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Diversity and Distribution of Zooplankton on surface of Rajsamand Lake, Rajasthan

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Abstract

Rajsamand Lake, a significant waterbody in Rajasthan, India, plays a crucial role in regional water management and supports diverse aquatic life. Rajsamand Lake primarily has freshwater. This study investigates the diversity and distribution of zooplankton in the surface waters of Rajsamand Lake. Standardized sampling methods were employed, including vertical and horizontal hauls with plankton net, to ensure comprehensive coverage of the lake's surface strata. The Zooplankton diversity in aquatic ecosystem depends on the limnological characteristics of the water. The zooplankton species belongs to order Cladocera, Copepods and Anastroca. A percentage composition consists of 13.7% Copepod among the zooplankton diversity. Copepods diversity reaches its peak during March, April and May and its diversity reduces during October, November and December. Copepods are crucial in aquatic ecosystems as primary consumers of phytoplankton, supporting the food chain by serving as prey for many fish and other marine organisms. Their role in nutrient cycling and their abundance across diverse aquatic environments highlight their ecological dominance. Economically, they are vital for fisheries and aquaculture due to their importance as a food source and live feed. Scientifically, copepods are used to study climate change impacts, biodiversity, and developmental biology, underscoring their ultimate significance and widespread influence. The findings highlight the dynamic nature of zooplankton communities in Rajsamand Lake and underscore the influence of environmental factors on their distribution.

Key words : Zooplankton, Cyclopoid, Copepods, Diversity, Rajsamand Lake.

One of the most precious gifts from nature to humanity is water. It is safe to say that water is essential to life on Earth. Without water, neither the evolution of life on Earth nor the rise of human civilisation would have been possible. Humans have had close ties to bodies of water ever since the dawn of civilisation[16]. Nature has endowed biodiversity as a priceless legacy to preserve both the Earth and humankind. According to Gastron[7] and

Malik *et al*.[10], it is a variety of life that includes various genera, species, communities, and ecosystems together with their relative abundance. Primary producers such as phytoplankton, algae, and hydrophytes, primary consumers such as zooplankton and phytophagous fish, and secondary and tertiary consumers such as fish and other organisms comprise the freshwater ecosystem. Zooplanktons are microscopic organisms whose distribution is mostly dictated by water currents and waves. They float freely in surface water and the water column of bodies. Numerous researchers have examined the zooplanktons found in Indian freshwaters[18,20]; Shivayogimath[22]. The need for water has grown recently due to rapid development, and it is dependent on ground water[4]. Two orders of Crustacea: Cladocera and Copepoda, and four major groups, Protozoa and Rotifera, make up the majority of freshwater zooplankton. South Rajasthan's lakes are home to a wide variety of planktonic species. Numerous scholars have made significant contributions to the limnology of Rajasthani waterways, focussing on the zooplanktonic composition and density[23]. Another researcher has made a noteworthy contribution to the assessment of the trophic structure and limnological quality of freshwater bodies[21]. The goal of the current project is to investigate Rajsamand Lake's zooplankton diversity. We chose the Rajsamand Lake because it is an excellent choice for examining zooplankton due to its unique freshwater ecosystem, diverse habitats, and significant seasonal variations in water quality. The lake's exposure to anthropogenic pressures such as agricultural runoff and urban development provides a relevant context for studying the impacts of human activities on aquatic life. By investigating zooplankton in Rajsamand, researchers can gain valuable insights into how environmental stressors affect these organisms and contribute to understanding broader ecological dynamics. This research is crucial for establishing baseline data, informing conservation efforts, and managing the lake's resources effectively.

Study area : The Rajsamand Lake, sometimes called Rajsamudra Lake, is a lake located 67 kilometres from Udaipur in the Rajsamand district of the Indian state of Rajasthan. It is roughly 1.75 miles (2.82 km) broad, 4 miles (6.4 km) long, and 60 feet (18 m) deep. With a catchment area of around 196 square miles (510 km2), the Gomti River was constructed over it. It rises from the Sewantri, Kelwa, and Tali rivers.

Sampling : Using conical plankton net, zooplankton samples were taken once a week during the morning hours, roughly between 7 and 9 a.m. for a period of one year Water samples were gathered using a net tow on the lake's surface and placed in collection bags. Following collection, the samples were taken to the lab, where they were filtered through plankton net and put into a 100 ml Tarson container. The filtered zooplankton are then stored in Lugol's solution and maintained in a dark, cool environment.

Qualitative estimation : A drop of preserved material was taken in a Sedgwick-Rafter counting chamber and examined under a light microscope at the necessary magnification (X 10 first, then X 40) in order to identify zooplankton. Then, zooplanktons were identified using the standard literature by Edmondson[5]; Battish[1] and Sharma and Sharma[19].

Copepods diversity :

Copepods are typically 1 to 2 mm long with a teardrop shaped body and large antennae. They have an armoured exoskeleton but they are so small that in most species, this thin armour and the entire body is almost totally transparent. Most copepods have a single median compound eye at the centre of the head some species are eyeless where as few genera consist of two eye like copilia and corycaeus. Copepods possess two pairs of antennae the first pair is long and conspicuous. Thorax has three to five segments, each with limbs. First pair thoracic (modified maxillipeds) assist in feeding. The abdomen contains five segments without any appendages, except some tail part like "rami" at the tip. Thus some representatives Cyclopoid - Copepods in the surface waters of Rajsamand Lake is shown in figure 1.

a) Mesocyclops edax :

It has hairy inner surface of caudal rami and the free margin of the leg, which has two broadly rounded, triangular protrusions. The first pair of thoracic appendages is modified to form maxillipeds, which do assist in feeding. The thorax is broader then abdomen. The abdomen contains five segments without any appendages, except for some tail-like 'rami' at the tip. Furcal rami bear prominent hairs on both the sides, inner margin of caudal ramus without hairs, mandibular palp not well developed and reduced to one segment with setae.

Ecological Role : Mesocyclops edax is a predatory copepod species known for its role in controlling phytoplankton populations and regulating other zooplankton species. Its predatory behavior contributes to maintaining a balanced aquatic food web by limiting the abundance of smaller zooplankton and influencing phytoplankton dynamics[2,12].

Scientific Significance : This species is an important model for studying predation effects in freshwater ecosystems. It helps researchers understand the interactions between predator and prey in aquatic environments, and its feeding habits can provide insights into nutrient cycling and energy flow within the ecosystem[9].

b) Mesocyclops thermocyclopoides :

Lateral arms of seminal receptacle is wide and short, antennules are uniramous and composed of seventeen segments. Different process of antennules consists of long feathered setae, short feathered setae, long non- feathered setae. The numbers of setae are of more in other segments. They are predatory but also feed on algae, bacteria and detritus.

Ecological role : Mesocyclops thermocyclopoides is notable for its ability to thrive in a range of thermal conditions, making it a useful species for studying the effects of temperature variability on zooplankton communities. Its adaptability to varying thermal environments helps researchers understand how climate change might impact freshwater ecosystems[24].

Scientific Significance : The species serves as a model for studying the physiological and behavioral responses of copepods to temperature changes. This research is crucial for predicting how shifts in climate and water temperature may affect freshwater zooplankton

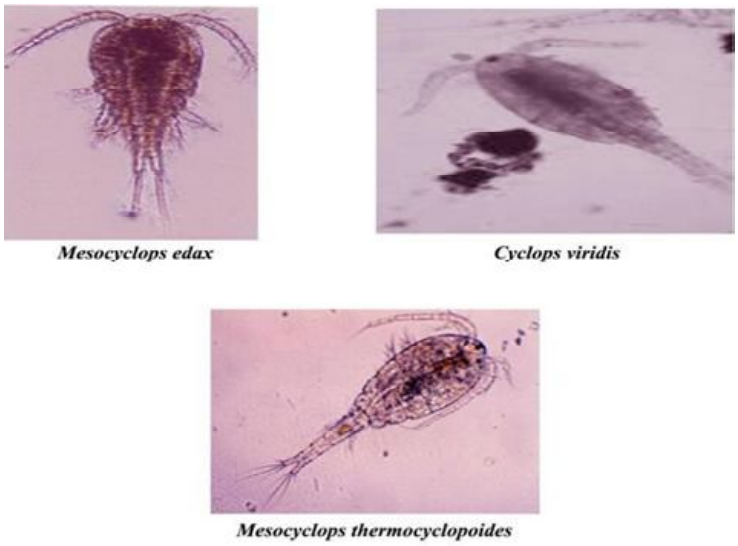

Fig. 1. Some representatives Cyclopoid - Copepods in the surface waters of Rajsamand Lake (Source: Original work picture)

populations and, consequently, aquatic food webs[8].

c) Cyclops viridis :

The number of spines on the terminal segments of the outer rami of the four swimming appendages, the receptaculum consists of a larger antero-median portion and two narrower
postero- ventral portions which are carried out laterally as the sperm ducts.

Ecological Significance : Cyclops viridis is a common freshwater copepod that plays a key role in the food web as both a primary consumer of phytoplankton and a prey item for larger aquatic organisms. Its abundance can significantly impact the distribution and diversity of other zooplankton and small fish[17].

Scientific Significance : This species is often used in ecological and environmental studies due to its wide distribution and sensitivity to changes in water quality. Cyclops viridis serves as an indicator species for monitoring freshwater ecosystem health and assessing the impacts of pollution and habitat alterations[6,11].

Thus these three copepod species—*Mesocyclops edax, Mesocyclops thermocyclopoides,* and *Cyclops viridis*—are significant due to their roles in food web dynamics, responses to environmental changes, and use as indicators of ecosystem health. Studying them provides valuable insights into freshwater ecology and helps in managing and conserving aquatic resources.

Later it was clearly observed that the Zooplankton diversity in aquatic ecosystem depends on the limnological characteristics of the water. The zooplankton species belong to *Rotifer, Cladocera*, *Copepod Ostracoda* and

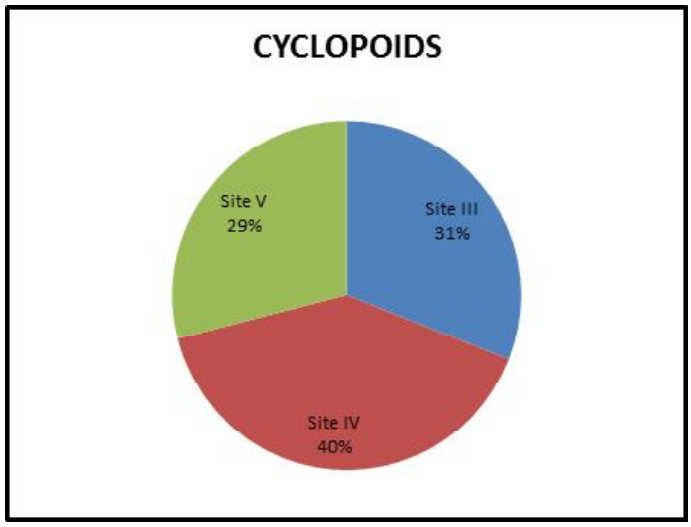

Fig. 2. Percentage contribution of Cyclopoids (Org/L) in Rajsamand Lake.

a*nastroca*. A percentage composition consists of 13.7% Copepod among the zooplankton diversity. Copepods diversity reaches its peak during March, April and May and its diversity reduces during October, November and December. Figure 2 shows the percentage contribution of Cyclopoids (Org/L) in Rajsamand Lake.

In both freshwater and marine settings, copepods are the dominating group of plankton. These make use of a broad range of food sources, including bacteria, detritus, and a variety of unicellular and multicellular phytoplankton, and they also provide a fantastic source of food for zooplanktivorous fish. It is interesting and important to note that throughout the whole research period on the surface waters of Rajsamand Lake only the abundance of Cyclopoid- Copepods was observed.

In conclusion, the diversity of copepods within Rajsamand Lake demonstrates a significant variation, reflecting the ecological complexity and health of the aquatic environment. The varied species composition and abundance indicate a dynamic and balanced ecosystem, influenced by factors such as water quality, nutrient availability, and seasonal changes. This diversity not only highlights the ecological importance of copepods as a fundamental component of the lake's food web but also underscores the need for ongoing monitoring to ensure the preservation of this crucial habitat. Understanding copepod diversity in Rajsamand Lake provides valuable insights into the broader ecological interactions and helps in formulating effective conservation strategies.

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