

COMPARATIVE STUDY OF PHYSICO-CHEMICAL PARAMETERS OF VARIOUS WATER BODIES OF MARATHWADA REGION, MAHARASHTRA, INDIA, IN RELATION TO FISH CULTURE

¹O. S. Chilgar and ²H. S. Jagtap

¹Research scholar, ²Asso.Prof and Head

P.G. Department of Zoology & Research Center,

Shri Shivaji College, Parbhani (M. S.) India

(² author for correspondence)

Abstract: The present work deals with the study of water quality parameters of various reservoirs of Marathwada region. Water samples were collected from, Majalgaon dam (Beed dist.); Yeldari, Siddheshwar and Masoli dams (Parbhani dist.); Vishnupuri dam (Nanded dist.) during the period from January to February, 2017. Samples were analyzed for various parameters and obtained range temperature (23 - 26 °C), pH (7.5 - 8.1), dissolved oxygen (4.7 - 7.5 mg/l), free carbon dioxide (3.2 -10.6 mg/l), chloride (41.4 - 76.0 mg/l), total dissolved solids (207- 402 mg/l), total hardness (59.43 – 147 mg/l), calcium hardness (49.2 – 262 mg/l), magnesium hardness (1.71 - 27.94 mg/l). This study provides the comparative data of water quality parameters of various water bodies of Marathwada region. The present obtained values are suitable for fish rearing.

Keywords: Water, Physico-chemical parameters, Marathwada region, Dams.

Introduction

Water is one of the most vital elements of the environments. It is being used for many purposes e.g., industrial water supply, irrigation, drinking, propagation of fish and other aquatic systems and generation of hydro-power plants. Water is the main source of energy and governs the evolution on the earth. 71% of earth surface is covered by water, 96.5% of the world's water is sea water which is salty that is not to be directly useful for irrigation, drinking, domestic and industrial purposes. 1.7% in groundwater, 1.7% in glaciers and the ice caps. Less than 1% water is present in ponds, lakes, rivers, dams, etc., which is used by man for industrial, domestic and agricultural purposes. According to an estimate about 70% of all the available water in our country is polluted due to the discharge of effluents from the industries, domestic waste, land and agricultural drainage (Shrivastava and Kanungo, 2013). Chemicals are a major source of water contamination that introduced during water movement through geological materials (Kataria *et al.*, 2011). Fertilizers and pesticides are major contributors to water pollution. Weathering of rocks, leaching of soils and mining processing, etc., these are contaminate natural water (Manjare *et al.*, 2010).

In the ecosystem water is considered to be the most important component for the life but day by day the quality of water become degraded. There are several factors which are responsible for deterioration of water bodies such as increased human population, industrialization, use of excess fertilizers in the agriculture and other man-made activities etc. There are several diseases have been identified among the fishes, which caused due to contaminated water. Therefore it is necessary that the quality of water should be checked at regular time of interval because the financial losses due to water borne diseases have negative impact on the nation. Nowadays this is the major problem of developing countries throughout the world.

Marathwada is the region comprising the eight districts of (divisional headquarters) Jalna, Aurangabad, Parbhani, Hingoli, Nanded, Latur, Osmanabad and Beed. It accounts for 16.84% of the state's population and is home to nearly 30% of the state's Below Poverty Line families. Its literacy rate is the lowest in the state (51.23%). All eight districts figure in the list of the 100 poorest districts in the country. Perhaps, the most neglected region of Maharashtra.

In Marathwada region various Dams like Nathsagar Dam (Aurangabad), Majalgaon Dam (Beed), Yelderi and Masoli Dams (Parbhani), Siddheshwar Dam (Hingoli), Vishnupuri Dam (Nanded) etc. were the major water resources. This region also present large rivers like Godavari, Sindhphana, Purna etc. These are the huge water sources. Along with that various small lakes, reservoirs, rivers are also present. These are the major natural sources for releasing the fish seed of various species for rearing. The various private pisciculturists have also involved if fish culture. In Marathwada region (M.S.) 70% population depend for their survival on agriculture. Some unproductive land is not in use such land can use for fish culture the farmers will get additional benefits. There is need to study these water bodies with reference to rearing of fish.

There is scanty information is available in relation to comparative physico-chemical characteristics of water bodies of Marathwada region. Few researchers (Kiran, 2010; Raut *et al.*, 2011; Naik *et al.*, 2012; Bahekar and There, 2013; Mahajan and Tank, 2013) in different regions of India have been studied the physico-chemical parameters of the various water bodies.

In view of that in the present work attempts were made to study the physico-chemical characteristics of various water bodies of Marathwada region in relation to fish culture.

Materials and Methods

Water sample were collected from different dams like Majalgaon, Yeldari, Siddheshwar, Masoli and Vishnupuri of Marathwada region. Water samples were collected during morning hours in cleaned 2.5 liter plastic container. Samples were collected during the period January to February, 2017. Water temperatures and pH were recorded at sampling sites with the help of thermometer and pH paper respectively. Later samples were kept in cool and dark box and transported to laboratory for analysis. Collected water samples were analyzed for major physical and chemical parameters like dissolved oxygen (DO), free carbon dioxide (CO₂), chloride (Cl), total dissolved solids (TDS), total hardness, calcium hardness, and magnesium hardness by using the standard methods (APHA, 1995 and Trivedi and Goel, 1986).

Results and Discussions

Nine physico-chemical parameters of water samples of different dams were determined in the month of January to February, 2017. Temperature, pH, DO, CO₂, chloride, calcium, magnesium, total hardness and alkalinity were measured within few hours after sampling. These parameters were analyzed by standard methods. Variation in physico-chemical parameters of different samples is shown in Table 1.

Temperature

Temperature is very important to maintain aquatic environment. Rise in atmospheric temperature also give rise to water temperature. This rise in water temperature effects on chemical parameters and finally biochemical changes in organism.

Temperature ranges from 23 °C to 26 °C. Lowest temperature (23 °C) is recorded at Siddheshwar dam while highest temperature (26 °C) is recorded at Vishnupuri dam.

Temperature between 20 °C to 37 °C suitable for Indian major carps, the upper limit for air breathing fishes may range up to 41 °C (Gupta and Gupta, 2013).

pH

In this study the pH of different water bodies ranges between 7.5 to 8.1. Lowest value of pH (7.5) is recorded of Yeldari and Siddheshwar dam while highest value of pH (8.1) is recorded of Vishnupuri

dam. These values of pH are under permissible limit for potable water. This little alkaline nature of pH is suitable for growth of aquatic organisms. The pH constantly remains above 7 which indicate high buffering capacity of the system (Nagraj and Patil, 2008).

The pH of water indicates the health of a water body. The pH range 5 to 9 is suitable for the survival of aquatic life (Lloyd, 1960) so all the water bodies are capable for sustaining the aquatic life. Pond water having pH values from 6.5 to 8.5 is most suitable for fish aquaculture. In the present study Yeldari Dam water pH value reported is 7.5. The pH value reported 7.2 of Yeldari dam (Sahu et al., 2017). Also the pH range reported 7.4 to 8.5 of Majalgaon dam (Ingole, 2012).

Dissolved oxygen

DO is important in the study of physico-chemical parameters of water. It has great impact on chemical and biological processes of aquatic life. In present study DO ranges from 4.7 mg/l to 7.5 mg/l. The lowest value of DO (4.7 mg/l) is recorded for Masoli dam while highest of DO (7.5 mg/l) is recorded for Majalgaon dam. The low oxygen concentration causing a wide array of stress related response (Mathews, *et al.*, 1992).

If a sufficient level of DO is not maintained, animal will succumb to stress and become vulnerable to disease and parasitic outbreaks leading to their death. The fish pond should possess DO at least above 5 ppm (Gupta and Gupta, 2013).

CO₂

CO₂ is main source of carbon for plants. Plants absorb CO₂ from both free and dissolved state to produce glucose by carbon pathway. Free CO₂ is highly soluble in water. Aquatic animals release CO₂ in water during the process of respiration. It has often been found to be negatively correlated with zooplankton abundance (Dutta and Patra, 2013). CO₂ content of present study varies from 3.2 mg/l to 10.6 mg/l. The high concentration of CO₂ (10.6 mg/l) is present in Vishnupuri dam water. The low concentration of CO₂ (3.2 mg/l) is present in Siddheshwar and Masoli dam water.

High level free CO₂ hamper the sexual courtship and lead to poor spawning results. A further high concentration of CO₂ (above 16 ppm) has been observed to increased mortality in carp hatchery operations (Gupta and Gupta, 2013).

The presence of carbonate – carbonic acid mixtures, prevent major fluctuations in the alteration of pH of pond waters and create relatively more stable conditions for sustenance of animal and plant life.

Chloride

Chlorides are inorganic substances commonly found in water. Salts present in water and soil are sources of chloride. Chloride content of present study area is analyzed which ranges between 41.4 mg/l to 76 mg/l. In the present study of dam water, highest chloride (76 mg/l) content is observed of Masoli dam. According to WHO maximum permissible limit of chloride is 500 mg/l. Chloride value of the present study is within range. Large concentration of chloride is an indicator of organic pollution of water (Venkatasubramani and Meenambal, 2007). Similar results were observed and recorded by (Verma *et al.*, 1978; Mukharjee *et al.*, 1991; Thresh *et al.*, 1944; Vass, 1980; Shinde, 2006 and Negi *et al.*, 2006. Padhi, 1995 and Rana *et al.*, 1995) reported that the enrichment of chloride in the aquatic bodies is due to rainfall and substances carried from the catchments.

Total hardness

Total hardness is a measurement of mineral content in water sample. It is equivalent total calcium and magnesium hardness. In present study the minimum value of hardness (14.6 mg/l) is recorded of Vishnupuri dam and maximum value of hardness (262 mg/l) is recorded of Masoli dam. Present study revealed that all values of total hardness are within permissible limits.

Pond water having a hardness of 15 ppm or above may be considered suitable for growth of fish, while less than 5 ppm CaCO_3 causes slow growth and eventual death of fish. The hardness reported 148.33 ppm of Yeldari dam (Sahu *et al.*, 2017). The total hardness range reported 95 to 147 mg/l of Majalgaon dam (Ingole, 2012).

Calcium

The level of calcium ranges between 59.43 mg/l to 147 mg/l. The minimum value of calcium (59.43 mg/l) is for Majalgaon dam water and maximum value of calcium (147 mg/l) is for Masoli dam water. High content of calcium may be due to soil deposition of limestone, gypsum (Patil, *et al.*, 2003). Calcium in the form of CaCO_3 is highly beneficial, and is utilized in bone building and shell formation. The calcium range reported 59 to 90 mg/l of Majalgaon dam (Ingole, 2012).

Magnesium

Magnesium is a vital mineral required to maintain various life processes in a living organism. In the present study, the level of magnesium varies from 1.71 mg/l to 27.94 mg/l. The high concentration of magnesium (27.94 mg/l) is present in Masoli dam water. The low concentration of magnesium (1.71 mg/l) is present in Vishnupuri dam water. High concentration of magnesium causes nausea, muscular weakness and paralysis in the human body when it reaches up to the level of about 400 mg/l (Trivedy and Goel, 1986). Magnesium is essential for chlorophyll-bearing algae and plants. The magnesium range reported 4.86 to 18.2 mg/l of Majalgaon dam (Ingole, 2012).

TDS

TDS is important to check the quality standards of drinking water. TDS provides a characteristic taste to drinking water due to the presence of soluble salts. High concentration of TDS greatly affects and reduces the quality of drinking water. In the present study, the value of TDS ranges from 207 mg/l to 402 mg/l. The highest value (402 mg/l) is recorded for Siddheshwar dam water while the lowest value (207 mg/l) is recorded for Vishnupuri dam water. These values are under permissible limits of drinking water standards (500-1500 mg/l) suggested by WHO. A sudden or extreme change in TDS could kill aquatic life (Sivakumar, *et al.*, 2000; Gaikwad, 2003). The high TDS level (1200 mg/l) will result in excessive scaling in the water distribution system (Tihansky, 1974). The total solids reported 266.66 mg/l of Yeldari dam (Sahu *et al.*, 2017). The total solids range reported 220 to 311 mg/l of Majalgaon dam (Ingole, 2012).

Conclusion

Water quality of various water bodies studied were found good quality in relation to physico-chemical characters. Need to be sustained to maintain the water quality. In the present study, most of the parameters are found within the prescribed limit of IS and WHO.

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Table 1. Comparative study of the Physico-chemical parameters of various water bodies of Marathwada Region

Sr. No.	Physico-chemical Parameters	Water Bodies / Dams of Marathwada Region				
		Majalgaon	Yeldari	Siddheshwar	Masoli	Vishnupuri
1	Temperature (⁰ C)	24	25	23	25	26
2	pH	7.8	7.5	7.5	7.9	8.1
3	Dissolved oxygen (mg/l)	7.5	5.8	5.2	4.7	5.9
4	CO ₂ (mg/l)	4.0	6.6	3.2	3.2	10.6
5	Chloride (mg/l)	57.5	59.6	41.4	76	65.9
6	Total Dissolved Solids (mg/l)	389	260	402	347	207
7	Total Hardness (mg/l)	59.43	134.4	116.6	262	75.6
8	Ca Hardness (mg/l)	49.2	116	92.4	147	14.6
9	Mg Hardness (mg/l)	2.48	4.47	24.2	27.94	1.71

