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Temporal and Spatial Changes in Zooplanktondiversity from Wetlands of Ajara Tahsil, Maharashtra, India

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Abstract:

Present study deals with the temporal and spatial changes in zooplankton diversity of five major wetlands from Ajara tahsil of Maharashtra. The investigation revealed that total 23 species of zooplanktons were recorded. During the study period 13 species from Gavase wetland, 14 species from Dhangarmola wetland, 14 species from Yarandol wetland, 7 species from Khanapur wetland and 16 species from Ningudage wetland were noted. Among all, rotifer was dominant at all wetlands except Ningudage wetland, where it was copepod. On the basis of density, rotifer was dominant at Gavase, Dhangarmola and Khanapur wetlands during all seasons while copepod was dominant during summer season and cladoceron was dominant during monsoon and winter season at Yarandol wetland. Ningudage is only wetland where copepod was dominant order during all seasons. The density of Cyclops was noted higher at this wetland which is pollutant tolerant.

Keywords: Ajara tahsil, Wetland, Zooplankton, Diversity, Pollution

Introduction:

Wetlands are life supporting systems for millions of biotic entities. India is one of the most known for its water resources over world. Most of the civilization in India settled to periphery of major rivers and remaining near small rivers and wetlands. Since pollution status at the wetlands are considerably alarming and influencing diversity of biotic factors in and around these wetlands. Zooplankton is an important biotic entity which directly affected by anthropogenic activities. Hence, preliminary assessment of zooplankton diversity and composition provide baseline data to manage the wetlands on strategic level.Zooplankton is a

major link in energy transfer to the higher trophic level. They form an integral component of an aquatic ecosystem and comprises of microscopic animal life that passively float or swim freely (Purushothama*et al.*, 2011). According to Rao (2005), zooplankton incorporates primary and partly secondary micro faunal consumer operative system. This serves the functional biomass on the detrital spectrum in water. Zooplankton plays an important role in the food chain. These constitute important supply for many omnivorous and carnivorous fishes. The larvae of carps feed mostly on zooplankton (Dewan*et al.*, 1977). Zooplankton plays a principle role within the water bodies as a source of food for fishes, since they occupy the second trophic level as primary consumer. Jeje and Fernando (1986) emphasize that the distribution of zooplankton is influenced by interaction of biotic and abiotic factors such as temperature, dissolved oxygen, salinity and other physico-chemical characteristics. Furthermore, Balarabe (1989) inculcate that zooplankton are primary consumers feeding mainly on phytoplankton and are regarded as secondary producers in the trophic structure of an aquatic ecosystem. Production of fish in freshwater water body is directly or indirectly dependent on the abundance of zooplankton. Purushothama*et al.* (2011) highlights that zooplankton are sensitive to their environment, variation in zooplankton density can indicate a subtle environmental change. Zooplankton communities are responsive to nutrient levels, temperature and pollution and can be used to determine the health of an ecosystem. These are typically tiny animals found near the surface of the aquatic environments. Like phytoplankton, zooplankton are usually poor swimmers, drifting along with the water currents and being the key components of freshwater ecosystem from the base of most freshwater food webs. Present study is carried out to reveal the diversity and relative composition of zooplankton from five major wetlands of Ajara tahsil, Kolhapur district.

Materials and Methods:

Study Area:

Ajara is one of the important tahsil of Kolhapur district, located at southern region with N 16^0 12’ and E 74^0 2’. Total population of the tahsil is about 1,21, 430 residing in 74 villages. The total area of the tahsil is about 54, 853 ha. The climate is moderate subtropical with an average annual rainfall of 2000 mm. The people residing here depend on two important rivers for their domestic, agricultural and drinking water needs, viz. Hiranyakeshi River and Chitri River. On the other hand, villages away from these rivers depend on bore-wells, dug-wells, small and large

freshwater water bodies for their daily use. The present study deals with major wetlands from this tahsil. Gavase freshwater water body is situated south-west to the Ajara city at N 16^0 05' 761" and E 74^0 07' 596". The submergence area of this reservoir is 37.04 ha during monsoon season and 3.79 ha during summer season (Patil *et al.* 2014). Dhangarmola freshwater water body is situated at south-west to the Ajara city with longitude and latitude of 16^0 03' 687" and 74^0 05' 647". The actual submergence area is 55.17 ha. The submergence area during summer season is 7.32 ha (Patil *et al.* 2014). The location of Yarandol freshwater body is N 16^0 03' 629" and E 74^0 10' 539", situated to the south of Ajara city. The submergence area of this water body at present is 71.48 ha during monsoon season (Patil *et al.* 2014). According to Patil *et al.* (2014), Khanapur freshwater water body is situated at south-west of Ajara city with the location of N 16^0 05' 352" and E 74^0 18' 132". The actual submergence area is 20.71 ha. Ningudage freshwater body is situated at north-east of the Ajara city with the location of N 16^0 09' 325" and E 74^0 18' 132" with submergence area of 4.28 ha (Patil *et al.* 2014).

Zooplankton Analysis:

The present study was carried out from July 2011 to June 2013 for all sites. The water samples were collected by filtering 100 liters of water seasonally through plankton net made up of bolting silk with pore size of 50 µ for the analysis of plankton which was brought to laboratory and 4% formalin was added. Qualitative and quantitative analysis of zooplankton was carried out in the laboratory by using Sedgwick- Rafter cell counting chamber as suggested by Adoni*et al.* (1985) and Trivedy and Goel (1984). Identification of plankton were carried out by using keys by Needham and Needham (1962), Adoni*et al.* (1985), Michael (1984) and Tonapi (1980).

Result and Discussion:

The distribution of zooplankton at all study sites is presented in Table 1 while the percent composition of zooplankton with respect to orders is represented in Figure 1.1 to Figure 1.5. The seasonal variation in density of zooplankton at all study sites is depicted in Figure 2.1 to Figure 2.5.

The present study for the diversity status of zooplankton at Gavase freshwater body is shown in Figure 1.1. The study revealed that 13 species of zooplankton were observed which

belong to 4 orders, namely, rotifers (5 species) with 38.46%, copepods (2 species) with 15.38%, Cladoceran (3 species) with 30.77% and protozoans (2 species) with 15.38%. Among all orders, rotifers were found to be dominant. The seasonal variation in the density of zooplankton is represented in Figure 2.1. It indicates that rotifers were recorded maximum during summer season with 528 Org/L for 2011-12 while minimum during monsoon season with 306 Org/L during 2011-12. Copepods were found minimum during monsoon season with 51 Org/L for 2012-13 whereas maximum during summer season with 104 Org/L for 2011-12. The seasonal variation in the density of cladocerans exhibited higher number of individuals during summer season with 521 Org/L in the year 2012-13 and lower during monsoon season in the year 2011-12. Comparatively, organisms belonging to order protozoa were found lower than that of all other orders. The highest number of individuals belonging to protozoa was noted during summer season with 63 Org/L in the year 2011-12 while lowest was during monsoon season in the year 2011-12.

The status of zooplankton diversity at Dhangarmola freshwater water body is represented in Figure 1.2 and the study exhibited that 14 species of zooplankton among which 6 species belong to rotifers with 42.85%, 2 species belong to copepods with 14.28%, 3 species belong to cladoceran with 21.43% while 3 species belong to protozoans with 21.43% of the total composition. The water body exhibited rotifers as dominant over other orders. The seasonal variation in density of zooplankton is depicted in Figure 2.2. The study indicates the maximum density of rotifers with 593 Org/L during summer season in the year 2011-12 while minimum density was 366 Org/L during monsoon season in the year 2011-12. Copepods were found minimum during monsoon season with 43 Org/L for 2012-13 whereas maximum during summer season with 71 Org/L for 2012-13. The density of cladocerans was higher during summer season with 502 Org/L in the year 2012-13 and lower with 222 Org/L during monsoon season in the year 2011-12. An order protozoan was found lower than that of all other orders. The highest number of individuals belonging to protozoa was observed during summer season with 38 Org/L in the year 2012-13 while lowest density with 11 Org/L was during monsoon season in the year 2012-13.

In Yarandol freshwater water body (Figure 1.3), total 14 species of zooplankton population were recorded, among which rotifer contributed 5 species, copepod contributed 4

species, cladoceran contributed 2 species and protozoa contributed 3 species with 35.71%, 28.57%, 14.29% and 21.43% respectively. Rotifer was observed dominant species at this water body. When seasonal variation considered, rotifers reached the maximum during summer season with 243 Org/L in the 2011-12 and minimum during 161 Org/L in the year 2012-13. The density of copepods was recorded maximum during summer season in the year 2011-12 with 288 Org/L whereas minimum during monsoon season in the year 2012-13 with 143 Org/L. The seasonal density of cladoceran exhibited higher during summer season in the year 2011-12 with 256 Org/L and lower during rainy season in the year 2012-13 with 183 Org/L. The density of protozoan was varied from 12 Org/L to 39 Org/L. The maximum density was noted during summer season in the year 2011-12 while minimum during monsoon season in the year 2012-13.

The zooplankton diversity at Khanapur freshwater water body is depicted in Figure 1.4. The present results emphasize that seven species of zooplankton were recorded which belong to four orders. The order rotifer comprises three species with 42.86% of total composition. This order is dominant over all others. Other orders like copepod and protozoa comprise one species each with 14.28% and cladoceran comprises 2 species with 28.57%. The seasonal variation in density of rotifer was higher during summer season 2012-13 with 361 Org/L while lower density was recorded during monsoon season with 218 Org/L in the year 2012-13. The record of higher density of copepods was observed during summer season in the year 2012-13 with 76 Org/L whereas lower density with 60 Org/L was observed during winter season in the year 2011-12. The density of cladoceran was observed maximum during summer season in the year of 2011-12 with 256 Org/L while it was noted minimum with 196 Org/L during monsoon season in the year 2012-13. Order protozoa exhibited highest density of 39 Org/L during summer season in the year 2011-12 and lowest density of 16 Org/L was recorded during monsoon season in the year 2011-12.

The composition of zooplankton at Ningudage freshwater body is given in Figure 1.5. The study indicated that 16 species of zooplankton were noticed at this site which belongs to 4 orders. Order copepod was dominant which contributed 5 species with 31.25% of total composition which was followed by rotifer and cladoceran with 4 species each with 25.00% while order protozoan was at the least contributing 3 species with 18.75%. The seasonal variation in the density of rotifers fluctuated between 81 Org/L and 161 Org/L. The maximum

density of rotifers was recorded during summer season in the year 2011-12 while minimum was recorded during monsoon season in the year 2011-12. The maximum density of copepods was 396 Org/L during summer season in the year 2012-13 while minimum density was 106 Org/L during monsoon season in the year 2011-12. The density of cladoceran was fluctuated from 81 Org/L to 289 Org/L. There was record of lower density during monsoon season in the year 2012-13 while higher density was recorded during summer season of year 2011-12. The seasonal density of order protozoa varied from 8 Org/L to 31 Org/L. The minimum density of protozoa was recorded during monsoon season in the year 2011-12 while maximum density was recorded during summer season in the year 2012-13.

The present study also revealed that rotifer was the dominant order at all the water bodies except Ningudage, where copepod was dominant. The seasonal variation in density of zooplankton indicated that the rotifer was dominant at three freshwater water bodies viz. Gavase, Dhangarmola and Khanapur during all seasons for both the years while copepod was dominant at Yarandol during summer season for both the years and cladoceran was dominant during both monsoon and winter seasons. Ningudage is the only freshwater body that exhibited copepods as dominant order during all seasons for both the years. During the study period, the density of Cyclops species was higher at Ningudage freshwater water body indicates that water of this water body is polluted as Cyclops are pollution tolerant. According to Dahlia and Vyas (1992), Cyclops is pollution tolerant, found abundantly in nutrient rich environments and thus can be considered eutrophication indicators. On the contrary, Purushothama*et al.* (2011) have observed that rotifers show negative correlation with nutrients like phosphorus and phosphate. Similar observation of high density of rotifers was recorded from lower phosphorus and phosphate containing water bodies during present study. The water bodies like Gavase, Dhangarmola and Khanapur have shown higher density of rotifers than Yarandol and Ningudage and it might be due to lower levels of nutrients.Thirupathaiah*et al.* (2011) have estimated the diversity of zooplankton in freshwater Lake of Kamalapur. Their study reported the eighteen species of zooplankton belonging to four groups. Purushothama*et al.* (2011) have recorded the physico-chemical profile and zooplankton community composition in BrahmanaKalasi tank. In the study, they have reported 18 species of zooplankton where rotifer and cladocera were found to be dominant and they have concluded that the temperature and turbidity influence the zooplankton community. Koli and Muley (2012) studied zooplankton diversity and seasonal variation with

special reference to physico-chemical parameters in Tulsi water body. During their study, they emphasized zooplankton population showed positive significant correlation with physico-chemical parameters like temperature, alkalinity, phosphate, hardness and BOD whereas negatively correlated with rainfall and salinity. Devi *et al.* (2013) have reported 17 species of zooplanktons belonging to four major groups among which rotifer was dominant group.

References:

Adoni, A. D., Gulwant, J,Chourasia,S. K., Vaidya,A.K., Yadav,M. and Verma ,H.G.(1985). Work book of Limnology, Prabha Publishers, C-10, Gour Nagar, Sagar (India).

Balarabe, M. L. (1989). Limnology and zooplankton distribution of Makwaye (ABU University farm) Lake, Samaru Zaria.Unpublished *M. Sc. Thesis*.submitted to Department of Biological Sciences, ABU University, Zaria. PP- 164.

Dahlia, U. N. and Vyas, A. (1992).Correlation between and limnochemistry of Mansarovarwater body, Bhopal.*J. Environ. Biol.* 13: 281-290.

Devi Amsha, V., Baskaran, S. and Suresh Kumar, R. (2013).Physico-chemical parameters and zooplankton diversity of a temple pond in Virudhunagar, Tamil Nadu.*Inter. J. Sci. Envi. and Tech.* 2 (2): 250-257.

Dewan, S., Ali, M. and Islam, M. A. (1977). Study on the size and pattern of feeding of fries and finger limbs of three major carps, eg. *Labeorohita*(Ham.), *Catlacatla and Cirrhinamrigala. Bangladesh J. Agri.* 2 (2): 2.

Jeje, C. V. and C. K. Fernando (1986).A practical guide of Identification of Nigeria zooplankton, Kainji Lake Institute.pp 89-99.

Koli, K. B. and D. V. Muley (2012).Study of zooplankton diversity and seasonal variation with special reference to physico-chemical parameters in Tulsiwater body of Kolhapur District (M. S.), India.*International Scientific Research Journal*, 6(1): 37-46.

Michael, R. G. (1984). Ecological methods for laboratory and field investigations.Tata McGraw Hill publishing Company Ltd. New Delhi. PP. 4-11.

Needham, J. G. and Needham, P. R. (1962).A guide to freshwater biology.Holden Day Ins., San Francisco (USA).PP. 108.

Purushothama, R., H. A. Sayeshwara, Mahesh AnandGuodar and K. Harish Kumar (2011).Physico-chemical profile and zooplankton community composition in BrahmanaKalashi tank, Sagara, Karnataka, India. *The Ecoscan.*5 (1 and 2): 43-48.

Rao, S. I. (2005). Zooplankton limnology in the Indian subcontinent, Ukaaz Publication, Hyderabad.PP 209-277.

Sachinkumar R. Patil, S. S. Patil and T. V. Sathe (2014).Status of freshwater bodies from Ajara tahsil of Kolhapur district (MS), India with special reference to morphometric characteristics.*IOSR-JESTFT,* 8 (9), Ver. IV: 17-22.

Thirupathaiah, M., Ch. Samata and Ch. Sammaiah (2011). Diversity of zooplankton in freshwater Lake ofKamalapur District, (A. P.) India. *The Ecoscan.*5 (3 and 5): 195-197.

Tonapi, G. T. (1980). Freshwater animals of India an ecological approach. Oxford and IBH Publishing Company, New Delhi. PP 314-315.

Trivedi, R. K. andGoel, P. K. (1984).Chemical and Biological methods for water pollution status.Environmental publication, Karad (India).

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Table 1: Distribution of zooplankton at study sites

S. No.	Name of species	Gavase	Dhangarmola	Yarandol	Khanapur	Ningudage
A	**Rotifera**					
01	*Brachionuscalciflorus*	+	+	+	+	-
02	*Brachionusangularis*	+	+	+	+	-
03	*Brachionusforficula*	+	+	-	-	+
04	*Brachionusquadrientata*	+	+	-	-	-
05	*Brachionusfalcatus*	+	+	+	-	+
06	*Polyarthra vulgaris*	-	-	+	-	+
07	*Keretellatropica*	-	-	-	-	+
08	*Keretellaquadrata*	-	-	+	+	-
09	*Tricholeralongiseta*	-	+	-	-	-
B	**Copepoda**					
10	*Encyclopsprinophorus*	+	+	+	+	+
11	*Mesocyclopsluckart*	-	-	+	-	+
12	*Mesocyclops sp.*	-	-	-	-	+
13	*Paracyclops sp.*	-	-	+	-	+
14	*Nauplius sp.*	+	+	+	-	+
C	**Cladocera**					
15	*Basminalongrostris*	+	-	-	-	-
16	*Daphnia carinata*	+	+	+	+	+
17	*Cerodaphnia reticulate*	-	-	+	+	+
18	*Monia brachiate*	-	+	-	-	-
19	*Macrotrixlaticornis*	+	-	-	-	+
20	*Cyprissubglobusa*	+	+	-	-	+
D	**Protozoa**					
21	*Paramecium quadatum*	+	+	+	-	+
22	*Arcelladiscoldes*	+	+	+	+	+
23	*Difflugialobosa*	-	+	+	-	+

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Note: + indicates present, - indicates absent

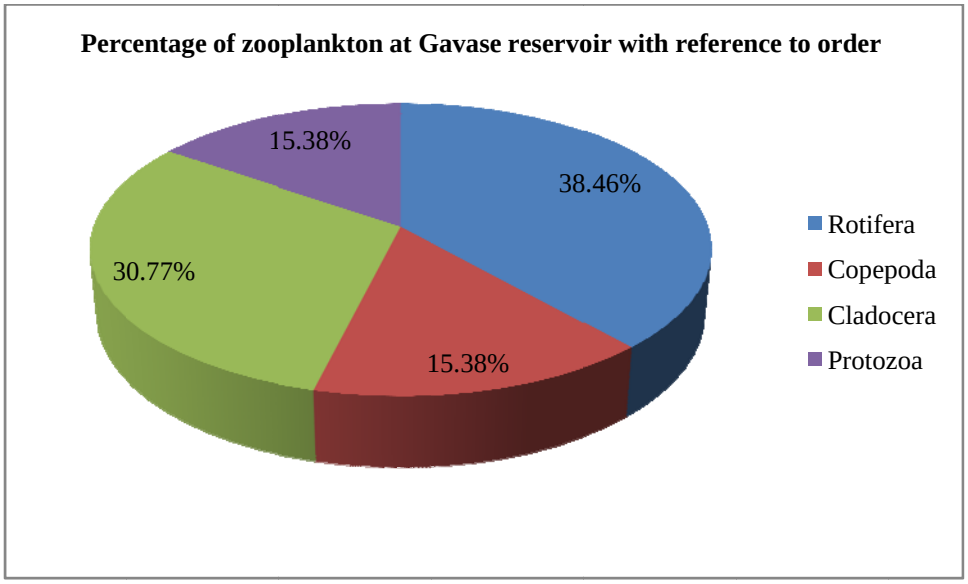

Figure 1.1: Percentage of zooplankton at Gavase water body with reference to order

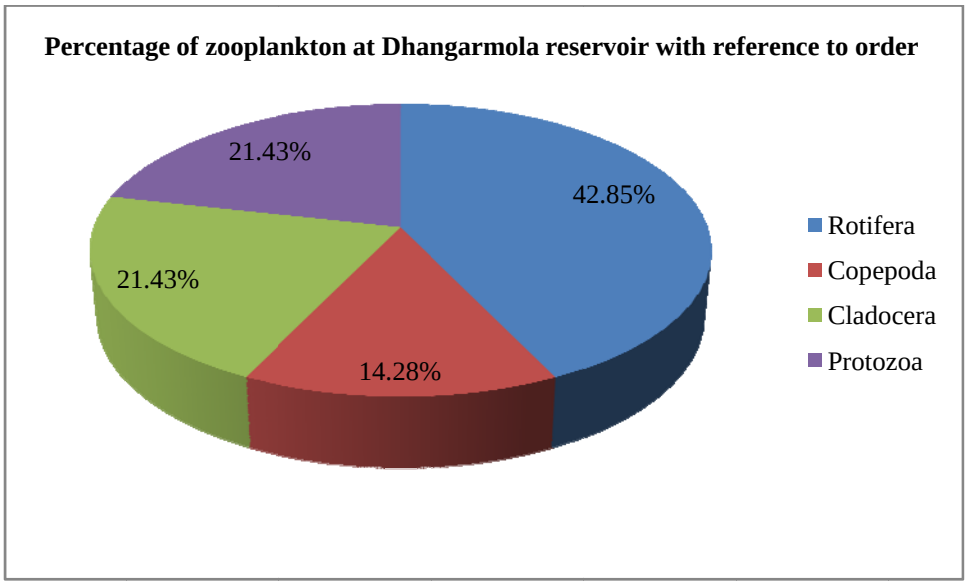

Figure 1.2: Percentage of zooplankton at Dhangarmola water body with reference to order

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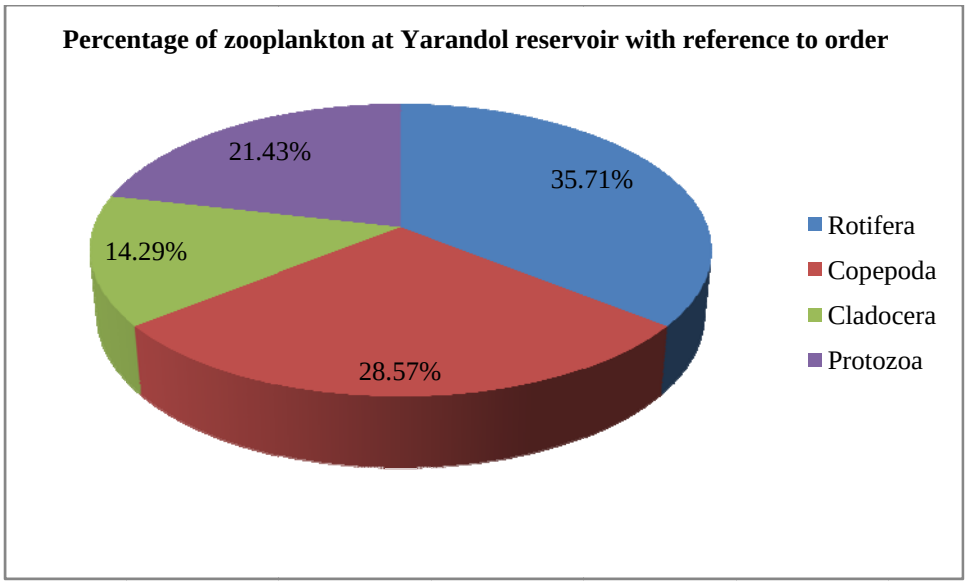

Figure 1.3: Percentage of zooplankton at Yarandol water body with reference to order

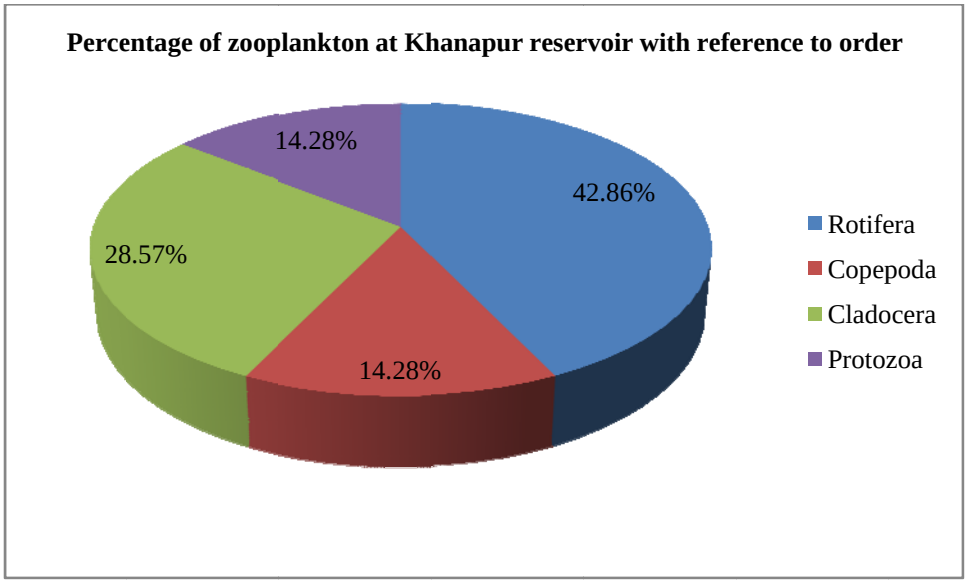

Figure 1.4: Percentage of zooplankton at Khanapur water body with reference to order

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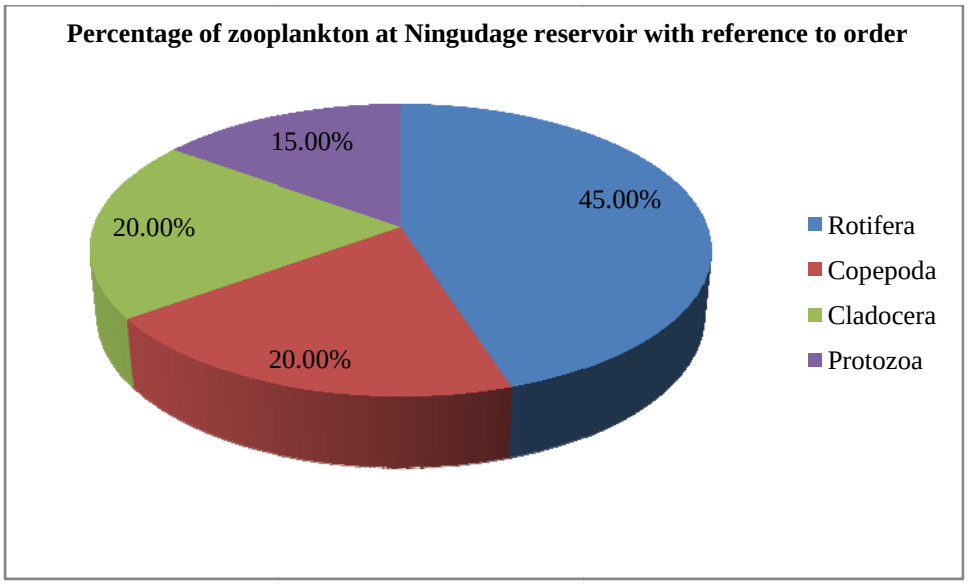

Figure 1.5: Percentage of zooplankton at Ningudage water body with reference to order

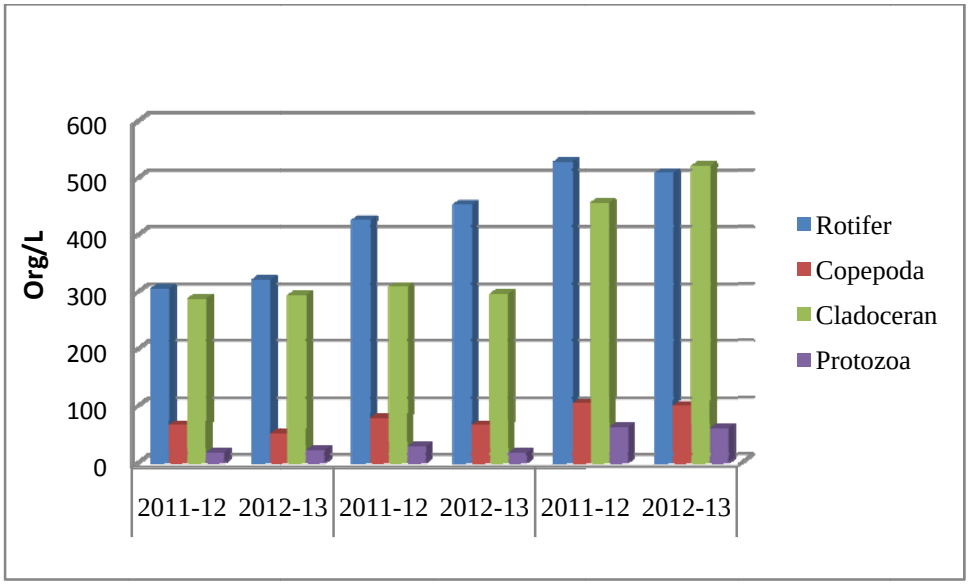

Figure 2.1: Seasonal variation in density of zooplankton at Gavase water body during 2011-12 and 2012-13

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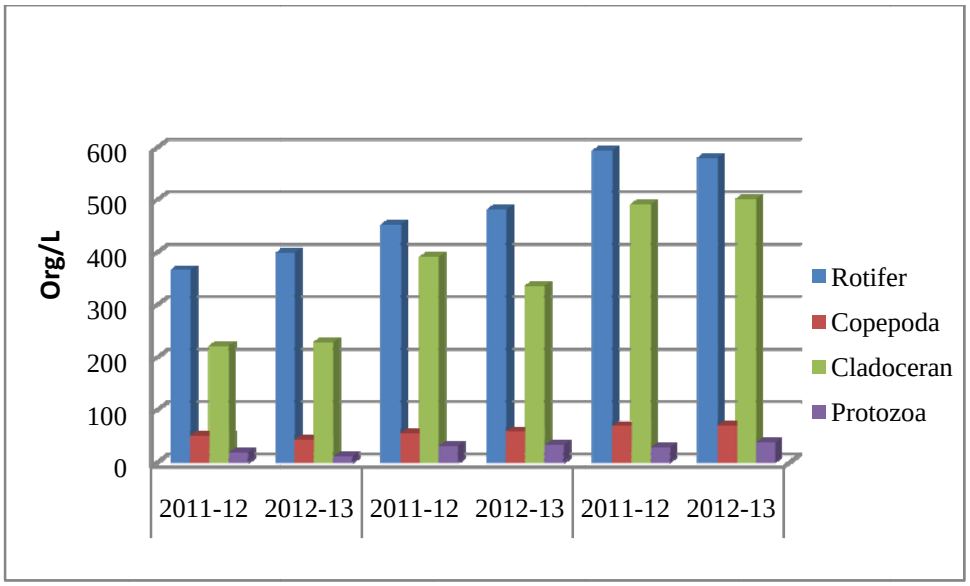

Figure 2.2: Seasonal variation in density of zooplankton at Dhangarmola water body during 2011-12 and 2012-13

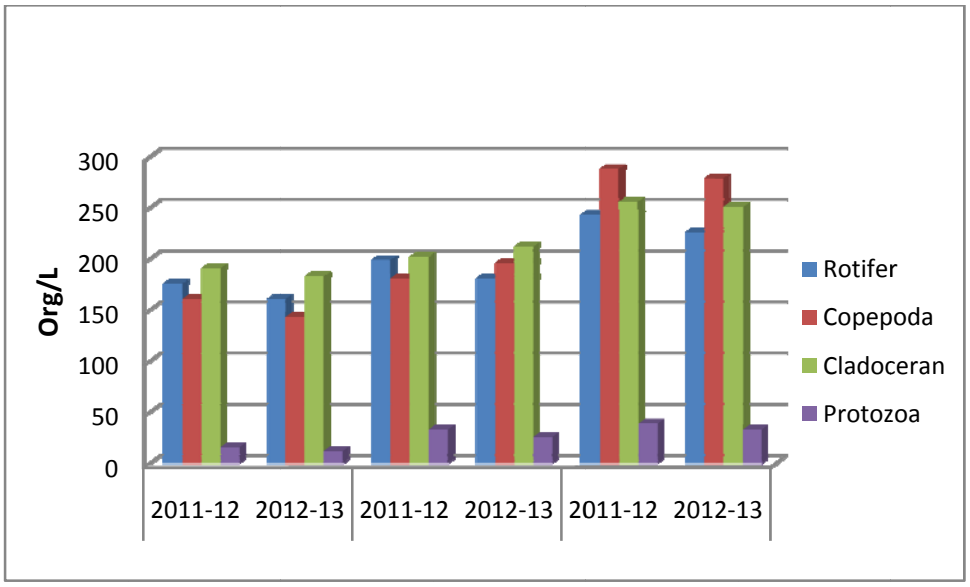

Figure 2.3: Seasonal variation in density of zooplankton at Yarandol water body during 2011-12 and 2012-13

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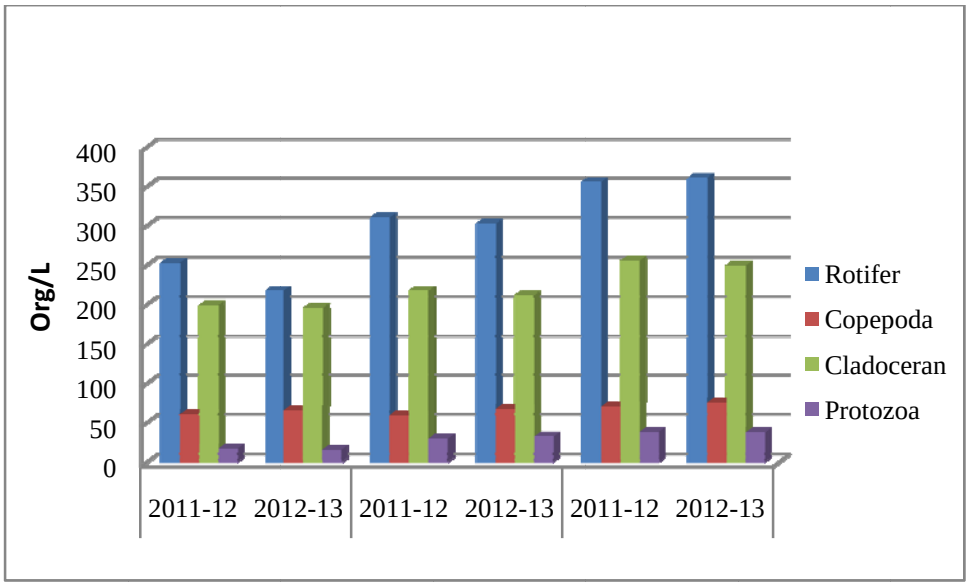

Figure 2.4: Seasonal variation in density of zooplankton at Khanapur water body during 2011-12 and 2012-13

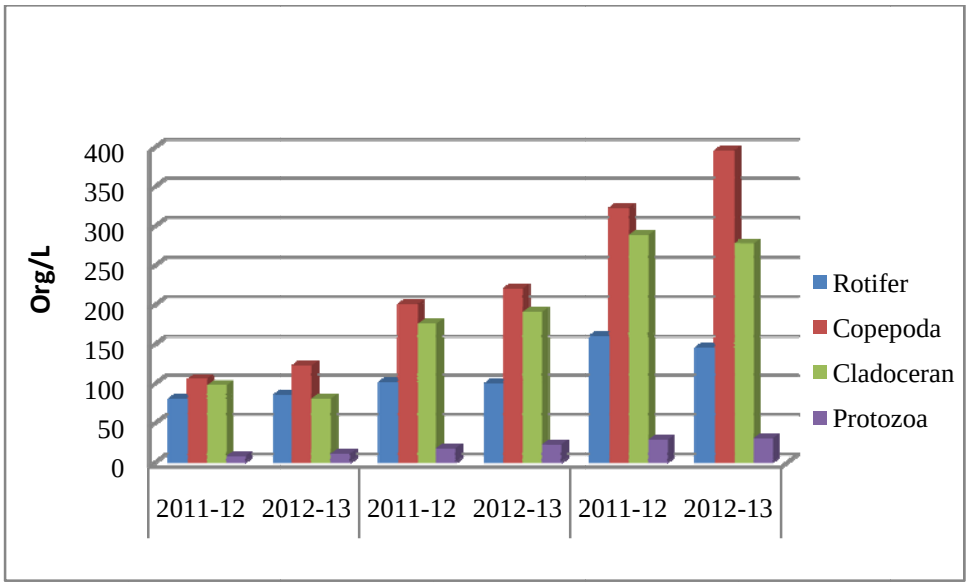

Figure 2.5: Seasonal variation in density of zooplankton at Ningudage water body during 2011-12 and 2012-13