Studies on seasonal variation of zooplankton population in Elanthakulam , Palayamkottai, Tirunelveli District

Abstract

In Elanthakulam Pond in the Tirunelveli District, a study of the zooplankton population was carried out, and plankton samples were taken from August to October of 2023. Abiotic and biotc variables have worked together to produce seasonal shifts in the zooplankton population pattern. In order to evaluate the zooplankton population in the Elanthakulam pond, the current study was conducted. The findings show that during the research period, 10 species from four genera were identified. Of the ten species, four belonged to the rotifer genus, three to the Cladoceran genus, two to the copepod genus, and one to the Ostracoda genus. The presnet study suggests that due to unfavourable environmental conditions, zooplankton did not reach its peak during the monsoon season. It also shows a minor fall in August and September, followed by an increase in October.

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Keywords: Elanthakulam, Cladiceran, Moina, Daphnia, Ostracoda

Introduction:

According to Ali (1999), biodiversity can also be defined as the variation found in all living things, including those found in terrestrial, marine, and other aquatic ecosystems, as well as the ecological complexes of which they are a part. Details regarding the evenness, dominance, richness, and variety of species Analysing the ecosystem's biological components is crucial to comprehending harmful environmental changes (Krishnamoorthy and Subramanian, 1999). Major taxonomic groups are represented in the rich array of zooplankton found in Indian water bodies. Numerous of these types have distinct physiological and environmental assemblages. Any aquatic habitat's population size, composition, and distribution can reveal information about the environmental conditions that are present there.

It is evident that a variety of environmental elements combine to create the right conditions for zooplankton growth in both seasonal and geographical contexts (Shah and Pandit 2013). An essential component of an aquatic ecosystem's relevance and a major player in energy transmission is zooplankton. Because they are highly sensitive to their surroundings, plankton populations' tolerance, abundance, variety, and dominance in the habitat will all shift in response to environmental changes. As a result, plankton population observation could be a trustworthy method for biomonitoring research that evaluates the level of pollution in aquatic environments. The ecosystem and food chain of ponds, lakes, and reservoirs depend heavily on freshwater zooplankton (Manicam et al., 2014). Zooplankton consume phytoplankton as food. They are in control of consuming millions of tiny algae that would otherwise spread uncontrollably. Different zooplankton species have distinct life histories that are impacted by predation pressure, feeding ecology, and seasonal changes in biotic variables. Primary consumers, which consume phytoplankton, and secondary consumers, which eat other zooplankton, make up the zooplankton community. They offer a direct conduit between upper tropic levels, such fish, and primary producers. During their larval stages, almost all fish rely on zooplankton as their primary food source, and some fish consume it for the entirety of their lives (Madin et al., 2001). The freshwater zooplankton population is essential to the food chain's food web because it recycles nutrients and moves organic matter from primary producers like diatoms to secondary consumers like fish. The amount of fish stock is determined in part by zooplankton, and the decline in the Copepod population is thought to be the cause of the fishing resources' failure (Stottrup 2000 and Tiwari et al., 1991). The water quality is assessed in terms of domestic, municipal, and industrial contamination using species diversity indices of zooplankton communities (Acharjee et al., 1995). Thus, zooplankton can serve as a sorority indicator. For the purpose of managing zooplankton populations and maximising system production, research on their variety, density, commonness, and energy levels is currently necessary.When taking into account an aquatic system, planktons show to be quite significant since they can respond instantly to changes in the surrounding environment (Thakur et al., 2013 and Malik et al., 2013). Many biotic and abiotic elements, including as light, temperature, available nutrients, hydrodynamics, predation, oxygen content, pH, and so forth, affect the growth and development rate of plankton (Dhar et al., 2012). The trophic level that comes after the phytoplanktons is called the zooplanktons (Malik et al., 2013 and Shanthala et al., 2008). The physicochemical characteristics of the water body have an impact on the zooplankton population, which also varies with the seasons (Hulyal and Kaliwal 2007 and Kudari and Kanamadi 2007). Unlike physicochemical methods that have led to the detection of one pollutant at a time, the analysis of such indicator organisms, both qualitative and quantitative, has resulted in an assisting option to combine the effects of a number of contaminants. Furthermore, the current state of many water bodies has been ascertained by using indices and other technologies. According to Mahadev et al. (2007), biomonitoring has emerged as a crucial component of studies on water pollution and makes a significant contribution to the field's understanding of water quality assessment. The physicochemical parameters of the environment cause fluctuations in the zooplankton population; in particular, rotifer species are affected by biotic variables (Karuthapandi et al., 2012). The dominance of fish, macroinvertebrates, and water fowl, as well as their feeding preferences, determine the amount and composition of zooplanktons (Russell et al., 2006). In a similar vein, Jafari et al. (2011) investigated the relationship between the physicochemical conditions of the Haraz River and the variety and compositions of zooplankton. Due to their heterotrophic nature, zooplanktons connect primary producers to higher trophic levels and play a crucial role in the food web. Because there are less opportunities for an individual in a water body to remain in the eutrophic zone, where photosynthesis takes place, the abundance of zooplankton is declining (Dhembare, 2011).When assessing the temperature, pollution, and nutrient levels of an ecosystem, zooplanktons play a significant role (Purushothama et al., 2011). Evaluating the zooplankton population in the Eanthakulam pond, Tirunelveli District is the aim of the present study.

Material and Methods:

The plankton sample used in this investigation was collected at Elanthakulam Pond during the winter months of August, September, and October of 2016 (Fig 1a-b). A 25µm-mesh plankton net was swept over surface water, and the plankton it caught was then placed in a different plastic container. To get plankton, around 1 litre of surface water was sieved via a net. Without delay, the zooplankton was preserved in 4% formalin for subsequent microscopic examinations. Post-Clegg (1956), Edmondson (1959), Hutchinson (1967), Michael (1973), Ward and Whipple (1963), Pennak (1978), APHA (1989), and Sridharan (1989) planters were identified. Useful indices of species organisation in communities, as described by Odum (1971), were also computed when planters were identified.

Result:

Tables 1 to 5 show the zooplankton that was seen in the Elanthakulam. The tables display that the zooplankton present in the pond belonged to four distinct groups: Ostracoda, Cladacera, Rotifera, and Copepoda. During the study period, a total of 10 species were reported in the Elanthakulam pond. Four rotifer species in total were identified: Keretella cochlearis, Brachionus rubens, Brachionus caudatus, and Brachionus calyciflorus.Table 1 lists the different zooplankters that constituted the Rotifera group.The table makes it clear that a total of 4 species from 4 genera were found. Of them, three species belong to the genus Brachionus, whereas just one species represents genera like Keretella. For Brachionus calyciflorus and B.rubens, the best counts were recorded in February; for B. caudatus, the best counts were recorded in January; and for Keratella, the best counts were recorded in February.

Table 2 lists the different zooplankters that represented the Cladoceran and Anostracan groups. The table makes it clear that a total of 3 species from 2 genera were found. Of these, two species belong to the genus Moina, while one species represents genera such as Daphnia. *Moina micrura* chose to record her maximum counts in January, while *Daphnia pules* and *Moina brachiata* preferred to record their best counts in February. Table 3 lists the different zooplankton that constitute the copepod group. The table makes it clear that a total of 2 species from 2 genera were found. Of them, one species represented the genus Diaptamous, while another species represented genera such as *Mesocyclops hyalinus*. *Mesocyclops hyalinus* favoured January to record their highest counts, while Diaptamus castor preferred February. Table 4 showed the zooplankters that constituted the Ostracode group. A total of solitary species from solitary genera were noted. One species from the genus Cypris was present among them. The best counts of Cypris Ostracodan were recorded in January, and there were less of them available during this season.

Disussion:

While being present all year round, rotifers preferred the months of August through October for recording their counts, according to an overall comparison of the population. A detailed examination indicates that, out of this time frame, December to February seems to be the most preferred month because during these months, four of the species that were noted reached their peak counts. According to research, one of the most prevalent rotifer genera found in the majority of India's water bodies is Brachionus (Sreenivasan, 1974; Rajasekhar et al., 2010; Singh et al., 2012; Srivastava, 2013). Therefore, it makes sense that Brachionus was the most prevalent genera in this pond during the current investigation as well. It has also been found via numerous researchers' studies that rotifers seem to favour particular months of the year over others in distinct bodies of water. When it came to their preferences, Michael (1969), Chourasia and Adoni (1985), Singh et al. (2012), Tidame and Shinde (2012), Kastooribai (1991), and Sivakami (1996) stated that they liked June through August, Jayanthi (1994), and Rajasekhar et al. (2010) stated that they preferred September and October. The present observation is consistent with these reports. It has been suggested by Tidame and Shinde (2012) that rotifers are used as an important aquatic faunal component for biomonitoring, while Bogdan and Gilbert (1984) claim that rotifers are the dominant members of the zooplankton in most aquatic systems and that almost all fish feed on tiny rotifers during their early development. Sharma (1991) also notes that of the different rotifers that have been identified so far, rotifers belonging to the genus Brachionus are more suitable for feeding fish larvae. The most significant soft-bodied metazoans, or invertebrates, with a brief life cycle among plankton are called rotifers. Table 4 displays the different zooplankters that represented the Anostracan and Cladoceran groups. A single species represented the genus Cypris. The best counts of Cypris ostracodan were recorded in January, and there were less of them available during this season. Numerous studies indicate that Chourasia and Adoni (1985) said they liked October and April, Khan et al. (1986) said they liked summer, and Haque and Khan (1997) said they liked December, May, and August. According to Rajasekhar et al. (2010), they both liked the winter and the rainy season (Tidame and Shinde, 2012). A vital class of zooplankton, cladocerans are the most beneficial and nutrient-dense group of crustaceans for fish further up the food chain. Cladocera constituted the major group within the Zooplankton. Daphnia sp., Moina sp., Ceriodaphnia sp., and Bosmina sp. are the representatives of this group. According to Murugan (1998), this group consumes tiny zooplankton, bacterioplankton, and algae. They are also quite sensitive to pollutants; in fact, they might react even when the concentration of the contaminants is very low. Numerous researchers have examined the physicochemical characteristics, biotic components, and seasonal variations in zooplankton population density, composition, and abundance in freshwater bodies (Thirupathaiah et al., 2011; Patel et al., 2013).

Conclusion

The present study concludes that zooplankton were not maximum in winter season because unfavorable environmental condition.

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Table 1. Rotifer population of Elanthakulam pond

S.No	Rotifer	August	September	October
1	*Brachionus calyciflorus*	0	10±2	15±2
2	*Brachionus caudatus*	3±2.3	11.6±3.5	8.3±3.5
3	*Brachionus rubens*	0	4.3±0.5	3±2.5
4	*Keretella cochlearis*	6±2	2.6±1.1	9.6±2

Table 2. Cladoceran and Anostracan population of Elanthakulam pond

S.No	Cladoceran and Anostracan	August	September	October
1	*Daphnia pulex*	0.5±1.6	5±1.7	9.3±3
2	*Moina brachiata*	8.3±4.7	1±1	10±2
3	*Moina micrura*	2.6±1.1	10.6±5	6±1.7

Table 3. Copepod population of Elanthakulam pond

S.No	Copepod	August	September	October
1	*Diaptomus castor*	9.3±3	4±1	12.6±7
2	*Mesocyclops hyalinus*	3.3±1.1	13.3±5.7	8±2

Table 4. Ostracodan population of Elanthakulam pond

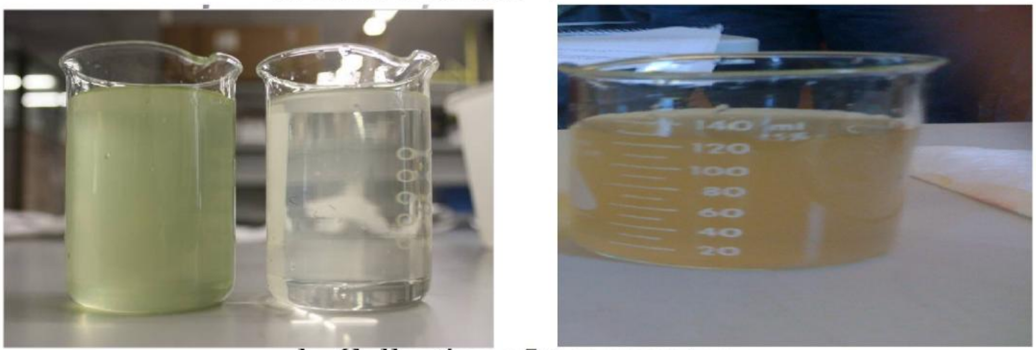
S.No	Ostracodan	August	September	October
1	*Cypris Ostracodon*	0	2.6±1.5	1.3±0.5

Table.5 Zooplankton Total Count of Elanthakulam pond

S.No	Zooplankton	August	September	October
1	Rotifera	14	38	56
2	Copepoda	19	26	31
3	Cladocera	19	25	38
4	Ostracoda	0	4	2
	Total	**52**	**93**	**127**

Figure 1

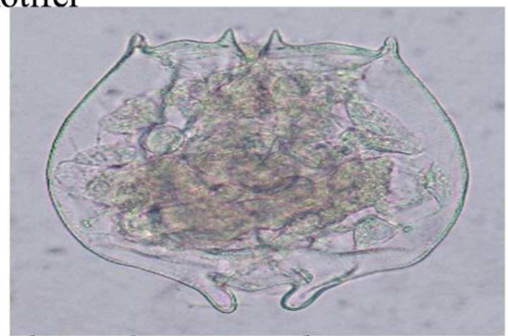
a. Collection site



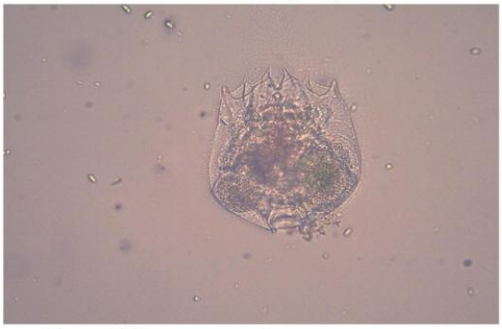
b. Collection of Zooplankton

Figure 2: Rotifer

a.*Brachionus calyciflorus*



b.*Brachionus caudatus*



c.*Brachionus rubens*

d.*Keretella cochlearis*

Figure 3 - Cladoceran and Anostracan

a.*Daphnia pulex*

b. *Moina brachiata*

c.*Moina micrura*

Figure 4 - *Ostracoda*

a.Cypris ostracodan

Figure 5 -*Copepod*

a.Cyclops hyalinus

b. Diaptamus castor

Fig 6: Abundance of different groups of zooplankton during August,September and October in the surface water of Elanthakulam pond