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Studies on certain physico-chemical parameters of Visapur Dam, Maharashtra, India

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Abstract
Studies were conducted at the Visapur Dam (Ahilyanagar, Maharashtra) for a period of two years. Certain physico-chemical parameters as pH, temperature, TDS, salinity, hardness, turbidity, chloride, total alkalinity, and dissolved oxygen were measured. The effect of water parameters on the flora and fauna are discussed. Such studies are important to understand the importance of water environmental parameters on aquatic habitats as dams.

Keywords: Aquaculture, conservation, dam, freshwater, zooplankton

Introduction

Studying the environmental parameters of an ecosystem is important because it helps us understand and maintain the health, productivity, and balance of that ecosystem. Physical and chemical parameters, such as temperature, pH, dissolved oxygen, and salinity, determine the suitability of water for aquatic life. Each aquatic organism living in the water has specific environmental needs. It is important to study these parameters to ensure favourable conditions for the survival and growth of aquatic organisms. Such studies also help us understand the interactions among biotic and abiotic factors, ensuring the ecological stability of the ecosystem. Changes in any of the prevailing parameters may indicate contamination or pollution from industrial, agricultural, or domestic sources. In water bodies such as ponds, lakes, reservoirs, and culture systems such as fish or pearl culture, monitoring helps optimize growth and prevent diseases. Regular observation and monitoring help identify the early signs of ecosystem stress or imbalance, which can result in changes in species diversity and abundance. Finally, understanding environmental conditions helps protect local endangered species and restore damaged habitats. Thus, environmental studies have important implications for biodiversity, ecology, aquaculture, and other allied fields.

Physical and chemical properties of water body are important as they in turn result in formation of food chains and webs. Occurrence of zooplankton is affected by the complex interaction of various physical, chemical, geographical, biological and ecological parameters (Vanjare and Pai, 2013) [12]. Each of these factors individually contributes to the formation of zooplankton assemblages as well as their seasonal occurrence. However, the ultimate effect is the result of the interplay and interaction among all these environmental factors (Hulyal and Kaliwal, 2008) [7].

Ecological work on freshwater zooplankton for the first time was done in a small tank in Calcutta, West Bengal, followed by many studies in India and Maharashtra (Battish, 1992; Ranga Reddy, 2001; Slathia and Dutta, 2013) [1, 10, 11].

Phytoplankton and bacteria are dependent on chemicals and fertilizers for their growth. Zooplankton the feed on these smaller organisms, which in turn are eaten by fishes and other major organisms. Especially in aquaculture this becomes extremely important. All carps in their larval and juvenile stages feed exclusively on zooplankton which becomes an important constituent of energy for the.

The current study over a period of 2 years (2022-24) at a manmade reservoir in Ahilyanagar district tries to understand the changes in physical and chemical conditions. This water body has been studied for its zooplankton, sponges, fish and avian fauna (Bhalsing and Pokale, 2023; 2025; 2025) [2-4].

Materials and Methods

The study was conducted at the Visapur dam, near Shrigonda, Ahmednagar (18.8035565°N 74.5827484°E). The Visapur dam is an earthfill dam on the Hanga River in Ahmednagar. Three stations were selected based on human interference, pollution status, and accessibility. The selected stations were monitored for selected environmental parameters for two years from October 2022 to September 2024.

Environmental parameters of water, such as pH, temperature, TDS, salinity, hardness, turbidity, chloride, total alkalinity, and dissolved oxygen, were measured at all three stations. Standard multiparameter meters (Eutech, Hanna) and kits (Aquasol, Hanna) were used to monitor environmental parameters. Readings were taken on-site and noted immediately. Environmental data and correlation studies were analyzed from the study area using software such as PAST software and Microsoft Excel.

Results and Discussion

The environmental parameters were studied over a period of two years from September 2022-August 2024. Water parameters as, pH, Temperature, Salinity, TDS, Conductivity, turbidity, hardness, alkalinity, chloride and Dissolved Oxygen were studied for the said period. The results indicate an improvement in the condition of water in both water bodies. The study also highlights the necessity for future protection and conservation of such habitats.

The water quality parameters exhibited significant variations over the two-year study period. pH levels fluctuated between slightly acidic to alkaline, with a range of 6.97 to 8.27. Water temperature showed considerable variation, ranging from 22.3°C to 33.0°C, indicating seasonal fluctuations. Turbidity levels remained relatively moderate, ranging from 11.4 to 16.2 NTU. Total Dissolved Solids (TDS) and salinity demonstrated notable changes, with TDS varying between 95.7 and 156.7 mg/L and salinity between 67.5 and 111.2 mg/L.

Other important water quality indicators also showed variations during the study period. Total hardness ranged from 183.3 to 320 mg/L, while total alkalinity fluctuated between 102.7 and 187.7 mg/L. Dissolved oxygen levels, crucial for aquatic life, varied from 4.6 to 6.4 mg/L. Chloride concentrations showed a range of 21.1 to 32.8 mg/L. These fluctuations in water quality parameters suggest the influence of various environmental factors, potentially including seasonal changes, anthropogenic activities, or natural processes affecting the water body over the two-year period.

Table 1: Monthly record for mean values of physico-chemical parameters of Visapur Dam during 2022-2023

Parameters	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
pH	7.37	7.47	7.48	8.03	7.93	6.97	7.47	7.43	7.60	8.03	8.17	8.23
Temperature (°C)	25.3	23.1	23.7	24.2	26.6	28.5	32.3	33.0	31.3	26.2	25.4	24.1
Turbidity (NTU)	12.6	12.4	11.9	12.5	12.6	12.8	13.8	13.9	14.6	14.9	12.8	13.1
Total Dissolved Solids (mg/L)	126.7	126.0	132.7	148.3	149.3	145.7	149.3	151.3	112.0	108.3	124.7	126.3
Salinity (mg/L)	89.9	89.9	93.4	105.7	106.5	103.4	106.3	107.4	79.5	76.9	88.3	89.2
Total Hardness (mg/L)	250.0	256.7	246.7	250.3	273.3	273.3	293.3	276.7	183.3	186.7	203.3	250.0
Total Alkalinity (mg/L)	137.7	135.7	147.3	137.0	142.7	143.7	156.7	176.0	102.7	105.3	103.3	147.0
Dissolved Oxygen (mg/L)	5.1	5.4	5.4	5.4	5.1	4.9	4.8	4.7	6.4	6.3	6.0	5.2
Chloride (mg/L)	23.4	25.5	26.0	28.7	28.1	28.4	30.2	32.8	25.7	22.2	21.1	22.6

Table 2: Monthly record for mean values of physico-chemical parameters of Visapur Dam during 2023-2024

Parameters	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
pH	7.87	7.70	7.87	8.07	8.07	7.17	7.30	7.47	7.50	7.97	8.03	7.97
Temperature (°C)	23.2	22.3	23.6	23.1	24.0	27.7	32.2	31.7	29.7	26.1	26.3	23.7
Turbidity (NTU)	13.1	11.4	11.8	12.1	12.1	13.1	13.9	14.2	16.1	16.2	14.8	14.8
Total Dissolved Solids (mg/L)	123.3	131.0	125.0	142.7	121.7	126.0	137.0	156.7	96.0	95.7	101.0	105.0
Salinity (mg/L)	87.6	93.0	88.5	101.5	86.6	89.5	96.4	111.2	68.2	67.5	71.3	75.0
Total Hardness (mg/L)	273.3	266.7	250.0	253.3	256.7	280.0	296.7	320.0	190.0	186.7	213.3	270.0
Total Alkalinity (mg/L)	145.3	144.7	155.7	162.3	155.7	160.0	156.7	187.7	130.0	128.3	118.3	136.7
Dissolved Oxygen (mg/L)	5.6	5.8	5.5	5.5	4.9	4.7	4.7	4.6	5.2	5.3	5.8	5.8
Chloride (mg/L)	23.0	24.8	24.5	26.6	26.7	25.9	30.7	31.6	23.0	24.8	22.8	23.3

The pH ranged from neutral to slightly alkaline, and were more or less similar in trend for both the years. Aquatic organisms as fish and zooplankton are affected by pH because most of their metabolic activities dependent on minute temperature changes. The temperature values are also in line with the subtropical conditions than occur in India. Maximum temperature was seen in the summer months, and lower in winter months. The water temperature significantly affects all metabolic and physiological activities, as well as life processes such as feeding, reproduction, movement, and distribution of aquatic organisms. Salinity values are lower for both the years and are important as they define the presence or absence of freshwater and/or brackish water species. Salinity was maximum in summer months than in rainy season. Dissolved Oxygen values were also towards a higher side and indicates good water quality. DO was maximum in winter and rainy as compared to summer months. Lower values in summer might be due to the input of sewage and agricultural wastes, as biochemical decomposition of organic matter is higher then. The water chemistry changed over the both years in similar fashion, and the season changes (summer, winter, and monsoon) seem to have effect on the environmental parameters.

It was observed that all physico-chemical parameters of Visapur dam are within a range of the permissible limits stated by the regulatory authorities. The water parameters also coincide with most of the studies that have taken place in Maharashtra and India. It can be concluded water of

Visapur dam is non-polluted and may be suitable for domestic, agricultural and industrial purposes.

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