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Diversity of zooplankton from Visapur dam, Ahilyanagar with notes on studies similar habitats of Maharashtra state

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Abstract
Dams and reservoirs are important aquatic habitats providing water for human consumption, irrigation, industry and a source of food. Zooplankton are important components of such freshwater ecosystems. Freshwater zooplankton consist of rotifers, cladocerans, copepods and ostracods. We studied the diversity of zooplankton over a period of one year in the Visapur dam, Ahilyanagar. We documented 23 rotifers and 2 cladocerans from the waterbody. We also surveyed selected research papers on dams and reservoirs for their zooplankton fauna composition. Most studies conclude that rotifers are the most diverse and abundant group, followed by cladocera. Importance of zooplankton is emphasized, and urgent need for conservation of aquatic habitats is addressed.

Keywords: Zooplankton, dams, importance, Rotifera, Cladocera, food chains, reservoirs

Introduction

Even though only less than 0.01% of freshwater is present on just 0.8% of the surface of the earth, it is necessary for survival of humans, animals and plants (Gleick, 1996; Zaman and Sizemore, 2017) [10, 30]. Over 10, 000 fish (Lundberg *et al*., 2000) [15] and one third of vertebrates (aquatic reptiles, mammals, birds) live in such small area (Dudgeon *et al*., 2006; Lundberg *et al*., 2000) [7, 15]. Despite such profound benefits they provide, freshwater ecosystems are the most endangered habitats in the world (Dudgeon *et al*., 2006) [7]. Also, biodiversity losses are far greater in fresh water habitats as compared to the terrestrial ecosystems (Sala *et al*., 2000) [25]. Threats to these habitats include pollution, over exploitation, habitat fragmentation, construction of dams, introduction of exotic species, eutrophication, biotic homogenization, urbanization, global warming etc (Dudgeon *et al*., 2006; Braghin et., 2018; Vanjare *et al*., 2023) [4, 7, 27]. Such anthropogenic effects on environment tend to alter the biological and functional diversity by modifying faunal communities (Loreau *et al*., 2001; Kulkarni and Padhye, 2021) [17].

Biodiversity information on invertebrates of fresh water habitats is not up to the mark, especially from the tropical and subtropical regions that are known to support highest biodiversity (Dudgeon *et al*., 2006) [7]. High levels of local endemism and species richness have been reported from crustaceans, molluscs and aquatic insects (Dudgeon *et al*., 2006; Padhye *et al*., 2023) [7, 20].

Plankton of freshwater are composed of zooplankton and phytoplankton. Zooplankton (heterotrophic), generally do not actively swim on their own and move from one place to the other by the action of water currents or by drifting. Zooplankton are different from phytoplankton, which are known to be autotrophic producing their own food by the process of photosynthesis. Most zooplankton are known to be phytoplankton consumers. Zooplankton in freshwater bodies are composed of cladocerans, copepods and rotifers. These are micro-invertebrates found abundantly in inland freshwater bodies like lakes, ponds, rivers etc.

Rotifers are a diverse assembly of pseudocoelomate, bilateral organisms exclusive to freshwater (Vanjare *et al*., 2017) [26]. They are commonly called “wheel animalcules” due to the rotating motion of their cilia on the anterior side (corona). Cladocerans and Copepods are microcrustaceans found in aquatic habitats. The cladoceran head is like a dome with large compound eyes and five pairs of appendages. The first two pairs act like an antenna, with one pair used for sensation and the other pair used for swimming. The remaining pairs of appendages help in collection of food. Copepods have short and cylindrical bodies. Free living copepods have two pair of antennae and a single red eye. They inhabit the benthic, littoral and open water zone in aquatic habitats (Dumont & Negrea, 2002; Chatterjee *et al*., 2013) [6, 8].

Zooplankton are important to freshwater as they are at the base of aquatic food chains, play an important role in ecological processes (Dumont & Negrea, 2002; Kulkarni and Padhye, 2021) [8, 17]. They are well known biological models due to their use in ecotoxicology, pollution biology, graduate studies and aquaculture. They are rich source of protein rich food to their predators. The are well known biological indicators giving information about water quality in which they are present. Zooplankton respond to environmental changes in their habitat by changes in growth, community composition, density, diversity and distribution (Nogrady *et al*. 1993; Hulyal & Kaliwal, 2008; Vanjare *et al*., 2023) [11, 19, 27].

Reservoirs are artificial structures constructed to store the rain water. Reservoirs are constructed by creating dams over river. This ensures continuous supply of water for irrigation and municipal use during drier period. Reservoirs are also used for fishing, boating, electricity generation and recreational activities.

We surveyed the Vispaur dam over a period of one year (Sept 2022- August 2023) and documented 25 zooplankton. In this paper, we also summarize the zooplankton studies done on reservoirs of Maharashtra state, India, and comment on the ecological and economic importance of zooplankton in such freshwater bodies.

Material and methods

The study was conducted for a period of one year (Sept 2022- August 2023) at Visapur Dam, near Shrigonda, Ahilyanagar (18.8035565°N 74.5827484°E). The reservoir is an earthfill dam on the Hanga River covering an area of 385 sq. km. The zooplankton samples were collected using plankton net of 53-micron mesh size which was towed over the water surface. The collected samples were preserved in 4-5% formalin. Rotifers were identified under a compound microscope directly (Magnus MLX), micro-crustaceans were identified under stereomicroscope and photographed using a digital camera. All the zooplankton were identified using external morphological features. The latest monographs and keys were used for identification.

Results

The study resulted in documentation of 25 zooplankton, from the waterbody. The rotifers were the most diverse group (23 species), followed by cladocerans (2 species) (Figure 1). In Rotifers, the family Brachionidae was the most abundant group, with 11 species (see table 1). The phylum Rotifera, showed 10 families and 15 genera, whereas cladocera showed 2 families and 2 genera. The family Brachionidae was the most species rich, with seven species.

Literature review of selected dams and reservoir reveals the state of zooplankton studies in Maharashtra. Studies only on rotifers, cladocerans and copepods have been considered (Table 2).

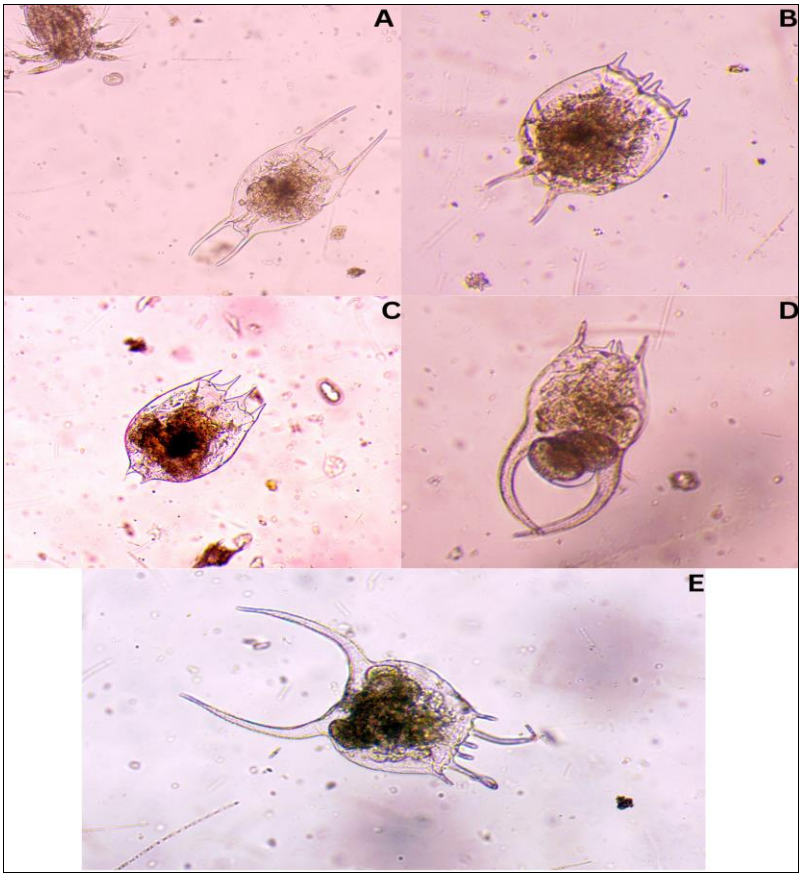

Fig 1: List of *Brachionus* rotifers seen at Visapur Dam, Ahilyanagar (**A.** *Brachionus diversicornis*, **B.** *Brachionus caudatus* **C.** *Brachionus calyciflorus* **D.** *Brachionus forficula* **E.** *Brachionus falcatus*)

Table 1: List of zooplankton observed at Visapur Dam during Sept 2022- August 2023

Sr. No	Family	Species
	Phylum Rotifera	
1	Asplanchnidae	*Asplanchna* sp.
2	Brachionidae	*Anuraeopsis fissa* Gosse, 1851
3	Brachionidae	*Brachionus angularis* Gosse, 1851
4	Brachionidae	*Brachionus calyciflorus* Pallas, 1766
5	Brachionidae	*Brachionus caudatus Barrois & Daday, 1894*
6	Brachionidae	*Brachionus falcatus* Zacharias, 1898
7	Brachionidae	*Brachionus forficula* Wierzejski, 1891
8	Brachionidae	*Brachionus quadridentatus* Hermann, 1783
9	Brachionidae	*Brachionus diversicornis (Daday, 1883)*
10	Brachionidae	*Platyias quadricornis* (Ehrenberg, 1832)
11	Brachionidae	*Keratella cochlearis* (Gosse, 1851)
12	Brachionidae	*Keratella tropica* (Apstein, 1907)
13	Lepadellidae	*Colurella* sp
14	Lepadellidae	*Lepadella (Heterolepadella) ehrenbergii* (Perty, 1850)

15	Euchlanidae	*Euchlanis dilatata* Ehrenberg, 1832
16	Lecanidae	*Lecane bulla* (Gosse, 1851)
17	Lecanidae	*Lecane closterocerca* (Schmarda, 1859)
18	Mytilinidae	*Mytilina ventralis* (Ehrenberg, 1830)
19	Trichotriidae	*Macrochaetus sericus* (Thorpe, 1893)
20	Hexarthridae	*Hexarthra mira* (Hudson, 1871)
21	Synchaetidae	*Polyarthra* sp.
22	Testudinellidae	*Pompholyx sulcata* Hudson, 1885
23	Testudinellidae	*Testudinella patina* (Hermann, 1783)
Cladocera		
24	Moinidae	*Moina* sp
25	Chydoridae	*Indialona ganapati* (Petkovski, 1966)

Table 2: List of studies on zooplankton from Maharashtra

Sr. No	Reservoir	Author and Year	Rotifer	Cladocera	Copepod
1	Haranbari Dam, Nashik	Ahire, 2022	16	-	-
2	Visnhupuri Dam, (Shankar Sagar reservoir), Nanded	Balkhande and Kulkarni. 2018			
3	Dynaneshwar dam, Ahmednagar	Dembhare, 2011	21	-	
4	Shahanoor Dam, Amravati District	Gadhikar and Sawale, 2016	25		
5	Bhogaon Reservoir, Parbhani	Kadam, 2016	13	5	6
6	Dnyanganga Reservoir, Buldhana	Kale, 2013	8	6	8
7	Rajura dam, Buldhana	Panpatil and Deshmukh, 2021	6	2	1
8	*Ekburji Dam, Washim*	Wanjari., 2019	11	10	7
9	Visapur Dam, Ahmednagar	Pandharkar et a., 2014	20	5	4
	Visapur Dam, Ahmednagar	Bhalsing and Pokale, 2023 [3]	19	-	-
10	Kurnur Dam, Ahmednagar	Patil and More, 2016	18	6	6
11	Mugdal Dam, Ahmednagar	Rankhamb and Mulgir, 2024 [23]	7	5	3
12	Sina Kolegaon dam, Osmanabad	Jadhav et a., 2012 [12]	5	4	2
13	Kalisar dam, Gondia	Gadekar, 2020 [9]	3	2	3

1. Ecological importance:

Components of aquatic food chains: Zooplankton are integral components of freshwater chains. All aquatic organism depends on the them for their survival. They serve as an intermediary species in here and transfer energy from phytoplankton to larger invertebrate predators and thus to the fishes and large aquatic organisms (Araujo *et al*., 2022) [2]. It is important to study of effects of climate change and adverse anthropogenic changes on plankton, as any harm at the base may result in catastrophic effects. Zooplankton can also act like consumers of the phytoplankton.

Zooplankton as bioindicators: Zooplankton are extremely sensitive to even microscopic changes in water (Wooldridge and Perissinotto, 2016). Any environmental disturbance can change their species composition, abundance and changes in their certain morphological feature (Rotifers-cyclomorphosis). Zooplankton are commonly used as bioindicators to monitor sudden and long terms ecological changes in freshwater habitats (Wooldridge and Perissinotto, 2016). Zooplankton thus help to keep a check on the health of the ecosystem and provide information to take necessary action to prevent algal and unwanted hydrophytes blooms. Thus, urban and rural policy makers by understanding ecology of zooplankton (ex. growth of harmful plankton due to eutrophication) at a particular waterbody can use the services provided by them to take decisions (Anderson et.al., 2002) [1].

Role in Biogeochemical cycles: Both phytoplankton and zooplankton play a crucial role in the cycling of nutrients (nitrogen and phosphorus) which are important for the productivity in aquatic ecosystems. Thus, zooplankton contribute to the global biogeochemical cycle add carbon dioxide in the atmosphere (Araujo *et al*., 2022; Brierley, 2017) [2, 5].

2. Economic importance:

Industry and biotechnology: Zooplankton also hold great importance in industry and biotechnology to be potentially used in commercial products (Wooldridge and Perissinotto, 2016). Zooplankton are used in wastewater treatment, food and feed supplements etc regularly.

Zooplankton in space: Few behavioural experiments (MacCallum *et al*., 1998) [18] on zooplankton have been performed in microgravity (cladocerans and ostracods). Few zooplankton can survive for few months in space and dormant eggs can be revived in space (Russomano and Rehnberg, 2018) [24]. Food, water and oxygen are extremely essential on long term space survey, thus plankton studies in future may fulfil the need (Aquatic bioregenerative life support systems (BLSS)- see Knie *et al*., 2018) [16].

Aquaculture: Zooplankton are commonly used as live food for larval stages of fish, shrimp and mollusks (Vigani et. al., 2015) [28]. Zooplankton like rotifers (*Brachionus plicatilis* and *B. rotundiformis*) are rich in nutrients (polyunsaturated fatty acids and essentials amino acids), easy to digest and ingest (Lubzens *et al*., 2003) [14]. Feeding copepods (ex. Moina) to commercial aquatic organism like fish, results in an increase in better survival, growth and a less incidence of larval deformities (Wilcox *et al*., 2006; Loh *et al*., 2012) [13, 29].

Discussion

The literature survey, revealed that 3-25 species were documented from most of the studies in reservoirs of Maharashtra. We were able to document 25 rotifer species in a year, and the number will surely increase in the upcoming collections. It is a well-known fact that rotifers are found at the base of food chain, and thus their numbers and population will always be towards the higher side, as compared to cladocerans, copepods and ostracods (see Bhalsing and Pokale, 2023) [3]. We were able to collect 2 cladocerans, whereas the previous studies in Maharashtra indicate 2-10 species of cladocerans. The low number of cladocerans, may be indicative of the sampling strategy, as cladocerans are mostly found at the bottom.

The genus *Brachionus* is a well-known indicator of alkaline, eutrophic water bodies (Sharma, 1983) this is also evident from the environmental parameters seen at the site (see Bhalsing and Pokale, 2023) [3]. We found 7 species of *Brachionus* at the site.

Plankton are important component of the freshwater bodies like lakes, river, ponds, dams and reservoirs. Their presence is important for the existence of the waterbody itself. Phytoplankton and zooplankton together are responsible for the continued survival of flora and fauna in the aquatic ecosystems.

Literature review indicates that good number of studies have taken place on zooplankton of dams and reservoirs in Maharashtra, state. Most of the studies are concentrated on the diversity and abundance of zooplankton (rotifers, cladocerans, copepods and ostracods). Some authors have commented on the physico-chemical parameters as well. Most of the reports, indicate good diversity of rotifers from such waterbodies followed by cladocera and copepoda. Ostacoda being benthic organism may or may not be caught in the plankton nets.

Zooplankton are important for the continuance of life in aquatic ecosystems, as is evident from studies all over the world. It is important for us to protect the aquatic habitats and zooplankton that live in them. Urbanization, pollution, intensive farming and other adverse anthropogenic activities are affecting the diversity and abundance of zooplankton in such important waterbodies. We need to protect such waterbodies on an urgent basis.

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References

1. Anderson DM, Glibert PM, Burkholder JM. Harmful algal blooms and eutrophication: nutrient sources, composition, and consequences. Estuaries,2002:25:704-726.
2. Araujo GS, Pacheco D, Cotas J, da Silva JWA, Saboya J, Moreira RT, Pereira L. Plankton: Environmental and economic importance for a sustainable future. Plankton Communities, 2022, 19.
3. Bhalsing DG, Pokale SN. Occurrence of some freshwater rotifers from Visapur Dam, Ahmednagar, Maharashtra, India. Uttar Pradesh J Zool,2023:44(16):100-106.
4. Braghin L, Almeida BDC, Canella TF, Garcia B, Bonecker CC. Effects of dams decrease zooplankton functional-diversity in river-associated lakes. Freshwater Biol,2018:63:721-730.
5. Brierley AS. Plankton. Curr Biol,2017:27(11):R478-R483.
6. Chatterjee T, Kotov AA, Van Damme K, Chandrasekhar SVA, Padhye S. An annotated checklist of the Cladocera (Crustacea: Branchiopoda) from India. Zootaxa,2013:3667(1):1-89.
7. Dudgeon D, Arthington AH, Gessner MO, Kawabata ZI, Knowler DJ, Lévêque C, *et al*. Freshwater biodiversity: importance, threats, status and conservation challenges. Biol Rev,2006:81(2):163-182.
8. Dumont HJ, Negrea SV. Branchiopoda. Guides to the Identification of Microinvertebrates of the Continental Waters of the World. Backhuys, 2002.
9. Gadekar GP. Variation in zooplankton diversity of Kalisarar Dam of Gondia District, Maharashtra. Int J Environ Rehabil Conserv,2020:XI(SP2):48-53.
10. Gleick PH. Water resources. In: Schneider SH, editor. Encyclopedia of Climate and Weather. Oxford University Press, 1996, 817-823.
11. Hulyal SB, Kaliwal BB. Water quality assessment of Almatti Reservoir of Bijapur (Karnataka State, India) with special reference to zooplankton. Environ Monit Assess,2008:139:299-306.
12. Jadhav S, Borde S, Jadhav D, Humbe A. Seasonal variations of zooplankton community in Sina Kolegoan Dam Osmanabad district, Maharashtra, India. J Exp Sci, 2012, 3(5).
13. Loh JY, Ong HKA, Yii YS, Smith T, Lock MW, Khoo G. Highly unsaturated fatty acid (HUFA) retention in the freshwater Cladoceran, Moina macrocopa, enriched with lipid emulsions. Isr J Aquacult,2012:64:637-645.
14. Lubzens E, Zmora O, Stottrup J, McEvoy L. Production and nutritional value of rotifers. In: Lavens P, Sorgeloos P, Tacon A, editors. Live Feeds in Marine Aquaculture, 2003, 300-303.
15. Lundberg JG, Kottelat M, Smith GR, Stiassny ML, Gill AC. So many fishes, so little time: an overview of recent ichthyological discovery in continental waters. Ann Missouri Bot Gard, 2000, 26-62.
16. Knie M, Ribeiro BW, Fischer J, Schmitz B, Van Damme K, Hemmersbach R, *et al*. Approaches to Assess the Suitability of Zooplankton for Bioregenerative Life Support Systems. In: Russomano T, Rehnberg L, editors. Into Space: A Journey of How Humans Adapt and Live in Microgravity. BoD–Books on Demand, 2018.
17. Kulkarni MR, Padhye SM. Does habitat restoration disturb? A case study of a shallow urban water reservoir in western India using cladoceran zooplankton. bioRxiv, 2021.
18. MacCallum T, Anderson GA, Poynter JE, Stodieck LS, Klaus DM. Autonomous Biological Systems (ABS) experiments. Biol Sci Space,1998:12(4):363-365.
19. Nogrady T, Wallace RL, Snell TW. Rotifera, Vol. 1. Biology, ecology and systematics. In: Nogrady T, Dumont HJ, editors. Guides to the Identification of the Microinvertebrates of the Continental Waters of the World. SPB Academic Publishing BV, 1993, 142.
20. Padhye SM, Kulkarni MR, Pagni M, Rabet N. New leptestherid clam shrimps (Pancrustacea: Branchiopoda: Spinicaudata: Leptestheriidae) from peninsular India. Zootaxa,2023:5264(2):205-220.
21. Paul S, Wooldridge T, Perissinotto R. Evaluation of abiotic stresses of temperate estuaries by using resident zooplankton: A community vs. population approach. Estuar Coast Shelf Sci,2016:170:102-111.
22. Patil SS, More VR. Study of zooplankton community structure in different seasons at Kurnur dam (MS). Indian Streams Res J,2015:5(12):1-9.

23. Rankhamb SV, Mulgir VS. Zooplankton diversity of Godavari River at Mudgal dam, Pathari dist. Parbhani (MS), INDIA. Int J Biol Innov,2024:6(1):65-68.
24. Russomano T, Rehnberg L, editors. Into Space: A Journey of How Humans Adapt and Live in Microgravity. BoD–Books on Demand, 2018.
25. Sala OE, Chapin III FS, Armesto JJ, Berlow E, Bloomfield J, Dirzo R, *et al*. Global biodiversity scenarios for the year 2100. Science,2000:287(5459):1770-1774.
26. Vanjare AI, Panikar CAVN, Padhye SM. Species richness estimate of freshwater rotifers (Animalia: Rotifera) of western Maharashtra, India with comments on their distribution. Curr Sci,2017:112(4):695-698.
27. Vanjare AI, Shinde YS, Padhye SM. Faunistic overview of the freshwater zooplankton from the urban riverine habitats of Pune, India. J Threatened Taxa,2023:15(9):23879-23888.
28. Vigani M, Parisi C, Rodríguez-Cerezo E, Barbosa MJ, Sijtsma L, Ploeg M, *et al*. Food and feed products from micro-algae: Market opportunities and challenges for the EU. Trends Food Sci Technol,2015:42(1):81-92.
29. Wilcox JA, Tracy PL, Marcus NH. Improving live feeds: effect of a mixed diet of copepod nauplii (Acartia tonsa) and rotifers on the survival and growth of first-feeding larvae of the southern flounder, Paralichthys lethostigma. J World Aquacult Soc,2006:37(1).
30. Zaman MS, Sizemore RC. Freshwater resources could become the most critical factor in the future of the earth,2017:62(4):348.