

## **A SURVEY ON SEASONAL VARIATION OF FRESHWATER ZOOPLANKTON DIVERSITY IN KOLAVAI LAKE, CHENGALPATTU, TAMIL NADU, INDIA**

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### **ABSTRACT**

The present investigation was carried out to assess the freshwater zooplankton diversity and their seasonal abundance in a selected freshwater ecosystem. The survey was carried out during the period from December 2014 to November 2015 to investigate the seasonal diversity of zooplankton in Kolavai Lake at three different sites. In all the three sites, four zooplankton families were found belonging to six species of Protozoan, nine species of Rotifers, five species of Copepoda and five species of Cladocera. Results indicated that the Kolavai Lake is more productive and has remarkable zooplankton diversity.

**KEYWORDS:** Zooplankton, Rotifera, protozoan, cladocera, Copepoda.

### **1. INTRODUCTION**

Zooplankton plays an important role in aquatic food webs because they are important food for fish and invertebrate predators and the graze heavily on algae, bacteria, protozoa and other invertebrates. The species distribution and abundance of zooplankton in any water body depend upon the physicochemical parameters of water.<sup>[1]</sup> Zooplankton communities are typically diverse and occur in almost all lakes and ponds. Natural water supplies such as rivers, lakes and streams contain sufficient nutrients to support growth of various organisms.<sup>[2]</sup> Micro-organisms enter into natural waters from air, soil, sewage, organic wastes, dead plants and animals etc.<sup>[3], [4], [5]</sup> Zooplanktons constitute the food source of organisms at higher trophic levels. The Zooplankton and fish production depend to large degree on the phytoplankton.<sup>[6]</sup> In India, considerable work has been done on ecology and

seasonal distribution of zooplankton than other tropical and sub-tropical countries.<sup>[7], [8], [9]</sup> Zooplankton acts as bio-indicator of water quality as well as quantification of primary energy transfer from producer to primary consumer also observed the zooplankton communities respond more quickly to environment variations.<sup>[10],[11]</sup> Interactions between phytoplankton and zooplankton maintain the hydrological regimes for aquatic biodiversity.<sup>[12]</sup> The researches were show relations between zooplankton and environmental parameters in various water systems.<sup>[13], [14], [15], [16], [17], [18], [19], [20]</sup> The objectives of this study were to study the seasonally distributions of zooplankton abundance of Kolavai Lake because, seasonal variations between zooplankton species have not been studied so far. Therefore, a detailed study on the seasonally distributions of zooplankton species Kolavai lake was carried out during the study period. In this lake and our findings are providing first hand information on this aspect.

## 2. MATERIALS AND METHODS

### 2.1. Study Site

Kolavai Lake is situated at about two kilometres North of Chengalpattu Town (12°42'N and 79°59'E) (Near Chennai), which are considered as the biggest lake in Kanchipuram District. The three different study areas have been marked to observe the seasonal abundance of the zooplankton species in due course of the study period.

### 2.2. Collection of Water Samples

The zooplankton samples were collected in once in three different seasons between 5 to 6 am by using plankton net of mesh size 64μ for a period of one year, from December 2014 to November 2015. The collected samples were kept in plastic bottles containing 4% formaldehyde. Zooplankton identification is done by following systematic keys of.<sup>[21],[22][23],[24]</sup> Population density was quantified and calculated using the drop count method as prescribed by.<sup>[25]</sup>

$$N = \frac{n \times v}{V}$$

Where,

N = Total no. of organisms/ lit of water filtered,

n = Number of zooplankton counted in 1 ml plankton sample,

v = Volume of concentrate plankton sample (ml),

V= Volume of total water filtered through (L)

### 3. RESULTS AND DISCUSSION

The observations made from the survey clearly revealed that the zooplanktons population belongs to four major groups which are as follows: **Protozoa:** *Arcella discooides*, *Arcella vulgaris*, *Arcella hemispherica*, *Centropyxis spinosa*, *Centropyxis aculeata* and *Trigonopyxis arcuata*. **Rotifera:** *Branchionus spp.*, (*Branchionus angularis*, *Branchionus calyciflorus*, *Branchionus plicatilis*, *Branchionus urceolaris*), *Collthea cornata*, *Filinia longiseta*, *Lecane sp.*, *Polyarthra vulgaris* and *Trichocerca sp.* **Copepoda:** *Nuplius larvae*, *Copodit*, *Cyclopod naupli*, *Mesocyclops hyalinu* and *Mesocyclops sp.* **Cladocera:** *Alona intermedia*, *Ceriodaphnia reticulata*, *Chydorous sphaericus*, *Diaphnia kongispina* and *Diaphanosoma brachyurum* (Figure 1). In this lake, the four major groups of zooplanktons were identified. Those are Protozoa, Rotifera, Copepoda and Cladocera. Among the four groups, rotifers are dominant species in this Kolavai Lake. Among all the three major groups 6 species of protozoa, 5 species of Copepoda, 5 species of Cladocera were identified in the present investigations.

Zooplankton species belonging to Protozoa have been observed from three different sites such as Kolavai Lake Site-I, Site-II and Site-III during the study period of 2014 to 2015. Protozoans, Rotifers, Cladocerans and Copepods which float on the surface of water and are carried along with the water current. The physical and chemical characteristics of water affect the abundance, species composition, stability and productivity of the indigenous population of aquatic organisms.

Zooplankton is an important component of ecosystem; they act as primary and secondary links in the food chain.<sup>[26]</sup> Knowledge of the zooplankton communities and their population dynamics is a major requirement for better understanding of life processes in a fresh water body since eutrophication influences both the composition and productivity of zooplanktons.<sup>[27]</sup> Zooplankton communities are very sensitive to environmental changes and thus are of considerable potential value as water quality indicators.<sup>[28]</sup> In the present observation quantity of zooplanktons was found more during winter season<sup>[29]</sup> have reported similar findings. The Copepoda was comparatively in low profile in the site III < site <II and < site I. The Rotifer was comparatively in high profile in annual cycle and as such no definite pattern of their variation was observed. However, they were mostly abundant in winter and rainy seasons in site I > site III > and site II respectively (tables 1-4). Similar results were reported by<sup>[30]</sup>, in Wanprakalpa reservoir of Nagpur district in Maharashtra. The abundance

of some zooplankton in the aquatic food web has been reported to indicate eutrophication.<sup>[31]</sup> Earlier,<sup>[32]</sup> studied plankton dynamics of Yeshwant Sagar reservoir and they found that the Cladocera showed maximum density in the month of June. The availability of food is more due to production of organic matter and decomposition.<sup>[33]</sup>

**Table 1: Abundance of Zooplankton belongs phylum Protozoa in Kolavai Lake at three different sites during 2014– 2015 during different seasons.**

S.NO	Species observed	Seasons													
		Winter	Summer	Rainy	Total	Winter	Summer	Rainy	Total	Winter	Summer	Rainy	Total		
		Site-I				Site-II				Site-III					
1	<i>Arcella discoides</i>	68	8	93	169	44	10	56	110	59	9	65	133		
2	<i>Arcella vulgaris</i>	53	6	77	136	28	7	51	86	54	7	63	124		
3	<i>Euglypha sp.</i>	69	11	83	163	57	7	65	129	66	8	74	148		
4	<i>Centropyxis spinosa</i>	29	6	54	89	42	5	63	110	88	10	94	192		
5	<i>Centropyxis aculeata</i>	39	7	57	103	54	6	68	128	71	8	83	162		
6	<i>Trigonopyxis arcula</i>	25	7	58	90	41	8	80	129	39	5	65	109		
Diversity indices	Shannon Weiner Index	1.72	1.77	1.77		1.77	1.77	1.78		1.76	1.77	1.78			
	Simpson Index	0.81	0.82	0.83		0.83	0.83	0.83		0.82	0.83	0.83			
	Evenness	0.93	0.98	0.98		0.98	0.98	0.99		0.97	0.98	0.99			
	Brillouin Index	1.68	1.57	1.74		1.72	1.57	1.75		1.73	1.58	1.75			
	Margalef	0.89	1.31	0.83		0.9	1.33	0.84		0.84	1.3	0.82			
Regression	Winter Vs Summer	0.143				0.843				0.017				0.771	0.705
	Winter Vs Rainy	0.004				0.416				0.013				0.412	0.901
	Summer Vs Rainy	0.261				0.830				0.163				0.624	0.356

**Table 2: Abundance of Zooplankton belongs to family Rotifera in Kolavai Lake at three different sites during 2014– 2015 during different seasons.**

S.NO	Species observed	Seasons													
		Winter	Summer	Rainy	Total	Winter	Summer	Rainy	Total	Winter	Summer	Rainy	Total		
		Site-I				Site-II				Site-III					
1	<i>Brachionus angularis</i>	58	8	62	128	37	5	59	101	21	7	52	80		
2	<i>Brachionus quadridentatus</i>	66	8	78	152	19	9	67	95	35	7	70	112		
3	<i>Brachionus plicatlis</i>	52	7	59	118	65	7	71	143	59	10	64	133		
4	<i>Brachionus urceolaris</i>	51	6	59	116	45	8	63	116	57	8	65	130		
5	<i>Collthea cornata</i>	70	5	75	150	54	9	69	132	66	9	72	147		
6	<i>Filinia longiseta</i>	53	8	59	120	65	11	66	142	63	8	88	159		
7	<i>Lecane sp.</i>	51	11	62	124	59	7	74	140	72	12	84	168		
8	<i>Keratella cochlearis</i>	55	9	59	123	58	8	63	129	70	6	74	150		
9	<i>Monostyla bulla</i>	63	9	60	132	73	8	81	162	55	7	60	122		
Diversity indices	Shannon Weiner Index	2.19	2.18	2.19		2.15	2.18	2.19		2.15	2.18	2.19			
	Simpson Index	0.89	0.88	0.89		0.88	0.88	0.89		0.88	0.88	0.89			
	Evenness	0.99	0.98	0.99		0.95	0.98	1		0.95	0.98	0.99			
	Brillouin Index	2.15	1.97	2.15		2.1	1.98	2.16		2.11	1.98	2.15			
	Margalef	1.28	1.88	1.26		1.3	1.87	1.25		1.29	1.86	1.24			
Regression	Winter Vs Summer	0.349				0.701				0.235				0.502	0.356
	Winter Vs Rainy	0.007				0.110				0.042				0.860	0.719
	Summer Vs Rainy	0.403				0.726				0.293				0.260	0.497

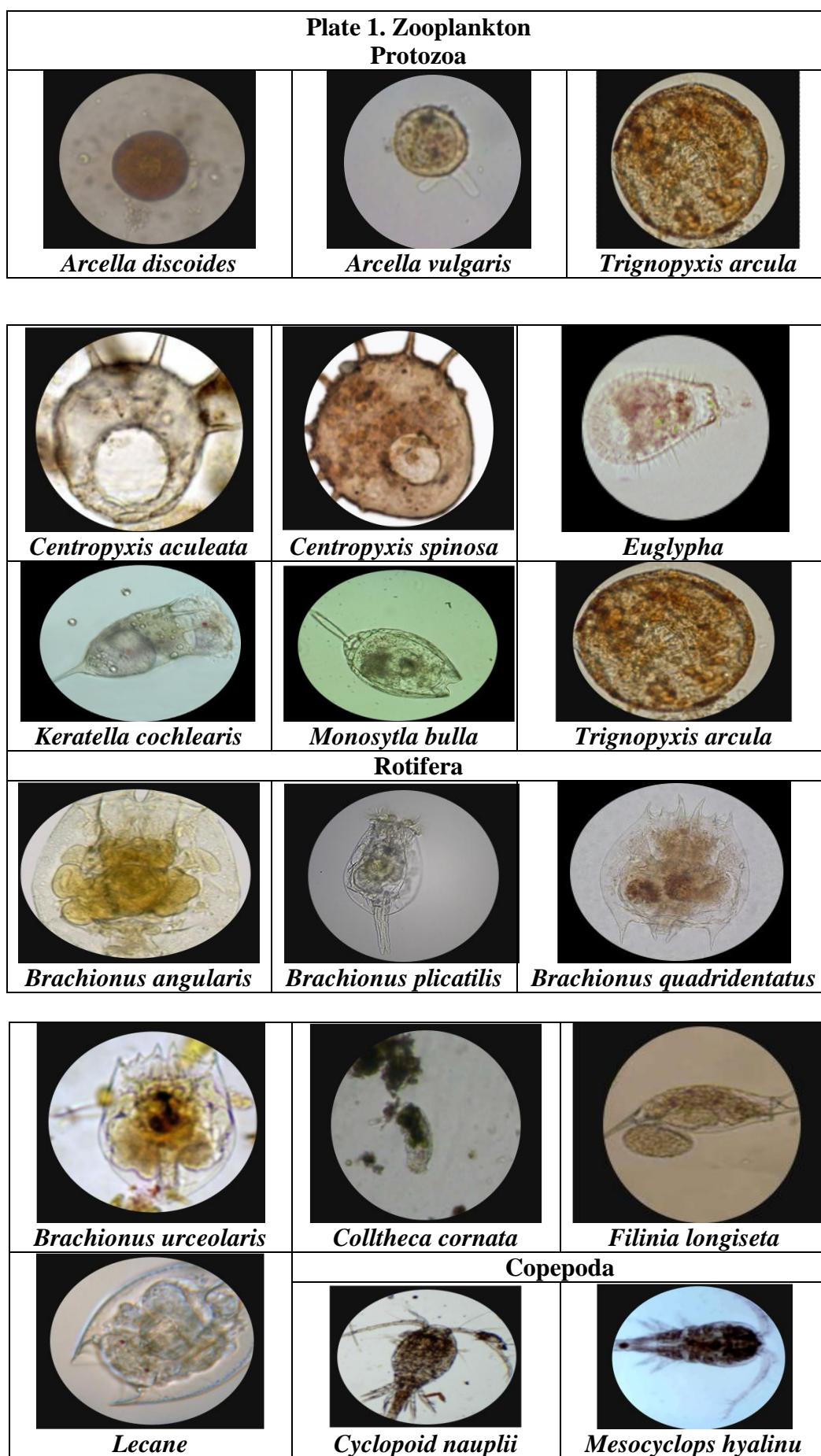
**Table 3: Abundance of Zooplankton belongs to family Copepoda in Kolavai Lake at three different sites during 2014– 2015 during different seasons.**

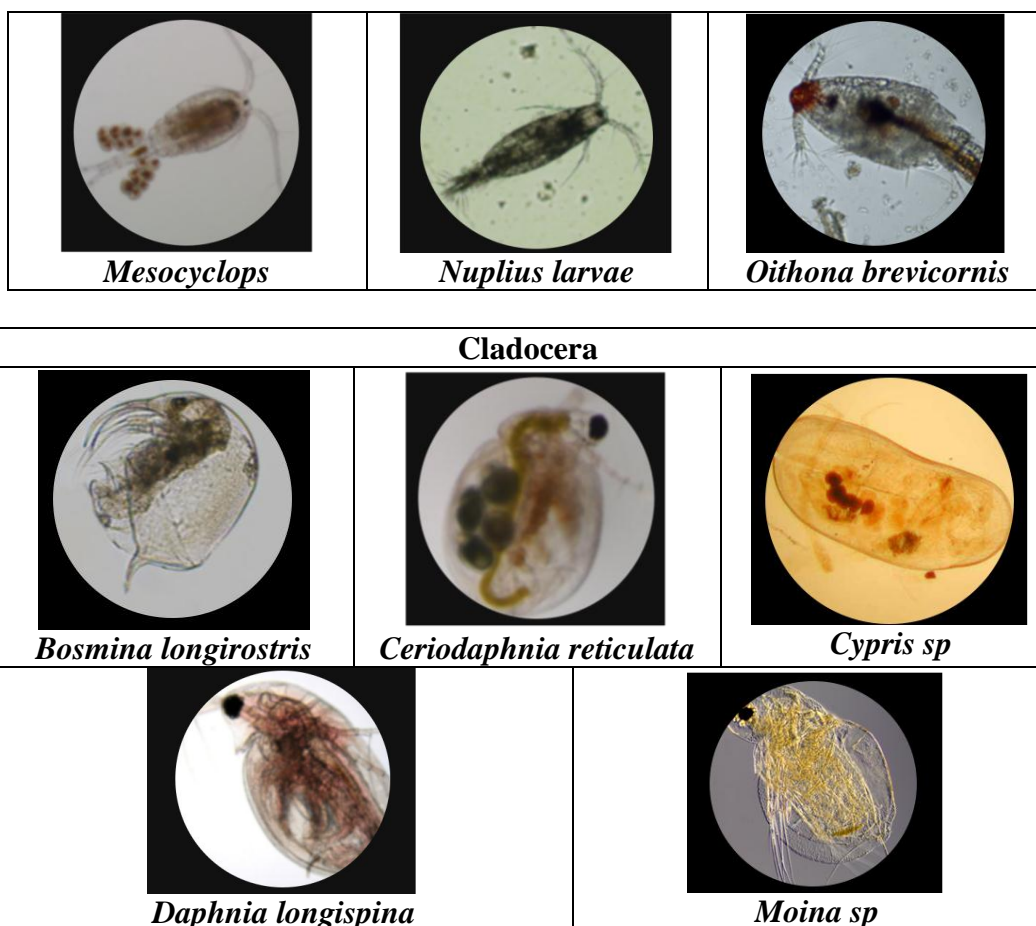
S.NO	Species observed	Seasons													
		Winter	Summer	Rainy	Total	Winter	Summer	Rainy	Total	Winter	Summer	Rainy	Total		
		Site-I				Site-II				Site-III					
1	<i>Nuplius larvae</i>	38	6	51	95	24	6	58	88	54	10	60	124		
2	<i>Oithona brevicornis</i>	14	7	56	77	67	7	78	152	73	8	86	167		
3	<i>Cyclopod naupli</i>	37	7	58	102	63	6	77	146	62	7	70	139		
4	<i>Mesocyclops hyalinu</i>	58	6	63	127	51	5	65	121	62	6	76	144		
5	<i>Mesocyclops sp.</i>	61	8	68	137	53	9	64	126	56	9	69	134		
Diversity indices	Shannon Weiner Index	1.52	1.6	1.61		1.56	1.59	1.6		1.6	1.59	1.6			
	Simpson Index	0.77	0.8	0.8		0.78	0.79	0.8		0.8	0.79	0.8			
	Evenness	0.91	0.99	1		0.95	0.98	0.99		0.99	0.98	0.99			
	Brillouin Index	1.47	1.41	1.57		1.52	1.39	1.57		1.57	1.42	1.57			
	Margalef	0.75	1.13	0.7		0.72	1.14	0.69		0.7	1.08	0.68			
Regression	Winter Vs Summer	0.867				0.749				0.424				0.0	1.14
	Winter Vs Rainy	0.171				0.037				0.015				0.899	0.94
	Summer Vs Rainy	0.281				0.995				0.343				1.0	1.0

**Table 4: Abundance of Zooplankton belongs to family Cladocera in Kolavai Lake at three different sites during 2014– 2015 during different seasons.**

S.NO	Species observed	Seasons													
		Winter	Summer	Rainy	Total	Winter	Summer	Rainy	Total	Winter	Summer	Rainy	Total		
		Site-I				Site-II				Site-III					
1	<i>Bosmina longirostris</i>	9	0	4	13	51	9	58	118	15	7	52	74		
2	<i>Ceriodaphnia reticulata</i>	61	8	67	136	60	6	66	132	59	9	81	149		
3	<i>Cypris sp.</i>	54	7	63	124	45	10	59	114	26	10	68	104		
4	<i>Daphnia longispina</i>	71	5	74	150	33	8	59	100	46	7	61	114		
5	<i>Moina sp.</i>	40	6	65	111	26	8	66	100	41	10	59	110		
Diversity indices	Shannon Weiner Index	1.48	1.37	1.44		1.57	1.6	1.61		1.52	1.6	1.6			
	Simpson Index	0.76	0.74	0.76		0.78	0.79	0.8		0.77	0.8	0.8			
	Evenness	0.88	0.99	0.84		0.96	0.99	1		0.91	0.99	0.99			
	Brillouin Index	1.43	1.18	1.4		1.52	1.42	1.57		1.47	1.43	1.56			
	Margalef	0.73	0.92	0.71		0.74	1.08	0.7		0.76	1.06	0.69			
Regression	Winter Vs Summer	0.105				0.658				0.760				0.0	0.0
	Winter Vs Rainy	0.023				0.953				0.167				0.036	0.722
	Summer Vs Rainy	0.042				0.157				0.457				1.0	1.0







#### 4. CONCLUSION

The zooplankton's play significant role in energy production and its circulation throughout the aquatic food web. The diversity, density and distribution of zooplanktons are much influenced by environmental factors in which they live. Hence, the study about zooplanktons can give an idea of water quality and can prove a good tool for monitoring and management of aquatic ecosystem.

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