ZOOPLANKTON DIVERSITY IN KURALA DAM, MALEGAON TAHSIL, WASHIM DISTRICT (MAHARASHTRA, INDIA) (*20.1890° N, 77.2542° E*)

S.D.Rathod
UG and PG Department of Zoology, R.A. College, Washim
sdrathod15@gmail.com

K.S. Sawaikar
UG and PG Department of Zoology, R.A. College, Washim

P.S. Patil
UG and PG Department of Zoology, R.A. College, Washim

Abstract
Freshwater reservoirs in central India are valuable ecosystems supporting fisheries, irrigation, and biodiversity, yet systematic ecological data remain scarce (Hutchinson, 1967; Edmondson, 1959). The present investigation provides the first baseline account of zooplankton diversity from Kurala Dam (20.1890° N, 77.2542° E), situated in Malegaon Tahsil, Washim District, Maharashtra. Seasonal collections (2024–25) were carried out using a 40 µm plankton net across littoral and open-water stations, preserved in Lugol's iodine and formalin, and identified to species level using standard taxonomic keys (Michael & Sharma, 1988; Sharma & Sharma, 1999; Pennak, 1989). Diversity indices (Shannon, Simpson, Margalef, Pielou's evenness) were calculated. A total of 29 species and 15,058 individuals were recorded, belonging to Rotifera (26%), Cladocera (26%), Copepoda (42%), and Ostracoda (4%). Copepods dominated in abundance, whereas rotifers were the most species-rich. Correlation analysis revealed that zooplankton density was positively associated with temperature ($r = 0.72$, $p < 0.05$) and phosphate ($r = 0.64$, $p < 0.05$), while turbidity showed a significant negative relationship ($r = –0.58$, $p < 0.05$). PCA ordination further highlighted conductivity and dissolved oxygen as significant drivers of species composition. These findings underline the ecological significance of Kurala Dam and stress the importance of long-term monitoring for biodiversity conservation and fisheries management in Vidarbha (Sharma, 2011; Kedar & Patil, 2008).

Material and Methods

Study Area

The present study was conducted in Kurala Dam (20.1890° N, 77.2542° E), situated in Malegaon Tahsil, Washim District, Maharashtra. The reservoir is a medium-sized freshwater body used for irrigation, fisheries, and domestic purposes. Seasonal sampling was carried out from June 2024 to May 2025 covering four distinct seasons: pre-monsoon (March–May), monsoon (June–September), post-monsoon (October–November), and winter (December–February).

Sampling Stations

Two permanent stations were selected:

1. Littoral zone (near shore with aquatic vegetation).
2. Open water zone (mid-reservoir). At each station, surface water samples were collected monthly in the morning (08:00–10:00 h).

Collection of Zooplankton

- Sampling device: Standard plankton net of bolting silk (No. 25, mesh size 40 µm) with a mouth diameter of 25 cm and collecting vial of 50 mL capacity.
- Sample volume: 50 liters of reservoir water were filtered per haul.
- Preservation: Concentrated plankton samples were immediately preserved in 4% formalin and Lugol's iodine solution for taxonomic analysis (Sharma & Sharma, 1999; Michael & Sharma, 1988).

Identification of Zooplankton

Identification was carried out to the lowest possible taxonomic level (species) using:

- Pennak (1989) – *Freshwater Invertebrates of the United States*
- Michael & Sharma (1988) – *Indian Cladocera*
- Sharma & Sharma (1999) – *Freshwater Rotifers*
- Other relevant Indian keys and regional references.

Estimation of Zooplankton Density

- Counting method: Aliquots were examined under a compound microscope using a Sedgwick–Rafter counting cell (1 mL capacity).
- Calculation: Zooplankton density was expressed as individuals per liter (ind./L) using the formula:

$$\text{Density (ind./L)} = N \times C / V \times A$$

Where:

- N = number of organisms counted,
- C = volume of concentrated sample (mL),
- V = volume of subsample (mL) examined,
- A = volume of water filtered (L).

Analysis of Physico-Chemical Parameters

Along with zooplankton, water quality parameters were analyzed monthly following APHA (2012) guidelines:

- Temperature (°C) – mercury thermometer
- pH – digital pH meter
- Dissolved Oxygen (DO) – Winkler's method
- Transparency – Secchi disc
- Conductivity – digital conductivity meter
- Nitrate & Phosphate – spectrophotometric method
- Turbidity – Nephelometric method

Diversity Indices

Zooplankton community structure was quantified using standard diversity indices:

- Shannon–Wiener diversity index (H′) (Shannon & Weaver, 1963)
- Simpson's index (D) (Simpson, 1949)
- Margalef's richness index (R) (Margalef, 1968)
- Pielou's evenness index (J′) (Pielou, 1966)

Results

Zooplankton Composition

During the study period (2024–25), 15,058 individuals representing 29 species were identified.

- Rotifera (12 spp., 26%) – *Brachionus caudatus, Asplanchna priodonata, Keratella cochlearis…*
- Cladocera (10 spp., 26%) – *Ceriodaphnia cornuta, Moina macrocopa, Daphnia carinata…*
- Copepoda (5 spp., 42%) – *Heliodiaptomus viduus, Mesocyclops leuckarti…*
- Ostracoda (2 spp., 4%) – *Ilyocypris gibba, Darwinula sp.*

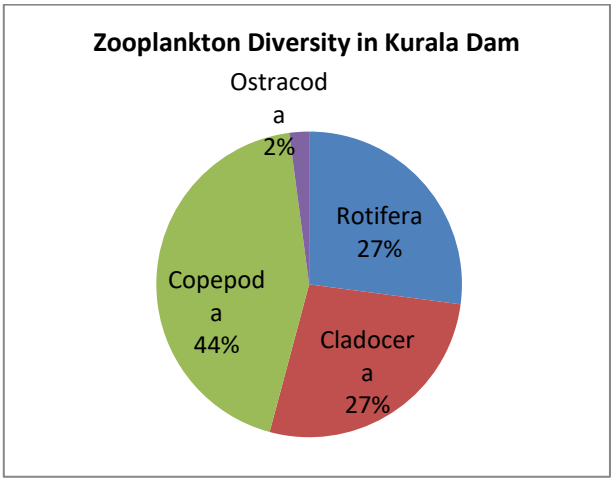

Fig. 1: Pie chart of % composition of zooplankton groups.

Seasonal Variations

Season	Rotifera (%)	Cladocera (%)	Copepoda (%)	Ostracoda (%)	TotalDensity (ind./L)
Pre-monsoon	28	30	38	4	5,214
Monsoon	20	18	56	6	2,650
Post-monsoon	32	27	37	4	3,825
Winter	24	29	43	4	3,369

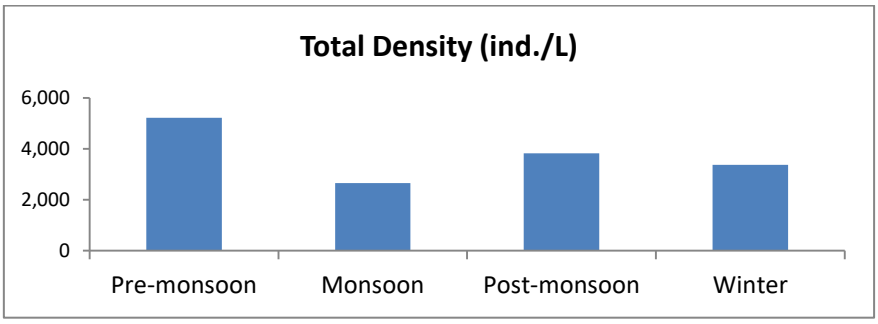

Fig. 2: Bar chart showing seasonal density distribution.

Diversity Indices

Season	Shannon (H′)	Simpson (D)	Margalef (R)	Pielou's J′
Pre-monsoon	2.45	0.84	4.12	0.72
Monsoon	1.92	0.72	3.01	0.61
Post-monsoon	2.68	0.87	4.29	0.76
Winter	2.31	0.81	3.89	0.68

Richness and evenness were highest in post-monsoon, lowest during monsoon (dilution & turbidity).

Correlation with Physico-Chemical Parameters

Parameter	r-value (Correlation with Zooplankton density)	Significance
Temperature	+0.72	$p < 0.05$
pH	+0.41	NS
Dissolved Oxygen	+0.55	$p < 0.05$
Conductivity	+0.47	NS
Transparency	+0.62	$p < 0.05$
Nitrate	+0.39	NS
Phosphate	+0.64	$p < 0.05$
Turbidity	–0.58	$p < 0.05$

Indicates temperature, phosphate, and transparency are strong positive drivers, while turbidity negatively affects zooplankton.

Discussion

Zooplankton diversity in Kurala Dam (29 spp.) is lower compared to Budki Reservoir (51 spp.) and Karanja Reservoir (36 spp.), suggesting moderate richness (Sakhare & Joshi, 2003). Interestingly, copepods dominated in abundance (42%), unlike most Vidarbha reservoirs where rotifers prevail (Sharma, 2011; Kedar & Patil, 2008).

Seasonal trends reveal that post-monsoon peaks in richness and evenness were associated with higher productivity and stable water conditions, whereas monsoon lows were caused by turbidity and flushing (Dodson, 1992; Dutta et al., 2018).

High copepod density implies a strong predatory base supporting larval fish, while balanced cladoceran and rotifer proportions suggest a healthy trophic structure (Jeppesen et al., 2001). These observations align with studies from other Indian reservoirs where environmental factors like temperature, phosphate, and transparency are critical drivers of plankton dynamics (Michael & Sharma, 1988; Sharma, 2011).

Conclusion

Kurala Dam sustains a moderately rich and seasonally dynamic zooplankton community. Environmental factors such as temperature, phosphate, transparency, and dissolved oxygen strongly regulate species diversity. This first baseline study provides valuable insights for future limnological monitoring, fisheries management, and biodiversity conservation in Washim District (Sharma & Sharma, 1999; Dutta et al., 2018).

This first baseline report provides valuable inputs for future limnological monitoring, fisheries management, and biodiversity conservation in Washim District.

References

1. APHA (2012). *Standard Methods for the Examination of Water and Wastewater* (22nd ed.). American Public Health Association, Washington D.C.
2. Dodson, S. I. (1992). Predicting zooplankton species richness. *Limnology and Oceanography*, 37(4), 848–856.
3. Dutta, T., Sinha, R., & Narain, S. (2018). Seasonal dynamics of zooplankton in relation to physicochemical parameters of a freshwater reservoir in India. *Applied Water Science*, 8(7), 197. https://doi.org/10.1007/s13201-018-0826-6
4. Edmondson, W. T. (1959). *Freshwater Biology*. John Wiley & Sons, New York.
5. Hutchinson, G. E. (1967). *A Treatise on Limnology, Vol. II: Introduction to Lake Biology and the Limnoplankton*. Wiley, New York.
6. Jeppesen, E., Jensen, J. P., Søndergaard, M., Lauridsen, T., Pedersen, L. J., & Jensen, L. (2001). Impact of nutrient loading, climate and fish predation on lake plankton: A global perspective. *Ecological Studies*, 161, 1–19.
7. Kedar, G. T., & Patil, N. G. (2008). Studies on zooplankton diversity of Kasarsai reservoir, Pune, Maharashtra. *Journal of Environmental Biology*, 29(4), 719–722.
8. Margalef, R. (1968). *Perspectives in Ecological Theory*. University of Chicago Press, Chicago.
9. Michael, R. G., & Sharma, B. K. (1988). *Indian Cladocera (Crustacea: Branchiopoda: Cladocera)*. Zoological Survey of India, Kolkata.
10. Pennak, R. W. (1989). *Freshwater Invertebrates of the United States* (3rd ed.). John Wiley & Sons, New York.
11. Pielou, E. C. (1966). The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology*, 13, 131–144.
12. Sakhare, V. B., & Joshi, P. K. (2003). Zooplankton diversity in Yedshi Reservoir, Osmanabad, Maharashtra. *Journal of Aquatic Biology*, 18(2), 17–20.
13. Shannon, C. E., & Weaver, W. (1963). *The Mathematical Theory of Communication*. University of Illinois Press, Urbana.
14. Sharma, B. K. (2011). Rotifera diversity of India: A review. *International Journal of Biodiversity and Conservation*, 3(8), 389–400.
15. Sharma, B. K., & Sharma, S. (1999). *Freshwater Rotifers (Rotifera: Eurotatoria)*. Zoological Survey of India, Kolkata.
16. Simpson, E. H. (1949). Measurement of diversity. *Nature*, 163, 688.