Das, 2005). An increased rise in developments around lakes surroundings has made them vulnerable to problems such as pollution, rapid sedimentation and eutrophication (Chakrapani, 2002).

Contamination of water bodies might lead to a change in their trophic status and render them unsuitable for aquaculture. Several physico-chemical or biological factors could act as stressors and adversely affect fish growth and reproduction (Iwama *et al*, 2000). Hence, regular monitoring of physico-chemical and biological water quality parameters is essential to determine status of water body with reference to fish culture. Earlier studies on water quality parameters of some freshwater bodies in relation to fish culture were made by Pawar and Mane (2006), Usha *et al* (2006), Kadam *et al* (2007), Aher *et al* (2007), Ranjan *et al* (2008), Pawar and Shendge (2009), Nooralam *et al* (2009), Pawar and Pandarkar (2011) and Biswas *et al* (2012). Present study aims at investigating the monthly variations if any, in physico-chemical water quality parameters of Adhala lake, and if so, whether or not they are within desirable limits for fish and fisheries practices.

MATERIALS AND METHODS

Adhala Lake selected as a freshwater body for the present investigation is a man-made perennial lake located across Adhala river, a tributary of Pravara at village Adhala, Akole taluka, Ahmednagar district, Maharashtra. This lake lies in the hilly region and is a rain fed water body containing water throughout the year and constitutes as a major water resource for domestic activities, irrigation and fisheries. It receives surface run off nearby agriculture field during rainy season.

In the present study for determining physico-chemical conditions of Adhala lake, monthly water samples were collected between 8.00 to 10.00 a.m. from December 2012 to November 2013. Water samples were collected in polythene bottle thoroughly cleaned with repeated washing with distilled water. A sample bottle was rinsed with sample water before collection of sample. Water parameters like temperature, TDS and pH was recorded on the field while for other parameters the water samples were brought to the laboratory. Air and water temperature was recorded with a centigrade thermometer, TDS by TDS meter and pH by using pH meter (Elico LI 613), dissolved oxygen was fixed in the field it self in dissolved oxygen bottles and estimated in the laboratory using modified Winkler's method (Golterman *et al*, 1978).

Alkalinity, chlorides, hardness, calcium and magnesium were estimated by titration and nitrite and phosphate by spectrophotometer (Elico, SI 171 mini Spec) on the same day in the laboratory (Golterman *et al,* 1978; APHA *et al,* 1985).

RESULTS AND DISCUSSION

The Adhala lake remains with full of water during continuous period of rain and winter season, but in summer water level decreases due to continuous pumping of water to nearby agricultural field. The monthly fluctuations in the physico-chemical parameters of Adhala Lake have been shown in table 1. The data obtained was divided in to three seasons, representing winter (December-February), summer (March-June and monsoon (July-November), and is presented in fig. 1.

Temperature is very important factor which influences the aquatic life. The temperature affects the concentration of dissolved gases and chemical solutes. In the present investigation, it was observed that the temperature of water of lake ranged between 20 (January, February and November) and 25°C (May and August), minimum during winter and maximum during summer. The atmospheric temperature ranged between 17 (January) and 32°C (April). Change of water temperature was found in accordance with seasonal changes.

pH range was 8.6 (November) to 9.7 (August), generally minimum in winter and maximum in summer. Similar results were also reported by Kadam *et al* (2007), Pawar and Pandarkar (2011) and Singh *et al* (2014). Highest values were observed during summer, might be due to low water level and presence of variety of waste in the water. The pH was found to be on the alkaline side throughout the study period which favours the growth of fishes (Swingle, 1967). Generally fish get prone to attack by parasites and become diseased in acid waters (Kadam *et al,* 2007). Fishes in Adhala Lake are free from such kind of hazard as the pH ranged between 8.6 and 9.7.

Tarzwell (1957) has stated that for supporting aquatic life minimum 3 mg/l dissolved oxygen is essential. In the present investigation, dissolved oxygen content varied from 5.04 (May) to 13.16 ml/l (July), minimum during summer and maximum during Monsoon. Similar trend of results were also reported by Pawar and Pandarkar (2011) and Jadhav *et al* (2013). Increase in the temperature of water in summer might have resulted in decrease of dissolved oxygen (Ellis, 1973). In summer, low DO retaining capacity of water due to increased organism's respiratory demand at high temperature may also support these low values of dissolved oxygen (Rao, 1986). In monsoon a little enhance in the content of DO was observed, might be due to inflow of surrounding water (Ranjan *et al,* 2008).

Total alkalinity was 96 (October) to 220 mg/l (August), being minimum in monsoon and maximum in summer. Similar results also noted by Pawar and Pandarkar (2011) and Biswas *et al* (2012). Higher concentration of bicarbonate during summer season might be due to decrease in water level by evaporation (Ranjan *et al,* 2008) and excess CO_2 production by decomposition process and decrease in its concentration during rainy season might be due to increase in water level of the lake, obviously due to dilution (Mishra *et al,* 1989). Highly productive water body has alkalinity over 100 mg/l (Jhingran, 1982). Banerjea (1967) stated that, alkalinity less than 100 mg/l, not suitable. In the present study variations in total alkalinity were desirable, as they were within the levels suitable for fish culture.

Table 1 : Monthly variation of physico-chemical parameters of Adhala lake during December 2012 to November 2013.

Sr. No.	Parameter		Months											
			Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov
1.	Temp. (^{0}C)	Air	25	17	24	22	32	29	26	23	24	25	25	24
		Water	21	20	20	21	24	25	24	23	25	23	23	20
2.	pH		8.8	8.9	8.7	9.1	9.6	9.5	9.3	9.3	9.7	9.3	9.3	8.6
3.	D.O. (ml/l)		10.64	8.96	7.28	7.52	7.84	5.04	8.12	13.16	11.02	8.4	10.64	9.24
4.	Alkalinity (mg/l)		180	164	168	176	172	184	212	208	220	104	96	120
5.	Chloride (mg/l)		16.79	14.39	16.79	19.19	25.59	24.79	26.39	20.79	13.59	19.19	10.39	18.39
6.	TDS (ppm)		151	153	151	155	165	170	185	187	130	129	135	139
7.	Hardness (mg/l)		124	132	140	144	136	132	140	144	108	112	108	120
8.	Calcium (mg/l)		30.46	32.06	30.46	32.06	28.85	35.27	36.87	32.06	32.06	33.66	22.44	27.25
9.	Magnesium (mg/l)		11.70	12.68	15.60	15.60	15.61	10.72	11.97	15.60	6.82	6.82	12.68	12.68
10.	Nitrite (mg/l)		0.044	0.042	0.034	0.043	0.039	0.021	0.016	0.042	0.013	0.025	0.025	0.026
11.	Phosphate (mg/l)		2.144	1.056	1.500	1.560	1.611	3.167	2.389	2.389	0.833	1.028	0.888	1.972

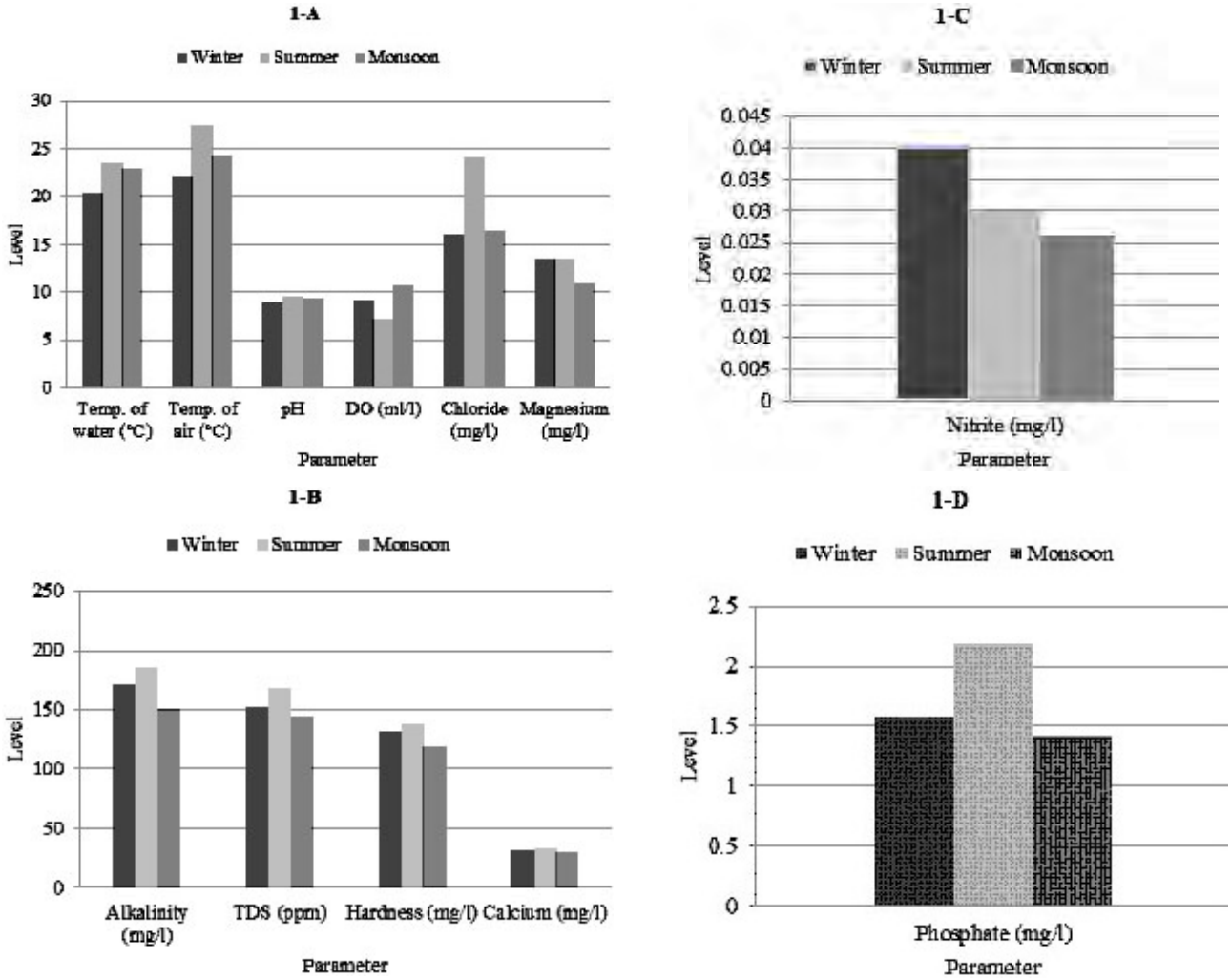

Fig. 1 (A-D) : Seasonal variations in the physico-chemical parameters of Adhala lake during December 2012 to November 2013.

Chloride content ranged between 10.39 (October) to 26.39 mg/l (June). The maximum chloride value was recorded in summer, might be due to decrease in the volume of water by evaporation (Vikal and Tyagi, 2007) and minimum in winter. Similar results were also reported by Jadhav *et al* (2013). In the present investigation, the values of chloride were not found to be very high throughout the year.

Total dissolved solids denote mainly various kinds of mineral present in the water. In the present study the TDS varied between 129 (September) and 187 ppm (July), minimum in monsoon and maximum in summer. Similar results were also reported by Jadhav *et al* (2013). Lowest TDS during rainy season also reported by Singh *et al* (2014).

The total hardness varied between 108 (August and October) and 144 mg/l (March and July), minimum in monsoon and maximum in summer. Results are in concurrence with the findings of Biswas *et al* (2012) in Budha Talab, Chhattisgarh. Maximum hardness in the months of summer season was also reported by Bedwal and Mathur (2015) from Kisangarh lake, Ajmer. Excessive evaporation in summer leads to concentration of salts resulting in increased hardness. Lower hardness in monsoon may be due to dilution with rain water (Nooralam *et al*, 2009; Biswas *et al*, 2012).

Calcium ranged between 22.44 (October) and 36.87 mg/l (June), minimum during monsoon and maximum during summer. Calcium more than 75 mg/l is not suitable for domestic applications. While low calcium content can leads to rickets and defective teeth.

Magnesium varied between 6.82 (August and September) and 15.61 mg/l (April), minimum in monsoon and maximum in summer. Similar results were also reported by Pawar and Pandarkar (2011).

Nitrite level varied from 0.013 (August) to 0.044 mg/l (December), being higher in winter and lower in monsoon.

Phosphates are the key factor for the eutrophication of the lakes and are mainly contributed through

anthropogenic sources such as sewage, agricultural run-off and run-off from unsewered residential areas. In the present study, phosphate ranged between 0.833 (August) to 3.167 mg/l (May), being higher in the summer and lower in the monsoon. High level of phosphate in summer is an indication of internal loading of phosphate from sediment, a common phenomenon in lakes (Sondergaard *et al*, 1999).

The evaluation of water quality of Adhala lake and its suitability for fish and fisheries practices was thought to be essential in present study. The comparison of the water quality of Adhala lake with limits laid down by fresh water quality criteria for fish and fisheries practices (Subbamma and Ramasarma, 1992; Chandra Prakash, 2001) suggested that, most of the physico-chemical parameters viz., fluctuations in water temperature, pH, dissolved oxygen, total alkalinity, TDS, hardness and nitrite were within the desirable limits for fish and fisheries practices. However, low level of chloride, calcium and magnesium and high level of phosphate were recorded. These parameters need to be modifying in order to favour fish culture.

In order to maintain the water quality of Adhala lake there is need to proper management of water body, a regular monitoring of physico-chemical characteristics of water should be done. In addition, the discharge of agricultural run-off should be checked. Bathing and washings should also be strictly banned.

ACKNOWLEDGEMENTS

Authors are thankful to Principal, Arts, Science and Commerce College, Rahata for providing requisite facilities for completion of this work. The financial assistance received from UGC, WRO, Pune (F. 47-695/ 13-WRO) is gratefully acknowledged.

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