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Zooplankton occurrenc in purle pond of Shivamogga district, Karnataka

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Abstract
One of the most crucial ecological parameters in assessing water quality is zooplankton diversity. They are thought to be potential indicators of water quality because they are very sensitive to changes in the environment. The purpose of this study is to examine the species composition of the zooplankton in Purle Pond of Shivamogga taluk over the course of a one year from January to December 2022. Diversity indices like the Shannon-Weiner Index and the Simpson Index were used to calculate these zooplankton. There were 32 species of zooplankton recorded in this study, including four groups of zooplankton: Ostracoda, Copepoda, Rotifera, and Cladocera. Cladocera has 11 species that belong to 8 genera, Rotifera has 10 species that belong to 6 genera, Copepoda has 8 species that belong to 7 genera, and Ostracoda has 3 species belong to 3 genera. Following Cladocera are Rotifera, Copepoda, and Ostracoda species. Cladocera was found to have the highest percentage of zooplankton species, followed by Rotifera, Copepoda, and Ostracoda. The Simpson Index was between 0.80 and 0.94, and the Shannon-Weiner Index was between 2.22 and 2.58. The pond's Shannon-Weiner and Simpson indices indicated moderate water pollution and good diversity. This helps in the planning of successful fisheries management and increases the pond's productivity.

Keywords: Purle pond**,** zooplanktons, diversity, groups, cladocera, diversity indices

Introduction
According to Gannon and Stemberger (1978) [5], zooplankton communities have a lot of potential value as indicators of water quality because they are so sensitive to changes in the environment. Eutrophication affects the structure and composition of zooplankton communities, so these communities can be used as indicators of an ecosystem's changing trophic status (Bhati and Rana, 1987) [3]. Since eutrophication influences both the composition and productivity of zooplankton, adequate knowledge of zooplankton communities and their population dynamics is essential for a better understanding of life processes in a freshwater body (Bhora and Kumar, 2004; Sreedhara Nayaka, 2018) [4, 14].

Zooplankton has long been used as an indicator of eutrophication (Webber *et al*., 2005; Vandysh, 2004) [18, 17]. The summer has a greater abundance of zooplanktonsic fauna, while, the rainy season has lower abundance. Changes in the environment are primarily to blame for the zooplankton's fluctuation (Sunkad and Patil, 2004; Sheeba and Ramanujan,2005; Sreedhara Nayaka,2018) [15, 12, 14].

The conditions of a tank's water quality are influenced by both natural processes and human actions. The physical and chemical elements of an aquatic organism's environment, as well as the relationships between them, are inseparable. Life in aquatic habitats is first influenced by flow and water chemistry, which are closely linked to seasonal variations.

In order to meet the ever-increasing requirements of humans for drinking water, agriculture, and industry, the demand for freshwater has increased exponentially over time. In the tropics and subtropics, rivers are the most important sources of drinking water among the various natural agents at work. However, in the beyond 40 to 50 years, there has been an uncommon decrease in the nature of water in numerous streams of world ensuing to different sorts of anthropogenic exercises (Ramesh and Shashikanth Majagi, 2016) [10]. Soils' physicochemical properties are influenced by a combination of natural and human-caused factors operating at various spatial and temporal scales (Vandana *et al*., 2011) [16]. The purpose of this investigation is to determine the species composition and variations in Purle Pond's zooplankton diversity.

Materials and Methods
Study Area
Figure 1 depicts location of Purle pond. This pond is used all the year because it gets water from the Tunga canal and waste water from the surrounding township. This water body is situated just beside Subbaiah medical college and hospital. The pond has a total surface area of 55 hectares, of which 43 hectares are covered by water with an average depth of 6 feet. The water from this pond is used for things like washing clothes, vehicles and household animals (Sayeswara *et al*.,2010) [11] among other things. and for pisciculture as well. The Karnataka of Shivamogga is the home to numerous ponds. One of the larger ponds in the city is Purle Pond. The human population is dense around this. The majority of the population falls into the lower and middle classes, and their standard of living is either low or moderate. The water in the pond is diluted, resulting in moderate pollution.

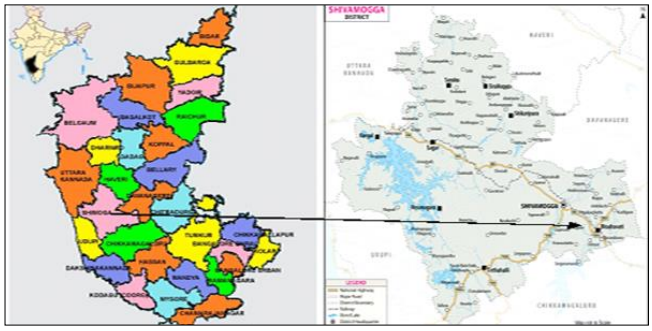

Fig 1: Study area map

Zooplankton Analysis

A modified plankton net with a square metal frame was used to collect zooplankton for qualitative analysis. The filtering cone was constructed of nylon bolting silk plankton net with a mesh size of 50µ for zooplankton collection. Ten meters of the net had to be towed. Labeled vial bottles containing 5% formalin were used to contain the collected samples. Standard methods were used for identification (Needham and Needham, 1962; Battish, 1992; ZSI) [7, 2]. The main zooplankton groups' relative abundance will be the only use of the data.

Results and Discussion

The pond water's physico-chemical characteristics reveal that it is moderately polluted. Tables 1 and 2 show the occurrence and Shannon-Weiner and Simpson Indices for zooplankton.

Table 1: Site-wise variation in zooplanktons (organisms/liter) at Purle pond (January–December2022)

Class	Zooplankton	Site 1	Site 2	Site3	Site 4
Rotifera	*Asplanchna priodonta*	+	+	-	+
	Brachionus calyciflorus	+	+	+	-
	Brachionus diversicornis	-	+	-	+
	Brachionus falcatus	-	+	+	+
	Brachionus forficula	+	+	+	-
	Brachionus rubens	+	+	+	+
	Filina longiseta	+	+	-	-
	Platyias polyacanthus	+	+	+	+
	Keratella tropica	+	+	+	+
	Cephalodella gibba	+	+	-	+
Cladocera	*Bosmina longirostris*	+	+	-	+
	Daphnia magna	+	+	+	+
	Macrotrix goeldi	+	+	-	+
	Moina daphnia.	+	+	-	+
	Cerodaphnia macrura	-	+	+	-
	Cerodaphnia sp.	+	+	+	+
	Diphanosoma sp.	-	+	-	+
	Moina brachiata	+	+	+	+
	Moina sp.	+	+	-	-
	Cerodaphnia macrura	+	+	+	+
	Daphnia carinata	+	+	+	+
Ostracoda	*Cypris sp.*	+	+	+	+
	Stenocypris sp.	-	+	+	+
	Hemicypris fossulate	+	+	+	+
Copepoda	*Anostrac sp.*	+	+	-	+
	Calanoid noupli	+	+	+	-
	Cyclop sp.	+	+	-	+
	Mesocyclop hyalinus	+	+	+	-
	Mesocyclop leucarti	+	+	-	+
	Heliodiaptomus vidus	+	+	-	-
	Diaptomus spp	+	+	-	+
	Eudiaptomus sp	+	+	-	-

Table 2: Zooplankton Species diversity indices of Purle pond

	Site 1	Site 2	Site 3	Site 4
Shannon-weiner Index				
Rotifera	2.40	2.47	2.49	2.50
Cladocera	2.50	2.52	2.58	2.49
Copepoda	2.42	2.38	2.44	2.41
Ostracoda	2.35	2.30	2.22	2.24
Simpson Index				
Rotifera	0.88	0.89	0.91	0.92
Cladocera	0.87	0.91	0.87	0.86
Copepoda	0.90	0.92	0.94	0.89
Ostracoda	0.80	0.85	0.88	0.87

The climate in the area has a significant impact on the water temperature in the pond. The turbidity ranged from 49 NTU to 90.4 NTU, and the temperature of the water was between 21.5 and 33 degrees Celsius. Conductivity is an indicator of the total amount of soluble salts present. It was discovered that the conductivity values ranged from 83 to 165 µmhos/cm. The concentration of minerals and organic matter increased, resulting in higher conductivity values. The pH ranged from 8.2 to 9.3 and showed very little variation. The value of free carbon dioxide ranged from 24.75 to 48.20 mg/L, and the value of dissolved oxygen ranged from 3.23 to 6.02 mg/L. BOD is the amount of water's degradable organic matter. The BOD typically rises with the microbial activities present in sewage. The BOD values ranged from 38.80 to 48.2 mg/L, the chloride values from 98.40 to 117 mg/L, and the total hardness from 152 to

260 mg/L. The concentrations of calcium and magnesium were found to be between 134 and 162.25 mg/L and between 26.30 and 39.4 mg/L, respectively. A total hardness of more than 200 mg/L is not safe for use in the domestic. Nitrite's value, which ranged from 0.23 to 0.34 mg/L, showed very little variation, while phosphate's value fluctuated from 0.42 to 0.70 mg/L.

The following four groups of zooplankton were examined in this study: Ostracoda, Copepoda, Rotifera, and Cladocera. Cladocera is the most dominant of these groups in all of the sites. 6 genera of Rotifera, 8 of Cladocera, 7 of Copepoda, and 3 of Ostracoda were discovered in the Purle pond. Rajagopal *et al*. (2010) [9] also reported similar results. The genera such as *Brachionus, Keratella, Ceriodaphnia, Daphnia, Moina, Cypris, Hemicypris and Mesocyclops* were recorded throughout the study period.

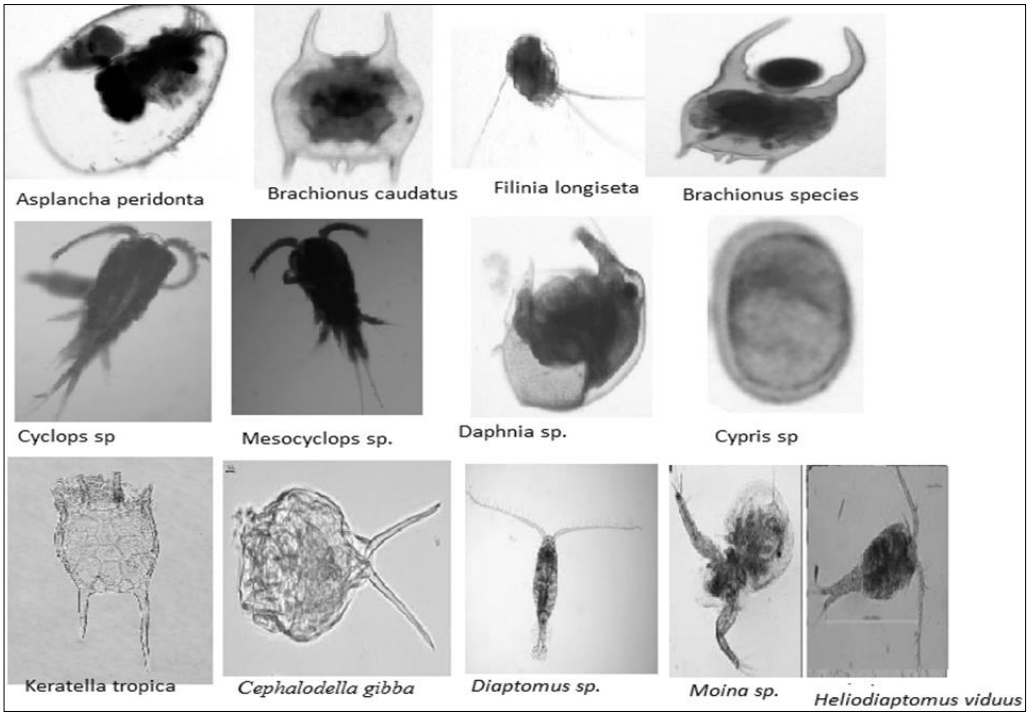

Fig 2: Some zooplankton of Purle pond, Shivamogga taluk

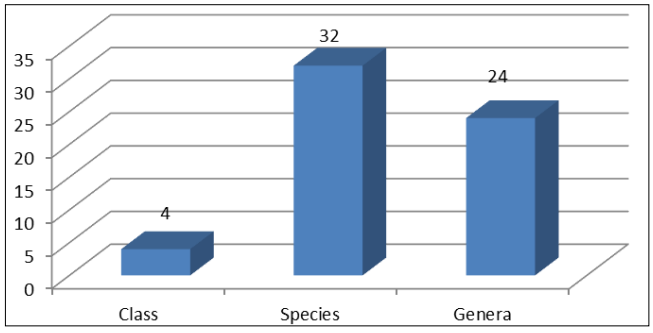

Fig 3: Total number of class, species and genera of zooplankton in Purle pond

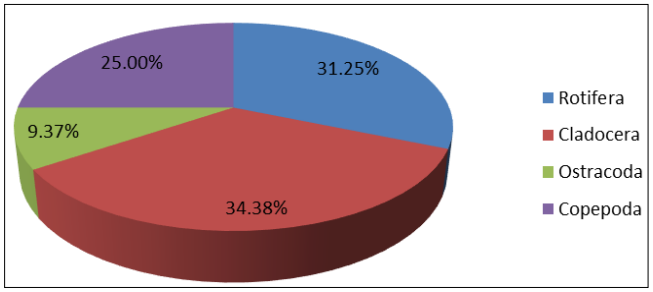

Fig 4: Percentage of occurrence of different groups of zooplankton in Purle pond

Nasar (1977) [8] made a similar observation when he found that Ostracoda were found in smaller numbers than Rotifera. There were 10 species of Rotifera in this study. Cladocera are the most useful and nutritive group of crustaceans for fish at the top of the food chain, making them an essential part of the zooplankton family. 11 species of Cladocera were recorded. Because of their tougher exoskeletons and longer, stronger appendages, they take a long time to develop and have a complicated life history, making it hard to tell the early larval stages apart. 08 species of Copepoda are identified in this study. There were 3 species of Ostracoda. Rajagopal *et al*. (2010) [9] and Smitha *et al*., (2009) have obtained comparable results. According to the current study, the total number of zooplanktons had a high population density during the summer in all of the locations, but it was low during the monsoon and winter. Bashini *et al* (2017) [1]. reported comparable outcomes., in which Temple pond at Thiruvottiyur's zooplankton population density was highest in the summer and lowest during monsoon season.

Lalitha and Ramakrishna (2021) [6] have recorded Rotifera with 10 species, Cladocera 8 species, Copepoda 5 species and Ostracoda by 2 species. Rotifera was dominant followed by Cladocera, Copepoda and Ostracoda They studied the percentage composition as Rotifera > Cladocera > Copepoda > Ostracoda.

The Shannon-Weiner Index value of zooplanktons in this study ranged from 2.22 to 2.58, indicating that there was little pollution and moderate plankton diversity. The Simpson Index ranged from 0.80 to 0.94, with a higher value indicating good diversity. The Shannon-Weiner Index and Simpson Index values found in this study indicate that

the Purle pond has moderate water pollution and good diversity.

Conclusion

The present investigation demonstrates that the pond is diverse and contains a greater number of species, resulting in a moderate level of pollution. The values of the Shannon-Weiner Index and Simpson Index point to a healthy diversity in Purle Pond. The diversity of zooplanktons, which serve as bioindicators, indicates the moderate pollution level of Purle Pond, which helps in the planning of successful fisheries management and increases the pond's productivity.

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