

Zooplankton diversity from Tembhapuri Dam (MS) India

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Abstract

The present communication deal with the study of Zooplankton diversity in Tembhapuri dam (MS) India. Most of the Zooplankton in freshwaters is members of four groups i.e. Rotifera and Cladocera, Copepoda and Ostracoda. Irrespective of the fact, whether plankton belongs to plant or animal origin. The present study on Tembhapuri dam revealed that total population of Zooplanktons per liter at the various sampling station i.e. A, B, C and D. At the sampling station A total population was 1115/lit., at sampling station B 1112/lit., at sampling station C 1037/lit., and at sampling station D 993/lit. during the year 2022-23. The season wise analysis shows that during summer and winter population density was maximum during the period studies, in monsoon population density was minimum.

Keywords: Tembhapuri dam, zooplankton, diversity

Introduction

Zooplankton have immense ecological value as a major food resource in aquatic ecosystems and play a significant role in the disposal of organic matter, sewage degradation, and the natural purification of polluted waters. The concept of bioindication of water quality has gained increasing attention in recent years, and numerous researchers have demonstrated the effectiveness of zooplankton communities as indicators for monitoring water quality, trophic status, and pollution levels (Ganpati, 1942; Chandrasekhar and Kodarkar, 1997; Jeppesen *et al.*, 2011; Kulkarni *et al.*, 2020; Sharma and Rawat, 2022) [4, 5, 6, 8, 16].

At higher trophic levels, zooplankton are consumed by a wide range of secondary consumers, including commercially important crustaceans and fishes, thereby playing an integral role in energy transfer and nutrient cycling within aquatic food webs (Lampert, 2011; Sommer *et al.*, 2012) [9, 17]. Any alteration in zooplankton diversity or abundance can therefore have cascading effects on ecosystem stability and fisheries productivity.

Zooplankton communities in freshwater ecosystems mainly comprise four major taxonomic groups, namely Rotifera, Cladocera, Copepoda, and Ostracoda. These groups exhibit distinct spatial and temporal distribution patterns, with higher abundance commonly observed in shallow littoral zones of reservoirs, while comparatively fewer species dominate the open pelagic waters (Matthew, 1977; Mahajan, 1981; Khan and Seshagiri Rao, 1981; Seshagiri Rao, 1984; Arora, 1987; Varma and Datta Munshi, 1987; Wetzel, 2001) [3, 7, 10, 11, 14, 19, 20].

Comprehensive knowledge of zooplankton abundance, species diversity, spatial distribution, and population dynamics is essential for understanding trophic progression, ecosystem health, and ecological responses to anthropogenic stressors in freshwater bodies (Allan and Castillo, 2007; Thorp and Rogers, 2015; Patil *et al.*, 2021) [1, 12, 18]. The present study focuses on the assessment of zooplankton diversity in Tembhapuri Dam, located in Aurangabad District, Maharashtra, with an emphasis on their ecological significance and role as bioindicators of water quality.

Material and Methods

Study Area

The present investigations have been carried out in the year 2022-2023 Tembhapuri Dam is a crucial water body located in the Gangapur Tehsil of the Aurangabad district, Maharashtra, India, near Tembhapuri village (Fig.1). It is known for its large storage capacity within the Nagzari River Basin, featuring a substantial length of around 5.3 km and significant height, serving irrigation and local water needs, with detailed topographic surveys used for management. Situated River Basin: Part of the vast Nagzari River basin, a major river system in central India. Length: Approximately 5,300 meters (17,400 ft), Height: Around 16.42 meters (53.9 ft) above its lowest foundation, Reservoir Area: The reservoir covers a substantial area, with digital surveys mapping its contours for capacity calculations, with a total probable submersible area of about 662.1 hectares. Primarily for irrigation and water supply, impacting the local administrative region which includes blocks like Aurangabad, Gangapur, and Kannad.

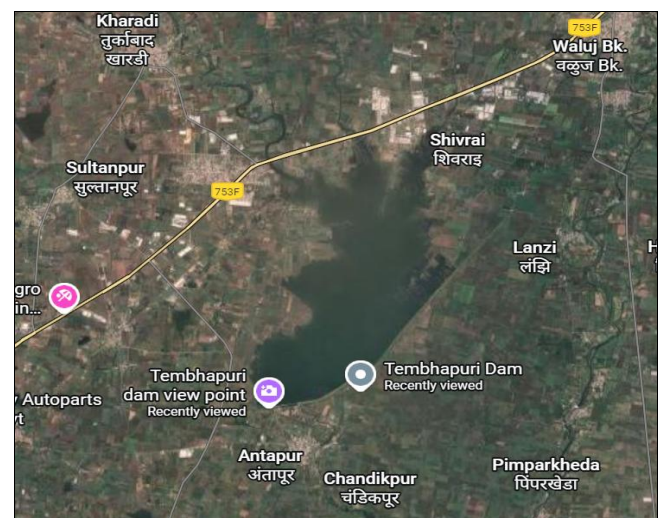


Fig 1: Photograph showing Satellite map of Tembhapuri Dam (Google Map)

Preparation of the sample for Zooplankton

For the study of Zooplankton following material have been used. Zooplankton net, centrifuge tubes, plastic container (0.5 or 1.0l), pipette, graduated tubes, Lugol’s solution, formalin, glycerin, filter paper, blotting paper, electronic balance, compound microscope, glass-slide, square cover slips standard dropper, literature for identification of plankton.

Known amount of water sample (5 lit.) is filtered through plankton net of bolting silk No.25. Collected plankton is transferred to 50 ml bottle and preserved in 4% formalin and few drops of glycerin are added to it. If further concentration is required the sample is kept undisturbed for a day. Practically all the Zooplankton settles down at the bottom of bottle Supernatants plankton free water is removed with the help of pipette and sample is reduced to the described volume.

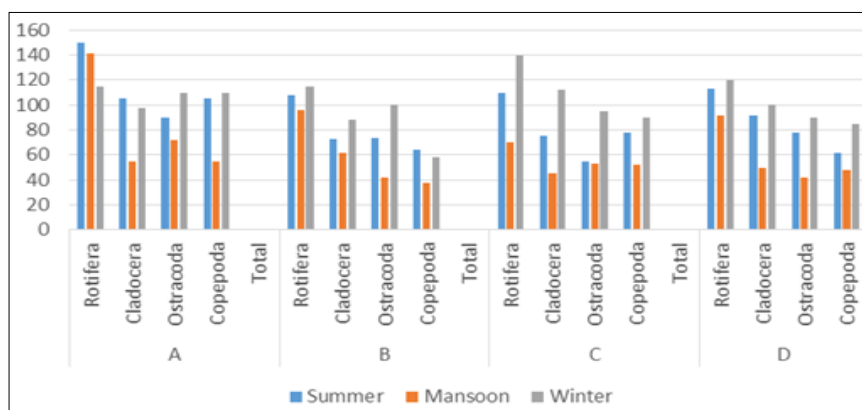
Counting

Sedgwick- Rafter cell is most common device used for counting Zooplanktons. This cell is 50 mm long, 21 mm wide and 1 mm. deep. The volume of the cell is 1 cm³ or 1 ml. For counting, the sample was agitated so as to distribute the organisms evenly. Erectly one ml of the sample was transferred into the cell with the help of pipette. The cover slip was placed on the cell taking the precaution, that these should not be any air bubble within the cell. The Zooplanktons were allowed to settle for some time. Then the counting was started under the microscope. All the Zooplankton was counted by moving the slides horizontally and vertically, by covering the entire area of the cell. The same procedure was repeated by taking the fresh drops from the sample and the population was calculated by standard method of estimation by APHA (1989) [2].

Result

Table 1: Seasonal Variation of Zooplanktons (No./Lit.) at Tembhapuri Dam (Year 2022-2023)

Station	Zooplankton	Summer	Monsoon	Winter	Total	%
A	Rotifera	150	141	115	406	33.83
	Cladocera	105	55	98	258	21.5
	Ostracoda	90	72	110	272	22.66
	Copepoda	105	55	110	270	22.5
	Total				1206	
B	Rotifera	108	96	115	319	26.58
	Cladocera	73	62	88	223	18.58
	Ostracoda	74	42	100	216	18
	Copepoda	64	38	58	160	13.33
	Total				918	
C	Rotifera	110	70	140	320	26.66
	Cladocera	75	45	112	232	19.33
	Ostracoda	55	53	95	203	16.91
	Copepoda	78	52	90	220	18.33
	Total				975	
D	Rotifera	113	92	120	325	27
	Cladocera	92	50	100	242	20.16
	Ostracoda	78	42	90	210	17.5
	Copepoda	62	48	85	195	16.25
	Total				972	



Graph 1: Seasonal Variation of Zooplankton in Tembhapuri dam 2022-2023

A study of the variation in population of Zooplanktons comprising of four groups viz. Rotifera, Cladocera, Ostracoda and Copepoda. All these four groups of Zooplanktons found out at four sampling stations i.e. A, B, C and D over the period of 2022-23.

The total population of Zooplanktons

Rotifera

During the study period (2022-23) maximum No. of Rotifers was 150/lit. at station A and minimum 108/lit. at station B in summer season. In the monsoon season they

were maximum no.141/lit. at station A and minimum no.70/lit at station C. where as in winter season they were maximum 140/lit. at the station C and minimum 115/lit. at station A & B.

Cladocera

During the first year (2022-23) maximum no. of Cladocera were 105/lit. at station A and minimum 73/lit. at station B in summer season. In the monsoon season they were maximum no. 62/lit. a station B and minimum no. 45/lit. at station C. where as in winter season they were maximum 112/lit. at the station C and minimum 88/lit. at station B.

Ostracoda

During the study period (2022-23) maximum no. of Ostracoda were 90/lit. at station A and minimum 55/lit. at station C in summer season. In the monsoon season they were maximum no.72/lit at station B and minimum no.42/lit. at station B and D. where as in winter season they were maximum 110/lit. at the station A and minimum 90/lit.at station C.

Copepoda

During the first year (2022-23) maximum no. of Copepoda were 105/lit at station A and minimum 62/lit. at station D in summer season. In the monsoon season they were maximum no.55/lit at station A and minimum no.38/lit at station B. where as in winter season they were maximum 110/lit. at the station A and minimum 58/lit. at station B.

The present study on Tembhapuri dam reservoir revealed that total population of Zooplanktons per liter at the various sampling station i.e. A, B, C and D as shown in Table No.1 and Graph No.1. At the sampling station A total population was 1115/lit., at sampling station B 1112/lit., at sampling station C 1037/lit., and at sampling station D 993/lit. during the year 2022-23. The season wise analysis shows that during summer and winter population density was maximum during the period studies, in monsoon population density was minimum.

Similar result was found by Sharma (1986) ^[15] studied on Zooplankton of fresh water ponds in and around Bhubaneswar (Orissa). Copepods were the consistent and dominant members of the Zooplankton. Their maximum density (4325 nos/100 L) in April and minimum density (286 nos/ 100L) in November was observed in Pond. Quadri (2000) studied on Salmi All Lake at Aurangabad (MS) and observed the Ostracoda population belong to the six species, *Cypris*, *Hemicypris*, *Centrocypris*, and *Cypridopsis*. The population density was highest in June 1993 and 1994 and lowest in the month of November of both the years, the high population of pathogenic and indicators species in monsoon season point to biological hazards caused by the pollution of the water body.

Discussion

The current study found a diverse range of Zooplankton in Tembhapuri Dam during the period from 2022 to 2023. The Zooplankton communities included four main groups: Rotifera, Cladocera, Copepoda, and Ostracoda. These groups were recorded at all four sampling stations (A, B, C, and D) throughout the study.

The seasonal changes in Zooplankton population showed a clear pattern across all stations. The highest Zooplankton density was observed in summer and winter, while the

lowest density occurred during the monsoon season. This seasonal trend was consistent at every sampling station, suggesting that environmental factors like temperature, water clarity, nutrient availability, and dilution from rainfall played a role.

Among the four stations, Station A had the highest total Zooplankton population, with 1206 No./L. Station B followed with 918 No./L, Station C had 975 No./L, and Station D had 972 No./L. The higher population at Station A may be due to better ecological conditions, such as higher nutrient levels and fairly stable water conditions.

Rotifera was the dominant group at all sampling stations, making up the largest percentage of the total Zooplankton population. At Station A, rotifers made up 33.83% of the population, while at Station B, they accounted for 26.58%, 26.66% at Station C, and 27% at Station D. The dominance of rotifers suggests moderate nutrient enrichment and their ability to adapt to different environmental conditions.

Cladocera was the second most common group at most stations, reaching peak numbers during the summer and winter. Their population dropped during the monsoon, likely due to higher turbidity and a dilution of nutrients.

Ostracoda and Copepoda were moderately abundant across all stations. Ostracods had higher numbers in winter, while copepods showed seasonal changes with more individuals during summer. These groups are sensitive to shifts in water quality and are important in the aquatic food web.

The dominance of Rotifera in this study supports previous research indicating that rotifers are good indicators of water quality and nutrient levels. Their abundance in summer may be linked to higher temperatures, increased metabolic activity, and more phytoplankton available as food. Similar findings were noted by Ganpati (1942) ^[5] and Chandrasekhar and Kodarkar (1997) ^[4].

The decrease in Zooplankton population during the monsoon can be attributed to greater water inflow, diluted nutrients, lower clarity, and the mechanical removal of organisms. Monsoon runoff brings in suspended particles that can negatively impact filter-feeding Zooplankton. This has been previously discussed by Sharma (1986) ^[15] and Quadri (2000).

The presence of Cladocera and Copepoda in significant numbers during summer and winter indicates good conditions for secondary productivity. These groups are essential links between primary producers and higher trophic levels, including fish, and play a key role in energy transfer within the aquatic ecosystem.

Although Ostracoda were less abundant compared to rotifers, their seasonal variation shows sensitivity to habitat conditions. Their continuous presence throughout the study indicates the ecological stability of the reservoir.

Overall, the diversity and population density of Zooplankton in Tembhapuri Dam suggest that the reservoir is moderately productive and supports a balanced aquatic ecosystem. The results of this study are similar to earlier research conducted on freshwater reservoirs in Maharashtra and other regions of India, such as the studies by Salve and Hiware (2010) ^[13] and Quadri (2000).

Conclusion

The present study reveals the diversity of Zooplanktons in Tembhapuri dam. All Five groups of Zooplanktons were recorded throughout the study period.

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