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Biodiversity of zooplankton in freshwater ecosystems of Rajasthan: A comprehensive review

Rakesh[1*], Nadim Chishty[2]
[1] Research scholar, Department of Zoology, Wildlife, Limnology and Toxicology Research Laboratory, Government Meera Girls College, Mohanlal Sukhadia University, Udaipur, Rajasthan, India
[2] Professor, Department of Zoology, Wildlife, Limnology and Toxicology Research Laboratory, Government Meera Girls College, Mohanlal Sukhadia University, Udaipur, Rajasthan, India

Abstract
The biodiversity of zooplankton in the fresh water ecosystems of Rajasthan reveals the ecological variations of this region. For the aquatic food web and the environment, zooplanktons are important as primary consumers. This study compiles data from several online research papers published between 2001 to 2024 on the distribution and diversity of zooplankton, which include over 273 species belonging to five major groups: Protozoa, Rotifers, Copepods, Cladocerans, and Ostracods. In southern Rajasthan, the most species rich of zooplankton particularly classed to the order Cladocera are *Daphnia* and *Keratella* species, which is common to tropic and subtropic regions. Highly adaptable organisms like *Keratella tropica* and *Daphnia magna* are abundant in the region. The rare forms like *Spicodiaptomus chelospinus* demonstrate the ecological peculiarity of the water bodies. These studies have highlighted the need to amplify the protective measures for zooplankton, and so the freshwater ecosystems.

Keywords: Zooplankton, biodiversity, Rajasthan, distribution, primary consumers, aquatic ecosystem

Introduction

Freshwater ecosystems have undergone major transformations since the past few years due to habitat disturbances which led to extensive ecological changes (Agostinho *et al*., 2009) [1]. Plankton refers to the collection of organisms found within water columns that contain both phytoplankton plants and zooplankton animals. Zooplankton is heterotrophic organisms that drift within the water columns of oceans and freshwater habitats (Brierley, 2017) [4]. The diversity, abundance and composition of zooplankton communities are closely linked to environmental changes (Chesson and Huntly, 1997; Gyllstrom *et al*., 2005) [7]. Studies have consistently demonstrated that zooplankton is crucial indicators of changes in trophic dynamics and lake ecosystems, which are influenced by nutrient concentrations and climatic fluctuations (Caroni *et al*., 2023) [5]. Alterations in the physicochemical parameters of aquatic ecosystems lead to changes in the composition and population of organisms inhabit in these habitats (Wetzel, 2001; Chishty and Choudhary, 2022a & 2022b) [8, 9, 34].

Zooplankton species have short life cycles, and they are prolific reproducers nonetheless. However, the mere assessment of their biomass or density does not assure a comprehensive understanding of their behavioral response to the ecological dynamics and environmental fluctuations (Edmondson, 1974) [12]. Recent investigations put forward the point that diversity availability has a great influence on the biomass and resource utilization in different levels of the trophic web that in turn bring about the most important impacts on ecosystem services such as fisheries, food security, and water purification (Duffy *et al*., 2017) [11].

This study provides a comprehensive overview of the diversity of the zooplankton in the aquatic ecosystems of Rajasthan, the ecological importance of it, and the conservation work to protect the critical organisms and their habitats.

Materials and Methods

This review study aims to prepare a compiling checklist of Zooplankton diversity in Rajasthan state. This has been made undertaking a thorough examination of validated published scientific articles and reliable reports. Only research articles were considered, while grey literature and newspaper articles were excluded. Rajasthan is a driest and largest (3, 42,239 km^2) state of India. It is known for arid and semi-arid landscapes with freshwater ecosystems disperse across the region. As per "National Wetland Decadal Change Atlas, 2017" published by the Space Application Centre of ISRO. Rajasthan has an estimated wetland area of 778824 hectors, constituting approximately 4.87% of the country's total wetland area (https://pib.gov.in/PressReleseDetailm.aspx?PRID=1913469&reg=3&lang=1).

In this review, we have incorporated various studies published on zooplankton diversity in the Rajasthan region from 2001 to 2024.

Results and Discussion

Table 1: Group-wise Diversity of Zooplankton in Rajasthan, India

S. No.	Common Name and Group of Zooplankton	Location Region of Rajasthan	References
Protozoan			
1.	*Volvox*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
2.	*Euglena acur*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Shwetanshumala and Sharma

			(2020)
3.	*Euglena spirogyra*	Southern	Vijayvergiya *et al*. (2020) [31]
4.	*Euglena spp*.	Southern & Western	Rawat and Jakher (2005) [20]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
5.	*Euglenacus*	Southern	Vijayvergiya *et al*. (2020) [31]
6.	*Amoeba sp*.	Southern & Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26] Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Yadav *et al*. (2019) [35]; Shwetanshumala and Sharma (2020)
7.	*Amoeba verrucosa*	Southern	Vijayvergiya *et al*. (2020) [31]
8.	*Amoeba proteus*	Southern	Vijayvergiya *et al*. (2020) [31]
9.	*Arcella spp.*	Central, Southern & Northern	Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Sharma *et al*. (2010a) [25]; Bishnoi and Sharma (2016) [3]; Mishra *et al*. (2019) [17]; Yadav *et al*. (2019) [35]
10.	*Arcella gibboosa*	Southern	Vijayvergiya *et al*. (2020) [31]
11.	*Arcella discoida*	Southern& Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Shwetanshumala and Sharma (2020); Nama and Dhanraj (2019) [10]
12.	*Arcella mitrata*	Southern	Naruka (2017) [18]
13.	*Difflugia spp.*	Southern & Western	Sharma *et al*. (2010a) [25]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Shwetanshumala and Sharma (2020)
14.	*Difflugia lobostoma*	Southern	Vijayvergiya *et al*. (2020) [31]
15.	*Difflugia pyriformis*	Southern	Vijayvergiya *et al*. (2020) [31]
16.	*Paramecium sp.*	Central & Southern	Rawat and Jakher (2005) [20]; Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Mishra *et al*. (2019) [17]; Yadav *et al*. (2019) [35]; Shwetanshumala and Sharma (2020);
17.	*Paramecium aurelia*	Southern	Vijayvergiya *et al*. (2020) [31]
18.	*Paramecium bursaria*	Southern	Vijayvergiya *et al*. (2020) [31]
19.	*Paramecium caudatum*	Southern	Sharma *et al*. (2010b) [23]; Vijayvergiya *et al*. (2020) [31]
20.	*Prodon edentates*	Southern	Vijayvergiya *et al*. (2020) [31]
21.	*Peridinium spp.*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Naruka (2017) [18]
22.	*Phacus spp.*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
23.	*Platyophrya vorax*	Southern	Naruka (2017) [18]
24.	*Astramoeba radiosa*	Southern	Balai *et al*. (2014) [2]; Shwetanshumala and Sharma (2020)
25.	*Centripyxis spp.*	Southern	Sharma *et al*. (2010a) [25]
26.	*Centropyxis aculeate*	Southern	Balai *et al*. (2014) [2]; Naruka (2017) [18]
27.	*Centropyxis hemisphaerica*	Southern	Balai *et al*. (2014) [2]
28.	*Centropyxis ecornis*	Southern	Balai *et al*. (2014) [2]; Shwetanshumala and Sharma (2020);
29.	*Trinema spp*	Southern	Balai *et al*. (2014) [2]; Shwetanshumala and Sharma (2020)
30.	*Actinolophus spp*	Southern	Balai *et al*. (2014) [2]
31.	*Actinospharerium sp*	Southern	Naruka (2017) [18]
32.	*Actinophrys spp.*	Southern	Naruka (2017) [18]
33.	*Didinium spp.*	Southern	Mishra *et al*. (2019) [17]
34.	*Vorticella spp.*	Central, Southern, Western	Rawat and Jakher (2005) [20]; Sharma *et al*. (2012b) [26]; Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Yadav *et al*. (2019) [35]; Vijayvergiya *et al*. (2020) [31]
35.	*Vorticella campanula*	Southern	Vijayvergiya *et al*. (2020) [31]
36.	*Vorticella microstoma*	Southern	Vijayvergiya *et al*. (2020) [31]
37.	*Ceratium hirudinella*	Southern	Vijayvergiya *et al*. (2020) [31]
38.	*Chlamydomonas spp.*	Southern	Vijayvergiya *et al*. (2020) [31]
39.	*Clathrulina elegans*	Southern	Vijayvergiya *et al*. (2020) [31]
40.	*Coleps hirtus*	Southern	Vijayvergiya *et al*. (2020) [31]
41.	*Colpoda aspera*	Southern	Vijayvergiya *et al*. (2020) [31]
42.	*Colpoda inflata*	Southern	Vijayvergiya *et al*. (2020) [31]
43.	*Cyclidium glaucoma*	Southern, Central	Sharma *et al*. (2010b) [23]; Vijayvergiya *et al*. (2020) [31]
44.	*Dileptus anser*	Southern	Vijayvergiya *et al*. (2020) [31]
45.	*Frontonia bursaria*	Southern	Vijayvergiya *et al*. (2020) [31]
46.	*Trachelomonas*	Southern	Vijayvergiya *et al*. (2020) [31]
47.	*Oxytricha spp.*	Southern	Sharma *et al*. (2010a) [25]
48.	*Oxytricha ovalis*	Central	Sharma *et al*. (2010b) [23]
49.	*Oxytricha oblongatus*	Central	Sharma *et al*. (2010b) [23]
50.	*Holophyra simplex*	Central	Sharma *et al*. (2010b) [23]
51.	*Euglypha spp.*	Southern	Sharma *et al*. (2010a) [25]
52.	*Oppercularis spp.*	Southern	Sharma *et al*. (2010a) [25]
53.	*Nebala spp.*	Southern	Naruka (2017) [18]
54.	*Frontoniella spp.*	Southern	Naruka (2017) [18]
Rotifers			
55.	*Keratella spp*.	Central, Southern, Northern & Western	Rawat and Jakher (2005) [20]; Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Sharma *et al*. (2010); Balai *et al*. (2014) [2]; Bishnoi and Sharma (2016) [3]; Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Yadav *et al*. (2019); Kumar and Sharma (2022) [16]
56.	*Keratella cochlearis*	Southern Rajasthan	Chandrasekhar (2010) [6]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Sharma *et al*. (2016) [24]; Parmar *et al*. (2018) [19]; Shwetanshumala and Sharma (2020)

57.	*Keratella quadrata*	Southern	Balai *et al*. (2014) [2]
58.	*Keratella hiemalis*	Southern	Balai *et al*. (2014) [2]; Yadav *et al*. (2019) [35]
59.	*Keratella valga*	Southern	Balai *et al*. (2014) [2]; Sharma *et al*. (2016) [24]
60.	*Keratella canadensis*	Southern	Balai *et al*. (2014) [2]
61.	*Keratella lielmalis*	Banswara	Yadav *et al*. (2019) [35]
62.	*Keratella tropica*	Eastern, Central, Southern & Western	Chandrasekhar (2010) [6]; Sharma *et al*. (2010b) [23]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Shrimali and Dashora (2014) [27]; Vyas and Chouhan (2017) [33]; Parmar *et al*. (2018) [19]; Nama and Dhanraj (2019) [10]; Vijayvergiya *et al*. (2020) [31]
63.	*Keratella porcurva*	Central & Southern	Sharma *et al*. (2010b) [23]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]
64.	*Brachionus spp.*	Western, Central, Southern & Northern	Rawat and Jakher (2005) [20]; Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Sharma *et al*. (2010a) [25]; Balai *et al*. (2014) [2]; Bishnoi and Sharma (2016) [3]; Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Yadav *et al*. (2019) [35]; Kumar and Sharma (2022) [16]
65.	*Brachionus plicatilis*	Southern	Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Shrimali and Dashora (2014) [27]
66.	*Brachionus calyciflorus*	Eastern, Southern & Western	Chandrasekhar (2010) [6]; Sharma *et al*. (2010b) [23]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Shrimali and Dashora (2014) [27]; Sharma *et al*. (2016) [26]; Vyas and Chouhan (2017) [33]; Parmar *et al*. (2018) [19]; Nama and Dhanraj (2019) [10]; Shwetanshumala and Sharma (2020)
67.	*Brachionus havanaensis*	Southern	Balai *et al*. (2014) [2]
68.	*Brachionus falcatus*	Eastern, Western & Southern	Chandrasekhar (2010) [6]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Vyas and Chouhan (2017) [33]; Parmar *et al*. (2018) [19]; Nama and Dhanraj (2019) [10]; Shwetanshumala and Sharma (2020)
69.	*Brachionus angularis*	Eastern & Southern	Chandrasekhar (2010) [6]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Shrimali and Dashora (2014) [27]; Parmar *et al*. (2018) [19]
70.	*Brachionus diversicornis*	Southern & Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]
71.	*Brachionus quadridentatus*	Eastern, Southern & Western	Chandrasekhar (2010) [6]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]
72.	*Brachionus forticula*	Central & Southern	Sharma *et al*. (2010b) [23]; Sharma *et al*. (2012b) [26]; Vijayvergiya *et al*. (2020) [31]
73.	*Brachionus caudatus*	Southern & Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]; Parmar *et al*. (2018) [19]
74.	*Branchionus rubens*	Southern	Sharma *et al*. (2012b) [26]
75.	*Brachionus bidentata*	SouthernNorthern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2016) [24]
76.	*Brachionus bidentatus*	Southern	Shrimali and Dashora (2014) [27]
77.	*Brachionus quadridentata*	Southern	Shrimali and Dashora (2014) [27]; Parmar *et al*. (2018) [19]
78.	*Cephalodella mucronata*	Southern	Riddhi *et al*. (2011) [21]
79.	*Cephalodella exigua*	Southern	Riddhi *et al*. (2011) [21]
80.	*Lepadella ovalis*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
81.	*Lepadella patella*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
82.	*Lopocharis salpina*	Southern	Riddhi *et al*. (2011) [21]
83.	*Anuraeopsis fissa*	Eastern Southern	Chandrasekhar (2010) [6]; Sharma *et al*. (2012b) [26]
84.	*Monostyla lunaris*	SouthernNorthern	Sharma *et al*. (2012b) [26]; Sharma *et al*. (2016) [24]
85.	*Monostyla closterocerca*	SouthernWestern	Balai *et al*. (2014) [2]; Nama and Dhanraj (2019) [10]
86.	*Monostyla quadridentata*	SouthernNorthern	Riddhi *et al*. (2011) [21]; Balai *et al*. (2014) [2]; Sharma *et al*. (2016) [24]
87.	*Monostyla bulla*	Southern	Sharma *et al*. (2012b) [26]; Vijayvergiya *et al*. (2020) [31]
88.	*Monostyla spp.*	Southern	Mishra *et al*. (2019) [17]; Shwetanshumala and Sharma (2020)
89.	*Monostyla punctata*	Southern	Naruka (2017) [18]
90.	*Monostyla hemata*	Southern	Naruka (2017) [18]
91.	*Mytilina spp.*	Southern	Balai *et al*. (2014) [2]
92.	*Mytilina ventralis*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
93.	*Notholca spp.*	Southern	Mishra *et al*. (2019) [17]
94.	*Filinia longiseta*	Eastern, Southern, Northern & Western	Chandrasekhar (2010) [6]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Sharma *et al*. (2016) [24]; Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Yadav *et al*. (2019) [35]; Vijayvergiya *et al*. (2020) [31]
95.	*Filinia spp.*	Central, Northern & Southern	Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Sharma *et al*. (2010); Bishnoi and Sharma (2016) [3]; Parmar *et al*. (2018) [19]; Shwetanshumala and Sharma (2020); Kumar and Sharma (2022) [16]
96.	*Filinia terminalis*	Southern, Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Nama and Dhanraj (2019) [10]
97.	*Filinia tetramatris*	Southern	Riddhi *et al*. (2011) [21]
98.	*Filinia opoliensis*	Southern	Sharma *et al*. (2012b) [26]
99.	*Filinia brachiata*	Southern	Naruka (2017) [18]
100	*Testudinella patina*	Southern	Riddhi *et al*. (2011) [21]
101	*Testudinella spp.*	Western & Southern	Vyas and Chouhan (2017) [33]; Mishra *et al*. (2019) [17]; Kumar and Sharma (2022) [16]
102	*Horella mira*	Southern	Riddhi *et al*. (2011) [21]; Naruka (2017) [18]
103	*Horella brechmi*	Eastern	Vyas and Chouhan (2017) [33]
104	*Lopocharis salpina*	Southern	Riddhi *et al*. (2011) [21]

105	*Trichotria tetractis*	Southern	Riddhi *et al*. (2011) [21]
106	*Trichotria similis*	Southern	Riddhi *et al*. (2011) [21]
107	*Lecane luna*	Southern	Riddhi *et al*. (2011) [21]
108	*Lecane depressa*	Southern	Riddhi *et al*. (2011) [21]
109	*Lecane papuana*	Southern	Naruka (2017) [18]
110	*Lecane similis*	Southern	Naruka (2017) [18]
111	*Lecane decipience*	Eastern	Vyas and Chouhan (2017) [33]
112	*Lecane cornuta*	Eastern	Vyas and Chouhan (2017) [33]
113	*Lecane ohioensis*	Eastern	Vyas and Chouhan (2017) [33]
114	*Lecane monostyla*	Eastern	Vyas and Chouhan (2017) [33]
115	*Conochilius arborius*	Southern	Sharma *et al*. (2012b) [26]; Naruka (2017) [18]
116	*Asplanchna spp.*	Central & Southern	Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Yadav *et al*. (2019) [35]; Shwetanshumala and Sharma (2020)
117	*Asplanchna herricki*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
118	*Asplanchna brightwelli*	Southern & Eastern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]
119	*Asplanchna priodonta*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Shrimali and Dashora (2014) [27]
120	*Hexarthra mira*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
121	*Hexarthra spp.*	Southern	Mishra *et al*. (2019) [17]; Kumar and Sharma (2022) [16]
122	*Philodina spp.*	Southern& Central	Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Vijayvergiya *et al*. (2020) [31]
123	*Philodina citrina*	Southern	Riddhi *et al*. (2011) [21]
124	*Polyarthra vulgaris*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
125	*Polyarthra appendiculata*	Southern	Sharma *et al*. (2012b) [26]
126	*Polyarthra spp.*	Southern	Mishra *et al*. (2019) [17]; Kumar and Sharma (2022) [16]
127	*Tricocera rattus*	Southern	Shrimali and Dashora (2014) [27]
128	*Tricocera spp.*	Western & Southern	Vyas and Chouhan (2017) [33]; Mishra *et al*. (2019) [17]; Shwetanshumala and Sharma (2020); Kumar and Sharma (2022) [16]
129	*Tricocerca cylindrico*	Southern	Riddhi *et al*. (2011) [21]
130	*Tricocerca longiseta*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
131	*Tricocera polyporum*	Southern	Naruka (2017) [18]
132	*Platyias spp.*	Southern	Balai *et al*. (2014) [2]; Mishra *et al*. (2019) [17]
133	*Platyias quadricornis*	Southern	Riddhi *et al*. (2011) [21]
134	*Platyias patulus*	Southern	Sharma *et al*. (2012b) [26]
135	*Anuraeopsis fissa*	Southern	Riddhi *et al*. (2011) [21]
136	*Ascomorpha Saltans*	Eastern	Singh (2015) [29]
137	*Rotaria spp.*	Southern	Mishra *et al*. (2019) [17]; Kumar and Sharma (2022) [16]
138	*Rotaria vulgaris*	Southern	Vijayvergiya *et al*. (2020) [31]
139	*Filidina*	Southern	Parmar *et al*. (2018) [19]
140	*Plationus patulus*	Western	Vyas and Chouhan (2017) [33]
141	*Gastropus*	Southern	Kumar and Sharma (2022) [16]
		Copepods	
142	*Allodiaptomus raoi*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Vijayvergiya *et al*. (2020) [31]
143	*Diaptomus spp.*	Central, Southern& Western	Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Balai *et al*. (2014) [2]; Parmar *et al*. (2018) [19]; Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Yadav *et al*. (2019) [35]; Vijayvergiya *et al*. (2020) [31]; Sankhla and Nama (2020); Shwetanshumala and Sharma (2020); Kumar and Sharma (2022) [16]
144	*Pseudodiaptomus*	Southern	Shrimali and Dashora (2014) [27]
145	*Heliodiaptomus viddus*	Southern	Riddhi *et al*. (2011) [21]
146	*Helicyclops spp.*	Southern	Balai *et al*. (2014) [2]; Mishra *et al*. (2019) [17]
147	*Phyllodiaptomus annae*	Southern	Riddhi *et al*. (2011) [21]; Vijayvergiya *et al*. (2020) [31]
148	*Filipinodiaptomus insulanus*	Southern	Shrimali and Dashora (2014) [27]
149	*Rhinediaptomus*	Southern	Riddhi *et al*. (2011) [21]
150	*R. indicus*	Southern	Vijayvergiya *et al*. (2020) [31]
151	*Neodiaptomus spp.*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Vijayvergiya *et al*. (2020) [31]
152	*Neodiaptomus schmackeri*	Central & Southern	Sharma *et al*. (2010b) [23]; Vijayvergiya *et al*. (2020) [31]
153	*Cyclops leuckarti*	Southern, Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Sankhla and Nama (2020)
154	*Cyclops spp.*	Western, Central & Southern	Rawat and Jakher (2005) [20]; Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Sharma *et al*. (2010); Parmar *et al*. (2018) [19]; Nama and Dhanraj (2019) [10]; Mishra *et al*. (2019) [17]; Yadav *et al*. (2019) [35]; Kumar and Sharma (2022) [16]
155	*Cyclops sternus*	Eastern	Sankhla and Nama (2020)
156	*Eucyclops spp.*	Central, Western & Southern	Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Balai *et al*. (2014) [2]; Nama and Dhanraj (2019) [10]; Mishra *et al*. (2019) [17]; Sankhla and Nama (2020); Shwetanshumala and Sharma (2020);
157	*Eucyclops agilis*	Southern	Sharma *et al*. (2012b) [26]
158	*Eucyclops speratus*	Southern	Naruka (2017) [18]
159	*Eucyclops serrulatus*	Southern	Shrimali and Dashora (2014) [27]
160	*Mesocylops hyalinus*	Central & Southern	Sharma *et al*. (2010b) [23]; Riddhi *et al*. (2011) [21]; Vijayvergiya *et al*. (2020) [31];

			Shrimali and Dashora (2014) [27]
161	*Mesocyclops spp.*	Central, Western & Southern	Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Sharma *et al*. (2010); Balai *et al*. (2014) [2]; Mishra *et al*. (2019) [17]; Yadav *et al*. (2019) [35]; Sankhla and Nama (2020); Shwetanshumala and Sharma (2020);
162	*Paracyclops affinis*	Southern	Riddhi *et al*. (2011) [21]
163	*Microcyclops bicolor*	Southern	Riddhi *et al*. (2011) [21]
164	*Microcyclops varicans*	Southern	Shrimali and Dashora (2014) [27]
165	*Mesocyclops leuckartii*	Eastern & Southern	Sharma *et al*. (2010b) [25]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Shrimali and Dashora (2014) [27]; Singh (2015) [29];
166	*M. strenuous*	Southern	Vijayvergiya *et al*. (2020) [31]
167	*Nauplii*	Southern Western	Riddhi *et al*. (2011) [21]; Mishra *et al*. (2019) [17]; Sankhla and Nama (2020); Kumar and Sharma (2022) [16]
168	*Thermocyclops neglectus*	Eastern	Singh (2015) [27]
169	*Canthocampus spp.*	Southern	Mishra *et al*. (2019) [17]; Yadav *et al*. (2019) [35]; Kumar and Sharma (2022) [16]
170	*Spicodiaptomuschelospinus*	Southern	Vijayvergiya *et al*. (2020) [31]
171	*Trophocyclops prascinus*	Southern	Shrimali and Dashora (2014) [27]
		Cladocerans	
172	*Daphnia spp.*	Central, Western, & Southern	Rawat and Jakher (2005) [20]; Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Sharma *et al*. (2010); Parmar *et al*. (2018) [19]; Mishra *et al*. (2019) [17]; Yadav *et al*. (2019) [35]; Nama and Dhanraj (2019) [10]; Shwetanshumala and Sharma (2020); Kumar and Sharma (2022) [16]
173	*Daphnia carinata*	Southern & Western	Sharma *et al*. (2012b) [26]; Shrimali and Dashora (2014) [27]; Nama and Dhanraj (2019) [10]; Vijayvergiya *et al*. (2020) [31]; Sankhla and Nama (2020)
174	*Daphnia lumholtzi*	Eastern & Southern	Chandrasekhar (2010) [6]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Sharma *et al*. (2012b) [26]; Vijayvergiya *et al*. (2020) [31]
175	*Daphnia pulex*	Southern & Western	Sharma *et al*. (2012a); Balai *et al*. (2014) [2]; Nama and Dhanraj (2019) [10]; Sankhla and Nama (2020)
176	*Daphnia dubia*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
177	*Daphnia magna*	Southern	Sharma *et al*. (2012b) [26]
178	*Daphnia ambigua*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
179	*Daphnia longiremia*	Southern	Balai *et al*. (2014) [2]
180	*Diaphanosoma leuchtenbergianum*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Sharma *et al*. (2012b) [25]
181	*Sida crystalline*	Southern	Sharma *et al*. (2012b) [26]
182	*Sida spp.*	Southern	Mishra *et al*. (2019) [17]; Kumar and Sharma (2022) [16]
183	*Diaphanosoma spp.*	Southern & Western	Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Vijayvergiya *et al*. (2020) [31]; Kumar and Sharma (2022) [16]
184	*Diaphanosoma brachyurum*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Sharma *et al*. (2012b) [26]
185	*Diaphanosoma excisum*	Southern, Western	Shrimali and Dashora (2014) [27]; Vyas and Chouhan (2017) [33]
186	*Diaphanosoma sarsi*	Southern, Western	Naruka (2017); Vyas and Chouhan (2017) [33]
187	*Diaphanosoma sengal*	Western	Vyas and Chouhan (2017) [33]
188	*Moina spp.*	Central, Western, Northern, & Southern	Rawat and Jakher (2005) [20]; Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Sharma *et al*. (2010); Bishnoi and Sharma (2016) [3]; Parmar *et al*. (2018) [19]; Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Yadav *et al*. (2019) [35]; Shwetanshumala and Sharma (2020); Kumar and Sharma (2022) [16]
189	*Moina dubia*	Western	Sankhla and Nama (2020)
190	*Moina micrura*	Southern & Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Sharma *et al*. (2012b) [26]; Shrimali and Dashora (2014) [27]; Vyas and Chouhan (2017) [33]
191	*Moina hutchinsoni*	Southern	Sharma *et al*. (2012b) [26]
192	*Moina macrocopa*	Southern, Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Sharma *et al*. (2012b) [26]; Sankhla and Nama (2020)
193	*Moina rectirostris*	Southern	Sharma *et al*. (2012b) [26]
194	*Moina brachiata*	Southern	Sharma *et al*. (2012b) [26]
195	*Moina rosea*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
196	*Bosminopsis deitersi*	Southern	Sharma *et al*. (2012b) [26]
197	*Bosmina spp.*	Northern, Southern, Western	Bishnoi and Sharma (2016) [3]; Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Yadav *et al*. (2019) [35]; Kumar and Sharma (2022) [16]
198	*Bosmina coregoni*	Southern, Western	Sharma *et al*. (2012a); Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Sankhla and Nama (2020)
199	*Bosmina longirostris*	Southern & Western	Riddhi *et al*. (2011) [21]; Balai *et al*. (2014) [2]; Shrimali and Dashora (2014) [27]; Vyas and Chouhan (2017) [33]; Shwetanshumala and Sharma (2020);
200	*Bosmina fatalis*	Southern	Shrimali and Dashora (2014) [27]
201	*Simocephalus spp.*	Central & Southern	Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Mishra *et al*. (2019) [17]; Kumar and Sharma (2022) [16]
202	*Simocephalus exspinosus*	Southern	Sharma *et al*. (2012b) [26]
203	*Simocephalus vetulus*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Sharma *et al*. (2012b) [26]

204	*Simocephalus serrulatus*	Southern	Sharma *et al*. (2012b) [26]
205	*Scapholebris spp.*	Southern	Vijayvergiya *et al*. (2020) [31]
206	*Scapholebris kingi*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Shwetanshumala and Sharma (2020)
207	*Scapholebris aurita*	Southern	Sharma *et al*. (2012b) [26]
208	*Macrothrix spp.*	Southern	Sharma *et al*. (2010a) [25]; Mishra *et al*. (2019) [17]; Kumar and Sharma (2022) [16]
209	*Macrothrix rosea*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
210	*Macrothrix laticornis*	Southern	Sharma *et al*. (2012a); Vyas and Chouhan (2017) [33]
211	*Macrothrix spinosa*	Southern	Shrimali and Dashora (2014) [27]
212	*Macrothrix hirsuticorni*	Southern Rajasthan	Sharma *et al*. (2012b) [26]
213	*Macrothrix goeldii*	Southern, Western	Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]
214	*Acantholeberiscurvirostris*	Southern	Sharma *et al*. (2012b) [26]
215	*Anchistropus minor*	Southern	Sharma *et al*. (2012b) [26]
216	*Leydigia*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
217	*Leydigia quadrangularis*	Southern	Sharma *et al*. (2012b) [26]
218	*Leydigia acanthocercoides*	Southern	Sharma *et al*. (2012b) [26]
219	*Oxyurella tenuicaudis*	Southern	Sharma *et al*. (2012b) [26]
220	*Oxyurella longicaudis*	Southern	Sharma *et al*. (2012b) [26]
221	*Pleuroxus hamulatus*	Southern	Sharma *et al*. (2012b) [26]
222	*Pleuroxus trigonellus*		Balai *et al*. (2014) [2];
223	*Pleuroxus aduncus*	Southern, Western	Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]
224	*Pleuroxus similis*	Southern	Naruka (2017) [18]
225	*Pseudochydorus globosus*	Southern	Sharma *et al*. (2012b) [26]
226	*Chydorus spp.*	Southern & Western	Balai *et al*. (2014) [2]; Mishra *et al*. (2019) [17]; Sankhla and Nama (2020); Shwetanshumala and Sharma (2020)
227	*Chydorus faviformis*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Sharma *et al*. (2012b) [26]
228	*Chydorus gibbus*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
229	*Chydorus ovalis*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2]; Shwetanshumala and Sharma (2020)
230	*Chydorus sphaericus*	Southern Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]
231	*Chydorus bicornutus*	Southern	Sharma *et al*. (2012b) [26]
232	*Chydorus globosus*	Southern	Riddhi *et al*. (2011) [21]
233	*Chydorus ventricosus*	Southern	Shrimali and Dashora (2014) [27]
234	*Ceriodaphnia laticaudata*	Southern Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]
235	*Ceriodaphnia reticulate*	Southern	Sharma *et al*. (2012b) [26]; Vijayvergiya *et al*. (2020) [31]; Shwetanshumala and Sharma (2020)
236	*Ceriodaphnia quadrangula*	Southern Western	Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]
237	*Ceriodaphnia cornuta*	Southern Western	Sharma *et al*. (2012b) [26]; Shrimali and Dashora (2014) [27]; Vyas and Chouhan (2017) [33]
238	*Ceriodaphnia acanthina*	Central & Southern	Chandrasekhar (2010) [6]; Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
239	*Ceriodaphnia pulchella*	Southern Western	Sharma *et al*. (2012b) [26]; Vyas and Chouhan (2017) [33]
240	*Ceriodaphnia rigaudi*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
241	*Ceriodaphnia lacustris*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
242	*Ceriodaphnia spp.*	Central, Western & Southern	Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Sharma *et al*. (2010a) [25]; Parmar *et al*. (2018) [19]; Nama and Dhanraj (2019) [10]; Shwetanshumala and Sharma (2020)
243	*Alona spp.*	Western Southern	Nama and Dhanraj (2019) [10]; Sankhla and Nama (2020); Shwetanshumala and Sharma (2020)
244	*Alona pulchella*	Southern	Naruka (2017) [18]
245	*Alona intermedia*	Southern	Sharma *et al*. (2012a)
246	*Alona quadrangularis*	Southern	Sharma *et al*. (2012a); Shrimali and Dashora (2014) [27]
247	*Alonamacrocopa*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
248	*Alona affinis*	Southern	Sharma *et al*. (2012a)
249	*Alona avidi punctata*	Western	Vyas and Chouhan (2017) [33]
250	*Alona guttata*	Southern	Sharma *et al*. (2012a)
251	*Alona karau*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]; Balai *et al*. (2014) [2];
252	*Alona rectengula*	Eastern, Western, Southern	Chandrasekhar (2010) [6]; Shrimali and Dashora (2014) [27]; Vyas and Chouhan (2017) [33]
253	*Alona verrucosa*	Southern	Shrimali and Dashora (2014) [27]
254	*Alonella spp.*	Southern & Western	Balai *et al*. (2014) [2]; Mishra *et al*. (2019) [17]; Nama and Dhanraj (2019) [10]; Sankhla and Nama (2020); Shwetanshumala and Sharma (2020)
255	*Alonella nana*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
256	*Alonella excisa*	Southern	Sharma *et al*. (2012b) [26]
257	*Alona globosa*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
258	*Alona dentifera*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012b) [26]
259	*Alonella diaphana*	Southern	Sharma *et al*. (2012b) [26]

260	*Alonella destifera*	Southern	Naruka (2017) [18]
261	*Coronatella rectangula*	Southern	Sharma *et al*. (2012b) [26]
262	*Conochilius arborius*	Southern	Sharma *et al*. (2012b) [26]
263	*Oxyurella tenuicaudis*	Southern	Naruka (2017) [18]
264	*Oxyurella spp.*	Southern	Naruka (2017) [18]
265	*Holopedium gibberum*	Southern	Balai *et al*. (2014) [2]
266	*Karualona karua*	Southern	Sharma *et al*. (2012b) [26]
Ostrocods			
267	*Cyprinotus spp.*	Southern	Parmar *et al*. (2018) [19]
268	*Stenocypris spp.*	Southern Western	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Parmar *et al*. (2018) [19]; Sankhla and Nama (2020)
269	*Cypris spp.*	Central, Western & Southern	Rawat and Jakher (2005) [20]; Khanna and Yadav (2009) [15]; Sukhija (2010) [30]; Parmar *et al*. (2018) [19]; Nama and Dhanraj (2019) [10]; Vijayvergiya *et al*. (2020) [31]; Sankhla and Nama (2020); Shwetanshumala and Sharma (2020)
270	*Cyclocypria spp.*	Southern, Western	Riddhi *et al*. (2011) [21]; Nama and Dhanraj (2019) [10]; Sankhla and Nama (2020); Shwetanshumala and Sharma (2020)
271	*Heterocypris*	Southern	Riddhi *et al*. (2011) [21]; Sharma *et al*. (2012a); Parmar *et al*. (2018) [19]; Vijayvergiya *et al*. (2020) [31]; Shwetanshumala and Sharma (2020)
272	*Centroypris spp.*	Southern	Vijayvergiya *et al*. (2020) [31]
273	*Eucypris*	Southern	Riddhi *et al*. (2011) [21]

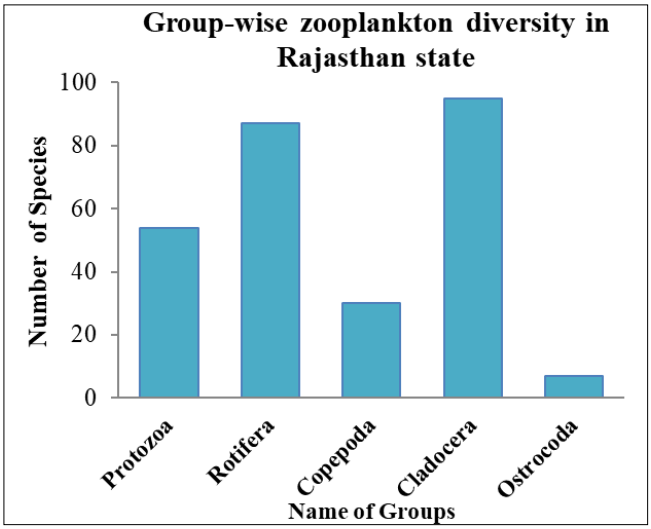

Fig 1: Group-wise diversity of Zooplankton

This review emphasizes the diversity & geographical distribution of zooplankton in different freshwater ecosystems of Rajasthan, focusing on five main groups: Protozoans, Rotifers, Copepods, Cladocerans, & Ostracods (Figure 1).

Group 1: Protozoa

Protozoa includes over 50 species, primarily concentrated in southern Rajasthan, a biodiversity hotspot due to its favorable aquatic environments and climate. Notable genera like *Volvox*, *Euglena*, *Amoeba*, *Arcella*, and *Paramecium* are identified, with species such as *Arcella discoida* and *Amoeba proteus* showing remarkable adaptability. While central and northern regions have lower diversity, the presence of protozoa there underscores their resilience and ecological importance.

Group 2: Rotifers

Rotifers, with over 85 species, are the most diverse zooplankton in Rajasthan, particularly in the southern region. Notable genera include *Keratella*, *Brachionus*, and *Monostyla*, with species like *Keratella tropica* and *Filinia longiseta* showing adaptability to varying water quality. Their widespread distribution highlights their ecological versatility and role as bioindicators for water quality assessment.

Group 3: Copepods

This group represented 30 species namely Cyclops, *Eucyclops*, and *Diaptomus* as the main genera. Their prevalence in southern and western Rajasthan highlights their preference for stable aquatic environments. Rare species like *Spicodiaptomus chelospinus* are found only in the south, showcasing specific ecological adaptations.

Group 4: Cladocerans

Cladocerans include over 90 species, mainly from the genera *Daphnia*, *Moina*, and *Bosmina*. Southern Rajasthan is notable for its species diversity, featuring robust species like *Ceriodaphnia* spp. and *Daphnia magna*. The common presence of *Bosmina longirostris* underscores their ecological resilience and adaptability.

Group 5: Ostracods

Seven species of ostracods were observed from different parts of Rajasthan mainly southern and western regions. Key genera include *Cypris*, *Cyclocypria*, and *Heterocypris*, while unique species like *Eucypris* emphasize the ecological distinctiveness of Rajasthan's aquatic ecosystems.

In brief, fresh water bodies of Rajasthan have an incredible diversity of 273 zooplankton species that have so far been documented. In response to the pattern of distribution, it seems that environmental factors are the main reason for diversity of species; namely, it is the Rotifer and the Cladoceran. Besides, some rare and highly specialized taxa are there, adhering to the property of protection and proper water resource management. Consequently, these aquatic organisms are threatened by ecological hazards, such as global warming, pollution, and habitat loss. For the protection of freshwater biodiversity of Rajasthan, conservation efforts and the performance of more scientific work to be done should be promoted so that the nature of the area is properly maintained.

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