



Studies on abundance of zooplankton population in Salakinakoppa pond of Dharwad. Dharwad Taluk, Karnataka, India

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Abstract

Abundance of zooplankton population was studied in the Salakinakoppa pond of the Dharwad taluk, Dharwad district, Karnataka, from January 2023 to December 2023. Zooplankton samples were collected every month between 8 am and 10 am from the pond. And samples were preserved in 4% formalin. Zooplankton identification and counting were carried out in the laboratory with the help of a Sedwick-Rafter counting cell. Analyzed results were exhibited that zooplankton populations were observed to be maximum during the summer season than in winter and monsoon seasons. A greater number of zooplankton were observed during summer because the temperature of water leads to the speeding up of chemical reactions. At elevated temperatures, metabolic activities of organisms increase; hence the number of zooplankton increases during summer more than in winter and monsoon. Among zooplankton, rotifer density was observed to be maximum throughout the study period. Copepods were placed in second position and then cladocera in third position. Among cladocera, *Ceriodaphnia cornuta* and *Bosminopsis longirostris* were recorded abundantly; among copepoda, *Tropocyclops leuckarti* and *Tropocyclopes prasinus*. copepod larvae were dominant and among rotifera *Brachionus calyciflorus*, *Brachionus falcatus*, *Keratella tropica*, and *Asplanchna priodonta* were observed in more numbers throughout the investigation period. More cladocerans were observed because pond water is very clean. There is no eutrophication.

Keywords: Rotifera, Cladocera, Copepoda, anthropogenic activities

Introduction

Zooplankton are the microscopic organisms that are drifting in all types of water bodies, like fresh water and marine water bodies. The word "zooplankton" is derived from the Greek. "Zoon" means animals, and "plankton" means wanderer or drifter. Phytoplankton are plant plankton. Zooplankton are one of the most important biotic organisms which influence all the functional aspects and play a vital role in the food chain, nutrient recycling, and energy flow in the aquatic ecosystem^[1, 2]. The zooplankton constitute an important component of secondary production in aquatic ecosystems that play a key role in energy transfer from primary to higher levels in the ecosystem^[3], are generally considered as water quality indicators because they are very sensitive to environmental changes^[4, 5]. zooplankton populations are used as tools to study water pollution of particular water bodies^[6]. Freshwater and marine water bodies generally comprise rotifers, cladocerans, copepods and ostracods. Abundances of rotifers are more as compared to other zooplankton groups^[7, 5]. Zooplankton are consumed by carnivorous fishes^[8]. The larvae of carps feed on zooplankton^[3]; hence zooplankton act as food for fishes and other aquatic organisms. Quality of water is different from one water body to another. water quality also depends on the abundance of zooplankton in a particular water body^[9]. Zooplankton move passively in the water bodies. Some groups of zooplankton are called *cladocerans*, popularly called "*waterfleas*" which live in clean water. As a group, they constitute a major item of food for fish; thus, they hold key position in the food chain and energy transformation^[10]. Cladocerans are tiny aquatic crustaceans and are also known as water fleas. They are highly responsive to pollutants and hence serve as good biological indicators of water pollution^[11]. Second group of zooplankton are copepods which are frequently brightly colored and lead a

roaming, predatory life and well deserve the name of scavengers. Freshwater copepods, though small in number of species, constitute one of the major zooplanktonic communities occurring in all types of water bodies and ranging from free-living to parasitic forms. Copepods dominate most aquatic ecosystems because of their resilience and adaptability to changing environmental conditions and their ability to withstand varying environmental stresses (Barnes *et al.*, 1988). Rotifers are also a group of zooplankton; these are generally called "*wheel animalcules*" or "*Rotatoria*". Rotifers were the most dominant form of zooplankton in freshwater bodies. The majority of the rotifers are solitary, motile, and free-living animals, although some form colonies and a few are in parasitic forms. They are cosmopolitan in distribution and are found in all sorts of habitats. Rotifers respond more quickly to environmental variations and help as tools to study water quality^[12]. Ostracods are mainly bottom dwellers; they live on detritus and dead phytoplanktons. Present study carried out to study the abundance of zooplankton in Salakinakoppa of the Dharwad Taluk of the Dharwad district, Karnataka, India.

Materials and Methods

Study area

Salakinakoppa is a small village in Dharwad Taluk in the Dharwad District of Karnataka State, India. It is located 7 km towards the west from district headquarters Dharwad and 463 km from the State capital, Bangalore. Salakinakoppa is surrounded by Hubli Taluk towards the east, Kalghatgi Taluk towards the south, Haliyal Taluk towards the west, and Bylahongal Taluk towards the north. The pond is having very clean water, and there are no anthropocentric activities in this Pond.



Fig 1: Map showing Dharwad district in karnataka

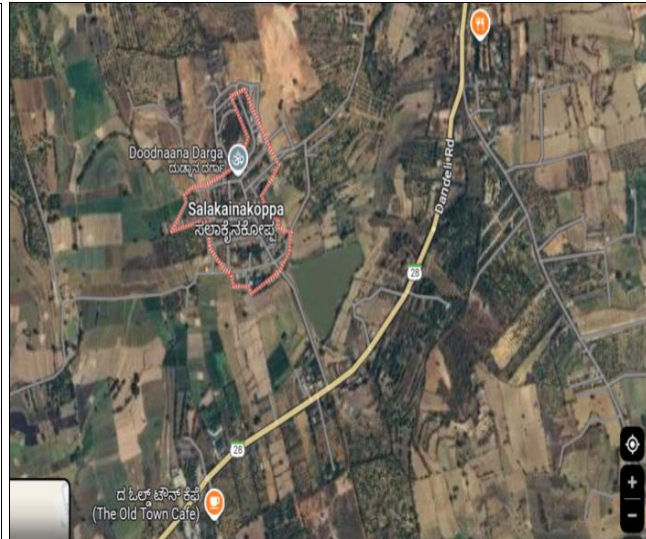


Fig 2: Google map of salakinakoppa study site

Collection of zooplankton samples:

Zooplankton abundance was studied from January to Dec 2023. During the study period, four sample stations, S1, S2, S3 and S4 were established, and zooplankton were collected from each study station every month by using a plankton hand net. The plankton hand net consists of nylon bolting cloth no.25, and the pore size is 68 µm. Nylon bolting cloth is rolled into a cone at its upper end, and is sewed to the brass ring. The bottle is attached to its lower end of net. The plankton hand net is dipped 20-25 cm below the water surface and is horizontally towed for a distance of about 40 to 50 meters for 20 to 30 minutes, and 50 liters of water sample was sieved through the nylon bolting cloth. Weeds were taken into bucket and rinsed vigorously, and the water from the bucket was sieved through the nylon bolting cloth in order to collect the zooplankton species adhering to the weeds. The plankton samples collected were immediately fixed in 4% formalin and preserved in 100 ml glass bottles in order to avoid deterioration of collected plankton samples. Later the zooplankton were identified with the help of a compound microscope and photographs taken from the microscope with the help of a camera. Zooplankton were

identified with the help of standard literature, [13, 14, 15, 16, 17, 18, 19, 20].

Counting of zooplankton:

A concentrated zooplankton sample was stirred, and 1ml of sample was taken into a pipette and was transferred to the Sedgwick-Rafter cell, cover slip was carefully placed on the cell. And care was taken to avoid the formation of air bubbles. The counting cell was adjusted under the compound microscope having the mechanical stage. The number of individual zooplankton species in each sub square of the counting cell was counted, and the total of all the sub squares was recorded. This was repeated five times. And average counting was calculated. The number of zooplankton per liter of pond water was calculated by using the following formula (Welch,1952) [21].

$$n = a \times 1000/l$$

n = number of Zooplankton per liter of pond water

a = average number of organisms from all the counts

c = volume of concentration in ml

l = volume of water sieved through net in liter.

Observations:

Table 1: Zooplankton population density of Pond from January- 2023 to December- 2023

S. No	Cladocera	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	<i>Daphnia carinata</i>	51	52	58	68	72	42	36	38	31	42	45	48
2	<i>Ceriodaphnia cornuta</i>	112	146	158	182	186	77	61	58	43	99	110	102
3	<i>Diaphanosoma sarsi</i>	40	64	81	75	71	28	22	19	21	31	30	36
4	<i>Diaphanosoma excisum</i>	51	68	76	97	110	59	48	48	52	56	62	64
5	<i>Biopertura karua</i>	79	89	93	102	124	47	54	49	53	77	81	84
6	<i>Chydrous sphaericus</i>	56	65	68	72	81	32	31	36	53	45	48	49
	Total	389	484	534	596	644	285	252	248	253	350	376	383
	Copepoda												
1	<i>Tropocyclops leuckarti</i>	210	223	260	289	278	140	154	168	102	160	143	191
2	<i>Tropocyclops prasinus</i>	173	186	198	210	246	98	98	87	97	110	121	165
3	<i>Rhinediaptomus indicus</i>	154	178	220	246	253	81	110	98	106	114	120	134
4	<i>Neodiaptomus stregilipes</i>	275	289	304	324	357	157	161	147	100	124	268	270
5	Copepod larvae	265	296	380	410	440	152	158	248	171	181	187	261
	Total	1077	1172	1362	1479	1574	628	681	748	576	689	839	1021
	Rotifera												
1	<i>Brachionus. calyciflorus</i>	131	295	285	298	301	118	110	98	130	137	120	105

2	<i>Brachionus falcatus</i>	61	98	86	93	73	42	38	39	24	51	56	58
3	<i>Brachionus forficula</i>	67	97	86	97	98	48	49	34	47	69	63	57
4	<i>Brachionus. rubens</i>	43	88	79	35	54	23	38	25	22	67	52	55
5	<i>Brachionus diversicornis</i>	48	68	88	96	112	52	38	21	18	22	34	42
6	<i>Brachionus urceolaris</i>	53	61	58	73	55	28	31	38	32	42	48	54
7	<i>Brachionus angularis</i>	95	125	117	137	128	78	67	57	41	85	87	91
8	<i>Brachionus. caudatus</i>	97	128	119	126	118	102	88	74	78	89	91	93
9	<i>Brachionus. plicatilis</i>	45	68	56	53	59	32	28	32	41	51	54	43
10	<i>Keratella tropica</i>	45	66	57	68	55	41	47	54	48	44	53	56
11	<i>Keratella tropica</i>	71	81	90	97	81	52	48	43	48	57	61	66
12	<i>Keratella cochlearis</i>	58	61	71	64	67	42	43	41	43	53	56	59
13	<i>Asplanchna priodanta</i>	97	122	143	158	178	135	89	78	85	93	87	89
14	<i>Asplanchna brightwelli</i>	57	98	128	164	182	84	74	66	48	56	48	52
15	<i>Filinia longiseta</i>	56	63	57	69	72	31	28	32	29	51	54	48
16	<i>Filinia opoliensis</i>	44	56	61	57	53	35	38	28	34	48	53	49
	Total	1068	1555	1582	1685	1686	1043	854	760	768	1015	1017	1017

Table 2: Seasonal variation of zooplankton in pond (ORG/LIT) (January 2023 to December 2023)

Season/month	Cladocera	Copepoda	Rotifera	Total
Summer				
Feb	484	1172	1555	
Mar	534	1362	1582	
Apr	596	1479	1685	
May	644	1574	1686	
Total	2258	5587	6508	14353
% Contribution in Summer	16.42%	40.64%	45.32%	
Monsoon				
Jun	285	628	809	
July	252	681	762	
Aug	248	748	724	
Sep	253	576	757	
Total	1038	2633	3052	6723
% Contribution in Monsoon	14.99%	39.16%	44.08%	
Winter				
Oct	350	689	1011	
Nov	376	839	1016	
Dec	383	1021	1020	
Jan	389	1077	1058	
Total	1498	3626	4105	9229
% Contribution in winter	15.64%	39.28%	42.88%	
Grand total	4794	11846	13665	30305
Annual percentage contribution (%)	15.81%	39.08%	45.09%	

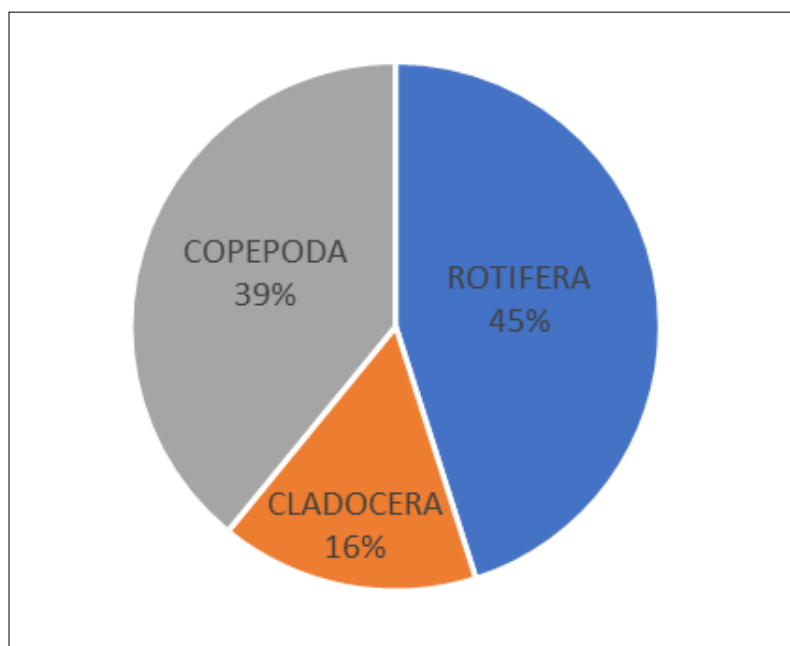


Fig 3: Annual Percentage contribution (%) of Zooplankton (January 2023 to December 2023)

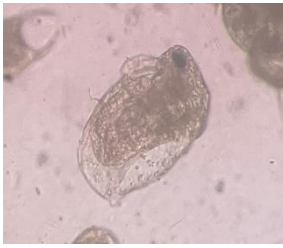









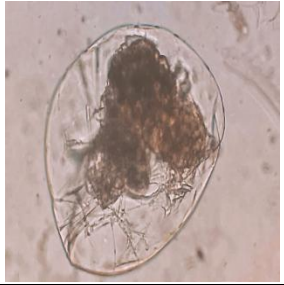


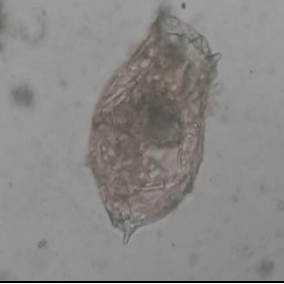


			
<i>ceriodaphnia cornuta (Cladocera)</i>	<i>Diaphnosoma exicem (Cladocera)</i>	<i>Tropocyclopes(copepoda)</i>	<i>Tropocyclopes prasinus(copepoda)</i>
			
<i>Neodiaptomus-stregilipes(copepoda)</i>	<i>Copepod larva</i>	<i>Brachionus diversicornis (Rotifera)</i>	<i>Brachionus caudatus (Rotifera)</i>
			
<i>Brachionus calyciflorus (Rotifera)</i>	<i>Brachionus calyciflorus (Rotifera)</i>	<i>Asplanchna priodonta (Rotifera)</i>	<i>Brochionus forficula (Rotifera)</i>
			
<i>Brachionus falcatus (Rotifera)</i>	<i>Brachionus angularis (Rotifera)</i>	<i>Keratella cochlearis (Rotifera)</i>	<i>Keratella tropica (Rotifera)</i>

Fig 4: Some Zooplankton observed in study site

Results and Discussion

Results of the present investigation were shown that different types of zooplankton were observed from January to December 2023. Increased temperature in summer leads to increased metabolic activities of organisms [22]; hence, in the present investigation, number of zooplankton increases during summer than in winter and monsoon [Table 1]. Water temperature plays a very significant role as it regulates various abiotic characters and also activates an aquatic ecosystem (Kataria, 1996). Rotifer density was observed to be maximum during summer (45.32%). And minimum during monsoon (44.08%), and winter (42.88%). In the present investigation, results of observations of rotifers are similar to the observations of (Patil & Gouder, (1985) [13] who worked in some ponds of the Dharwad (Karnataka, India) area. Temperature plays a very important role in the hatching of rotifer eggs; hence, the rotifer number was more as compared to other groups of zooplankton [23]. They are primary consumers that feed on various phytoplankton; some also feed on bacterial cells, and some rotifers are

raptorial predators [24]. Rotifers have the versatile capacity to thrive in different environments; hence they usually dominate over other zooplankton communities (Edmondson, (1974). Cladoceran population was observed to be maximum during summer (16.42%) and minimum during the monsoon season (14.99%) and winter (15.81%). The population was maximum during summer and winter and least during the rainy season; these observations are similar to the findings of Tidame [25]. In the present investigation, cladoceran density shows two peaks, one in October to January (Winter) and another one in March to May (summer), similar observations were also reported by Bohra and Arvind Kumar [26] who studied zooplankton diversity in Jarkhand. According to them, the maximum density of zooplankton in summer may be attributed to the increased alkalinity, hardness, and presence of a high population of bacteria. And present observations are again similar to the observations of Karunakar *et al*; [27], who worked on a perennial lake in Warangal district, Telangana. Chlorophyceae and Bacillariophyceae were also maximum in the winter season, confirming a rich food

supply for the growth of cladocerans ^[31]. In the present investigation, abundance of cladocerans is more in summer; these findings are also similar to the observations of Uttangi ^[10] who worked on freshwater bodies of the Dharwad area. According to him, cladocerans prefer clean water. Copepods also show maximum density during summer (40.64%) and minimum during monsoon. (39.16%) and winter (39.28%). In copepod density, young Nauplii, were observed as common forms. Similar observations were made by (Patil & Gouder ^[13]). The high densities of the immature forms are generally because of the continuous reproduction of these organisms. In the present investigation the group of copepods was dominated by Cyclops leuckarti. These results are similar to the observations of Sharma V ^[28] who worked on Madar Tank of Udaipur, Rajasthan, India. In the present investigation, copepods were recorded at a maximum during summer and post-monsoon and recorded at a minimum during monsoon. These results are similar to the observations of Kutre, M ^[29]. According to him, high copepod densities during summer may be attributed to high nutrient content in summer.

Conclusion

In the present invention, zooplankton abundance was more in summer and minimum during the rainy season and winter. Rotifer density was observed more as compared to cladocera and copepoda. Among rotifera, Brachionus species were dominant in this pond. Rotifers were followed by copepods, which are placed in second position in this pond water. Cladocerans form the most useful nutritive group of crustaceans for higher members like, fishes, cladocerans placed third position in order of dominance. And seasonal variations in all groups of zooplankton were observed. The present study was attempted to record seasonal variations of zooplankton population in Salakinakoppa Pond and analysis of our results exhibited that a rise in temperature during summer leads to the speeding up of chemical reactions. Hence, in increased temperature, metabolic activities of organisms increase; hence in the present investigation, the number of zooplankton increases during summer than in winter and monsoon. Maximum rotifer density was observed during summer (45.32%), and minimum during monsoon (44.08%) and the cladoceran population was observed maximum during summer (16.42%) and minimum during rainy season (14.99%) and copepod's maximum density was observed during summer (40.64%) and minimum in monsoon 39.16(%) and winter (39.28). High copepod densities were recorded in this pond, during summer.

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