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Zooplankton Diversity in Didwana Lake: A Saline Lake in Rajasthan

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ABSTRACT

Didwana lake is the second largest saltwater lakes in Rajasthan, considered for its commercial salt production. The lake and its catchment area exhibit a diverse array of biological life. A thorough analytical investigation was conducted to evaluate current status of zooplanktonic fauna and their conservation. This study reveals that saline lakes host a variety of zooplankton fauna for fisheries point of view, which are classified within the group protozoa, rotifera, cladocera and copepoda arthropods. Zooplankton taxa were documented in Didwana lake from January to December 2018. The research area was visited every month for collection the samples. The water samples were collected by standard bolting silk plankton net (0.25 mm mesh size). Concentrated zooplankton samples were taken from two different sites and initially examined in C.Z. inverted microscope to determine the species. During the study, numerous species belonging to genus namely *Nebela, Amoeba, Paramecium, Artemia, Moina, Bosmina, Ceriodaphnia, Daphnia, Chydorous, Heliodiaptomus, Mesocyclops, Eucyclops, Brachionus, Keratella, Monostyla, Polyarthra, Hexarthra* and *Filinia* were reported. A total 22 species of zooplankton were identified. *Artemia, Moina* and *Brachionus* species are prevalent in all zooplankton, whereas *Filinia longiseta* species are rare. The abundance exhibited an increase in sub saline and hyposaline water, whereas it was diminished in meso- and hypersaline water.

Key words: Abundance, Aquatic environment, Didwana playa, Saline lake, Zooplanktonic fauna.

Zooplankton are tiny animals that live near the surface of aquatic environments. They play an important role in the aquatic food web, nutrient cycling and carbon sequestration. (Fernandez, 2014; Heneghan *et al.,* 2016; Lomatire *et al.,* 2021). They are important components of the holistic ecosystem evaluations because they play an intermediary function in the food chain, connect the food chain to higher trophic levels (Kovalev *et al.,* 1999). Zooplanktons are a valuable tool for assessing and monitoring the ecological integrity of aquatic systems (Benedetti *et al.,* 2018; Meena, 2022). Zooplankton provide healthy nourishment for marine aquatic larvae and other creatures (Siddika *et al.,* 2012). They are nutritionally valuable with proteins, minerals, fatty acids and lipids (Khan *et al.,* 2025). Their vital rates vary greatly according to species (Hirst, 2017).

Marine lakes have hypersaline environments that frequently have strong UV radiation, low oxygen concentrations and high alkalinity (Norton *et al.,* 2020). The Didwana lake is natural saline inland water reservoir and situated in town of Didwana in the Rajasthan. It has an arid climate with little precipitation. In summer, the average temperature goes beyond 40°C, while in winter, it drops to 10°C. The Aravalli Hills encircle this saltpan on three sides, while the heavily populated town of Didwana occupies the fourth. In the eastern Thar Desert, this is the second-largest playa. The migratory birds from North Asia and Siberia, including flamingos, falcons and other winter avifauna, gather to Didwana lake every year. The lake provides unique weather conditions and food sources for winter avifauna. The biodiversity of a saline lake is typical of harsh ambient climate conditions. Many physiochemical characteristics influence the lake's biodiversity, including PH, temperature, salinity, chloride content, iron content and oxygen solubility (Williams, 1998). The lake has recently been under great anthropogenic pressure and is becoming increasingly contaminated as a result of city trash.

The water level of lake Didwana has dropped dramatically as a result of silt deposition on the lake bed, reducing the lake's bed depth. Many researchers are showed interest in Salt lakes study in the past and investigations have been carried out for the physical-chemical parameters and zooplankton of saline lakes (Kavindra *et al.,* 2020; Sahni *et al.,* 2011; Srivastava *et al.,* 2009; Rajkumar 2005, Mali *et al.,* 2023). The current study was conducted to analyse the zooplankton species in Didwana saline Lake.

Study area

The Didwana lake is a natural saline playa in Didwana city (Fig 1). The ecosystem of lake Didwana is between 26°24′-

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27°42′N 73°04′-75°22′E coordinates. It is situated 70 km west from Sambhar lake in Didwana-Kuchaman district of Rajasthan. This lake is 6.5 km long and 2.5 km wide, with saline water covering an area of 16.5 km^2 with an average depth of 1.0 m. During the rainy season, water fell on the city, filling the lake. A portion of the lake is often used to dump house hold and municipal trash.

Sample collection and Zooplankton analysis

Sampling of the research area was conducted from January to December 2018. For the qualitative study, the water samples were collected in a plastic bucket (10 liters capacity). The zooplanktons were analyzed after being filtered through a standard bolting silk plankton net (0.25 mm mesh size). Concentrated zooplankton samples were taken from two different sites and initially examined in C.Z. inverted microscope to determine the species in Research Laboratory of Department of Zoology, Government Bangur College, Didwana, Rajasthan.

Zooplankton taxa were documented in Didwana lake from January to December 2018. Six zooplankton taxa were identified from the investigated site during the study period. In this study, waters of Didwana lake harbours diverse taxonomic fauna of zooplankton which are represented mainly by protozoans, rotifers, cladocerans, copepods and ostracods.

During the finding, four species of protozoans belonging to four genera were reported. Along with these seven species of rotifers represented by two genera, six species of cladocerans belonging to three genera (Table 1), four species of two genera related to copepods were enlisted. Excluding occasional zooplankters like insects with their larvae, crustacean larvae, spiders, nymph and mites (Table 1), a total twenty-two (22) forms of zooplankters were recorded. Group rotifers had the highest species richness (32%) and diversity followed by Cladocera (27%), Copepoda (18%), Protozoa (14%), Branchiopoda (5%) and Cilliophora (4%) (Fig 2).

The identify protozoan belonged to families Hyalosphenidae, Euglenaceae, Amoebidae, Parameciidae, were represented species diversity include *Nebela collaris, Euglena acur, Amoeba sps* and *Paramecium duboscqui*. Copepods were represented by different forms of calanoids as well as by cyclopoids group. There have been reports of species *Heliodiaptomus viddus, Eucyclop sps, Mesocyclops leuckarti, Nauplii (Larva),* from the family Diaptomidae and Cyclopoidae.

Cladocera is also another most important group of the zooplanktonic fauna. *Moina salina, Bosmina coregoni, Ceriodephnia sps, Daphnia sps, Chydorus sps* and *Diaphanosoma* species from the Cladocera group were represented by the families Daphnidae, Chydoridae, Sididae and Bosminidae and Moinidae. *Moina* and *Daphnia* species were abundant, whereas *Ceriodaphnia* and *Chydorus* had the lowest populations in the survey.

The rotifea group includes seven species such as *Brachionus calyciflorus, Brachionus sps, Keratella sps, Monostyla sps, Polyarthra vulgaris, Hexarthra mira* and *Filinia longiseta*. These species are members of the Lecanidae, Synchaetide, Hexarthridae and Trochosphaeridae families. *Branchionous* species are numerous and abundant in all zooplankton, but *Filinia longiseta* species are rare.

A diverse ecosystem of zooplankton, including cladocera, copepods, rotifers and ostracods, is maintained in saline water bodies of Rajasthan. Protozoans such as *Nebela collaris, Euglena acuta, Amoeba sps* and *Paramecium duboscqui* were found to be prevalent zooplankton in the saline waters of Didwana lake throughout the research. *Nebala* species was most common in saline water of Rajasthan (Chaumal *et al.,* 2020; Durgapal, 2024).

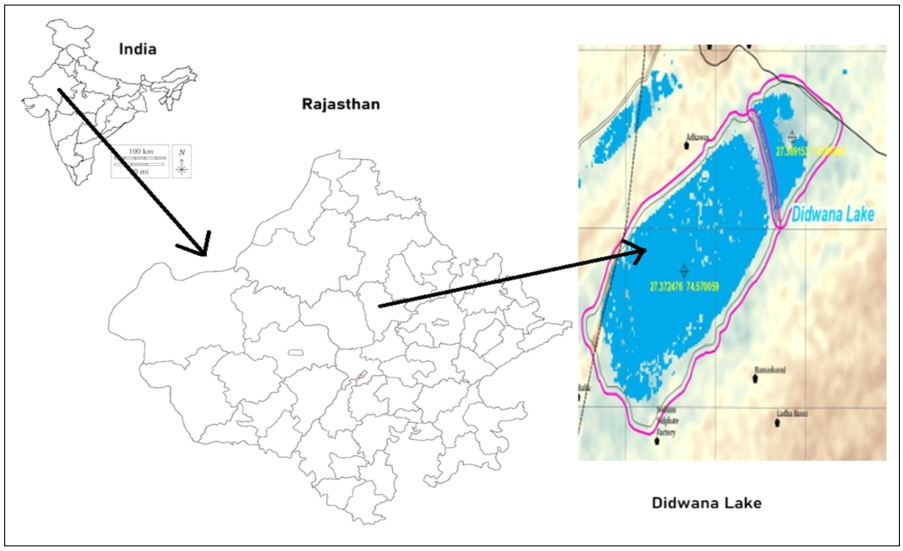


Fig 1: Map showing study area of Didwana lake.

Rotifer genera present in the zooplankton population include *Brachionus calyciflorus, Brachionus sps, Keratella sps, Monostyla sps, Polyarthra vulgaris, Hexarthra mira* and *Filinia longiseta* having high abundance during the investigation. *Brachionus* species populations increased in Sanbhar Lake due to the presence of unialgal phytoplankton in salt water (Bhargava *et al.,* 1987).

Cladocerans are microscopic crustacean zooplankton that live in freshwater habitats, but certain species can tolerate salty conditions. *Moina salina, Bosmina coregoni, Ceriodephnia sps, Daphnia sps, Chydorus sps and Diaphanosoma sps* are among the zooplankton species reported. In Rajasthan, investigations have identified *Daphnia, Bosmina* and *Chydorus* as Cladocera species found in saline water bodies (Jakher *et al.,* 1990). Some Cladocera species are halotolerant or halophilic, they may survive and thrive in salty environments. Their versatility allows them to fill a gap in the ecosystem of salty water.

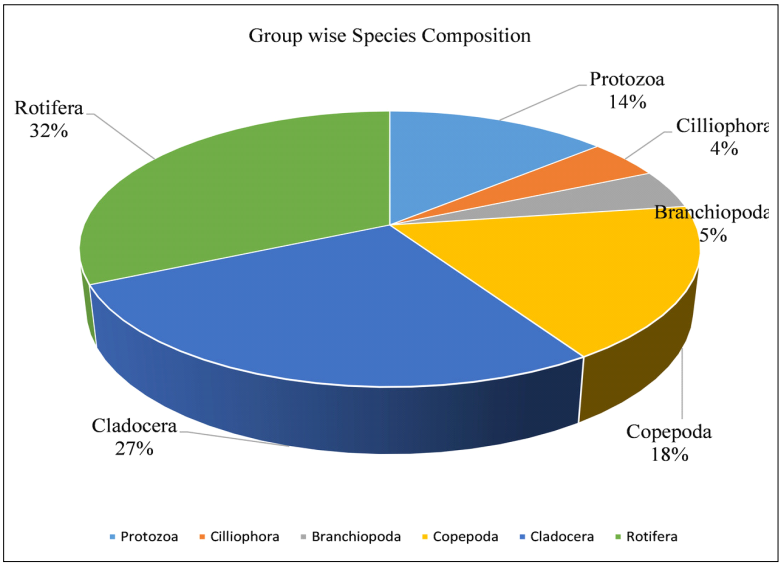


Fig 2: Taxon wise species composition in Didwana Lake.

Table 1: Reported zooplanktonic fauna in Didwana lake from January to December 2018.

Taxa	Order	Family	Species	Site I	Site II
Protozoa	Arcellinida	Hyalosphenidae	*Nebela collaris*	+	+
	Euglenales	Euglenaceae	*Euglena acur*	+	+
	Amoebida	Amoebidae	*Amoeba sps.*	+	+
Cilliophora	Peniculida	Parameciidae	*Paramecium duboscqui*	+	+
Copepoda	Calanoidea	Diaptomidae	*Heliodiaptomus viddus*	+	+
	Cyclopoida	Cyclopoidae	*Eucyclop sps*	+	+
			Mesocyclops leuckarti	+	+
			Nauplii (Larva)	+	+
Branchiopoda	Anostraca	Artemiidae	*Artemia sps*	+	+
Cladocera	Diplostraca	Moinidae	*Moina salina*	+	+
	Anomopoda	Bosminidae	*Bosmina coregoni*	+	+
		Daphniidae	*Ceriodaphnia sps*	-	+
			Daphnia sps	+	+
		Chydoridae	*Chydorus sps*	+	-
	Ctenopoda	Sididae	*Diaphanosoma sps*	+	+
Rotifera	Ploina	Brachionidae	*Brachionus calyciflorus*	+	+
			Brachionus sps	+	+
			Keratella sps	+	+
		Lecanidae	*Monostyla sps*	+	+
		Synchaetide	*Polyarthra vulgaris*	+	+
	Flosculariaceae	Hexarthridae	*Hexarthra mira*	+	+
		Trochosphaeridae	*Filinia longiseta*	+	+

In Didwana lake, where the salinity ranged from 15 to 288%, *Artemia* was the dominant zooplankter and other zooplankters like *Moina, Cyclops* and *Brachionus* flourished at lower salinity levels (Jakher *et al.,* 1990). The same report was investigated during the study, in which several *Artemia* zooplankter were noted. Didwana Lake is of particular relevance since it is the only natural inland biotope of the brine 246 shrimp *Artemia* in India (Bhargava *et al*., 1987a) and *Artemia* is well regarded as a high-quality live food in aquaculture (Jakher *et al.,* 1990). According to the Murmu *et al.* (2020) genetically modified rohu's lifespan and physiological response are very slightly impacted by salinity exposure, suggesting that the enhanced rohu "Jayanti" may be able to withstand salinity levels of up to 8 ppt. Striped catfish *P. hypophthalmus* has a high growth potential, stress tolerance and balanced physiological activities up to 10 ppt salinity (Lingam *et al.,* 2025).

Numerous factors, like as salinity, temperature, the presence of predators and the availability of nourishment, influence the distribution and abundance of these zooplankton species. Physical and chemical factors alter the planktonic composition, chlorophyll concentration and phytoplankton primary productivity (Jakher *et al.,* 1990). Saline water bodies in Rajasthan support a diverse zooplankton community, including rotifers, copepods and ostracods, in addition to Cladocera. Determining the association between salinity and zooplankton dispersion may be essential for comprehension of how the ecosystem works in the particular context (Yuan *et al.,* 2020). Copepods and cladocerans species are less abundant than rotifers especially *Brachionus sps*. because of their susceptibility to high salinity.

According to Jakher *et al.* (1990), the two most common genera*, Cyclops* and *Brachionus,* are present throughout the salinity range of sambhar lake while in Didwana Lake, at this low salinity, various zooplanktonic forms such as *Moina sps., Cyclops sps., Brachionus sps.* and insect larvae resurfaced. During the study, *Heliodiaptomus viddus, Eucyclop sps, Mesocyclops leuckarti* and *Nauplii* (Larva) were observed at high salinity and *cyclops sps.* were absent. Therefore, key findings emphasize the contributions of these planktonic communities to nutrient cycling, food web dynamics and lake production, as well as the effects of seasonal changes and human pressures like as pollution and eutrophication (Joshi *et al.,* 2024).

Although ostracods are part of the zooplankton community (Table 1), they frequently do not report during investigations. Greater tolerant of saltwater cladocerans could prevail over lesser salt-intolerant ones as a result of freshwater salinization, which might have a significant impact on freshwater communities as well as ecosystems (Huang *et al.,* 2022). The distribution and abundance of these zooplankton species are influenced by various factors, including salinity levels, nutrient availability, temperature and the presence of predators (Mishra *et al.,* 2015; Shivakrishna *et al.,* 2020). According to the estimation, zooplankton in the water have a direct impact on fish diversity, marketing and economics in fish markets (Sit *et al.,* 2001).

CONCLUSION

As a result of this work, it is possible to conclude that zooplankton species constitute an important part of the food chain in saline water of Didwana lake since they feed by fish and other larger species. Further, it is possible that local or migrating aquatic birds prefer to feed on zooplankton at this lake. They also contribute to better water quality and nutrient cycling by consuming phytoplankton and generating nutrients.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

All animal procedures for experiments were approved by the Committee of Experimental Animal care and handling techniques were approved by the University of Animal Care Committee.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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