VOLUME 9 ISSUE 2 2023

ISSN 2454 – 3055

INTERNATIONAL JOURNAL OF ZOOLOGICAL INVESTIGATIONS

Forum for Biological and Environmental Sciences

Published by Saran Publications, India

International Journal of Zoological Investigations Vol. 9, No. 2, 1099-1104 (2023)

International Journal of Zoological Investigations
Contents available at Journals Home Page: www.ijzi.net
Editor-in-Chief: Prof. Ajai Kumar Srivastav
Published by: Saran Publications, Gorakhpur, India

ISSN: 2454-3055

Water Quality Assessment of Harsool Dam, Aurangabad (M.S.), India

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Received: 13th September, 2023; **Accepted:** 22nd October, 2023; **Published online:** 19th November, 2023

https://doi.org/10.33745/ijzi.2023.v09i02.122

Abstract: The need for water in all areas of life, from microorganisms to humans, is today a serious problem, since all water resources have reached a point of crisis due to unexpected urbanization and industrialization. The physico-chemical analysis of water consists of determining the state of the various chemical components present in the natural and disturbed aquatic ecosystem. Pollution can affect water quality in several ways. Pollution manifests itself in the change of existing elements in the water or in the production of new substances. The present study deals with the assessment of the water quality, seasonal variations, and Correlation between parameters of Harsool Dam at Aurangabad (M.S.) India during July 2009 - June 2010.

Keywords: Water quality, Seasonal variations, Harsool Dam, Physico-chemical analysis

Citation: Munde A.S., Agale Priyanand, More P.R. and Shinde S.E.: Water quality assessment of Harsool Dam, Aurangabad (M.S.), India. Intern. J. Zool. Invest. 9(2): 1099-1104, 2023.

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Introduction

Water is an essential natural resource. The primary water sources are precipitation, surface water (ponds, dams, rivers, lakes) and groundwater (wells, water pumps). Water is of considerable ecological importance. It accounts for 70% of the weight of organisms and is, therefore, an essential medium for biological activities. Around 70% of the Earth's surface is covered with water, which represents aquatic ecosystems. Water is an energy transfer medium in ecosystems. Geological actions lead to the formation of rocks that are eroded by atmospheric influences; a nutrient release medium as a solvent for the soluble salts or a suspending medium for the insoluble salts; Atmospheric temperature settings cause water vapors to act as an atmospheric layer and absorb heat radiation, thereby regulating the temperature of the earth crust and an atmospheric trapper. In contrast, water vapors absorb gaseous particles and

pollutants and wash them. Almost 5% of the total estimated water on Earth and in the atmosphere is in free circulation, and the remaining 95% is blocked in the lithosphere and sedimentary rock. About 99 parts of the 5% freely available water (4.95%) are in the oceans, and only 1 part (0.05%) may be available for coastal traffic. Among the planet's various water resources, the oceans account for 97.6%, the polar ice caps and glaciers for 1.87%; Groundwater 0.5%; Rivers, lakes and inland seas 0.02%; Soil moisture 0.01%; and the atmosphere 0.0001% (Asthana and Asthana, 1998). Dams are a significant part of freshwater resources. By definition, a dam is created due to depression on land in which water from all around accumulates. Reservoirs, on the other hand, are human-made impoundments created by dams a lotic system, a stream, or a river. All over the water, vast reservoirs have been constructed mainly to meet irrigational needs, drinking purposes, industrial, and domestic use (Shinde *et al*., 2010).

There are three major global resources for precipitation of water from the Earth's surface in the form of rain, dew, and snow. The waters with natural water are called "lenticels" (ponds, dams, ditches, and lakes). The waters with running water are called "loti" (rivers and streams). These two ecosystems differ significantly in their biological, chemical, and physical properties. The languid waters stop and close from the bottom on all sides. These waters have no outlet for water drainage. Freshwater bodies across the country are invariably damaging to the environment to varying degrees. The degradation is due to the penetration and eutrophication of domestic and industrial wastewater and silt. During the last century, there has been a qualitative jump in the population without the corresponding expansion of civil structures, which has led to lakes and reservoirs, especially urban ones, which have become wells for pollutants.

There is different climatic conditions in India, that is, summer from February to May, Monsoon from June to September and winter from October to January. In tropical countries, there may be a direct link between the duration of the sun and the temperature.

The present study was conducted to assess the water quality of the Harsool Dam at Aurangabad (M.S.) in India, which is essential for human use in this environment. Residents use the water for drinking, domestic, agricultural, and recreational purposes.

Materials and Methods

Water samples were taken for physico-chemical analysis at the Harsool Dam in Aurangabad (M.S.), India, early in the morning between 8:00 and 11:00 AM in the first week of each month from July 2009 - June 2010. Samples were collected in an acid-washed five-liter plastic container at a depth of 5 to 10 cm below the surface of the water. Separate samples were collected to dissolve the oxygen in 250 ml bottles, and the dissolved oxygen was fixed in the field by adding an alkaline iodide-azide solution immediately after collection. The samples were analyzed directly and returned to the laboratory.

The status of the Dam water quality has been determined seasonally, that is, summer, monsoon, and winter. Physico-chemical properties such as Rainfall, Atmospheric and Water temperature, pH, dissolved oxygen (DO), Free Carbon Dioxide (CO_2), and Calcium have been seasonally determined in monthly variation at Site A and B using standard methods (Trivedi and Goel, 1987; APHA, 2005).

Results and Discussion

The water parameters were examined and recorded in three seasons: Summer, Monsoon, and Winter. The table shows seasonal data on the physicochemical parameters of the Harsool Dam in Aurangabad (M.S.) India. The present study deals with the physico-chemical properties of the Harsool Dam at Aurangabad (M.S.) in India.

Rainfall:

The rainfall values ranged from 0 to 180 mm. The average rainfall values were maximum in Monsoon 116.25±41.64 mm and minimum during

summer 6±34.93 mm (Table 1). In Harsool dam it was positively co-related with Calcium (Table 2).

It has recorded identical seasonal patterns and is influenced by the southeast monsoon, which in turn coincided with periods of relatively warmer temperatures. The amount of precipitation plays a vital role in regulating the various seasonal biological rhythms. The change in the concentration of the individual chemical components observed hereafter rainwater had entered the dams suggests their effects, which in turn affect the quality of the plankton. Precipitation played an essential role in the annual controls.

Atmospheric and water temperature:

The water temperature is one of the essential properties that decisively determine the trends and trends in the development of its quality. Temperature is a critical factor affecting phase and ion balance, as well as the speed of biochemical processes associated with changes in the concentration and content of organic and mineral substances. Temperature data are also used to calculate the degree of water saturation of oxygen and other gases.

The atmospheric temperature values ranged from 22ºC to 32ºC. The average atmospheric temperature values were maximum in summer 30±3.11ºC and minimum during winter 22.25±1.90ºC. The water temperature values ranged from 18 to 29 ºC. The average water temperature values were maximum in summer 27.25±2.05ºC and minimum during winter 20.5±1.92ºC (Table 1). In the Harsool dam, the atmospheric and water temperature was positively correlated to atmospheric temperature, calcium, and free CO (Table 2).

In this study, the highest water temperatures in summer and before monsoons and the lowest in winter at all sampling points indicate sharp seasonal fluctuations. The increase in the temperature of the surface waters in dams and lakes at any time of the year is due to surface heating and less mixing of the water, which allows a uniform distribution of heat in the water column.

pH:

The pH value is a scale to measure the acidity, alkalinity, and neutrality of the aqueous solution. It is given as the inverse of the logarithm of the activities of hydrogen ions. The pH scale ranges from 0 to 14. Natural water has a pH of 7.0, which indicates the same amount of H and OH ions. At the same time, acidic water has a pH below 7.0, which shows the predominance of heavy ions. A neutral pH, even in the case of contaminated water in studies, indicating that the neutral pH should only necessarily be a purity index. For higher purity, pH 7.0 must correspond to other parameters. The typical pH range in surface water systems is between 6.5 and 8.5 and in groundwater systems between 6 and 8.5. The pH of the water is controlled by the balance obtained from the compounds dissolved in the system.

The pH values in this study ranged from 7 to 8.5. The average pH values were maximum in summer 8.01±0.41 and minimum during winter 7.17±0.14 (Table 1). In the Harsool dam, pH was positively correlated with dissolved oxygen and negatively correlated with carbon dioxide (Table 2).

The pH of water determines the solubility (the amount that can be dissolved in water) and the bioavailability (the amount that can be used by aquatic life) of chemical components such as nutrients (phosphorus, nitrogen, and carbon)) and heavy metals (lead, Copper, cadmium, etc.). The pH can also determine whether aquatic organisms can use it. In the case of heavy metals, their degree of solubility determines their toxicity. Metals tend to be more toxic at lower pH because they are more soluble.

Dissolved oxygen (*DO*):

Dissolved oxygen is a crucial parameter that reflects the quality of the water and is therefore used to classify its variety, especially the water that absorbs the waste. Its consumption during the decomposition of organic substances reduces the concentration to zero and thus reflects the degree

Table 1: Seasonal variations in physico-chemical parameters of Harsool dam July 2009 - June 2010

Parameters	Rainfall (MM)	Atmospheric Temp. (^{0}C)	Water Temp. (^{0}C)	pH	DO mg/l	CO_2 mg/l	Calcium mg/l
Monsoon	116.25± 41.64	24.5± 1.19	23.75± 1.16	7.53± 0.28	10.9± 0.6	7.02± 1.47	28.65± 2.06
Winter	14.25± 26.38	22.25± 1.90	20.5± 1.92	7.17± 0.14	10.97± 1.06	5.52± 0.89	19.15± 2.12
Summer	6± 34.93	30± 3.11	27.25± 2.05	8.01± 0.41	10.52± 0.74	9.31± 0.82	23.68± 4.93
Range	0-180	20-32	18-29	7-8.5	9.7-12.5	4.8-10.7	15.9-22.5

Table 2: Correlation coefficient of the physico-chemical variables of Harsool dam during July 2009 - June 2010

	Atmospheric temp	Ca^2	CO_2	DO	pH	Water temp	Rain fall
Atmospheric temp	1	0.340	**0.780****	-0.445	-0.524	**0.651***	0.488
Ca^2		1	0.181	-0.363	-0.140	**0.649***	**0.649***
CO_2			1	**-0.671***	**-0.792***	0.541	0.120
DO				1	**0.713****	-0.484	-0.237
pH					1	-0.174	0.131
Water temp						1	0.261
Rain fall							1

** Correlation is significant at the 0.01 level; *Correlation is significant at the 0.05 level

of organic contamination in the water. If waters receive a large number of organic pollutants, the oxygen content drops to zero, and aerobic organisms are entirely destroyed.

In this study dissolved oxygen values ranged from 9.7 to 12.5 mg/l. The average dissolved oxygen values were maximum in winter 10.97±1.06 mg/l and minimum during summer 10.52±0.74 mg/l (Table 1). In Harsool the dissolved oxygen has a positive correlation with pH and negatively correlated with free CO_2 (Table 2).

The amount of oxygen that water can contain depends on the temperature, salinity, and pressure of the water. Gas solubility increases with decreasing temperature and decreasing salinity: the partial pressure and the degree of oxygen saturation change with altitude. Gas solubility decreases with decreasing pressure. Therefore, the amount of oxygen absorbed in the water decreases with increasing height due to the decrease in relative influence.

Free carbon dioxide (*CO_2*):

Carbon dioxide constitutes 0.03% of the atmosphere. It is present in the atmosphere due to biota respiration and also to industrial combustion, while plants consume it during photosynthesis. Carbonic acid is formed by the temporary dissolution of CO_2 in water and also by the decomposition process of organic waste. Surface water contains less than 10 mg/l of carbon dioxide typically. CO_2 rich water is relatively less alkaline, while CO_2 poor water is more alkaline.

The free carbon dioxide values in this study ranged from 4.8 to 10.7 mg/l. The average free carbon dioxide values were maximum in summer 9.31±0.82 mg/l and minimum during winter 5.52±0.89 mg/l (Table 1). In Harsool dam it showed a positive correlation with atmospheric temperature and negatively correlated with dissolved oxygen and pH (Table 2). Various researchers have also demonstrated such

variations for different water bodies. Thus higher levels of free carbon dioxide were mostly due to the decomposition of organic waste.

Calcium:

Calcium is one of the most important element as it plays a vital role in the growth and dynamics of the freshwater population and wildlife in many ways. It is considered a crucial inorganic element of algae and a nutrient for various metabolic processes. It is necessary as a micronutrient. Calcium is essential to maintain the structural and functional integrity of cell membranes in the absorption of ions (Wetzel, 1975).

The calcium values ranged from 15.9 to 22.5 mg/l in the present study. The average Calcium values were maximum in monsoon 28.65±2.06 mg/l and minimum during winter 19.15±2.12 mg/l (Table 1). In Harsool dam, calcium was positively correlated with water temperature, and rainfall, no negative correlation was observed (Table 2).

The rise in the concentration of calcium during winter may be because of low water temperature, which increases the calcium solubility in water (Borana *et al*., 2013). The increase during monsoon may be due to the addition of contents from catchment area by runoff during heavy rains (Bhandarkar and Bhandarkar, 2013) and also due to rapid oxidation of organic matter (Pulugandhi, 2014). The decrease was observed during the summer season at both the stations may be because of the uptake of calcium by plankton for their growth (Sawhney, 2008).

Conclusion

The present study showed detailed research regarding the quality of water in Harsool Dam at Aurangabad (M.S), India. The summer, monsoon, and winter seasons show fluctuations of the different physico-chemical parameters. During the present investigation, the observed values are lower than the permitted limit values specified by the ISI, which indicates that the Dam's water is suitable for consumption. This study examines the physico-chemical and biological factors to assess water quality, and it is clear that all parameters are also important. We found that the dam water sample is ecologically and ecologically balanced. These parameters were selected for their simple, fast, and continuous measurement in water quality monitoring stations. It can be concluded that temperature, pH, oxygen, CO_2, and calcium represent the full range of quality parameters of drinking water, irrigation, aquatic life for surface water and aquaculture. In the present study, it appears that the positive and negative correlation of the physico-chemical parameters between them improve water quality; the level of contamination must be monitored continuously to maintain favorable conditions for the survival and reproduction of fish in the Harsool Dam in Aurangabad (M.S.), India.

Acknowledgements

The authors are thankful to the authorities at Department of Zoology, Sambhajirao Kendre Mahavidyalaya, Jalkot Dist. Latur, (M. S.) India for providing laboratory and library facilities.

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