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Hydrological study of Harsool Dam, Aurangabad, (M.S.) India

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Abstract
Water required for digestion and food intake, helps maintain correct muscle tone; supplies cells with oxygen and nutrients, and acts as a natural air conditioning system. The typical daily water requirement for an individual is 70% of their body weight. As a result, it is crucial for normal growth. However, if water is contaminated with poisonous or dangerous compounds and pathogenic bacteria are present in addition to inadequate hygiene, it can be fatal. In the first week of July 2009 to June 2010, samples of water were taken for a physicochemical investigation at the Harsool Dam in in Aurangabad [M.S.], India, between 8:00 and 11:00 AM. The current study examines the seasonal fluctuations, the correlation between metrics, and The Harsool Dam physicochemical qualities were examined and analyzed of water From July 2009 to June 2010. The physicochemical parameters connect with the various seasons, and with this information, the dam's water quality can be determined and the correlation coefficient shows a highly significant positive and negative relationship ($p<0.01$) as well as a significant positive and negative relationship ($p<0.05$). To gauge how strongly two factors are related, correlation coefficients are utilized. The outcomes showed that in these dams' states, the metrics varied depending on the season. The fact that the observed parameter levels during the current analysis fell below the ISI-permitted limit demonstrates that the dam's water is suitable for residential usage and drinking.

Keywords: Hydrology, harsool dam, seasonal variations, and water quality

Introduction
The Physicochemical properties of pond water directly impact the dominant organisms and the person who uses that water. Freshwater is perhaps the most vulnerable habitat and is more susceptible to change by human activity. This essential resource is becoming increasingly limited in many areas of the world as a result of the severe decline in water quality (Munde *et al*, 2021) [12]. Numerous physicochemical or biological elements may affect fish growth and reproduction by acting as stressors (Iwama *et al*, 2000) [6]. It is difficult to comprehend the biological phenomenon without understanding the chemistry of water. The general hydrobiological connection and ecosystem metabolism are explained by the chemistry of water (Deshmukh and Ambore, 2006) [4]. The eutrophication process is accelerated by phosphorus and nitrogen inputs from household garbage and fertilizers (Madhusudan *et al*, 2017) [11]. Natural factors such as dust, storms, runoff, and mineral weathering are slow processes that cause eutrophication (Kudari *et al*, 2006) [10]. Waters that move very slowly are important because they fill reservoirs that are used to store water for domestic usage, drinking, and fish farming. Declining water quality is now widely understood to be a result of eutrophication (Kim *et al*, 2001) [9]. Understanding the trophic dynamics of this body of water requires a thorough understanding of the physicochemical aspects of limnology. While each component plays a part, the overall outcome is the product of how all the elements interact (Hulyal and Kaliwal, 2008) [5]. Keep this in mind; this study was conducted to assess the monthly values, standard deviation, and correlation of different water parameters of Harsool Dam in Aurangabad [MS] India.

Material and methods
The Harsool Dam is situated seven km from Aurangabad's North Side. The dam's location is altitude and 190.32'0" North latitude and 750.14' East longitude. When the Nizam state ruled the Marathwada region, a huge tank was built to supply drinking water to the city of Aurangabad. It was constructed in 1954 along the Harsool River. The band measures approximately 3172 meters in length, 4.50 meters in breadth, and 73.64 square kilometers in catchment area. 4.50 meters wide is the peak. The tank receives ample water throughout the monsoon, but the water level drops during the post-monsoon period, especially in March and April. The water spread area is around 2511.00 hectares. Water samples were obtained from July 2009 to June 2010, in the morning between 8:00 and 11:00 AM every month. In the laboratory of the Department of Zoology at Dr. Babasaheb Ambedkar Marathwada University in Aurangabad (M.S.), India, the samples were examined. Physico-chemical properties such as Total Dissolved Solids, Magnesium, Chlorides, Sulphates, Phosphate, Total Hardness, and Total Alkalinity have been seasonally determined in monthly variation using standard methods (APHA, 2005) [2]. Using SPSS 17.0 statistics, the analysis of variance (ANOVA) and significance test were used to examine the data.

Results and discussion
These consist of inorganic salts such as calcium, magnesium, potassium, sodium, bicarbonates, chlorides, Sulphatess and some heavy metal compounds. The organic substance in small amounts also contributes to the total number of solids dissolved in water. TDS in drinking water comes from natural sources, wastewater, urban runoff, and

industrial wastewater. "Dissolved solids" refer to minerals, salts, metals, cations, or anions dissolved in water. They include everything in the water except the pure water molecule (H_2O) and suspended solids. Suspended matter does not disappear and does not settle in water. Total dissolved solids (TDS) is a measure of the variety of minerals in water. They don't have any gas or colloids in them. Salts and other organic compounds that easily dissolve in water and frequently add a certain amount of hardness are examples of dissolved solids in naturally occurring water. The excessive total dissolved solids generally affect palatability (Jawale and Patil, 2009) [7]. The dissolved solid's total values reached 39 to 75 mg / l. The average values of the total solids dissolved were a maximum of 65.62 ± 9.57 mg / l in winter and a minimum of 48.37 ± 4.53 mg / l in summer, as indicated (Table 1). In the Harsool Dam, the total solids dissolved were positively correlated with the total alkalinity, although they were not negatively correlated (Table 2). (Salve and Hiware, 2006; Shinde *et al*, 2010; Shinde *et al*, 2011) [17, 18, 19] reported in Wanparakalpa Reservoir, Nagapur near Parali Vaijanath Dist. Beed, Maharashtra, seasonal analysis revealed that low total dissolved solids were reported in the winter season while the maximum value was in the monsoon due to the addition of solids from surface runoff. (Solanki, 2006) [21] reported the maximum values of TDS in July at all stations in Belial and Pandu Lakes of Bodhan, (A.P.) India. A medium with a high TDS content has a higher water density, which improves osmoregulation. (Jawale and Patil, 2009) [7] reported that magnesium showed a significant positive correlation with pH, electric conductivity, calcium, T.A., and sulfates. Magnesium is widely used in minerals. It is also highly chemically active; So it cannot be found in nature in its primary state. Except for magnesium hydroxide with a high pH, its salts are highly soluble. Magnesium ions are of particular importance in water pollution. They can contribute to water hardness. The amount of magnesium and calcium in the water may also be a distributive factor for crustaceans, fish, and other organisms in some inland passages. Magnesium is the eighth most common element in the earth's crust and the natural element of water. It is vital for the proper functioning of living things and is found in minerals such as dolomite and magnetite. The human body contains about 25 grams of magnesium (60% in bones and 40% in muscles and tissues). The Magnesium values reached 1.12 to 179 mg/l. The average Magnesium values were maximum in monsoon at 45.77±82.22 mg/l and minimum during winter at 2.67±0.23 mg/l as recorded (Table 1). In the Harsool dam, the Magnesium was not positively and negatively correlated (Table 2). Chlorides are generally found in natural waters. The presence of chlorides in natural water can be attributed to the dissolution of salt deposits, the discharge of wastewater from the chemical industry, the exploitation of oil wells, the release of sewage and the drainage of irrigation, contamination by leachate waste and ingress of seawater into coastal areas. Each of these sources can cause local pollution of the surface and groundwater. The chloride anion is generally present in natural waters. The most prevalent anions in wastewater are chloride and chloride anions (Cl-). The concentration of chloride is higher in organic wastes, and its higher level in natural water is unmistakable evidence of sewage contamination. Chloride values reached 35.1 to 57.1 mg / l. In summer, the average chloride values were a maximum of 48.98 ± 5.36 mg / l and minimal during the monsoon at 40.96 ± 4.76 mg / l, as indicated (Table 1). Chlorides were not positively and negatively correlated in the Harsool Dam (Table 2). (Anita *et al*, 2005) [1] the chloride content of water at two sites of the littoral zone of the Lake revealed that it recorded maximum value in May and minimum in August in Mir Alam Lake, Hyderabad. (Reddy *et al*, 2009) [16] reported that the Chloride maximum value was recorded in May while the minimum was recorded in August. The most stable Sulphates in the water at 250 ° C and one atomic pressure are free Sulphates, SO-24, H_2SO_4-, HS-H_2S, and S_2-. The participation of Sulphates types in geological and biological processes and the use of Sulphates fertilizers contribute to water contamination. In urban areas, the industrial emission of SO_2 gas and its contact with the humidity formed by Sulphatesic acid is one of the primary sources of Sulphates pollution in surface waters. The discharge of industrial wastes and sewage into the water also increases concentration. From a chemical point of view, Sulphates play an essential role in forming Ca and Mg salts to give water a permanent hardness. Sulphate in fertilizers increases the concentration of sulphate in the water body and causes water pollution. Additionally, they originate from runoff water, which has significant concentrations of both mineral and organic sulphur compounds. In adults, water with roughly 1000 mg/l of magnesium sulphate serves as a purgative; however, children and beginning users may still be affected by lower doses (Joshi and Sakhare, 2003) [8]. Sulphate is important constituent producing water with calcium and magnesium. High amounts of sulphate impart a bitter taste to water (Bhalerao and Khan, 2000) [3]. Sulphates values reached 0.8 to 6.1 mg / l. The average Sulphates values were a maximum of 4.25 ± 1.36 mg / l in winter and a minimum of 1.46 ± 0.47 mg / l during monsoons, as shown (Table 1). In the Harsool dam, the Sulphatess were not positively correlated, although they were negatively correlated with phosphate (Table 2). (Telkhade *et al*, 2008) [22] Stated that Sulphate is a crucial element in protein metabolism and is essential for plant growth. It was most abundant in March in Neri Nala in Durgapur, District of Chandrapur. A vital component of both plants' and animals' metabolic processes, phosphorus is a nutrient for plant growth. It regulates primary productivity and algal growth. Phosphorus concentrations in most natural waterways range from 0.005 to 0.020 mg/L. Only trace amounts of phosphorus are needed by algae. Algal blooms can result from eutrophication, which can be brought on by too much phosphorus. Phosphate levels of 0.1 to 0.3 mg / l were achieved. The average phosphate values were a maximum of 0.25 ± 0.05 mg / l in winter and a minimum of 0.2 ± 0.07 mg / l during monsoons, as indicated (Table 1). In the Harsool Dam, phosphate was not positively correlated, although it was negatively correlated with sulfate and total alkalinity (Table 2). The maximum concentration of 0.74 mg/l phosphate was observed in the deeper zone in December 2004 and the minimum of 0.22 mg/l in the shallow zone in July 2005 at Upper Lake of Bhopal (Sisodia *et al*, 2007) [20]. (Rao *et al*, 2002) [15] in Julur tank reported maximum phosphate in monsoon. Phosphate is the key nutrient in the productivity of water in reservoirs (Piska *et al*, 2000) [14]. Alkaline earth metal concentration is what causes the overall hardness. The main cations that impart hardness and stop leather from developing are Ca^{++} and Mg^{++} ions. The most prevalent elements in natural surface

and groundwater are Ca^{++} and Mg^{++}, which are mostly found as carbonates, bicarbonates, and carbon dioxide. These compounds serve as important sources of inorganic carbon for producers in aquatic ecosystems. They also serve to control the buffers. Total hardness values reached 40 to 77 mg / l. The average values of total hardness were a maximum of 67.25 ± 5.31 mg / l in winter and a minimum of 50.37 ± 4.62 mg / l in summer, as indicated (Table 1). The total hardness in the Harsool dam was not correlated positively and negatively (Table 2). (Pawar and Pulle, 2005) [22] studied Maximum values were reported during the monsoon at Pethwadaj Dam in Nanded, Maharashtra, while minimum values were recorded during the winter. (Salve and Hiware, 2006) [10] reported that Winter and monsoon were both moderate in terms of total hardness, but summer was lower. Surface water's alkalinity is primarily determined by its carbonate and hydroxide content, as well as by the presence of borates, phosphates, silicates, and other bases. Alkalinity is defined as the quantity of strong acid required to get a sample's pH down to 8.3 (free alkalinity; also known as phenolphthalein alkalinity); a pH of 4.5 indicates complete alkalinity. The sum of the hydroxides, carbonates, and bicarbonates is the total alkalinity. Water's ability to neutralize a potent acid is measured by its total alkalinity. Total alkalinity values reached 54 to 82 mg / l. The Average Total alkalinity was 77.25 ± 3.49 mg / l maximum during the monsoon and 59 ± 3.92 mg / l minimum in winter, as recorded (Table 1). In the Harsool dam, the overall alkalinity was positive for sulfate, although it was negatively bound to phosphate (Table 2). In the Free State, alkalinity is typically provided by the salts of carbonates, bicarbonates, phosphates, nitrates, borates, silicates, etc. in addition to the concentration of hydroxyl ions. The total alkalinity ranged from 90 to 120 mg/l, with summertime values being a little higher (Reddy *et al*, 2009) [15].

Table 1: Seasonal changes in the harsool dam's physical and chemical parameters july 2009 - june 2010

Parameters	Total dissolved solids (mg/l)	Magnesium (mg/l)	Chlorides (mg/l)	Sulphates (mg/l)	Phosphate (mg/l)	Total hardness (mg/l)	Total alkalinity (mg/l)
Monsoon	62.5±14.26	45.77±82.22	40.96±4.76	1.46±0.47	0.2±0.07	60.87±13.74	77.25±3.49
Winter	65.62±9.57	2.67±0.23	42.55±4.07	4.25±1.36	0.25±0.05	67.25±5.31	59±3.92
Summer	48.37±4.53	45.67±81.05	48.98±5.36	3.83±1.70	0.22±0.04	50.37±4.62	64.25±7.34
Range	39-75	1.12-179	35.1-57.1	0.8-6.1	0.1-0.3	40-77	54-82

Table 2: Harsool dam's physico-chemical variables' correlation coefficient from july 2009 - june 2010.

	Cl	Mg	PO_4	SO_4	T A	TDS	T H
Cl	1	-0.104	-0.301	-0.218	-0.178	-0.043	-0.519
Mg		1	0.000	0.515	0.091	-0.305	-0.491
PO_4			1	-0.599*	-0.564*	-0.478	-0.119
SO_4				1	0.820**	0.296	-0.556
TA					1	0.615*	-0.447
TDS						1	0.278
TH							1

** Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level

Conclusions

During the summer, monsoon, and winter seasons, the other physical-chemical traits change in a variety of ways according to the seasons. The dam water sample is environmentally and ecologically balanced, according to our physicochemical study. A huge number of parameters need to be examined more closely to model water quality. These variables were chosen because they are easy to measure quickly and continuously at water quality monitoring stations. The range of Total Dissolved Solids, Magnesium, Chlorides, Sulphates, Phosphate, Total Hardness, and Total Alkalinity are quality metrics for aquaculture and irrigation, one can infer. The physicochemical characteristics appear to be positively and negatively correlated in the current investigation.

Future water quality improvements and regular monitoring of the level of contamination are required for the Harsool Dam in Aurangabad [M.S.], India, to continue to offer the best conditions for fish survival and reproduction.

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