I J R B A T, Issue (XI) Vol (II) May 2023 : 189-196
A Double-Blind Peer Reviewed & Refereed Journal
OPEN ACCESS
e-ISSN 2347 – 517X
Original Article
INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE AND TECHNOLOGY
 www.ijrbat.in

# STUDIES ON SEASONAL VARIATION AND DIVERSITY OF ZOOPLANKTON IN RIVER ZARPAT IN CHANDRAPUR, MAHARASHTRA, INDIA

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Communicated : 18.01.2023 | Revision : 22.02.2023 & 07.03.2023 Accepted : 29.03.2023 | Published : 30.05.2023

**ABSTRACT:**
Aquatic bionetwork is playing role as a vital component on the earth since the origin of life and have a primary importance in human life since from the development of civilization. Today, with the rapid increase in population and over exploitation for different purposes, the quality of water has been deteriorating at an alarming rate, which ultimately results in depletion of aquatic biota. A group of zooplankton is the characteristic indicator of water quality, pollution status and eutrophication and they also form an important link in the aquatic food chain. The present investigation has been carried out for two years i.e. during June - 2005 to May - 2007 on the Zarpat river in Chandrapur in order to characterize the zooplanktonic status of it. Chandrapur, a district headquarter in Maharashtra State of India is situated at 19°57' N latitude and 79° 22' Longitude at a height of 321.95 M above MSL. The collected data of present investigation indicate that seasonally, zooplankton were dominant during summer and the presence of indicator species like Moina micrura indicates the contaminated nature of river at the sampling station.

**Keywords: -** Seasonal variation, Zooplankton, Rotifera, Zarpat river, Chandrapur.

## INTRODUCTION :

Every species has its own importance in ecosystem.The zooplankton community consists of an extremely diverse assemblage of invertebrate phyla. They are very sensitive to environmental changes and thus are of considerable potential values as water quality indicators. The zooplankton communities are important for their role in trophic dynamics and in energy transfer in the aquatic ecosystem as they provide the food for fishes in the fresh water and play a major role in fish production.

Zooplankton not only take part in transforming food from primary to secondary level but also switch over conversion of detritus matter into edible animal food.The physiological and biological diversity of zooplankton species allows a wide range of indicator species for various environmental situations.

In India, number of lotic ecosystems has been extensively studied with respect to zooplankton diversity (Chacko and Srinivasan, 1955, Pahawa and Mehrotra, 1966, Jaya Raju *et al.,* 1994, Balamurugan *et al.,* 1999, Sawane *et al.,* 2006, Sivakami *et al.,* 2007) and, the study of plankton as an index of water quality with respect to industrial, municipal and domestic pollution has been reported earlier also (Jha *et al.,* 1997).

The river Zarpat flows through the city from near the Mahakali Mandir. On the occasion of Mahashivaratri the pilgrims from all over the Maharashtra visit the temple, take holy bath adding further anthropogenic wastes to river which is already polluted because of domestic and municipal sewage. The sampling site selected is near Anchaleshwar temple.

## MATERIALS AND METHODS:

Samples were collected from the site at monthly intervals during the period of investigation by filtering 50 L of water sample through plankton net no. 25 made of Nylon bolting cloth (mesh size 50 microns) at monthly interval, during the



http://doi.org/10.29369/ijrbat.2023.02.1.0028

period of investigation. The zooplankton samples were collected in 50 ml bottle and preserved in 4% formalin. Qualitatively zooplankters were identified up to species under (Labomade microscope model DG Pro. 2 attached to computer), using pertinent literature (Edmondson, 1959, Sehgal, 1983, Michael, 1984, Dhanapathi, 2000).

Quantitatively zooplankters were enumerated by Sedgwick Rafter Cell method and results expressed as,

$$\text{Zooplankton ind/L} = \frac{n \times c \times 1000}{V}$$

**Where,**

n = number of plankters in 1 ml.

c = volume of concentrate.

V = volume of sample filtered.

**RESULTS AND DISCUSSION:**

Zooplankton of lotic ecosystems consists of heterogeneous assemblage of minute floating micro invertebrates and their qualitative and quantitative study provides good indices of water quality and the capacity of water to sustain heterotrophic communities.They are one of the fascinating groups of microorganisms found in the aquatic environment. Many species of zooplankton are primary consumers and feed on phytoplankton, thus playing an important role in energy transfer. Apart from phytoplankton, many other species feed on particulate organic matter in detritus suspension thereby forming several links in the food web of aquatic ecosystems. Thus; knowledge of their abundance, species diversity, temporal and spatial distribution is important aspect in understanding trophodynamics and trophic progression of a water body (Mathew, 1977, Sheshagirirao, and Khan 1984, Verma, and Dattamunshi 1987). The zooplankton of river Zarpat studied under four groups Rotifera, Cladocera, Copepoda and Ostracoda. The diversity and monthly variation of zooplankton has been presented in Table 1 and 2 and seasonal distribution in Table 3.

In the present investigation, 21 species of zooplankton were recorded during the year 2005-2006 and 24 during 2006-2007. Rotifera with 12 species dominated the water body followed by Cladocera, Copepoda and Ostracoda. During the study of diversity of zooplankton from Cauvery River at Tirucherapalli in Tamilnadu, Balamurugan et al., (1999) reported 6 species of rotifers. Predominance of rotifers in zooplankton in Cauvery river is also reported by Kakkasery, (1990).

From polluted sites of river Mula at Pune, Vanjare et al., (2010) reported 18 rotifera and 10 Cladoceran species. Ayoade et al., (2009) reported 14 genera of zooplankton from 2 regulated high altitude rivers, Garhwal, Himalaya. Rao (1982) has identified 32 species of Rotifers belonging to 16 genera in an oligotrophic riverine impoundment-Manjira reservoir near Hyderabad.

The diversity of rotifers is influenced by the water quality and variation in suspended solids, dissolved solids, organic matter etc., immediately affect their distribution (Holland et al., 1983). Sawane et al., (2006) also studied the rotifer diversity from Erai river and reported presence of large number of rotifers due to lentic condition of dam water.

During the present investigation, group Cladocera is represented by 7 species with dominance of Moina micrura. Balamurugan et al., (1999) reported seven species of Cladocerans in Cauvery River at Tirucherapalli, Tamilnadu. Arvindkumar and Singh (2002) recorded 3 species of Cladocera from river Mayurakshi.

The Copepoda diversity was represented by 4 species. In the present investigation increase in number of Cyclops spp. was observed in sampling station which receives the domestic sewage. Mathivanan et al., (2007) recorded 11 and 3 species of copepod at station Pannavadi and Sankalimuniappan area respectively in river Cauvery in Salem district of Tamilnadu.



http://doi.org/10.29369/ijrbat.2023.02.1.0028

Kulshrestha et al., (1992) and Kumar and Singh (1994) observed that Cyclops are sensitive to pollution and increase with an increase in nutrients and is in agreement with observations of present investigation.

River Zarpat subjected to sustained inflow of sewage resulting into organic enrichment and consequent eutrophication, as the process progresses filter feeding diaptomids are replaced by Cyclopids (Gannon, 1972, Gannon and Stenberger, 1978). Among Copepods, three species of Cyclopoids dominate the population thereby indicating progression of eutrophication. So also among the Cladocera numerical domination of Ceriodaphnia and Moina micrura was evident in the present study.

The group Ostracoda is represented only by Cypris spp. Environmental factors like temperature, salinity, DO and sediment composition seems to influence cumulatively on the distribution of Ostracoda.

Like diversity, seasonal changes in zooplankton population density depend partially on physical condition i.e. water quality, partially on available food supply and partially on predatory pressure exerted by the carnivorous zooplankton, fishes and other vertebrates. In the present investigation population density was maximum in summer season and minimum in monsoon. Summer population maxima of zooplankton is correlated with higher temperature, lower transparency, high standing crop of primary producers leading to greater availability of food supported by a number of workers (Ramakrishnaiah and Sarkar, 1982, Bhati and Rana, 1987).

In both the years of study, rotiferans dominated the population and recorded maximum in winter while others were encountered with moderate number. Edmondson (1996) have observed that the high population in winter could be attributed with the favorable temperature and availability of abundance of food material in the form of bacteria, nanoplankton and suspended detritus. Biswas and Konar (2000) reported high rotifer population in winter in the river Ganga at Hathidah (Bihar).

The monsoon fall of population density of Cladocera and Rotifera during 2 years of study can be attributed to the dilution effect (Bais and Agarwal, 1995). Collection of Ostracodes during monsoon could be due abundance of fine detritus to which omnivorous organisms switch over during this period from their natural benthic habitat and bacteria, mould and algae as food (Tonapi, 1980).

**CONCLUSION :**

The diversity and seasonal density of different zooplankton components in Zarpat river indicate a characteristic pattern peculiar to water bodies in urban environment. Such aquatic ecosystems invariably receive large volumes of untreated sewage.

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http://doi.org/10.29369/ijrbat.2023.02.1.0028

**Table 1 Monthly Variation of Zooplankton at Site River Zarpat During The Year 2005-06**

| S.N. | Names | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rotifera** | | | | | | | | | | | | | | |
| 1 | Asplanchna spp. | 4 | 0 | 0 | 6 | 8 | 11 | 3 | 5 | 0 | 7 | 2 | 2 | 48 |
| 2 | Trichocerca longiseta | 4 | 2 | 0 | 0 | 24 | 14 | 0 | 2 | 2 | 13 | 23 | 0 | 84 |
| 3 | Brachionuscalyciflorus | 4 | 0 | 0 | 12 | 10 | 7 | 2 | 0 | 0 | 14 | 8 | 2 | 59 |
| 4 | B. falcatus | 6 | 2 | 0 | 7 | 17 | 9 | 0 | 7 | 2 | 7 | 19 | 14 | 90 |
| 5 | B. quadricornis | 4 | 0 | 0 | 14 | 18 | 0 | 6 | 7 | 13 | 0 | 13 | 9 | 84 |
| 6 | B. forficula | 4 | 1 | 0 | 9 | 11 | 11 | 12 | 3 | 0 | 15 | 11 | 0 | 77 |
| 7 | B. rubence | 2 | 1 | 0 | 6 | 16 | 4 | 4 | 2 | 0 | 10 | 9 | 0 | 54 |
| 8 | B. plicatilis | 5 | 0 | 2 | 0 | 11 | 2 | 2 | 7 | 1 | 0 | 13 | 0 | 43 |
| 9 | B.diversicornis | 4 | 0 | 0 | 2 | 14 | 16 | 4 | 2 | 2 | 12 | 11 | 11 | 78 |
| **Ostracoda** | | | | | | | | | | | | | | |
| 1 | Cypris spp. | 17 | 13 | 0 | 27 | 31 | 0 | 0 | 0 | 26 | 39 | 24 | 0 | 177 |
| **Cladocera** | | | | | | | | | | | | | | |
| 1 | Moinamicrura | 4 | 2 | 0 | 0 | 4 | 2 | 6 | 0 | 2 | 2 | 8 | 4 | 34 |
| 2 | Moinodaphnia spp. | 4 | 0 | 0 | 2 | 3 | 8 | 5 | 2 | 4 | 2 | 4 | 2 | 36 |
| 3 | Cereodaphniareticulata | 0 | 0 | 2 | 2 | 5 | 7 | 2 | 2 | 0 | 8 | 4 | 5 | 37 |
| 4 | Bosminalongirostris | 1 | 0 | 3 | 6 | 4 | 4 | 0 | 0 | 0 | 2 | 2 | 2 | 24 |
| 5 | Alonadavidipunctata | 2 | 1 | 2 | 0 | 0 | 0 | 4 | 6 | 2 | 2 | 1 | 1 | 21 |
| 6 | Chydorusparvus | 2 | 4 | 0 | 2 | 0 | 2 | 2 | 4 | 6 | 8 | 2 | 2 | 34 |
| 7 | Diaphanosoma spp. | 0 | 0 | 0 | 2 | 0 | 2 | 2 | 4 | 6 | 8 | 2 | 2 | 28 |
| **Copepoda** | | | | | | | | | | | | | | |
| 1 | Cyclops spp. | 6 | 0 | 0 | 14 | 21 | 0 | 0 | 0 | 19 | 22 | 12 | 13 | 107 |
| 2 | Diaptomus spp. | 3 | 0 | 21 | 11 | 2 | 0 | 0 | 0 | 0 | 17 | 12 | 0 | 66 |
| 3 | Mesocyclops spp. | 6 | 0 | 4 | 9 | 15 | 2 | 5 | 0 | 0 | 12 | 16 | 26 | 95 |
| 4 | Eucyclops spp. | 3 | 2 | 0 | 6 | 13 | 0 | 4 | 0 | 0 | 19 | 13 | 11 | 71 |

**Table 2 Monthly Variation of Zooplankton at Site River Zarpat During The Year 2006-07**

| S.N | Names | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rotifera** | | | | | | | | | | | | | | |
| 1 | Asplanchna spp. | 3 | 0 | 0 | 4 | 6 | 2 | 3 | 9 | 5 | 7 | 2 | 1 | 42 |
| 2 | Trichocercacylindrica | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 6 | 3 | 0 | 0 | 0 | 18 |
| 3 | Trichocercalongiseta | 2 | 0 | 2 | 6 | 0 | 0 | 0 | 0 | 7 | 6 | 0 | 0 | 23 |
| 4 | Brachionuscalyciflorus | 6 | 1 | 0 | 7 | 15 | 27 | 9 | 9 | 0 | 6 | 5 | 14 | 99 |
| 5 | B. falcatus | 7 | 0 | 2 | 9 | 23 | 25 | 3 | 0 | 0 | 4 | 15 | 13 | 101 |
| 6 | B. quadricornis | 0 | 0 | 1 | 1 | 0 | 1 | 2 | 3 | 5 | 5 | 2 | 0 | 20 |
| 7 | B. forficula | 3 | 0 | 4 | 26 | 31 | 18 | 9 | 9 | 4 | 0 | 3 | 2 | 109 |
| 8 | B. rubence | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 12 | 1 | 25 |
| 9 | B. plicatilis | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 1 | 6 |
| 10 | B.diversicornis | 3 | 1 | 0 | 0 | 7 | 13 | 12 | 0 | 0 | 2 | 4 | 18 | 60 |
| 11 | Lecane spp. | 2 | 0 | 0 | 3 | 13 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 22 |
| 12 | Monostyla spp. | 2 | 0 | 0 | 3 | 5 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 14 |
| **Ostracoda** | | | | | | | | | | | | | | |
| 1 | Cypris spp. | 25 | 9 | 0 | 22 | 17 | 0 | 0 | 0 | 0 | 13 | 33 | 24 | 143 |
| **Cladocera** | | | | | | | | | | | | | | |
| 1 | Moinamicrura | 3 | 0 | 0 | 8 | 13 | 17 | 9 | 0 | 0 | 18 | 12 | 0 | 80 |
| 2 | Moinodaphnia spp. | 2 | 0 | 0 | 3 | 2 | 4 | 7 | 1 | 0 | 3 | 2 | 1 | 25 |
| 3 | Cereodaphniareticulata | 2 | 0 | 0 | 2 | 5 | 9 | 1 | 4 | 8 | 12 | 7 | 5 | 55 |
| 4 | Bosminalongirostris | 4 | 1 | 0 | 4 | 4 | 0 | 0 | 3 | 2 | 4 | 8 | 6 | 36 |
| 5 | Alonadavidipunctata | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 11 |
| 6 | Chydorusparvus | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 0 | 0 | 10 |
| 7 | Diaphanosoma spp. | 0 | 1 | 1 | 1 | 0 | 2 | 2 | 2 | 0 | 0 | 1 | 1 | 11 |
| **Copepoda** | | | | | | | | | | | | | | |
| 1 | Cyclops spp. | 8 | 0 | 0 | 19 | 13 | 12 | 0 | 0 | 0 | 18 | 21 | 17 | 108 |
| 2 | Diaptomus spp. | 6 | 0 | 3 | 14 | 11 | 0 | 0 | 0 | 8 | 17 | 9 | 3 | 71 |
| 3 | Mesocyclops spp. | 13 | 2 | 0 | 11 | 2 | 12 | 0 | 0 | 20 | 16 | 16 | 10 | 102 |
| 4 | Eucyclops spp. | 9 | 0 | 0 | 15 | 11 | 19 | 12 | 0 | 0 | 13 | 5 | 11 | 95 |

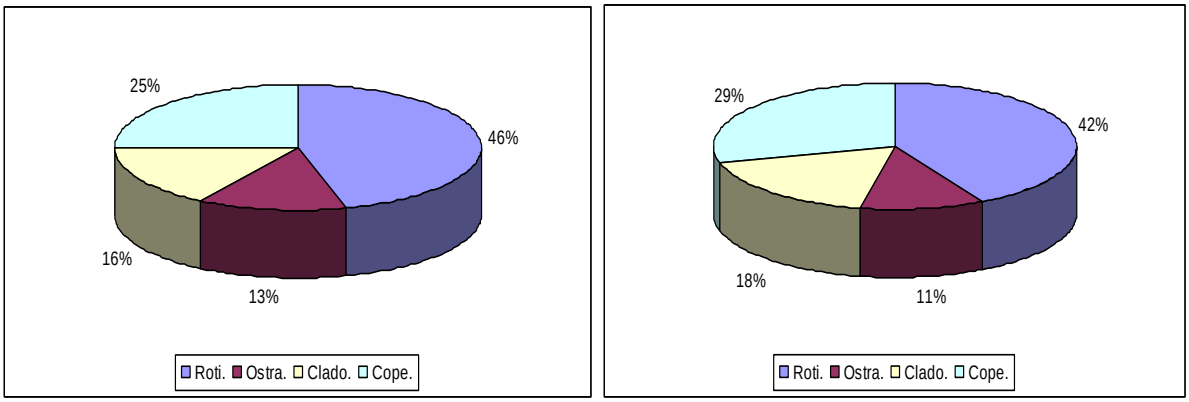


http://doi.org/10.29369/ijrbat.2023.02.1.0028

**Table 3 : Seasonal Variation In Zooplankton at Zarpat River During 2005-2007**

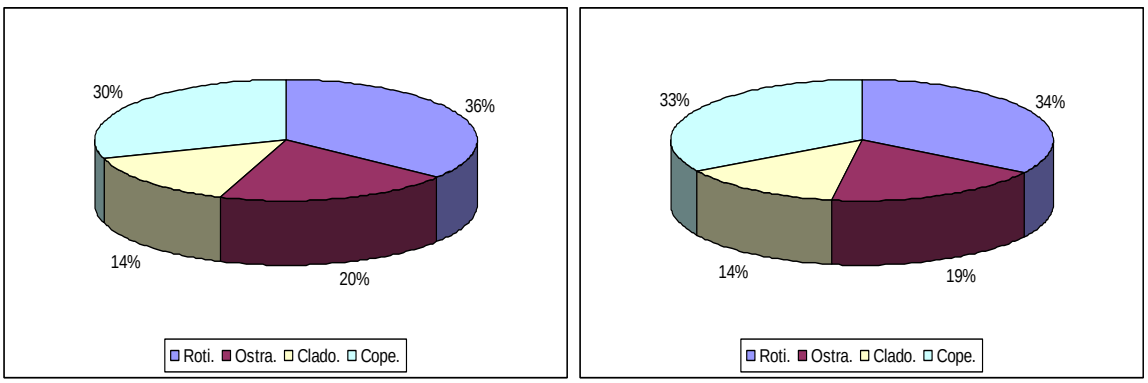
| Year : 2005-06 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **S.N.** | **Parameters** | **Monsoon** | | | **Winter** | | | **Summer** | | | **Average** | | |
| **5** | Rotifera | 25.25 | ± | 22.33 | 67.75 | ± | 38.96 | 61.25 | ± | 34.65 | 51.42 | ± | 18.89 |
| **6** | Ostracoda | 14.25 | ± | 9.68 | 7.75 | ± | 13.42 | 22.25 | ± | 14.08 | 14.75 | ± | 5.93 |
| **7** | Cladocera | 10.25 | ± | 3.27 | 20.00 | ± | 3.39 | 23.25 | ± | 5.36 | 17.83 | ± | 5.52 |
| **8** | Copepoda | 21.25 | ± | 13.66 | 15.50 | ± | 20.77 | 48.00 | ± | 18.40 | 28.25 | ± | 14.16 |
| **10** | Total | 71.00 | ± | 44.07 | 111.00 | ± | 69.33 | 154.75 | ± | 59.82 | 112.25 | ± | 34.20 |
| **Year : 2006-07** | | | | | | | | | | | | | |
| **S.N.** | **Parameters** | **Monsoon** | | | **Winter** | | | **Summer** | | | **Average** | | |
| **5** | Rotifera | 25.25 | ± | 21.91 | 69.50 | ± | 27.81 | 40.00 | ± | 10.20 | 44.92 | ± | 18.40 |
| **6** | Ostracoda | 14.00 | ± | 10.07 | 4.25 | ± | 7.36 | 17.50 | ± | 12.34 | 11.92 | ± | 5.61 |
| **7** | Cladocera | 10.50 | ± | 6.10 | 21.75 | ± | 7.56 | 24.75 | ± | 12.19 | 19.00 | ± | 6.13 |
| **8** | Copepoda | 25.00 | ± | 23.93 | 23.00 | ± | 17.65 | 46.00 | ± | 13.21 | 31.33 | ± | 10.40 |
| **10** | Total | 74.75 | ± | 60.14 | 118.50 | ± | 56.17 | 128.25 | ± | 38.82 | 107.17 | ± | 23.27 |

**Fig 1 Percentile Distribution of Zooplankton in river Zarpat during the year 2005-2007**




**2005-06** **2006-07**

**Fig 2.1 Seasonal Distribution of Zooplankton during Monsoon in River Zarpat**




**2005-06** **2006-07**



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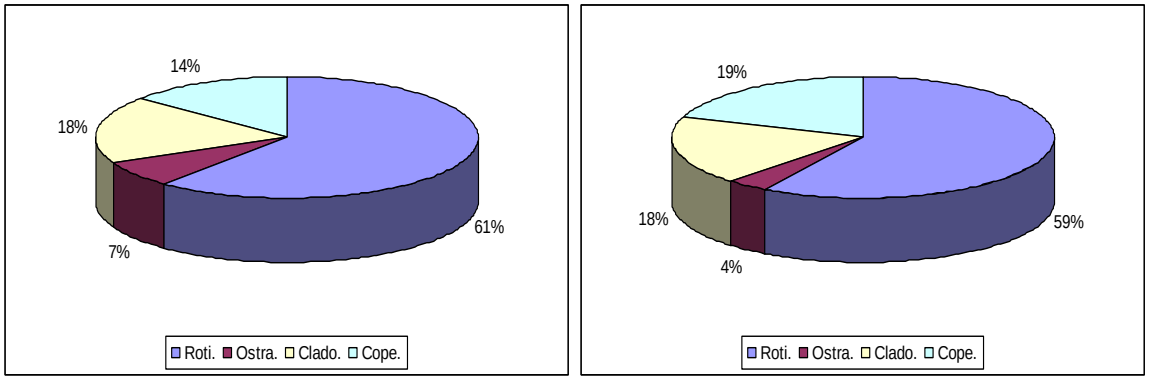
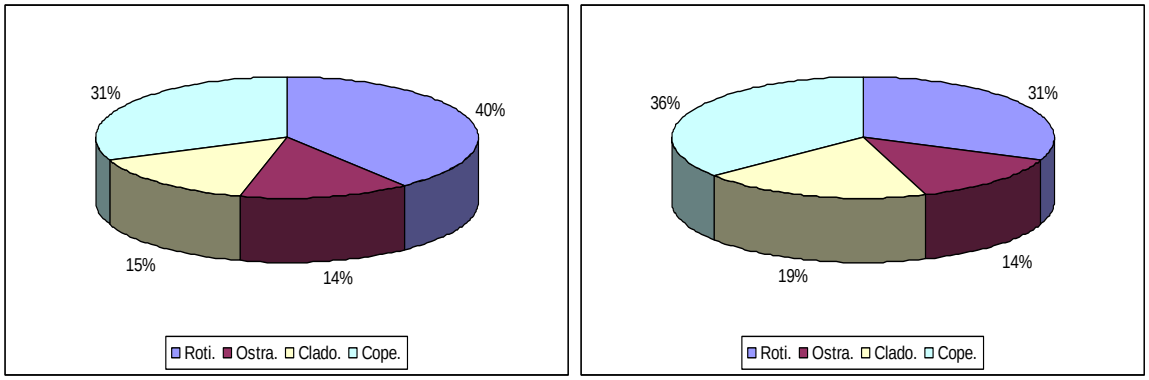
**Fig 2.2 Seasonal Distribution of Zooplankton duringWinterin River Zarpat**




2005-06 2006-07

**Fig 2.3 Seasonal Distribution of Zooplankton during Summer in River Zarpat**




2005-06 2006-07



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