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ORIGINAL RESEARCH ARTICLE

Seasonal Variation and Distribution of Zooplanktonic Fauna in Tandalam Pond (Chennai)

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ABSTRACT

The present work aims to study the seasonal distribution and diversity of zooplankton in Tandalam pond, Kancheepuram district for a period of one year from January 2008 to December 2008. We have recorded 33 species of which, 13 species belong to rotifera, 9 to cladocera, 7 to copepoda and 4 to ostracoda. Among zooplankton, rotifera was the dominant group throughout the study period and the highest count was recorded in the month of June 2008. Cluster analysis was also revealed by dendrogram and Shannon diversity index is also presented. Zooplankton community is also correlated with physicochemical parameters.

Key words: Zooplankton, Diversity, Kancheepuram district, Tandalam pond, Rotifera, Cladocera.

INTRODUCTION

The distribution of aquatic organisms and particularly plankton has long been known to be heterogeneous. Spatial heterogenicity is a common feature in all ecosystems and is the result of many interacting physical and biological processes (Pinel-Alloul 1995). The study of freshwater fauna especially zooplankton even of a particular area is extensive and complicated due to environmental, physical, geographical and chemical variations involving ecological, extrinsic and intrinsic factors. Although the distribution of biodiversity across the earth can be described in terms of the relatively small number of spatial patterns such as latitude, altitude or habitat size, understanding how these extrinsic drivers influence diversity remains one of the most significant intellectual challenges to ecologists and biogeographers (Gaston 2000). A large number of studies covering a wide variety of ecosystems and organisms suggest that species richness tends to vary strongly with ecosystem production and habitat heterogenicity (Rosenzweig 1995). This is particularly so with freshwater fauna (zooplankton), which plays a key role in preservation and maintenance of ecological balance. Its basic study is wanting and is absolutely necessary. The seasonal fluctuations of the zooplankton population are a well known phenomenon. Zooplankton exhibits a bimodal oscillation in a Spring and Autumn in the temperate lakes and reservoirs (Wetzel 2001). This fluctuation is greatly influenced by variations in the temperature along with many other factors. Among several factors, temperature seems to exhibit the greatest influence on the periodicity of zooplanktons (Byars 1960; Battish and Kumari 1986; Prasad and Singh 2002). Water temperatures between 10–29°C are suitable for zooplankton development (Kaushik *et al*. 1992).

The water bodies have their physico-chemical and biological characteristics. The biota of surface water is governed by various environmental conditions. Zooplankton supports the economically important fish population. They are the major mode of energy transfer between phytoplankton and fish. A number of workers such as Ayyappan & Gupta (1980) Chakravarty (1985), Balkhi *et al* (1987) have reported on different aspects of zooplankton inhabiting Indian fresh waters.

The zooplankton community is composed of both primary consumers (which eat phytoplankton) and secondary consumers (which feed on the other zooplankton). They provide a direct link between primary producers and higher trophic levels like fish. Nearly all fish depend on zooplankton for food during their larval phases and some fishes

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continue to eat zooplankton throughout their entire lives (Madin *et al.*, 2001).

MATERIALS AND METHODS

Study area

The freshwater Tandalam pond reservoir is situated near Poonamalle. Its area is about 1 hectare and has an average depth of 7-8 feet. This pond is rain fed and it is used by the people for many purposes. The bottom soil of the pond is sandy and surrounded by vegetation. Fishes such as *Catla catla, Tilapia mossambica* were seen this pond.

Separation

In the laboratory the plankton collected from the reservoir were poured into a broad petri dish. The different planktons were isolated with a pointed painting brush using a binocular dissection microscope.

For qualitative and quantitative analysis of zooplankton, collections were made using a modified Haron-Trantor net with a square metallic frame of 0.0625 m^2 area. The filtering cone was made up of nylon bolting silk plankton net (No. 25 mesh size 50 μ). This net was used for collecting zooplankton. The net was hauled for a distance of 10 m. A collected sample was transferred to labeled vial containing 5% formalin. After sedimentation, 100 ml of sample was subjected to centrifugation at 1,500 rpm for 20 min and used for further investigation. In the laboratory the plankton were poured into a broad petri dish. The different planktons were isolated with a pointed painting brush using a binocular dissection microscope. Counting of the rotifera, cladocera, copepod and ostracoda was carried out using a Sedgewick Rafter cell. The data was used only to express the relative abundance of the principle zooplankton groups (Needham and Needham 1962).

Water samples collected for the purpose of estimation of various parameters were brought to the laboratory and subjected to analysis immediately as far as possible. Estimation of parameters such as total dissolved solids, pH, dissolved oxygen, free carbon dioxide, total alkalinity, hardness, calcium, magnesium, chloride, nitrogen, phosphorus and biochemical oxygen demand was carriedout.

Zooplankton diversity was analyzed for all groups and species diversity with log to base two was calculated using the Shannon Weiner index which has moderate sensitivity to the sample number (Magurran 1988). Some values are mentioned in n/lit., because a single month data cannot be computed in Shannon Weinner Index.

Shannon Weinner Index

H=s/SUM(pi) (log2pi)

Where;

H = Shannon-Weiner diversity

SUM = represents a capital epsilon

s = number of species

pi = proportion of individuals of the total sample belonging to the species calculated as i/N for each species with number in species i and N the number of individuals in the sample.

RESULTS AND DISCUSSIONS

The values recorded for physicochemical variables during the study period are mentioned in (**Table 1**).

Table 1: Average values of physico-chemical variables

S. No	Parameters	Winter	Summer
1	Color	Brownish yellow	Green-brownish yellow
2	Odour	Unobjectionable	Unobjectionable
3	Electrical conductivity	709.5	1034.08
4	Water Temperature(C°)	18.54	19.06
5	pH	6.99	7.19
6	BOD	39	40
7	COD	225	230
8	Alkalinity	350	360
9	Hardness	366	370
10	Chloride	270	280
11	Nitrate	45	45
12	Calcium	105	200
13	Magnesium	100	115

Results of chemical examination are expressed in mg/l, except pH and temperature. BOD- Biological oxygen demand and COD- chemical oxygen demand.

The most important parameters concerning pond ecology are atmospheric temperature, color, odour, water temperature, pH, electrical conductivity, transparency etc. Variation in the following chemicals levels such as dissolved oxygen, biological oxygen demand, alkalinity, hardness, chloride, nitrate, calcium, magnesium etc., are also very important from the water chemistry point of view. Due to the variation in the physicochemical variables, the productivity of different ponds varies considerably.

The total dissolved solids observed during summer were higher and lower values were observed during winter season. Higher concentration of total dissolved solids increases water turbidity which in turn decreases the light penetration. Thus it affects the photosynthesis, by suppressing the primary producers in the form of algae and microphytes. Higher pH observed

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during the summer season could be attributed to enhanced rate of evaporation coupled with human interference and partly due to enhanced photosynthetic activity. The higher values of dissolved salts were recorded during summer season. The Tandalam pond water is moderately hard, which in turn is useful for higher zooplankton productivity. The chloride levels showed greater periodicity during summer, which may be due to high rate of evaporation during hotter months.

The population of zooplankton in Tandalam pond consist of Rotifera, Copepoda, Cladocera, and Ostracoda . The total number recorded were 2809 per liter of which rotifera 1,061 (37.44%), Cladocera 932 (33.17%), Copepoda 553 (19.69), and Ostracoda 263 (9.37%). All the above mentioned zooplanktons were dominant throughout the year. Diversity analysis showsthat rotifers have 13 species, Cladocera 7, Copepods 9, and Ostracoda 4. The diversity of zooplankton groups is mentioned in Table 2, 3.

Table 2: Composition of zooplanktons

Months	Zooplankton groups			
	Rotifera	Cladocera	Copepoda	Ostracoda
Jan	144	298	124	136
Feb	506	298	616	262
March	1,732	1,544	1,056	182
April	1,907	379	1,468	588
May	1, 959	648	1,193	706
June	1,972	1,478	943	432
July	1,560	1,728	200	196
August	1,313	500	649	328
Sept	1,270	1, 660	156	73
Oct	164	896	–	78
Nov	144	298	124	136
Dec	137	902	130	84
Total	12,726	11,181	6,637	3,159
% of Plankton Diversity	37.44	33.17	19.69	9.37

Table 3: Diversity of zooplanktonic groups of fresh water pond

Rotifera	Cladocera	Copepoda	Ostracoda
Brachionus Angularis	*Daphnia pule*	*Cyclops sp*	*Cypris sp.*
Calvciflorus	*Lumholtzi*	*Eucvlops sp.*	*Stenocypris sp.*
Quadridentatus	*Carinata*	*Microcyclops sp.*	*Hemicypris sp.*
Caudatus	*Simocephalus vetulus*	*Mesocyclops sp.*	*Strandesia Indica*
Falcatus	*Moina dubia*	*Diaptomus sp.*	
Keratella Tropica	*Micrura*	*Nauplii*	
Valga	*Bosmina longirostris*	*Copepodid sp.*	
Platvias Patulus	*Alona affinis*		
Quadicornis	*Ceriodaphina sp.*		
Rotaria sp.			
Philodina sp.			
Asplanchna sp.			
Synchaeta sp.			

The lowest count zooplankton abundance was recorded during the rainy season (when all the zooplankton groups had very low values). The main reason for this is not immediately known but we believe that predation by juvenile fish may have contributed to the decline in zooplankton. Concurrent samples taken showed high density of the juveniles of *Oreochromis niloticus* and *Clarias* spp. during the post-rainy season (Okogwu 2008). The juveniles of *Oreochromis* spp. and *Clarias* spp. are obligate zooplanktivores (Mwebaza-Ndawula 1994, Ovie & Ovie 2002). Fish predation on zooplankton during this season may have led to low zooplankton population.

In contrast to abundance, species richness was higher during the dry and post-rainy seasons than in the rainy and pre-rainy seasons. High richness of rotifer species was also recorded during these seasons in contrast to the findings of Ayoagui & Bonecker (2004). This may be ascribed to the low population of cladocerans and the relief of the rotifers from competitive suppression by the cladocerans. Aoyagui & Bonecker (2004) stated that zooplankton diversity can be increased by the removal of competitively dominant species. Shannon-Weaver diversity index varied from 0.68 to 1.28 and did not vary significantly between seasons which are characteristics of stable physico-chemical conditions.

CONCLUSION

Among the zooplanktons in Tandalam pond, 33 species belong to Rotifera, Cladocera, Copepoda and ostracods. During the study period seasonal fluctuations of zooplankton community have been observed. From the above results and discussion we conclude that, this pond is suitable for fish culture.

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