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Preliminary studies on water quality and zooplankton composition in Magadi Lake, Chikkamagaluru District, Karnataka, India

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Abstract
The aim of the present study was to analyse the Physico chemical parameters and composition of zooplankton and to evaluate relationship between Physico chemical parameters and zooplankton diversity in Magadi Lake, Chikkamagaluru district. Water samples were collected monthly basis at 6.00 to 7.00 a.m. from the selected study sites over one-year period between June 2024 and May 2025. Physicochemical parameters were analysed in the laboratory as described in the APHA, 2005. Zooplankton samples were collected using plankton net and the samples were preserved in 4% formalin solution. Zooplankton samples were identified with the help of standard identification keys (Needham and Needham, 1962, Edmondson, 1966). During the study period, a total of 29 species of zooplankton belonging to 24 genera were recorded, *Cladocera* was represented by 13 genera including 14 species, *Rotifera* having 5 genera with 8 species, *Copepoda* having 3 genera with 3 species, *Protozoa* having 2 genera with 3 species and *Ostracoda* represented by single genus with single species.From the above investigation, it may be concluded that the values of different physico-chemical parameters are within the permissible limits creating favourable environmental conditions for zooplankton growth and development.

Keywords: Ecosystem, zooplankton, physicochemical parameters, *Cladocera*, Magadi Lake

Introduction
Wetlands are areas where water is an important factor controlling the environment and the associated plants and animal life. They are cradles of biological diversity, providing the water and primary productivity upon which countless species of plants and animals depend for survival (Prakash, 2020) [23]. India is blessed with innumerable wetlands that provide the society numerous and crucial ecological services. Freshwater ecosystems such as rivers, lakes, wetlands, and groundwater occupy only a small portion of the Earth's surface, yet they support an exceptionally rich diversity of life (Lynch *et al*, 2023) [18].
Over exploitation of the wetland resources, urbanization and other developmental activities have been threatening the wetlands and the wetlands ecosystem services they provide. Wetlands form an important resource for humans and its conservation is essential in maintaining the environmental security. Plankton is of utmost importance in the freshwater ecosystem as these are the main source of energy and having a very high nutritive value. Plankton abundance and distribution are strongly dependent on factors such as nutrient concentration, the physical state of the water column, and the richness of other plankton.
Freshwater ecosystems host a different kind of aquatic organisms, with zooplankton playing a crucial role as primary consumers within aquatic food webs, thereby providing major influence on biological productivity (Steinberg and Condon, 2009) [32]. Zooplankton have important ecological significance in ecosystem as they play key role in the food web, in nutrient recycling, and in transfer of organic matter from primary producers to secondary consumers like fishes (Krishnamurthy and Barti,1979) [15]. The abundance of zooplankton diversity in wetland is influenced by factors such as water temperature, nutrient availability, predation, and structural complexity of the habitat.
Several studies have been conducted regarding the diversity of Zooplankton in different wet lands of India. Basavaraj and Kadadevaru (2024) [3] recorded 18 species of Zooplankton in the Gopalaswamy Tank, Chitradurga, Karnataka.50% of the zooplanktons observed were eutrophic indicators. Patil *et al*, (2025) [22] recorded 26 species of Zooplankton in Khajikotnoor Reservoir, Kalaburagi District, Karnataka. Rajani (2025) [22] documented 20 species Zooplankton in Freshwater Lake at Karimnagar District, Telangana State. Chaturvedi *et al*, (2026) [25] recorded 11 zooplankton genera with *Copepoda* as dominant species in Batapady mangrove ecosystem, Karnataka. Ravi *et al*, (2026) [8] evaluated 26 zooplankton species in Selected Stretches of Lower Reaches of the Krishna River. Singh and Jadhav (2026) [26] reported 10 genera of zooplanktons belonging to different groups in Gothavali and Rabade lakes of Navi-Mumbai, Maharashtra. Rakshaskar and Khabade (2026) [25] studied the Physico-chemical studies of Kodyache mal Lake, Tasgaon Tahsil, of sangli district, Maharashtra. Somnath and Indur (2025) [28] analysed physico-chemical parameters in the Channabasav Pattadevaru Lake Bhalki, Bidar District. The aim of the present study was to analyse the water quality and species diversity of zooplankton in Magadi Lake, Chikkamagaluru District.

Materials and Methods
Study Area
Magadi Lake (Fig.1) is located 12 km towards south from Chikkamagaluru. It lies between latitude 13.2687° north and

longitude 75.8446° east It covers a total geographical area of 106.60 ha, of which the water spread area 28.41 ha and its total catchment area is 4.25 sq. km. When the water is at its maximum depth of the lake would be 5 m. The lake is mainly depended on rainwater, and its water is used for irrigation as well as domestic needs.

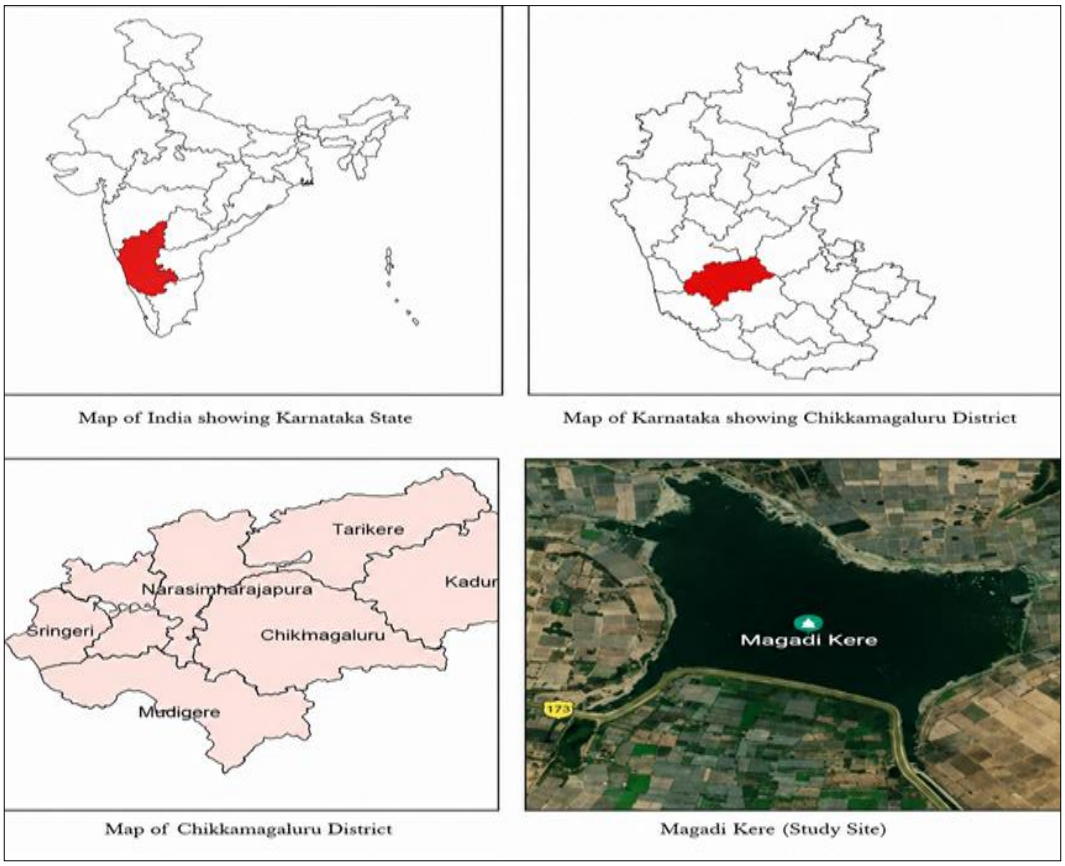

Fig 1: Location Map of Magadi Lake

Methodology

The present study focuses on the Physicochemical parameters and Zooplankton diversity of Magadi Lake in Chikkamagaluru, carried out from June 2024 to May 2025 [28]. Water samples were collected at regular intervals on monthly basis at 6.00 to 7.00 a.m. from the different sites of the study area. pH and Temperature were recorded on the spot by digital pH meter and mercury thermometer. Rest of the physicochemical parameters were analysed in the laboratory as described in APHA, 2005. Zooplankton samples were collected by towing and filtering through plankton net made up of bolting silk (mesh size No.25). The samples were preserved in 4% formalin solution. Collected samples were observed under the Microscope and Zooplankton was identified with the help of standard identification keys (Needham and Needham, 1962, Edmondson, 1966) [9, 19].

Result and Discussion

Result

In the present study zooplankton species recorded were grouped under *Cladocera*, *Rotifera*, *Copepoda*, *Ostracoda* and *Protozoa*.

Cladocera

*Cladocera*ns commonly known as water fleas are small sized crustaceans, inhabiting pelagic, littoral, and benthic zones of freshwater ecosystems. Most species feed on bacteria, detritus or algae but some are predators. *Cladocera* are considerably abundant in eutrophic, phytoplankton rich water bodies (De Bernardi *et al*, 1987) [5]. They play an important role in the freshwater ecosystem by connecting primary producers to higher trophic levels (Lampert, 1997) [17]. As primary herbivores in lakes, *Cladocera*ns also have major impact on nutrient recycling, and study of their population dynamics is necessary for understanding changes in aquatic ecosystems. About 600 species of freshwater *Cladocera*ns have been documented throughout the world, whereas only 110 species in India (Korovchinsky, 1996) [14]. In this study 14 species of *Cladocera*ns were recorded.

Copepoda

Copepods are probably the most common and abundant holoplanktonic organisms, observed in all oceans, seas, estuaries, rivers and lakes. As primary consumers, they play a major role in regulating energy and nutrient transport, linking phytoplankton production to higher trophic levels such as fish larvae and other predators (Verity and Smetacek,1996) [33]. Some species are adapted as carnivores and consume other copepods using limbs armed with sharp spines. About 5500 species of free-living copepods are present throughout the world, which includes about 2300 species of Calanoids, 450 species of Cyclopoids and about 2800 species of Harpacticoids (Bowman and Abele, 1982) [6]. In this study Copepods were represented by 3 species.

Rotifera

Rotifers are also known as "wheel-animalcule, belonging to the phylum *Rotifera*. They are microscopic metazoans, occurring in all types of water bodies. Rotifers play a major

role in many freshwater ecosystems (Segers and Smet,2008) [27]. Rotifers play a significant role in aquatic food webs as primary consumers of phytoplankton and serve as significant biological indicators for evaluating water quality (Wallace *et al*, 2015 [34]). Rotifers are omnivorous or filter feeders feeding on small organic particles, including bacteria, small microalgae and *Protozoa*. About 1700 species of rotifers have been described all over the world and 500 were described from Indian water bodies (Kiran *et al*, 2007) [13]. In the present study 8 species of Rotifers were documented.

Ostracoda

Ostracoda are small, bivalve crustaceans. They are commonly called as 'seed shrimps' and the carapace completely cover their body (Huys,2003) [10]. They inhabit marine and freshwater environments. Many of them are planktonic forms, but most of them live on the bottom where they are crawling or swimming near the surface of the water. *Ostracoda* are of great interest, due to their possible use as indicator species of climate and ecosystem changes (Martens *et al*, 2008) [21]. *Ostracoda* are herbivores on attached algae or Detritivores feeding on dead and decaying organic material. They are, consumed by fish, waterfowl, and various benthic and planktonic invertebrate predators. About 1700 species of known *Ostracoda* have been documented worldwide, and nearly one-third of them are freshwater forms. In this study *Ostracoda* was represented by a single species.

Protozoa

Protozoa are unicellular, microorganisms (Alcamo and Warner, 2009) [1] which are widespread in aquatic and terrestrial environments, and are cosmopolitan in aquatic habitat such as lakes, rivers and ponds. Some *Protozoa* are parasitic, infecting a wide range of hosts, including humans, livestock, and wildlife. *Protozoa* are among the most diverse and ecologically important groups playing vital roles in the cycling of nutrients and the functioning of ecosystems. In the present study 3 species of *Protozoa* were reported.

Table 1: Different groups of zooplankton identified in Magadi Lake

SL.NO	Groups	Name of the Zooplankton.
1	*Cladocera*	Alona davidi Richard, 1895
2		Alona globulosa (Daday, 1898)
3		Alonella nana (Baird, 1850)
4		Biapertura affinis (Leydig, 1860)
5		Ceriodaphnia Cornuta (Sars,1885)
6		Chydorus sphaericus (0.F. Muller, 1776)
7		Coronatella rectangula (Sars,1862)
8		Daphnia carinata (King, 1853)
9		Disperalona caudata (Smirnov, 1996)
10		Dunhevedia crassa (King, 1853)
11		Macrothrix triserialis (Brady, 1886)
12		Moina micrura (Kurz,1874)
13		Pseudosida bidentata (Herrick, 1884)
14		Simocephalus exspinosus (De Geer, 1778)
15	*Rotifera*	Brachionus calyciflorus calyciflorus (Pallas,1766)
16		Brachionus falcatus (Zacharias, 1898)
17		Brachionus quadridentatus (Hermann,1783)
18		Dicranophorus forcipatus (0.F. Muller, 1786)
19		Euchlanis dilatata (Ehrenberg,1832)
20		Euchlanis oropha (Gosse, 1887)
21		*Keratella* tropica (Apstein, 1907)
22		Mytilina ventralis (Ehrenberg,1830)
23	*Copepoda*	Heliodiaptomus cinctus (Gurney,1907)
24		Mesocyclops leuckarti (Claus, 1857)
25		Microcyclops varicans (Sars, G.0. 1863)
26	*Ostracoda*	Cypris subglobosa Sowerby, 1840
27	*Protozoa*	Centropyxis plagiostoma (Bonnet and Thomas, 1955)
28		Galeripora discoides (Ehrenberg, 1843)
29		Galeripora megastoma (penard, 1902)

Table 2: Physicochemical parameters of Magadi Lake

Physico chemical parameters	Range	Mean± SD
Temperature	21 -24.3 º C	22.65 ± 1.65
pH	8.23- 9.75	8.99 ±0.76
Total dissolved solids	148-204	176 ± 28
Electrical conductivity	305-444	374.5 ± 69.5
Total Alkalinity	67.3 -117.30	120.32 ± 53.02
Total hardness	131.3-171.33	151.32±20.02
Dissolved oxygen	5.62 – 8.44	7.03 ± 1.41
Chloride	29.6-68.63	49.12 ±19.52
Turbidity	2.60 – 7.60	5.10 ±2.50
Carbon dioxide	7.3 -22	14.65 ± 7.35

Water Quality

Life of an aquatic ecosystem depends on physico chemical and biological characteristics of water. The factors like Temperature, pH, TDS, DO, alkalinity and Co_2 are important for the production of plankton (Sivakumar, and Karuppasamy, 2008) [30]. Water temperature in Magadi Lake is from 21 to 24.3 ^{o} C. The pH of the water body is slightly alkaline in nature, water pH is ranged between 8.23 and 9.75.TDS level is ranged between 148 to 204 mg/L. Hardness is ranged between 131.3 to 171.33 mg/L. Dissolved Oxygen is most important parameter of the water quality, Oxygen is ranged between 5.62 to 8.44 mg/L. The Chloride value in this lake is ranged between 29.6 to 68.63 mg/L. Turbidity is ranged between 2.60 - 7.60 mg/L and Carbon dioxide value is ranged between 7.3 to 22 mg/L.

Zooplankton Diversity

During the study period, a total of 29 species (Table.1) of zooplankton belonging to 24 genera were recorded, *Cladocera* was represented by 13 genera including 14 species (Fig.3), *Rotifera* having 5 genera with 8 species, *Copepoda* having 3 genera with 3 species, *Protozoa* having 2 genera with 3 species and *Ostracoda* represented by single genus with single species. Among these *Cladocera*ns (48.4 %) (Fig.4) dominated the Zooplankton population followed by Rotifers (27.6%), Copepods (10.3%), *Protozoa* (10.3%), and *Ostracoda* (3.4 %).

Macrophytes Diversity

The macrophytes diversity of Magadi Lake increases zooplankton density by providing shelter, food resources, microhabitats, and improved water quality. Highly diverse group of macrophytes reported in Magadi Lake. This lake provide habitat for free-floating plants like *Eichhornia crassipes*, *Pistia stratiotes*, and *Lemna minor*. Submerged plants such as *Hydrilla verticillata.* Emergent plants are represented by *Typha angustata* and *Cyperus* species and floating-attached plants include *Nymphoides*, *Potamogeton* and *Marsilea crenata*.

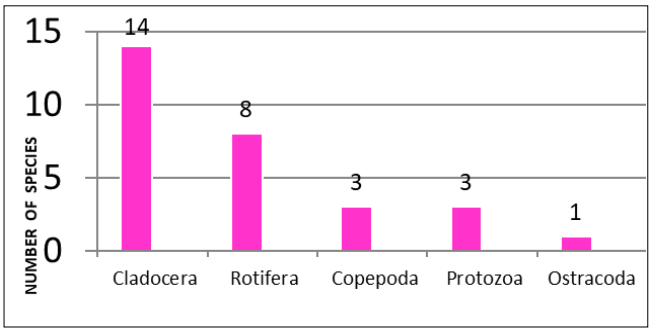

Fig 2: Zooplankton diversity of Magadi Lake

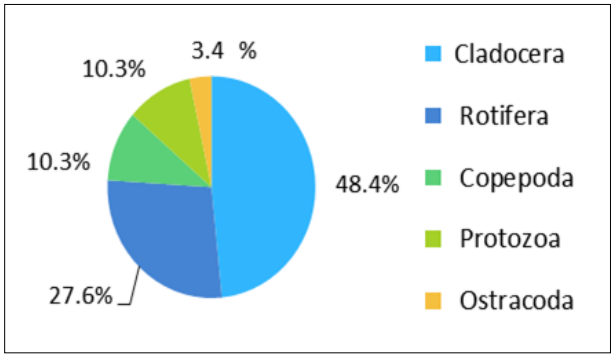

Fig 3: Percentage composition of Zooplankton

Discussion

Physico-chemical parameters play a major role in assessing the species composition of biota of wet land ecosystems, and changes in these factors considerably affect the species living within them. The physiological activities and vital biological processes such as feeding, reproduction, movements and distribution of organisms are significantly influenced by water temperature. Moderate water temperature was observed in the study area enhances the species richness of zooplankton (Sharma *et al*, 2013) [31]. Alkaline water supports high primary productivity (Kumar and Prabhakhar 2012) [16], in the present study Alkalinity was moderate. Amount of DO is one of the major factors that show the physical and biological processes occurring in freshwater. The high concentration of dissolved oxygen documented in the study area suggest that there may be high abundance of phytoplankton, which might be enhanced the zooplankton production (kalpana *et al*, 2017 [11]). A high amount of TDS in water is likely to disturb the ecological balance by causing suffocation of aquatic fauna even in the presence of sufficient amount of DO. Moderate amount of TDS recorded in the study area did not impair the production of zooplankton; rather it increases the zooplankton abundance. Electrical conductivity (EC) is a good indicator of overall water quality, with clean water normally exhibiting low EC values. The lower EC recorded in this lake indicates that it was less polluted, similar result was documented by (Chandran and Seetha, 2020) [7].A moderate concentration of Chloride was reported in the lake, similar result was documented by Maansi *et al*, (2022) [20].The documented results showed that lake has moderate range of CO_2, Total hardness and Turbidity, similar result were reported by (Kadadevaru, 2023) [12].Physico chemical parameters analysed in the study area were within the prescribed ranges of WHO. So, these factors facilitate the production of Zooplankton. The importance of the zooplankton is well recognized as these are significant component of food chain and plays an essential role in cycling of organic matter in the aquatic ecosystem. The present study result confirms that *Cladocera* is the most dominant group (48.4 %) followed by Rotifers (27.6%), Copepods (10.3%), *Protozoa* (10.3%), and *Ostracoda* (3.4%), Similar results have been obtained by Kadadevaru (2023) [12]. Zooplankton like *Cladocera*ns and rotifers were found to be abundant and serve as an excellent nutritional source for fish larvae. These results show high zooplankton diversity, indicating that the wetland is highly suitable for aquaculture. In the present study, *Cladocera*ns dominated the zooplankton community, indicating favourable feeding conditions with sufficient phytoplankton availability and moderate nutrient enrichment in the lake ecosystem. The occurrence of pollution-tolerant species such as *Chydorus sphaericus* and *Moina micrura*, along with productive-water species like *Daphnia carinata* and *Ceriodaphnia cornuta*, suggests that the lake has nutrient-rich water with moderate pollution, but is not highly polluted.

Conclusion

This study reported 29 species of zooplankton belonging to 24 genera. *Cladocera* is the most dominant group followed by Rotifers, Copepods, *Protozoa* and *Ostracoda*. From the above investigation, it may be concluded that the values of different physico-chemical parameters are within the permissible limits, creating suitable environmental conditions for zooplankton growth and development. The

dominant *Cladocera*ns population documented in the lake show good water quality and stable ecological conditions. Since zooplankton serve as primary consumers and an essential link between phytoplankton and higher trophic levels, their diversity reflects the overall ecological status of the lake. Evaluation of zooplankton biodiversity is necessary for monitoring water quality and fishery yield. It can also be stated that the overall productivity of a water body is directly regulated by physico-chemical as well as by biological parameters if properly managed, and they can support aquaculture activities of fishes and prawns. This study reveals Magadi Lake is mesotrophic, therefore measure must be taken to minimize the water Pollution by regulating human activities.

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