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SEASONAL VARIATIONS OF ZOOPLANKTONS IN VAIGAI RIVER, MADURAI DISTRICT, TAMILNADU

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ABSTRACT

Vaigai River is one of the largest Rivers in Tamil Nadu South India. The River maintains biological and ecological diversity. Vaigai River fosters high biological diversity, provides hydrological and ecological services and also supports livelihoods of a huge rural population. The nutrient rich physical environment support larvae and juvenile of many economically important species. It also acts as nursery grounds of commercially important fishes. The present paper deals with the diversity of zooplankton of the River Vaigai. The samples were collected from three sites at 11.30 am using plankton net and were analyzed monthly for the presence of zooplankton by using Sedgwick-Rafter cell methods. Planktons were identified up to genus level. Totally 4 genera of zooplanktons and many larval forms were recorded from the sites studied. The present study provided information about the presence of four major groups of zooplanktons namely Rotifers, Copepods, Protozoa and Cladocerans. Many larval forms were also identified. Among the zooplanktons copepods were the most dominant group in all the sites studied. Zooplanktons are the major component of an aquatic ecosystem which gives strength and stability to the system.

KEY WORDS: Zooplankton, Sedgwick-Rafter cell method, Plankton net and Vaigai River.

1.Introduction

Zooplanktons are tiny aquatic animals that are very weak swimmers. They are present in almost all the water bodies. Fresh water plankton is an important biological component in aquatic ecosystems, whose main role is to act as a primary and secondary links in the food chain and they play a vital role in energy transfer of aquatic ecosystems (Altaff, 2004). It can be used as "Bioindicators" for water pollution studies, because their occurrence, vitality and responses change under adverse environmental conditions (Oliver, 1996). The freshwater zooplankton comprises Protozoans, Rotifers, Cladocerans, and Copepods. Among these Rotifers are considered nature's water purifier an d respond more quickly to environmental changes. They are very prominent group among the zooplankton due to the less specialized feeding, parthenogenesis type of reproduction and high fecundity. Copepods are known to be the most abundant zooplanktons in the river water. They are more in number in stable environmental conditions and disappear as pollution load increases (Das et al, 1996). An investigations of freshwater zooplankton community is essential for assessing aquatic ecosystem health. Plankton fluctuations are triggered by several factors such as temperature, light, water quality, food availability, competition and predation. Therefore low abundance of zooplankton noted in the Vaigai River. Furthermore, Changes in zooplankton diversity are known to be significant indicators of environmental disturbance (Attayde and Bozelli, 1998).

Therefore changes in aquatic environment accompanying anthropogenic pollution are a cause of growing concern and require monitoring of surface waters and organisms inhabiting them. So the present study was carried out to understand the diversity and seasonal variation of zooplanktons in Vaigai river.

1.1 Study area

The Vaigai river originates in the Periyar Plateau of the western Ghats and flows northeast through the Kumbam valley, which lies between the Palani Hills to the north and Varushanad Hills to the South. As it round the eastern corner of the Varushanad Hills, the river flows through the region of Madurai. Vaigai River empties into the Palk strait in Ramanathapuram District. It is 258 kilometers (160 mi) long, with a drainage basin 7031 square kilometers large. It falls within the co-ordinates of Latitude 7°21'00" N and longitude 79°00'00"E.

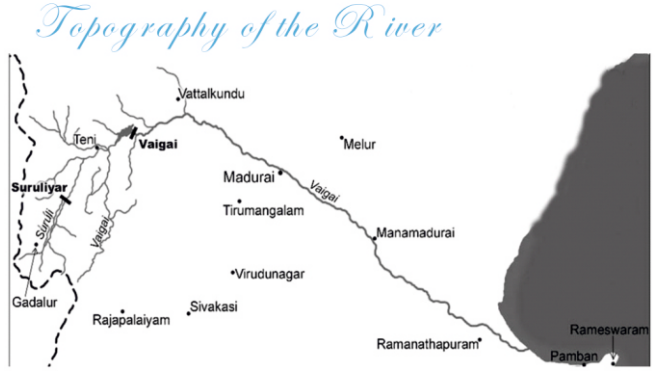

Figure-I Location map of study area

2. MATERIALS AND METHODS

To have a brief insight about the quality of Vaigai river water, a total of three samples were collected from Kunnur (Theni), Vaigai Dam and Annaipatty for the period of one year (Nov 2009 – Oct 2010) with an interval of 30 days for one year. In each station sampling spots were fixed for the collection and analysis of Zooplankton.

Figure 2- Kunnur Sampling Station

Figure 3- Vaigai Dam sampling station

Figure 4 – Anaipatti Sampling station

The volume of water to be filtered for zooplankton analysis was standardized by repeated trials and filtering different volumes of water through the plankton net i.e., 25L, 50L, 75L, 100L, 125L and 150L. The experiment was carried out twice in order to determine the precision of the results. Water was collected from the surface with minimal disturbance and filtered in a No. 25 bolting silk cloth net of mesh size 63 µm and 30 cm diameter. The final volume of the filtered sample was 125ml, which was transferred to another 125ml plastic bottle and labeled mentioning the time, date and place of sampling. The samples collected in 125ml plastic bottles were preserved by adding 2ml of 4% formalin. The preserved samples were kept for 24 hours undisturbed to allow the sedimentation of plankton suspended in the water. After 24 hours, the supernatant was discarded carefully without disturbing the sediments and the final volume of concentrated sample was 50ml.

2.1 Qualitative and quantitative analysis of zooplankton

The qualitative and quantitative analyses of zooplankton were done by using Sedgwick-Rafter cell (for standardization) and by Lackey's drop method. Six strips were counted in Sedgwick-Rafter cell with dimensions of 50mm x 20mm x1mm. In Lackey's drop method, the coverslip was placed over a drop of water in the slide and whole of the coverslip was examined by parallel overlapping strips to count all the organisms in the drop. About 20 strips were examined in each drop. Number of subsamples to be taken was dependent on the examining 2 to 3 successive subsamples without any addition of unencountered species when compared to the already examined subsamples in the same sample. The zooplankton were identified upto a taxonomic precision of species level in Rotifera, genus level in both Cladocera and Copepoda using standard identification keys (Murugan et al., 1998; Altaff, 2003; Edmondson, 1959; Battish, 1992; Dhanapathi, 2000).

The species belonging to each group were noted down and number of individuals in each species was counted. The number of organisms was expressed in Total organisms per liter using the formula,

2.3 Calculation: For Sedgwick – Rafter cell

$$\text{Organisms per liter (N)} = \frac{R \times 1000\ mm^3 \times 10^3}{L \times D \times W \times S}$$

Where,
R = number of organisms counted per subsample
L = length of each strip, mm
D = depth of a strip, mm
W = width of a strip, mm
S = number of strips counted.

Therefore,
Total organisms per liter = N x 1/C

$$\text{Where concentration factor, C} = \frac{\text{Volume of original sample (ml)}}{\text{Volume of concentrated sample (ml)}}$$

$$\text{Organisms per liter (N)} = \frac{R \times A_t \times 10^3}{A_s \times S \times V}$$

Where
R = Number of organisms counted per subsample
A_t = Area of coverslip, mm^2
A_s = Area of one strip, mm^2
S = Number of strips counted, and
V = Volume of sample under the coverslip, ml

Therefore,
Total organisms per liter = N x 1/C

$$\text{Where concentration factor, C} = \frac{\text{Volume of original sample (ml)}}{\text{Volume of concentrated sample (ml)}}$$

Table 1. Data of the seasonal variations in the Zooplakton population of the River Vaigai at Annaipatti for the year (Nov 211 to Oct 2012)

Species	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Protozoa												
Coleps Sp.	2	2	1	2	3	4	3	2	2	1	1	1
Sarcodina Sp.	2	1	2	2	2	3	2	2	2	2	2	1
Urocentrum Sp.	2	2	1	1	2	3	2	1	2	2	1	2
Loxodes Sp.	2	1	2	2	3	3	3	2	2	2	2	1
Vorticella Sp.	2	3	2	2	3	4	2	1	2	1	2	2
Copepoda												
Cyclops Sp.	1	1	1	1	2	2	2	2	1	1	1	1
Limnocalanoidea macrurus	1	1	1	2	1	2	1	2	2	1	1	1
Senecella calanoidea	1	1	2	1	1	1	1	1	1	1	2	2
Macrocyclops ater	1	1	2	1	1	1	1	1	1	1	1	1
Nauplius of Copepoda	1	2	1	2	2	1	2	1	2	1	1	1
Thermocyclops Sp.	1	1	2	1	1	1	1	1	1	2	2	1
Cladocera												
Daphnia carinata	1	2	1	2	2	2	3	1	1	2	1	2
Daphnia pulex	2	2	2	2	2	3	2	1	2	2	2	1
Diaphanosoma similes	2	2	1	3	3	4	3	2	2	1	2	1
Diaphanosoma Sp.	2	2	1	1	2	4	2	2	2	1	1	2
Rotifera												
Asphlanchna bright wells	2	2	2	2	2	3	2	1	2	2	1	2
Brachionus Sp.	1	1	2	2	2	2	2	2	2	2	1	1
Brachionus calyciflorus	2	2	1	1	1	2	2	1	1	2	1	2
Brachionus forticula	2	1	2	2	2	3	2	1	2	2	2	1
Lapadella Sp.	2	2	2	2	2	3	2	1	2	2	1	2
Lecane lunaris	1	2	1	2	2	4	2	2	2	1	2	2
Mytilina Sp.	1	2	1	2	2	2	3	1	2	1	2	2

Table 2. Data of the seasonal variations in the Zooplakton population of the River Vaigai at Kunnur for the year (Nov 2011 to Oct 2012)

Species	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Protozoa												
Sarcodina Sp.	1	1	1	1	2	2	2	1	2	1	3	1
Urocentrum Sp.	2	1	1	1	1	2	1	2	1	2	1	2
Vorticella Sp.	1	1	2	1	2	2	2	2	2	1	2	1
Copepoda												
Cyclops Sp.	1	1	2	2	1	2	2	2	2	1	1	1
Macrocyclops ater	2	2	1	1	2	2	1	1	1	2	1	2
Nauplius of Copepoda	1	1	1	1	2	2	2	1	2	2	2	2
Thermocyclops Sp.	1	1	2	1	1	2	3	2	2	1	1	1
Cladocera												
Daphnia carinata	1	1	2	1	1	3	2	3	2	2	1	1
Daphnia pulex	1	2	1	2	2	2	2	2	1	1	2	1
Diaphanosoma Sp.	2	1	1	1	2	4	1	1	2	2	1	1
Rotifera												
Brachionus Sp.	1	1	2	2	2	2	1	2	2	1	1	1
Brachionus calyciflorus	1	1	1	1	1	2	2	1	1	2	2	1
Brachionus forticula	1	1	2	2	2	3	2	2	1	2	1	2
Lapadella Sp.	2	2	1	1	3	2	1	2	2	1	2	1
Lecane lunaris	1	1	1	1	4	4	2	1	2	2	1	1
Mytilina Sp.	1	1	1	1	2	3	1	1	1	1	2	1

Values expressed in units/lit

Table 3. Data of the seasonal variations in the Zooplakton population of the River Vaigai at Vaigai Dam for the first year (Nov 2011 to Oct 2012)

Species	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Protozoa												
Coleps Sp.	1	1	1	2	2	3	3	2	1	1	1	1
Sarcodina Sp.	1	1	1	1	1	2	2	1	1	1	1	1
Urocentrum Sp.	1	1	1	1	2	2	3	1	1	1	1	1
Vorticella Sp.	1	1	1	2	3	3	2	2	1	1	1	1
Copepoda												
Cyclops Sp.	1	1	1	1	3	2	2	2	2	1	1	1
Macrocyclops ater	1	1	1	2	2	1	2	2	1	1	2	1
Nauplius of Copepoda	1	1	1	1	3	2	1	1	2	1	1	1
Thermocyclops Sp.	2	1	2	2	2	2	2	1	1	1	1	1
Cladocera												
Daphnia carinata	1	1	2	1	1	1	2	2	2	1	1	1
Daphnia pulex	1	1	1	1	2	3	2	1	1	2	2	1
Diaphanosoma Sp.	1	1	1	1	2	2	2	1	1	1	1	1
Rotifera												
Brachionus Sp.	1	1	1	2	2	2	2	1	1	2	1	1
Brachionus calyciflorus	2	1	2	1	1	3	2	1	1	1	1	1
Brachionus forticula	1	1	1	1	1	2	1	2	2	1	2	1
Lecane lunaris	1	1	1	2	2	1	1	2	1	1	1	1
Mytilina Sp.	1	1	2	2	2	2	2	1	2	1	1	1

Values expressed in units/lit

Results and discussion

The results obtained clearly revealed that all the three sampling sites were severely polluted during summer season and were least polluted during winter season. The pollution load is relatively high during summer season when compared to rainy and winter season, which may be due to high conductivity of pH, TSS and high concentration of chlorides (Yogendra and Pattaiah., 2008). The summer maxima of Zooplankton were co-related with higher temperatures, lower transparency and a high standing crop of primary producer leading to greater availability of food (Joshi,2011). Sitre (2012) stated that, during summer the concentration of nutrients increases and abundant food is present in the form of phytoplankton and microorganisms to zooplankton which in turn causes a high zooplankton population density during the summer season. Kumar et al., (2011), reported that sudden reduction in the zooplankton population during the rainy season could be due to sudden fall of temperature and dilution in concentration of minerals and salts.

A total of 23 species of Zooplanktons were recorded from Vaigai River. Among 21 species, Rotifera was dominant with 7 species followed by 6 species of Copepoda, 5 Species of Protozoa and 3 species of Cladocera.

Rotifers play a vital role in the trophic tiers of fresh water compounds and serve as living capsule of nutrition. Freshwater Copepods constitute one of the major zooplankton communities occurring in all types of water bodies. They serve as food to several fishes and play a major role in ecological pyramids. In the present study 5 species were recorded. Copepods showed higher population density in summer season and lower in winter. This pattern of seasonal fluctuation of

Copepods has also been observed by Mahor (2011) in fresh water reservoir Tighra Gwalior. Abundance of copepods in summer and monsoon is due to the river which is rich in organic matter supporting higher number of cyclopoids. Absence of parthenogenetic form of copepod might be responsible for their low population density in monsoon season, Stated by Mustapha, 2009).

Protozoans were the very diverse group of unicellular eukaryotic organisms. There were 5 species of protozoans are found in Vaigai river which are motile.

Cladocerans are the most useful and nutritive group of crustaceans for higher members of fishes in the food chain. In the present study a total of 3 species were recorded. The population density of cladocera were higher in summer season and lower in winter. The same observation was made by Dushyantkumar Sharma (2012) in Thigra Reservoir Gwalior (M.P). Cladocera is an order of small crustaceans, they are commonly called as " water fleas". The density and biomass of Cladocerans was primarily determined by food supply, stated by Smita,P.G.et al 2007).

The study indicates seasonal variations in the distribution of zooplanktons. Population of zooplankton was high in Summer and winter season and low in monsoon season. Rotifers and Coepods were dominated over Protozoans and cladoceran throughout the year.

Conclusion

Overall comparision between the the three sites of Vaigai River showed high variation in Anaipatti sampling station. Since the total abundance of Zooplankton of Anaipatti sampling unit was very high, there is contamination of water with reference to almost all the physicochemical and biological parameters of water studied which results the water not potable for human. So special attention has to be taken to control the pollution load of Anaipatti sampling station. Finally, it can be concluded by saying that Anaipatty sampling station is highly polluted whereas Kunnur and Vaigai Dam are moderately polluted.

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