



POPULATION DYNAMICS OF COPEPODS IN RELATION TO WATER QUALITY STATUS OF SEWAGE FED TANK IN BHADRAVATHI TALUK, KARNATAKA

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Abstract:

The present study deals with the monthly variations of copepods in relation to the physico- chemical parameters of sewage fed waterbody namely Jannapura tank, Bhadravathi town, Shimoga District, Karnataka during January to December 2008. The tank is surrounded by Arecanut, paddy, sugar cane and coconut plantations. A total of 7 genera and 7 species of copepods were recorded. The highest density of copepods was recorded during September 2008 (55 O/L) and their number was least (14 O/L) in May 2008. The study revealed that there is an indication of pollution in the tank due to anthropogenic activities, encroachments and inflow of sewage from surrounding residential areas and the sewage fed tank is productive and eutrophic. In the present study, as per water quality recommended by WHO and BIS standards, the tank water is not suitable for human consumption. Hence, preventive measures are required to avoid further deterioration of tank water quality.

Key Words: Copepods, Jannapura Tank, Eutrophication & Water Quality Parameters

Introduction:

Zooplankton acts as main sources of food for many fishes and plays an important role in early detection and monitoring the pollution of water. Zooplankton community distribution depends on some of the complex factors viz, change of climatic conditions, physical and chemical parameters and vegetation cover (Rocha et al., 1999; Neves et al., 2003). Most of the planktonic organisms are cosmopolitan in distribution (Mukherjee, 1997; Shivashankar and Venkataramana , 2013) .

Copepods constitutes a major zooplankton communities occurring in almost all the water bodies, which serve food for many fish and play a vital role in ecological pyramids. Nearly 120 species recorded from India (Uttangi, 2001). The important factors which controlled the distribution of copepods were rainfall, river discharge and decreased phytoplankton abundance due to increased turbidity (Bijoy Nandan and Abdul Azis, 1994; Hashemzadeh Farshad and Venkataramana , 2012; Shivashankar and Venkataramana ,2013) .

No literature is available related to the diversity and distribution of copepoda in freshwater urban tank of Bhadravathi town of Shimoga district, Karnataka region and therefore, the present study was carried out.

Materials and Methods:

Study Area:

Jannapura tank is a perennial water body located near Bhadravathi town in Shimoga district (Figure 1) of Karnataka (13^o48'37"-13^o52'30"N & 75^o40'42"-75^o43'33"E) and it

receives the water from Bhadra left bank channel as well as rain water. The area of the tank is 20 ha and depth is about 5-10mt. The tank water is utilized for agriculture as well as for fish culture.

Water and Zooplankton Analysis:

Surface water samples were collected by using polythene bottles on monthly basis, between 8 to 10 AM from January to December 2008. Water temperature and pH were recorded at the sampling site itself. Dissolved oxygen was fixed on the spot itself in BOD bottles. Other water quality parameters were estimated as per the standard methods of APHA (2005).

Zooplankton were collected on a monthly basis with the help of plankton net which is made by bolting nylon silk (mesh- size 50 μ m) and is conical in shape and reducing cone with the bottle at its end. The plankton net is towed horizontally and obliquely (for Qualitative) in surface water of the study area and about 100 liters of water is filtered by passing through plankton net. Samples were then washed into wide mouth bottles and were preserved by adding 5% formaldehyde solution. Further analysis was done by putting 1 ml of the preserved sample on a Sedgwick-Rafter counter cell and studying it under an inverted microscope. For qualitative analysis, the keys given in Needham and Needham (1962), Pennak (1978), Tonapi (1980), Battish (1992) and APHA (2005) were utilized and results were expressed in O/L.

Results and Discussion:

7 genera and 7 species of copepods were recorded and the species includes *Mesocyclops*, *Eucyclops sp.*, *Paracyclops*, *Cyclops*, *Diaptomus sp.*, *Heliodiaptomus* and *Leptodiaptomus sp.* (Table 1). The families cyclopidae and Diaptomidae consists of 4 species and 3 species of copepods respectively. Figure 2 depicted percentage composition of orders of Copepoda in Jannapura tank.

The highest density of copepods was recorded during September 2008 (55 O/L) and their number was least (14 O/L) in May 2008 (Figure 3). Copepods was mainly represented by *Cyclops* species and *Diaptomus sp.* Similar observations were also made by Padmavati and Goswami (1996), Ahmad et al.(2011) and Mirgane et al (2015).

Copepodes build up their population taking more time than rotifers and other zooplanktons. However, once they become dominant, they continue to dominate the habitat till the hydrobiological condition favour their existence (Prabhavathy and Sreenivasan, 1977; Meshram Wasudha, 2014). In Jannapura tank copepods showed the peak in density during rainy months indicating the influence of various physic-chemical factors. In the present investigations, the nutrients such as nitrates, phosphates etc. were recorded in higher concentration while high in dissolved oxygen during rainy season which may result into the increased population of copepods while, lower population was recorded during summer months. Kamble and Meshram (2005) in Khatijapur tank, Achalpur have reported the pollution indicator species like *Cyclops* were recorded more during the winter season. This pattern of distribution may be due to the interaction of biotic and abiotic components of water (Meshram Wasudha, 2014).

Rao and JayaRaju(2001) have reported maximum number of zooplankton during summer. Least count of both reported during monsoon season (Meshram Wasudha, 2014). Kumar (2001) has also reported maximum number of Copepods species during winter than summer season. In this study, the less number of copepods during summer months might

be attributed to the higher temperature, evaporation of water or due to the depletion of the important factors such as Dissolved oxygen. The reduction in the number of species may also be due to predation (Meshram Wasudha, 2014).

Zooplanktons by their heterotrophic activity play a key role in the cycling of organic materials in aquatic ecosystems and are used as bioindicators of environmental quality. Gajanan Sontakke and Satish Mokashe (2014) studied the diversity and abundance of zooplankton in Dekhu reservoir from Aurangabad district. They were recorded 6 species of copepods and cladocerans. In the present study, we have recorded 7 species of copepods from Jannapura tank.

Copepoda is occurring in almost all types of fresh water bodies and form an important component of fish food (Sunkad et al., 2013). In the present study occurrence of *Mesocyclops* indicating their ability to adapt clean water and contaminant waters. This is concurrence with the work of Sunkad and Patil (2004) and Sunkad et.al (2013).

Water Quality:

The water temperature of the present water body deviated from 22.5°C to 32°C (Table 2). pH of the water was alkaline in nature. Sulphate level fluctuated from 48.6 to 70.8 mg/L. High Dissolved oxygen level of 4.8 mg/L and low level of 2.4 mg/L was recorded. BOD fluctuated 4.8 - 16.8 mg/L. However, the nitrate and phosphate contents were deviated from 14.6-54.4 mg/L and 0.28-1.08 mg/L respectively. Cations viz., calcium content varied 18 - 50 mg/L but magnesium content was slightly lower than calcium and ranged between 16 & 40 mg/L. Total hardness is a measure of calcium and magnesium concentration in water and is controlled by the source of the tank water. Water body in limestone areas will generally have harder water than those in areas underlain by sandstone or shale. Total hardness varied between 246 and 362 mg/l. In potable water Ca⁺⁺ and Mg⁺⁺ range between 75 and 200 mg/l and 50 and 100 mg/l respectively (ICMR, 1975). In the present study, the water can be classified as hard category which is below the prescribed limit of 200-600 mg/l.

It is found that Jannapura tank receives sewage from the surrounding residential areas and the depth of the tank is slowly reduced due to deposition of silt/sediment from surface runoff. According to Bureau of India Standards (1993) and World Health Organization (1991) standards it is found that, tank water is included under eutrophic category as it possesses low DO and high BOD, phosphate and nitrate contents.

Conclusion:

In Jannapura tank the physico-chemical parameters have the direct impact on distribution and abundance of copepods. Occurrence of these bio-indicator copepoda species indicates the eutrophic nature of this tank. From the present findings on physico-chemical relationship with copepoda of a sewage fed tank the water is not suitable for human consumption as it possess higher values of phosphate and nitrate. Copepoda species such as *Cyclops* and *Diatomus* indicate organic pollution in the water body. There is an urgent need to conserve and manage the tank by the concerned authorities.

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Table 1: Diversity and Classification of copepoda in Jannapura tank during 2008.

Phylum-Arthropoda	Phylum-Arthropoda
Class - Maxillopoda	Class - Maxillopoda
Order – Cyclopoida	Order – Calanoida
Family – Cyclopidae	Family – Diaptomidae
<i>Mesocyclops</i>	
<i>Eucyclops sp.</i>	<i>Diaptomus</i>
<i>Paracyclops</i>	<i>Leptodiaptomus</i>
<i>Cyclops,</i>	<i>Heliodiaptomus</i>

Table 2 : Range values of water quality parameters of Jannapura tank

Sl.No.	Parameters	Range
1.	Air temperature (° C)	24.5 - 36
2.	Water temperature (° C)	22.5 - 32
3.	pH	7.7 - 8.2
4.	Sulphate , mg/L	48.6 - 70.8
5.	Nitrate, mg/L	14.6 - 54.4

6.	Phosphate, mg/L	0.28 - 1.08
7.	Total hardness mg/L	246-362
8.	Calcium , mg/L	18 - 50
9.	Magnesium, mg/L	16 - 40
10.	Dissolved Oxygen (DO), mg/L	2.4 - 4.8
11.	Biochemical Oxygen demand (BOD), mg/L	4.8 - 16.8

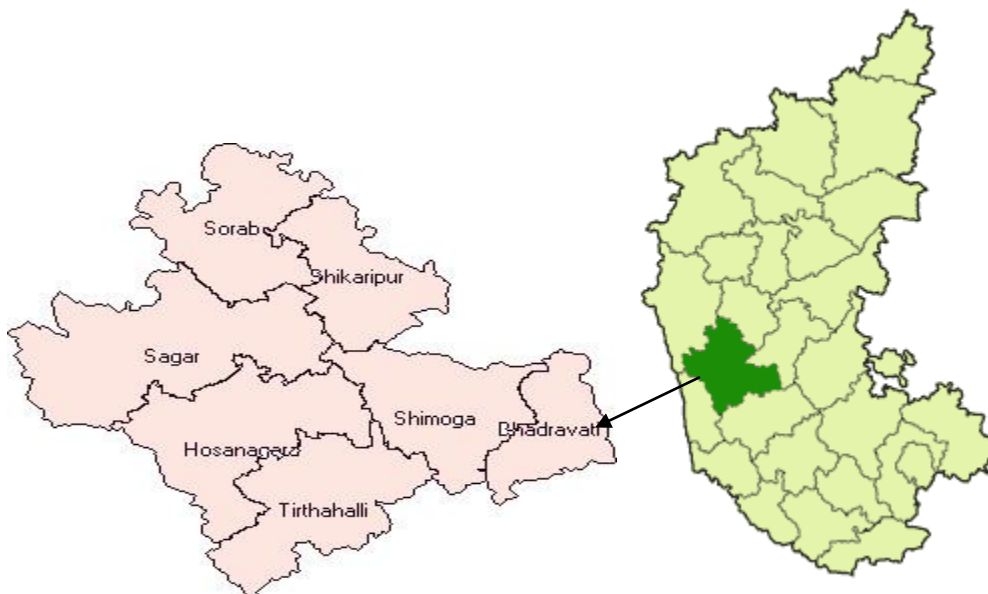


Figure 1: Map showing location of Jannapura tank in Bhadravathi taluk of Shimoga district (Source: en.wikipedia.org and kssidc.in)

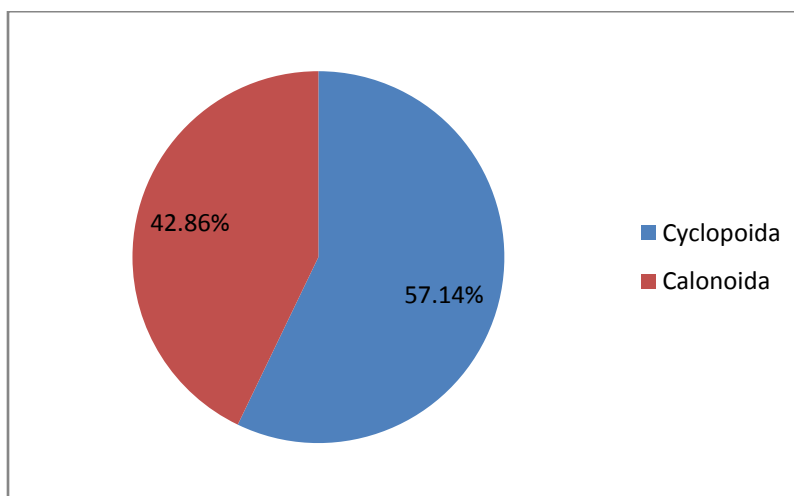


Figure 2: Percentage composition of orders of Copepoda in Jannapura tank

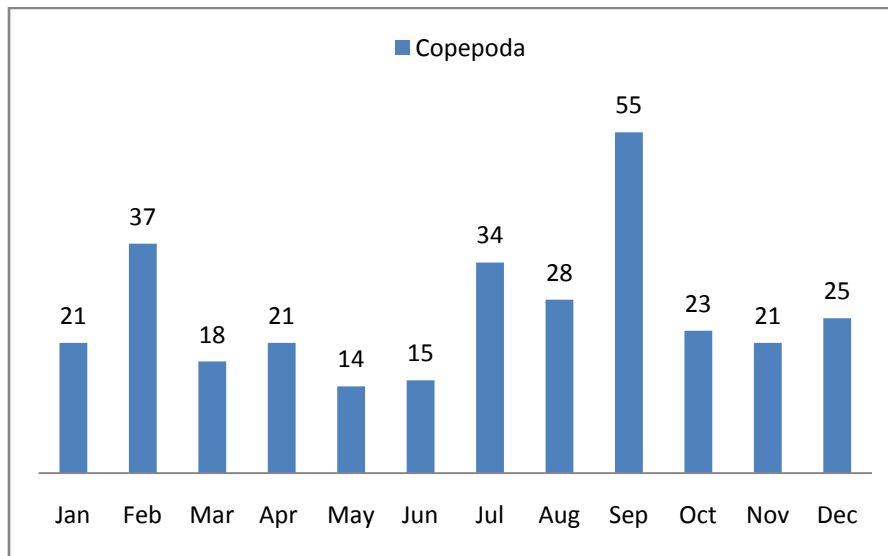


Figure 3: Monthly abundance and distribution of Copepoda species (O/L) in Jannapura tank during 2008