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Zooplankton diversity from Murna River, Shahdol district Madhya Pradesh, India

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Abstract

For a duration of two years, from 2023 to 2024, monthly zooplankton samplings from the water of the Murna River were conducted. Different species were identified using standard keys and additional literature. The variety and seasonal abundance of four important zooplankton groups-Ostracoda, Cladocera, Copepoda, and Rotifera-were examined. Because they could adjust to seasonal differences in water quality, different groups of zooplanktons exhibited different population densities. Certain zooplankton populations vanished during one time and then came back at a different time. It's possible that certain species have vanished because, given the right circumstances, their spores will germinate and turn into zooplankton. Three separate seasons-summer, monsoon, and winter-were used to assess river water bodies in relation to the species variety of zoo plankton.

Keywords: Zooplankton, Murna River, Shahdol district

Introductions

Water is an essential resource for all living things, whether they are single- or multicellular, as it is needed for many household tasks like farming, transportation, energy production, and industrial processes (Patil & Ghorade, 2012) ^[1]. The man's influence on these water bodies caused by rapid cutting of surrounding vegetation, thus increasing silt and nutrient load, disposal of sewage and industrial waters, use for defecation, cultural activities, and agriculture chemicals greatly increased the quantity of nutrients and organic input into a water body (Patil, 2011) ^[2].

Zooplankton, which are small organisms that drift in bodies of water, play a crucial role in maintaining aquatic ecosystems (Murugan *et al.*, 1998) ^[3]. While some of these organisms are too small to be seen without a microscope, others are visible to the naked eye. Positioned at the second trophic level, they are essential in various ecosystem functions such as food chains and the flow of energy (Ramachandra, 2008) ^[4]. The abundance and variety of zooplankton species are impacted by climate change and alterations in the physical and chemical properties of water bodies (Neves *et al.*, 2003) ^[5]. Additionally, the diversity of zooplankton species is closely linked to the physicochemical characteristics of the aquatic environment (Braich and Kayr, 2005, Chouhan, Satyendra Singh and Kumar, Kaushlendra 2024 and Pathak and Pathak, 2024) ^[6-8]. In fact, zooplankton are commonly utilized as bio indicator species to evaluate pollution levels in water bodies (Mikschi, 1989) ^[9].

In light of the water body's potential for recreation, economy, and ecology, the current study aims to evaluate the zooplankton population density and seasonal variety. An attempt was made in the current study to evaluate the ecological sustainability of the Murna River water flowing in Madhya Pradesh from the Shahdol district by analyzing the quantification of zooplankton and their seasonal diversity and abundance to show the water's sustainability from a drinking point of view.

Materials and Methods

The river basin lies between the latitudes of 23°15' N to 24° N latitude and 81°E to 81°45' longitude. District Shahdol is located roughly 110 miles (177 km) northwest of Bilaspur along the Murna River, a tributary of the Son River. The Murna River runs northeastward from the south. The Murna River also supplies a few Shahdol city settlements with the water they need. It was discovered during the survey that there is essentially no forest cover along the Murna River's bank.

Along the riverbank, there were also both big and little slum encroachments. The river Munra (Which is now a drainage) has drastically dried up as a result of the bank of the river being encroached upon (Khan, 2017) [10].

Survey of Murna river water bodies was carried out to assess the zooplankton quantification and their seasonal abundance for their seasonal diversity to indicate the sustainability of water quality at different stations of upper and lower Godavari to know the present status of Water Quality. Nearly of about 04 sampling stations were selected after survey such as - Station A (Kalyanpur): This station is located Shahdol (latitude 23.291216°/longitude 81.349732°; city entrance). Station B (MPEB Colony): This station is located near MPEB colpony Shahdol (latitude 23.296317°/longitude 81.348981°; city centre), Staton C (Sohagpur): Shahdol (latitude 23.2949° longitude 81.342176°; through the city). Station D (Kshirsagar): where the river Murna meets Sone.

The identification of zooplanktons was carried out in the research laboratory. The survey of Murna river water is carried out with references to species diversity of zooplanktons such as location, nature of catchment area and main human activities. The zooplankton sampling on monthly basis was carried out for a period of 2023 to 2024

from Murna river water. For qualitative analysis a compound microscope was used. As far as possible, the animals were identified to the species level. Preliminary identification was made by using standard monographs and published research papers (Patil, 2011, Chouhan, Satyendra Singh and Kumar, Kaushlendra 2024 and Pathak and Pathak, 2024) [2, 7-8] the taxonomic key (Murugan, 1989) [11] and a taxonomic manuals of freshwater invertebrates (Edmondsoan, 1965, Pennakrobert, 1989, Ward, 1954) [12-14] and other regional publication (Dahnpati, 1974) [15] as basic reference.

Results and Discussion

Four major groups of zooplankton (Protozoa, Rotifera, Cladocera and Copepoda) were studied the diversity and seasonal abundance. Zooplanktons like 5 species of Protozoa (*Diffugia*, *Vorticella*, *Paramecium*, *Arcella*, *Opercularia*), 10 species of Rotifera (*Branchionus calyoflorus*, *B. falcatus*, *B. quadridentatus*, *Philodina*, *Keratella*, *Asplanchna*, *Polyarthra*, *Monostyla*, *Trichotria*, *Filinia*), 3 species of Copepoda (*Cyclops virdis*, *Diaptomus*, *Nauplius larvae*) and 5 species of Cladocera (*Daphnia*, *Ceriodaphnia*, *Moina*, *Simocephalus*, *Bosmina*) were identified (Table 1).

Table 1: Mean Value of Seasonal Variation in Zooplankton groups (Organism/l) Murna River from July 2023 to June 2024

Groups	Rainy	Winter	Summer	Avg. ± SD
Station A				
Protozoa	10	12	46	23±16.51
Rotifera	31	27	83	47±25.52
Cladocera	9	19	43	24±14.18
Copepoda	31	41	76	49±19.52
Station B				
Protozoa	6	13	35	18±12.24
Rotifera	22	28	97	49±34.03
Cladocera	16	15	37	22±10.21
Copepoda	50	57	116	74±29.67
Station C				
Protozoa	11	10	25	15±6.67
Rotifera	23	21	102	49±37.84
Cladocera	14	22	46	27±13.60
Copepoda	55	54	127	79±34.30
Station D				
Protozoa	15	14	37	22±10.43
Rotifera	51	49	100	67±23.70
Cladocera	17	19	62	33±20.82
Copepoda	76	46	106	76±24.50

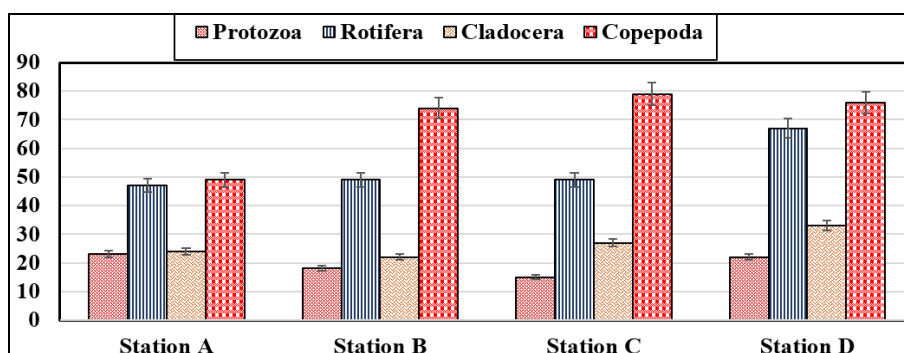


Fig 1: Graph analysis of average variation in Zooplankton groups (organism/l) Murna river from July 2023 to June 2024

The mean value of seasonal variation in Copepoda was recorded 31 org/l rainy season, 41 org/l winter season, 76 org/l summer season (station A), 50 org/l rainy season, 57

org/l winter season, 116 org/l summer season (station B), 55 org/l rainy season, 54 org/l winter season, 127 org/l summer season (station C) and 76 org/l rainy season, 46 org/l winter

season, 107 org/l summer season (station D) Table 1.

Among the groups of Zooplanktons, the population density showed variations due to their adaptability to seasonal changes in water quality, availability to food and predatory pressure. The degradative influence is mainly exerted by untreated domestic sewage at many stations and its diversion to downstream by a bypass line could result nutrient enrichment and consequent eutrophication.

Such aquatic ecosystems invariably receive large volumes of untreated domestic sewage that ensures a sustained supply of nitrates, BOD and COD remained more or less uniform (Patil, & Ghorade, 2011 & Pathak and Pathak, 2024) [16, 8]. Factors like temperature, transparency, turbidity, conductivity and dissolved oxygen plays an important role in regulating diversity and seasonal population densities due to dilution effect and in monsoon and winter water quality that control the zooplankton population (Patel *et al.* 2013 and Pathak and Pathak, 2024) [17, 8]. In summer, the biotic interactions operating through predation and feeding efficiencies, linked to the size particulate food material that has controlling influence.

Conclusion

Concluded the diversity specially the seasonal density of different zooplankton components at different locations along the Murna river bed indicated a characteristics pattern peculiar to water bodies in urban environment.

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