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# Copepod Diversity of Tembhapury Lake Aurangabad Region, M.S, India

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**Abstract:** ***Among the planktonic microcrustaceans, Cyclopoida and Calanoida copepods constitute the largest biomass of this community and are 60% and 40% of the total copepod respectively. Copepod species mostly had a positive association among themselves indicating overlapping ecological niche to some extent. The aim of this work is to catalogue and analyse the distribution of copepod species (Crustacea, Maxillopoda) from the Tembhapury reservoir. Analysis was also done to understand of the copepod community structure and their population dynamics, so that the ecological differences existing between sympatric copepod species could be understood. Cyclopoid density varied from month to month while Calanoid showed bimodal fluctuation pattern with peaks in summer and winter. Five species of copepods are recorded. Where in three species Heliodiaptomus viduus, Heliodiaptomus contortus and phyllodiaptomus blanci are from Calanoid copepods and two species Mesocyclop leukarti and Mesocyclop hyalinus are from Cyclopoid copepods.***

**Keywords**: Copepods, Shannon Weiner, Simpson, diversity, abundance

## 1. Introduction

Freshwater copepods constitute one of the major zooplankton communities occurring in all types of water bodies. Among microcrustacean planktonic, the copepods Cyclopoida and Calanoida are one of the most representatives, being the largest biomass of the plankton community (Rocha and Matsumura- Tundisi, 1984; González et al., 2008). These microcrustaceans can be found in a wide variety of lentic environments, in littoral and pelagic zones (Williamson and Reid, 2001). Copepods are much hardier and strongly motile than all other micro invertebrates with their tougher exoskeleton and longer and stronger appendages. They have long developmental time and a complex life history with early larval stages difficult to distinguish. They are mostly carnivorous and feed on the smaller organisms. Among the three orders of copepods, Cyclopoid copepods (Mesocyclop, Microcyclops etc) are generally predatory but also feed on algae, bacteria and detritus. The second group of copepods, Calanoid copepods changes their diet with age, sex, season, and food availability. Family Diaptomidae contains over 400 species in about 50 genera and the family Cyclopidae contains over 110 species (Dana, 1853) belonging to the order Cyclopoida of nearly 50 genera (Dussart and Defaye, 1983; Reid 1993). High zooplankton diversity has been linked with high macrophytes diversity in other studies (Matsumura-Tundisi et al., 1990; Nunes et al., 1996; Nogueira et al., 2003; Maia-Barbosa et al., 2008).

## 2. Materials and Methods

The copepod samples were collected by using plankton net of mesh size 64µm at an interval of 15days every month for a period of one year from Feb 2010- Jan 2011 between 7 to 8 am. The collected samples were kept in plastic bottles containing 4% formaldehyde solution. The Shannon –Weiner Diversity indices and Simpson indices of the copepods were observed and two samples from the water body and its mean value is represented The following taxonomy was done by using Dussart B.H and Defaye 1985, Altaff (2000), Pennak (1953) and Reddy Y.R (1994).

**Diversity indices analysis**: The qualitative and quantitive analysis of zooplankton organisms was carried out.

Species Shannon-Wiener index [H= -_ Pi longPi]
Shannon-Weiner index:
H= -_ Pi long Pi: Where, H =Shannon – Weiner index, Pi = ni /N, _ = Sum, ni = Number of individuals of each species in the sample, N = Total number of individuals of all species in the sample.
Simpson Index (λ) (1949)

$$\lambda = \sum_{i=1}^{S} (ni/n)2$$

Where,
λ =Simpson index
ni=Total population of ith species in community
n= Total population of all species in community

## 3. Results and Discussion

The results obtained are depicted in Table (1) and Fig (1) which shows that during this study 5 species of copepods belonging to 3 families and 3 genera were noticed. They are namely *Heliodiaptomus viduus*, *Heliodiaptomus contortus*, *Phyllodiaptomus blanci*, *Mesocyclops hyalinus*, and *Mesocyclop spp*. Shannon Weiner value showed highest H=1.483 in the month of April and lowest H=0.38 in the month of September. Seasonal Species diversity (H) for copepods in summer showed H=1.172, monsoon was H= 1.000 and in winter it showed H= 0.934. Whereas the value for Simpson index showed highest in D= 0. 831 in the month September and lowest in the month of April D=0.237. According to Simpson seasonal diversity index of copepods showed maximum diversity in monsoon with D=0.511 and in winter was minimum with D= 0.394 (Fig.2)and among the five species of copepod *Mesocyclops leukariti* showed highest diversity in monsoon season which was followed by *Heliodiaptomus contortus*. Where

as the lowest diversity showed by *Phyllodiaptomus blanci* in the winter (figure 3).

## 4. Discussion

In the present study Cyclopoids dominated over Calanoids. Rundle and Ormerod (1992) also found that the abundance and richness of cyclopoids. Similarly Nilssen and Waervagen (2000) opined that cyclopoid species, *M. leukarti* utilises periphytic and detritus food sources common in weed infested water bodies. Freshwater copepod provides a good food for aquatic organisms. In this study three species of *Heliodiaptomus viduus, Heliodiaptomus contortus and phyllodiaptomus blanci* and are from Calanoid copepods and two species *Mesocyclop leukarti and Mesocyclop hyalinus* are from Cyclop copepods. Where in study from our laboratory reported (Sontakke and Moakshe 2014) six species of copepods from the Dheku reservoir of Aurangabad, (M.S) and Harkal et al. (2011) also found four species of copepods from the Kagzipura Lake of Auarangabad region. Rigler and Langford (1967) found that 46%, 42% and 9% water bodies had one two and three calanoid species respectively in Southern Ontario lakes. Where as Nilsson and Waevagen (2000) described 3-6 cyclopoid species coexisting in European lakes. Although Green (1979) concluded that the number of species alone is a better and more realistic indicator of the status of aquatic ecosystem. Huges (1978) opined that a number of factors influence the diversity index. Diversity index is commonly used as bio criteria for the interpretation of the environmental status. Higher diversity indicates that such community have their resources more finely distributed among individuals of many species (Smith, 1977). The species diversity tends to be low in stressed and polluted ecosystem (Bass and Harrel, 1981). Wilhm and Doris (1968) and Stuub et al. (1970) proposed that value of <1 indicates pollution of water. As the diversity index was less than one, it can be concluded that the site was stressed to some extent.

In the present study *Heliodiaptomus viduus, Heliodiaptomus contortus, Phyllodiaptomus blanci, Mesocyclops edax,* and *Mesocyclop spp*. are recorded. Wherein, Cyclopoids showed 3 peaks comparable to multimodal population fluctuation of the related species, *M leukarti* as observed by Chakrapani et al., (1989) in India. . Similar observations have been made by Szluaer (1963) in lake Biwa for *M. thermocyclopoides* and by Zanki (1987) in European lakes for *M. leukarti*. Unlike Mesocyclop hyalinus *and phyllodiaptomus blanci*, was present during summer and absent during monsoon. Thus these two species alternated their population peaks and in this way avoided competition causing a temporal niche separation.

## 5. Conclusion

Cyclopoid density varied from month to month and showed winter, summer and monsoon peaks, while Calanoida showed bimodal fluctuation pattern with peaks in monsoon and summer. Cyclopoida and Calanoida copepods species together were dominant genera. The species richness and abundance of Cyclopoida *Mesocyclops leukariti* increased in number during monsoon when it was more common than *H. contortus.*

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## References

[1] Aman, S. & K. Altaff, Biochemical Profile of Heliodiaptomus viduus, Sinodiaptomus (Rhinediaptomus) indicus, and Mesocyclops aspericornis and their Dietary Evaluation for post larvae of Macrobrachium rosenbergii. *Zool. Stud.*, 43 (**2**): 267-275. (**2004**)

[2] Ambedkar, D. A study on the diversity of Diaptomid copepods (Crustacea: Calanoida) in certain localities of Karnataka and Andhra Pradesh States. M. Phil. Thesis. Department of Zoology, Acharya Nagarjuna University. 72 pp. (**2005)**

[3] Bass, D. & Harrell, R. C. Water quality of South East Texas Stream. *Hydrobiologia* 76: 69 – 79. (1981)

[4] Bradford-Grieve, J. M., Boxshall, G. A., Ahyong, S. T., Ohtsuka, S., Cladistic analysis of the calanoid Copepoda. *Invertebr. Syst*., 24: 291-321. (**2010)**

[5] Brandorff GO: The copepod invader Skistodiaptomus pallidus (Herrick, 1879) (Crustacea, Copepoda, Diaptomidae) from North America in water bodies of Bremen, northernGermany.*AquaticInvasions*6,Suppl.1:1–5, http://dx.doi.org/10.3391/ai.2011.6.S1.001**(2011)**

[6] Chakrapani, B. K., Chicka, I. N. and Reddy, R. Population dynamics and fecundity of the Copepod *Mesocyclops leukarti* (Claus) in a freshwater habitat of Bangalore. Ind. J. Inv. Zool. & Aqua. Biol. 1: 24-27. **(1989)**

[7] Chiambeng, G. Y. & Dumont, H. J.,. Calanoid copepods from the low land forest zone of Cameroon (West Africa), with the description of a new species of Tropodiaptomus. *Hydrobiologia*, 489: 99-106. **(2002)**

[8] Dussart and Defaye,; [Répertoire mondial des CrustacésCopépodes des eaux intérieures. Les Calanoïdes]. [Book in French] *Centre national de la recherche scientifique ed.,Paris:* 224 pp.**(1983)**

[9] Dussart, B. H. and Defaye, D. Copepoda: Introduction to Copepoda, *SPM Academic Publishing* bv: 6– 7. **(1995)**

[10] Einsle, U. The long term dynamics of crustacean communities in Lake Constance (Obersee, 1962-1986). Schweiz. Z. *Hydrol*., 50 : 136 – 165. **(1988)**

[11] Green, R. H. Statistical design and statistical methods for environmental biology. Wiley. New York. **(1979)**

[12] Harkal A.D, G.V. Arak, S. S. Mokashe and G. K. Kulkarni A report on micro-invertebrate associated with littoral macrophytes in kagzipura Lake. *JournalRecent sciences in sciences and technology* 3(3) 14-16. **(2011)**

[13] Huges, B. P. The influence of factors other than pollution on the value of Shannon's diversity index for benthic macro invertebrates in streams. Water Res. 12: 357 – 364. **(1978)**

[14] Krebs, C. J. Ecology. The experimental analysis of distribution and abundance. 3rd Edition, Harper and Row, Publishers, New York. **(1985)**
[15] Nilssen, J. P. and Waeruagen, S. B. Superficial ecosystem similarities vs autocological stripping: the "Twin species" *Mesocyclops luckarti* (Claus) and Thermocyclops oithonoides (Sars) – seasonal habitat utilization and life history traits. *J. Limnol.*, 59(2): 79 – 102. **(2000)**
[16] Reddy, Y. R., Copepoda: Calanoida: Diaptomidae. Key to the genera *Heliodiaptomus, Allodiaptomus, Neodiaptomus, Phyllodiaptomus, Eodiaptomus, Arctodiaptomus and Sinodiaptomus. SPB Academic Publ.*, The Hague 221 pp. **1994**.
[17] Rigler, F. H. and Langford, R. R. Congeneric occurrences of species of Diaptomus in southern Ontario lakes. Can. *J. Zool*. 45: 81 – 90. **(1967)**
[18] Rundle, S. D., Ormerod, S. J. The influence of chemistry and habitat features on some microcrustaceans of some upland welsh streams. *Freshwater Biology* 26(3) : 439 – 452. **(1992)**
[19] Sontakke and Mokashe Diversity of Zooplankton in Dekhu reservoir from Aurangabad, Maharastra. *Journal of Applied and Natural science* 6 (1) 131-133**(2014)**
[20] Staub, U., Applong, J. W., Hotsteiler, A. M. & Hass, I. J. The effect of industrial waters of mephis and Shelby country on primary plankton producers. *Bioscience* 20: 905 – 912. **(1970)**
[21] Szlvaer L. The resting stages of cyclopidae in Stary Dwor Lake. Polsk. Arch. *Hydrobiol*. 11, 24: 385-394. **(1963)**
[22] Wilhm, J. R. & Dorris, C. T. Biological parameters for water quality criteria. *Biosciences.* 18: 447 – 481. **(1968)**
[23] Zankai, N. P. Post embryonic development of cyclopoid copepods in various seasons at lake. Balaton (Hungary) *J. Plankton. Res. 9: 1057-1068*. **(1987)**

**Table 1:** The Seasonal population density of the copepods

| *COPEPODS/Seasons* | *Winter* | *Summer* | *Monsoon* |
|---|---|---|---|
| *Mesocyclops hyalinus* | 10 | 7 | 7 |
| *Mesocyclops leukariti* | 69 | 46 | 198 |
| *Heliodiaptomus contortus* | 14 | 16 | 22 |
| *Heliodiaptomus viddus* | 6 | 10 | 16 |
| *phyllodiatomus blanci* | 1 | 2 | 1 |

**Figure 1:** Graph showing the seasonal population density of the copepods 100% stack

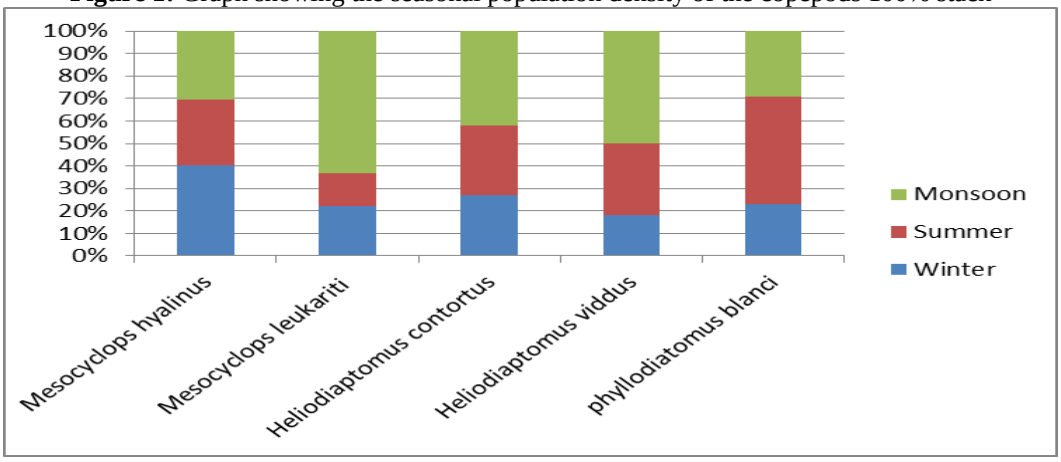


**Figure 2:** Graph showing the monthly diversity indices of Shanon Weiner and Simpson of Copepods

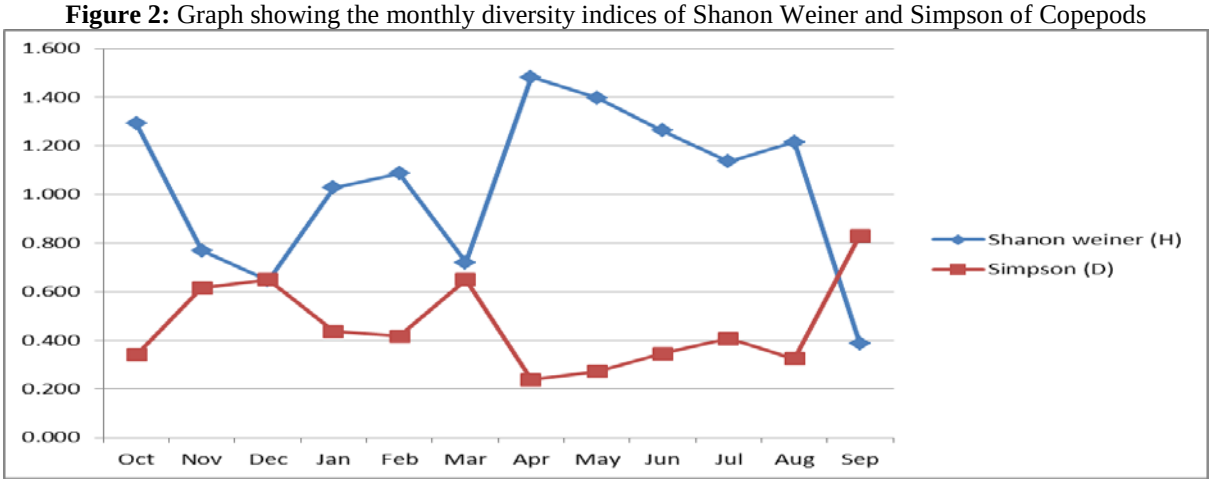

**Figure 3:** Graph showing the seasonal population diversity indices (H) and (D) of copepods