BIO-DIVERSITY OF PLANKTON IN MUPETMUT ESTUARY SOUTH EAST COAST TAMIL NADU INDIA

[1]T. SIVA*, [2]M. SUKUMARAN, AND [3]R. RENGARAJAN,

1&2. P.G. & Research Department of Zoology, Rajah Serfoji Govt. College (Autonomous), Thanjavur, Tamil Nadu, India - 613 005.

3. Department of Zoology, Government Arts College, Ariyalur, Tamil Nadu, India.

Abstract:

A study was undertaken to record the seasonal fluctuation in phytoplanktons and zooplanktons population in Muthupet estuary, Thiruvarur District, Tamil Nadu, India, for a period of two years (July 2012 to June 2013). In this study, Out of the 20 species, 13 were diatoms, 6 were Chlorophyceae (green algae) and 1 was cyanophyceae. In general, the diatoms ranked first in abundance followed by Chlorophyceae (green algae) and cyanophyceae among the total phytoplankton. Throughout the study period, out of 21 species of zooplankton, 7 were Protozoa, 7 were Rotifer, 4 were Cladocera and 3 were Coppepod identified in Muthupet estuary. The protozoa and rotifer constituted the major component of the zooplankton population throughout the study period. In general, the seasonal population density was maximum during summer and pre monsoon periods. Minimum population density was found during monsoon period.

***Index Terms**: Phytoplanktons, Zooplanktons, Diversity, Water samples.*

I. INTRODUCTION

Estuaries as transition areas between land and sea form aquatic ecosystems that are characterized by a variety of inter-related biotic and abiotic structural components and intensive chemical, physical and biological processes. On a global scale, estuaries form rather narrow belts (from hundreds of meters to hundreds of kilometers) where river and sea waters mix, often called marginal filters[1].

Biological processes such as primary production and decomposition can modify the physico-chemical conditions while the biological inter-relationships such as reproduction, recruitment and predator–pray cycles can modify the community structure. The latter, in turn, can have further consequences for the modification of the physical and chemical properties of the water and sediment [2]. In estuaries, particularly where the salinity reaches a ‘‘critical’’ level of 5–8 PSU, these biological processes are very intensive[3]. Specific structure and particular spatial zoning of functional ecosystem characteristics in the estuaries are the major consequence of their immense filtering capacity, or the ‘‘barrier effect’’, determined by existence of biologically active zones with high concentration of living organisms[4].

As part of the pelagic food webs, plankton participates in functioning of these marginal filters by producing and structuring the matter, energy, and information fluxes in the ecosystems. The increased input of growth-limiting nutrients causes higher phytoplankton concentration; the effects are higher amounts of zooplankton, and a rising fish biomass[5]. Imbalance in functions of the pelagic components leads to accumulation of nutrients in water column and bottom sediments. Furthermore, nitrogen conservation and release of phosphate from sediments reduce the sink function and buffering capacity of coastal ecosystems[6]. Thus, being properly identified, measured on the unified basis, and monitored, variability (or stability) of structural and functional parameters of plankton communities in the estuaries can serve as indicator of the modification of ecosystems under the eutrophication/pollution stress.

In general, water quality can be assessed by a variety of methods, including hydrophysical, hydrochemical, hydrological and biological. For example, a good criterion for evaluation of water quality in estuaries is the assessment of the intensity of cyanobacteria blooms that can be quantified according to Zhukinski *et al*.[7]. The effects of toxic pollution on zooplankton can be registered by presence of morphological abnormalities of planktonic organisms[8] and by control of mortality using vital staining of samples[9]. The latter method allows rapid determination of cases of toxic pollution from point sources based on extraordinarily high mortalities of micro zooplankton[10]. However, for the adequate assessment of water quality, a combination of biotic and abiotic parameters should be used, which would allow for statistically reliable evaluations, even during preliminary tests.

Plankton are an important (and sometimes the main) component of the diet of fish. For the larvae of planktivorous fish that hatch during the spring algal bloom and peak of density of rotifer assemblages and protozooplankton, these latter groups are essential food. For the young-of-the-year and small fish during summer, crustacean zooplankton is main food source.

Species diversity within aquatic communities is closely related with the trophic state of the water body. It is commonly accepted that in lakes values of the Shannon Index of species diversity is strongly correlated with the biomass of different groups of planktonic, but mainly benthic invertebrates, and with BOD. Plankton data from the littoral zone of Lake Ladoga (Russia) is in general conformity with these observations[11]. However, much less information is available for estuaries. Besides, similar correlations established for plankton in estuaries and rivers are generally rather weak.

II. Meterials and methods

Muthupet estuary (Lat. 11^0 42' N, long 79^0 39' E) is located at the southan end of Tamil Nadu. For the collection of plankton No.10 plankton net (bolting mesh aperture size 158 µm) was used in the present study. Plankton samples were collected by filtering about 200 liters of the surface water through the net. Immediately after collection, plankton samples were fixed in 5% formalin.

Plankton counts were taken in the laboratory using a sedge wick rafter counting cell. The capacity of the counting chamber in the slide is in 1 ml. The counting chamber is divided into 100 small squares. First the preserved sample of plankton collected from 200 liters of water was diluted in 100 ml of distilled water. Then the sample was gently stirred and a sub sample of 1 ml was drawn with a wide mouthed pipette and poured into counting chamber to observed under the binocular research microscope. The zooplankton components were counted in all the small squared and calculated the number of M^3 of water filtered. Identification of plankton was done using standard keys[12&13].

Plankton samples were collected from Muthupet estuary. The collection of plankton was made by a net made of bolting silk of #25 mesh. Since the dimensions of most of the Phytoplankton are between 0.06 mm (60/u) and 3 mm. The bolting silk No. 25 was used. Plankton samples were collected by filtering about 200 liters of the surface water through the net. Immediately after collection plankton samples were preserved in 10% neutral formalin (1 part of formalin diluted with 3 parts of distilled water adding a few drops of 10% NaOH).

Quantitative analysis was made using plankton counting plastic slide (Sedgewick raftor). The capacity of the counting chamber in the slide is 1 ml. This counting chamber is divided into 100 small squares. First, the preserved samples of plankton collected from 200 litres of water were diluted to 100 ml of distilled water. Then from this 1 ml was transferred to counting chamber to observe under the microscope. The phytoplankton components were counted in all the small squares and calculated the numbers per M^3 of water filtered.

III. RESULTS

Phytoplankton and Zooplankton diversity

Phytoplankton species composition in the present study revealed a total number of 14 species from Muthupet mangroves. Out of the 20 species, 13 were diatoms, 6 were Chlorophyceae (green algae) and 1 was cyanophyceae. In general, the diatoms ranked first in abundance followed by Chlorophyceae (green algae) and cyanophyceae among the total phytoplankton. Throughout the study period, out of 21 species of zooplankton, 7 were Protozoa, 7 were Rotifer, 4 were Cladocera and 3 were Coppepod in Muthupet mangroves were identified. The copepods constituted the major component of the zooplankton population throughout the study period. The Protozoa and rotifer were recorded during the monsoon and post monsoon periods in Muthupet estuary. In general, the seasonal mean population density was maximum during summer and pre monsoon periods. Minimum population density was found during monsoon period.

Table 1: Phytoplankton communities identified in the Muthupet estuary

Sl. No.	Family	Genus	Premonsoon (Summer)	Monsoon (Rainy)	Postmonsoon (Winter)
1	Bacillariophyceae (diatoms)	Asterionella	3.5 (2.0)	2.5 (1.7)	3.4 (2.0)
		Asterolampla	3.8 (2.6)	4.8 (2.3)	2.9 (1.8)
		Bacteriastrum	2.2 (1.6)	4.0 (2.1)	3.8 (2.1)
		Biddulphia	4.5 (2.2)	3.0 (1.9)	3.0 (1.9)
		Chaetoceros	2.2 (1.6)	3.1 (1.9)	3.4 (2.0)
		Coscinodiscus	3.2 (1.9)	3.0 (1.9)	3.8 (2.8)
		Fragilaria	4.4 (2.2)	3.1 (1.9)	3.5 (2.3)
		Grammatophora	3.0 (1.9)	4.0 (2.1)	3.9 (2.8)
		Palmeria	3.8 (2.1)	3.0 (1.9)	2.8 (1.8)
		Planktoniella	3.5 (2.0)	3.5 (2.0)	3.9 (2.2)
		Rhizosolenia	3.0 (1.9)	3.2 (2.0)	3.1 (1.9)
		Thallassiosira	3.5 (2.0)	2.9 (1.8)	2.8 (1.7)
		Thallassiothrix	4.5 (2.2)	2.2 (1.6)	2.6 (1.7)
2	Chlorophyceae (green algae)	Chlamydomonas	5.4 (2.4)	5.2 (2.4)	5.0 (2.5)
		Dunaliella	4.5 (2.2)	4.9 (2.3)	4.5 (2.4)
		Hydrodictyon	5.2 (2.4)	4.2 (2.2)	4.4 (2.3)
		Pediastrum	4.4 (2.2)	3.0 (1.9)	3.2 (1.9)
		Platymonas	4.1 (2.1)	3.1 (1.9)	3.2 (1.9)
		Scenedesmus	3.2 (1.9)	2.5 (1.3)	2.9 (1.8)
3	Cyanophyceae (Blue green algae)	Trichodesmium	3.0 (1.8)	3.0 (1.9)	3.2 (2.0)

Table 2: Zooplankton communities identified in the Muthupet estuary proper

Sl. No.	Group and Name	Premonsoon (Summer)	Monsoon (Rainy)	Postmonsoon (Winter)
1	Protozoa			
	Arcella	4.5 (2.2)	4.4 (2.2)	3.4 (2.0)
	Balantidium	3.5 (2.0)	3.0 (1.9)	3.0 (1.8)
	Coleps	3.8 (2.1)	3.1 (1.9)	2.9 (1.8)
	Amoeba	3.0 (1.9)	2.0 (1.6)	1.8 (1.5)
	Stentor	2.2 (1.6)	2.5 (1.7)	2.0 (1.6)
	Euglena	3.1 (1.9)	2.2 (1.6)	1.9(1.5)
	Paramecium	3.2 (1.9)	3.0 (1.8)	2.5 (1.7)
2	Rotifer			
	Brachionous	6.0 (2.5)	5.2 (2.4)	4.8 (2.3)
	Cristaluta	4.2 (2.2)	4.8 (2.3)	3.2 (1.9)
	Monostyella	5.4 (2.4)	4.1 (2.1)	4.0 (2.1)
	Rotaria	4.5 (2.2)	3.2 (1.9)	3.0 (1.9)
	Testiudinella	4.5 (2.2)	3.2 (1.9)	3.1 (1.9)
	Keratella	5.2 (2.4)	4.9 (2.3)	4.2 (2.2)
	Asplanchna	4.4 (2.2)	3.5 (2.0)	3.0 (1.9)
3	Cladocera			
	Alona	3.5 (2.0)	3.0 (1.9)	2.5 (1.7)
	Bosmia	2.0 (1.6)	1.8 (1.5)	1.5 (1.4)
	Daphnia	4.3 (2.2)	3.5 (2.0)	2.5 (1.7)
	Monia	3.0 (1.9)	2.3 (1.7)	1.2 (1.3)
4	Copepod			
	Eucyclopes	3.0 (1.9)	2.8 (1.8)	2.5 (1.7)
	Mesocylopes	2.5 (1.7)	2.1 (1.6)	1.0 (1.2)
	Nauplius larva	3.6 (2.0)	2.4 (1.7)	1.8 (1.5)

IV. DISCUSSION

The plankton refers to those microscopic organisms free floating or suspended in natural water bodies. The plankton consisting animal species are called as zooplankton and plant species are called as phytoplankton. Phyto-plankton, mostly the unicellular organisms are either multicellular or colonial. The density of phytoplankton is much higher than that of zooplankton. Therefore, representative water sample of about 100 ml was collected from the water body in clean, good quality of plastic bottles. These samples were preserved by adding Lugol's Iodine solution 1 ml per 100 ml of water sample. Lugol's solution was prepared by dissolving 20 gm potassium iodide (KI) in 50 ml distilled water. This solution is diluted by adding 150 ml distilled water. Then 20 ml glacial acetic acid was added to the solution and stored in coloured bottle and kept in cool place.

Some phytoplankton organisms are unicellular whereas others are multicellular or colonial. Therefore, Lackey Drop Counting procedure was adopted lo enumerate these algae. The Lackey Drop (Microtransect) method is a simple method of obtaining counts of consi-derable accuracy with samples containing a dense plankton population. The phytoplankton density in clean water is very less while it is dense in polluted water. Therefore, the phytoplankton in clean water needs to be concentrated before counting for accurate estimation. The water sample was concentrated 15 times by centrifugation at 250 rpm for 15 min. The supernatant water was decanted and the pellet of algal cell was suspended in 1ml drilled water.

Result of the present investigation has been depicted zooplankton constituents, 29.5% of protozoan, 43.72% rotifers, 15.38% cladocerean and copepod 11.38% were depicted in Table and Fig. 2. The percentage values of protozoan in summer, rainy and winter were 11.52%, 9.33% and 8.65% respectively. The percent value of rotifers in summer, rainy and winter were 16.91%, 14.29% and 12.51% respectively. The cladoceren were 6.33% in summer, 5.24% in rainy and 3.81% in winter, while the copepods were 4.50% in summer, 3.61% in rainy and 2.62% in winter. In the present study seven species of protozoan are observed. These were *Arcell* sp., *Balantidium* sp., *Coleps* sp., *Amoeba* sp., *Stentor* sp., Euglena sp. and Paramecium sp. These protozoans are being considered as a reprehensive of study area. The occurrence of these organisms depends upon organic matter. The CO_2 is low and organic matter is ultimately low resulting present population of zooplankton. About 39,000 species of protozoan have already been known and probably thousand more are not yet known to science.

The variations in rotifers would be due to seasonal changes, water pollution, generative phase, water chemistry, etc. Over all 2500 rotifer species belonging to 200 genera are known from world. Out of which 300 and more species get recorded in India. Hence, there is a need to investigate genera and species in India. In the present study the alkalinity recorded higher in summer. Many species of rotifers are having preference to more alkaline water. The alkalinity due to presence of sufficient quantity of carbonates and bicarbonates, which may be considered suitable factors for farming rotifers[14]. In the present study pH was 8.0 maximum. When pH rose above 8.2 and temperature above 29.0ºC the rotifer species disappears, but this was not occurred, because pH was not exceed 8.0. Dhanapathi[15] observed that pH and temperature has a profound influence on rotifer population.

Zooplankton comprising of protozoans, rotifers, cladocerans and coepodes are considered to be most important in terms of population density, biomass production and grazing and nutrient regeneration in any aquatic ecosystem. Their diversity and density is mainly controlled by availability for food as favorable water quality[16]. The occurrence and abundance of zooplankton in pond depends up on productivity, which influenced by physico–chemical properties and the level of nutrients.

V. CONCLUSION

The present study was undertaken to record the phytoplanktons and zooplanktons diversity in Muthupet estuary in Thanjavur District, Tamil Nadu. From this investigation it is observed, plankton density and diversity is higher in the summer season compared to winter and monsoon seasons.

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