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SEASONAL DISTRIBUTION OF PLANKTON IN AGNIAR ESTUARY

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Abstract

Seasonal distribution of both phytoplankton and zooplankton of Agniar Estuary was studied from January to December, 1985. The study indicated that the distribution of plankton is controlled by the flood and salinity. The salinity of the estuary varied from 0.1‰ to 36‰. The marine oriented phytoplankton with a major peak during July, a period of moderate salinity (15‰) and fresh water oriented phytoplankton with a minor peak during November, a period of freshwater dominance were recorded. Among zooplankton, copepods constituted the major portion (96%) during the period of neritic water dominance and less abundant (6.9%) during the period of freshwater dominance. Among copepods *Oithona* sp., was the most common and found throughout the year except during November. Copepod nauplii occurred throughout the year and the peak of copepod nauplii succeeded the peak of diatoms suggesting the herbivorous trophic level of estuarine ecosystem. The rotifers and daphnids were present only in the period of freshwater dominance. The veliger larvae were abundant during July which coincided with the peak of diatoms. Tintinnids were present throughout the year with a peak during summer. The paper discusses with reference to the salinity and water discharge in the Agniar River.

Introduction

A Review of literature reveals that most of the studies are confined to either coastal or backwaters of southwest coast of India and Vellar Estuary along the east coast of India. Though extensive work on the hydrobiology of estuaries in Tamil Nadu have been done, no attempt has hitherto been made in Agniar Estuary. It is hoped that the present paper will form a base line for the future research of Agniar Estuary and to compare this estuary where there is no mangrove vegetation with those associated with mangrove vegetation. The present paper deals with the seasonal distribution of plankton in relation to salinity and water discharge in the Agniar River.

Materials and Methods

Agniar Estuary is situated in the Palk Strait on the east coast of India (Lat. 10° 20′N ; Long. 79° 23′E) (Fig. 1). The River Agniar has its origin from the surplus water of Kulathur Taluk of Pudukkottai district (Tamil Nadu, South India) and traverses a distance of about 80 km to form an estuary near Adirampattinam. Maharaja Samudram, a tributory of River Cauvery joins the Agniar River at a distance of 5 km upstream from the river mouth. Agniar Estuary is an open estuary

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and is not associated with mangrove vegetation. The river mouth was not closed throughout the period of study. Two stations were selected for the present study (Fig. 1). Station I is situated at the mouth of Agniar River influenced more by neritic water. Station II is situated at a distance of one Kilometre upstream from the river mouth.

after collection plankton samples were preserved in 10% formalin and examined in the laboratory. Data on rainfall were obtained from the Meteorological Station, Adirampattinam. Data on river discharge were obtained from the Water Resources Division, Public works Department, Pattukottai, Government of Tamil Nadu.

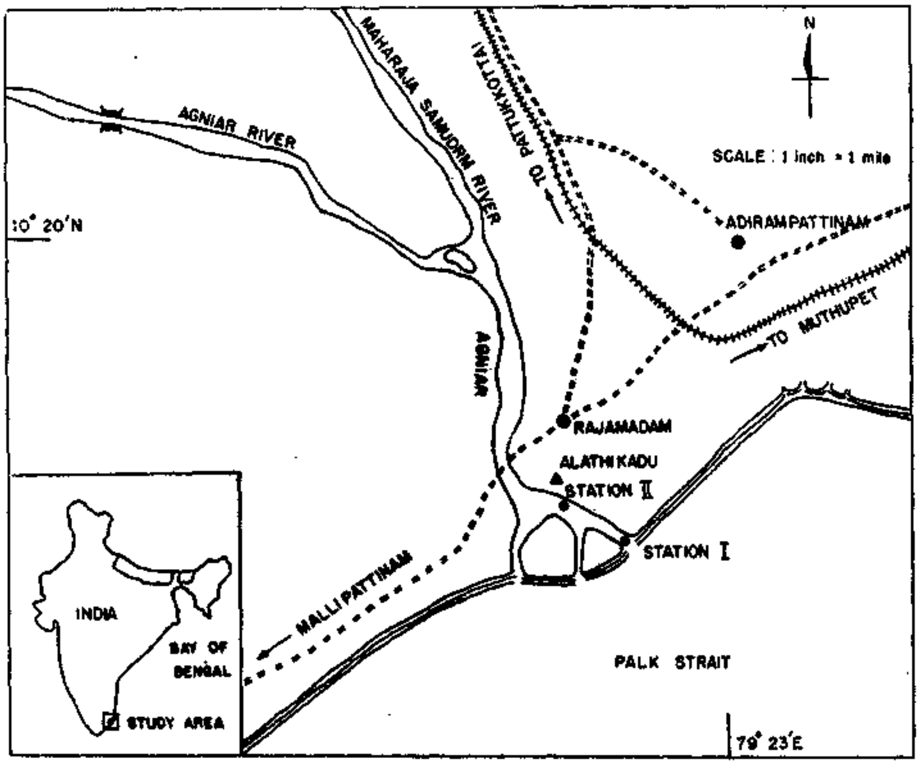

Fig. 1. Agniar Estuary and station positions.

Water samples were collected from both stations of the estuary during full moon and new moon high tides for the estimation of salinity and the salinity was determined by Mohr's titration method (Strickland and Parsons, 1968). The collection of plankton was made by a net made of bolting silk of 25 mesh (No. 25) with openings between the meshes 0.05 mm square. Plankton samples were collected by filtering about 200 litres of the surface water through the net. Immediately

Results and Discussion

Rainfall, river discharge and salinity

Data on rainfall and river discharge are shown in Fig. 2. The bulk of rainfall in this southeast coast of Bay of Bengal is chiefly due to the northeast monsoon that prevails during October to December. But the strength of Southwest monsoon showers is meagre when compared to the west coast (Nair, 1984). River discharge showed an increasing trend during the Monsoon period with a peak during November. The maximum discharge was 26573 cu. Secs in November due to North east monsoon showers and the minimum was 1260 cu. secs due to Southwest monsoon showers. There was no freshwater inflow to the estuary from February to July. On the basis of freshwater discharge and the monsoon rains, 4 seasons could be differentiated annually in this estuary and these being Monsoon (October-December), Postmonsoon (January-March),

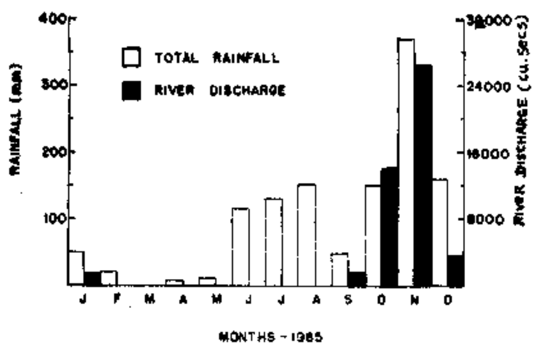

Fig. 2. Total monthly rainfall at Agniar River basin and monthly river discharge into the Agniar Estuary during 1985.

Summer (April-June) and premonsoon (July-September). Monthly salinity observed at station I and II are shown in Table 1. The seasonal change in salinity was similar in both stations with low salinity values (0.1‰ at station I and 0.5‰ at Station II) during the monsoon period and high values (35‰ at station I and 36‰ at station II) during the summer period. Eventhough low salinity value was recorded in the monsoon period contrary in the month of December there was sudden increase in salinity due to the inflow of neritic water and a very low river discharge.

Phytoplankton components and their distribution

The seasonal distribution of phytoplankton appears to depend greatly on the degree of variation in salinity. 16 species of diatomaceae, 5 species of dinophyceae, 4 species of cyanophyceae and 5 species of Chlorophyta were observed during the study period. Diatoms constituted the major bulk of phytoplankton during most of the period. The phytoplankton community in the Agniar Estuary is predominantly marine oriented during high salinity period and freshwater oriented during monsoon period. During the premonsoon period when the salinity was below 20‰ phytoplankters were dense which included *Fragilaria* sp., *Nitzschia* sp., *Planktonella sol*, *closterium* sp., *Ceratium* sp., *Peridinium* sp., *Asterionella* sp., *Thalassiothrix longisima* and *Thalassiothrix nitzschicoides*. However they were absent during the period of high salinity (above 30‰) recorded in summer. The diatomaceae were found in large numbers when the salinity was 15‰. Higher number of phytoplankton in the estuary could be attributed to the moderate salinity (15‰) observed during July, as moderate salinity would facilitate maximum production by tropical phytoplankters (Qasim *et al.*, 1971).

Owing to freshwater discharge in river, the salinity in the estuary was very low during monsoon period and freshwater algae such as *Merismopedia*, *Microcystis*, *Oscillatoria* *Eudorina*, *Spirogyra* and *Volvox* were observed in large numbers. On the contrary, the forms which occurred in Premonsoon period were rarely found. Thus a higher degree of river run off had flushed out the previously existed estuarine phytoplankters and caused a succession of freshwater forms following the estuarine forms. The present study showed a bimodal type of seasonal variation in phytoplankton with the primary maximum occurring during early pre-monsoon (July and August) and secondary maximum during middle monsoon period (November). But in Vellar Estuary (Ramadhas, 1977) the primary and secondary maximum in phytoplankton cell numbers occurred during early summer and premonsoon periods respectively.

Zooplankton components and their distribution

The seasonal distribution of zooplankton was studied from January to December, 1985. The total zooplankton number at station I varied between 9.650 and 244.6 × $10^3/m^3$. At station II the range of variation was from 3.5 to 104.5 × $10^3/m^3$. The highest number was recorded during December at station I and II and lowest number during August at station I and during March at station II (Fig. 3). Seasonal distribution of different zooplankters in the Agniar Estuary is presented in Fig. 4 - 7. Copepods occupied a major portion of the zooplankton population in the present study and similar observation was recorded in Vellar Estuary (Subbaraju and Krishnamurthy, 1972), and in Ashtamudi Estuary (Divakaran *et al.*, 1982). At station I copepods constituted 8.1% (November) to 63.7% (September) and at station II from 6.9% (November) to 96% (December) of the total zooplankton. The following species of calanoids namely *Acartia, Acrocalanus, Paracalanus, Centropages, Pseudodiaptomus* were recorded. Harpacticoids were represented by *Euterpina* sp., *Longipedia* sp., *Macrosetella* sp., *Microsetella* sp. and *Metis* sp. Cyclopoids were represented by *Oithona* sp. The peak period of abundance of calanoids and *Oithona* sp., was generally December and January. Harpacticoids were only lesser in numbers than cyclopoids and calanoids. Among copepods *Oithona* sp., was the most common and occurred throughout the year except in November with peak of abundance in December in both stations (85.1 × $10^3/m^3$ at station I and 70.0 × $10^3/m^3$ at station II) indicating the role played by salinity increase from 0.5‰ in November to 20‰ in December. They outnumbered calanoids and harpacticoids. Copepod nauplii formed a significant part occurring throughout the year in large numbers. Their highest number (107.5 ×

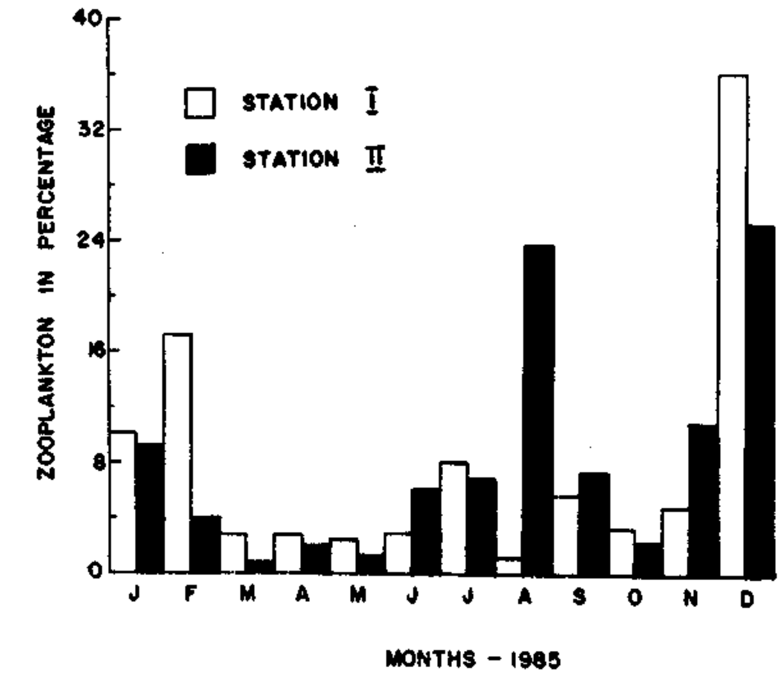

Fig. 3. Seasonal variations of total zooplankton in Agniar Estuary at station I and II.

$10^3/m^3$) was noticed in December at station I and in August ($25.5\times10^3/m^3$) at station II. The peaks in copepod nauplii coincided with diatom peaks. The secondary maximum of copepod nauplii in August succeeded the peak of diatoms in July. The primary maximum in December succeeded the peak of phytoplankton in November. In Vellar Estuary the primary maximum of copepod nauplii in July coincided with the secondary peak in diatom numbers were as the secondary maximum in June succeeded the primary peak of diatoms occurring in April (Ramadhas, 1977).

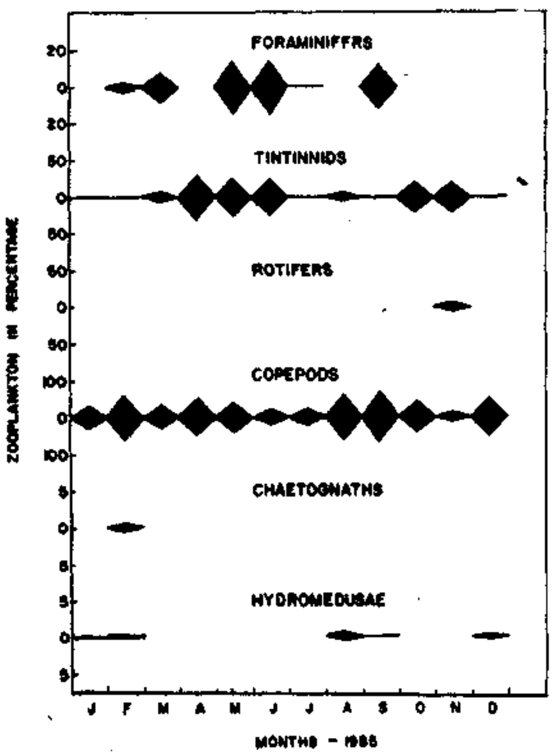

Fig. 4. Seasonal distribution of different zooplankton components at station I.

Tintinnids occurred throughout the year and their maximum numerical abundance was found in April (29.3%) at station I and in May (33.3%) at station II of the total zooplankton.

Foraminifers showed an irregular distribution with peak occurrence (about 14%) was in June in both stations. They were completely absent during monsoon period and showed their tolerance to high salinity only.

Hydromedusae were observed during Post-monsoon and Pre-monsoon periods in lesser numbers.

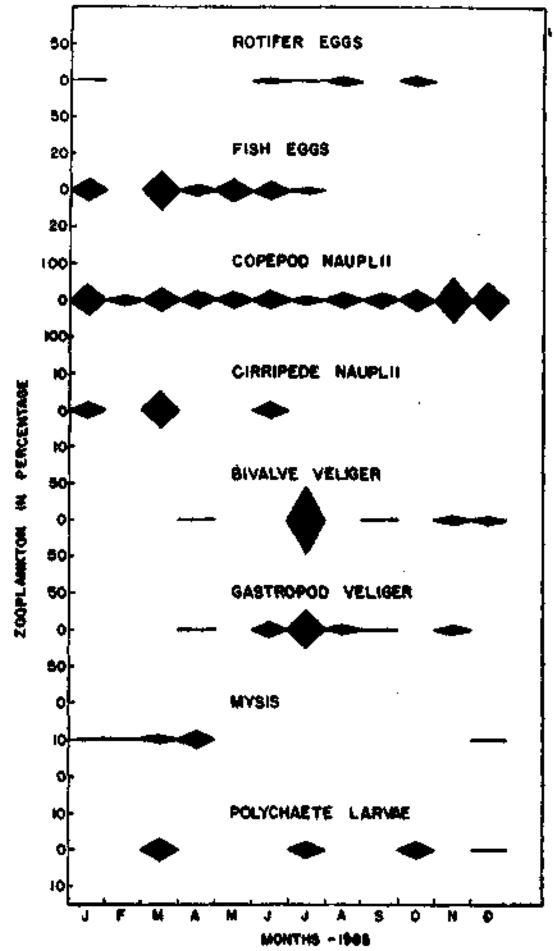

Fig. 5. Seasonal distribution of different zooplankton components at station I.

Chaetognaths were observed only in February (station I) forming 0.5% of the total zooplankton.

Acetes sp. was found at station I in large numbers during February (35.5% of the total zooplankton).

Daphnids were noticed at station II only in September and November when the salinity was 2.5‰ and 0.1‰ respectively. Such fresh-water forms were brought to the estuary by heavy influx of river water and disappeared immediately after the cessation of freshwater, like other forms of freshwater origin.

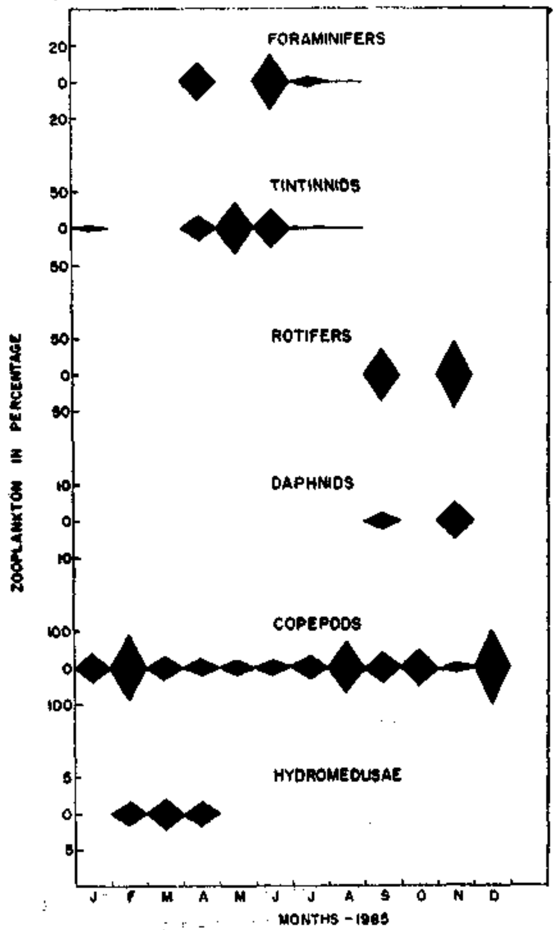

Fig. 6. Seasonal distribution of different zooplankton components at station II.

Rotifers were present during monsoon period only. They were observed in November at station I where the salinity was 0.5‰ and in September and November at station II where the salinity was 2.5‰ and 0.1‰ respectively. Their peak occurrence was in November constituting 46.5% of the total zooplankton. It may be recalled that the rainwater discharge in September and November coincided with the increase in the rotifer population and later in December rotifers were not recorded. Further when a comparison is made between the two stations, it may be said that the rotifer population was minimum at station I due to neritic water inflow into the estuary whereas maximum at station II indicating their presence in the more dilute

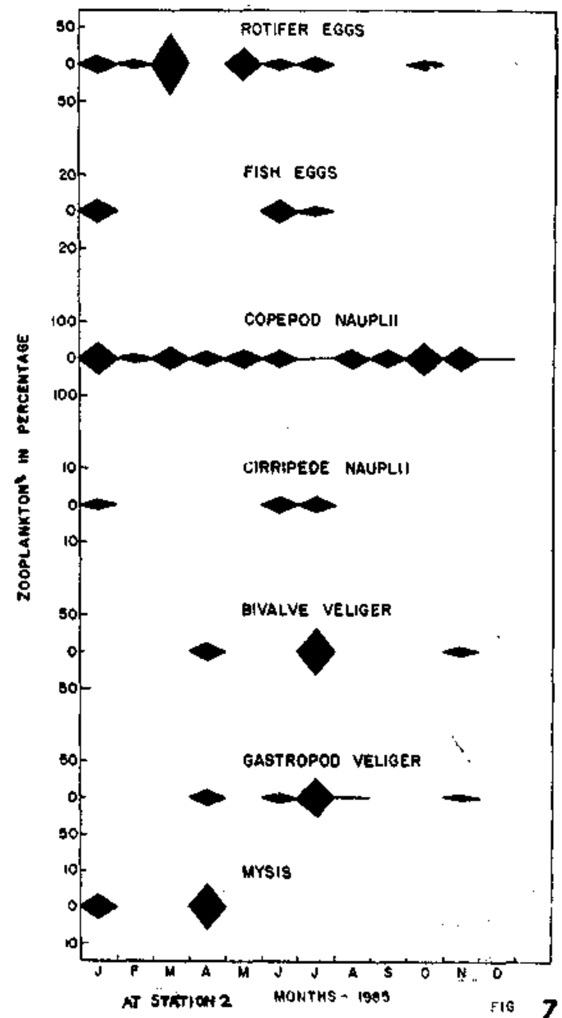

Fig. 7. Seasonal distribution of different zooplankton components at station II.

salinity water (freshwater). Rotifers formed a common group among the zooplankton components in Kadinamkulam Backwater and constituted the dominant group in the upper reaches of the backwater region where freshwater influx was relatively high (Nair *et al.*, 1984).

Rotifer eggs showed a peak occurrence in December at station I following the rotifer population in November.

Fish eggs were noticed in most of the period except during monsoon. Their maximum numerical abundance was in January.

Nearly 6 larval forms were identified and among which copepod nauplii dominated. Cirripede nauplii were recorded in certain months of Post-monsoon and summer periods in both stations. Bivalve larva seen as veligers showed an irregular distribution with a peak during July at station I and II constituting 45% and 28.5% respectively of the total zooplankton. The gastropod veligers were observed during summer and Premonsoon periods with peak occurrence in July at station I and II constituting 24% and 25% respectively of the total zooplankton. Mysis was observed during postmonsoon period. Polychaete larvae were seen in lesser numbers in certain months at station I.

The overall picture shows the distribution of zooplankton in Agniar Estuary is controlled to a large extent by salinity and river discharge. Subbaraju and Krishnamurthy (1972) recorded a similar observation in the estuarine waters of Porto Novo. In the present study the peaks of zooplankton population in August and December succeeded the two peaks in phytoplankton population in July and November respectively showing a bimodal type of oscillation. An observation of phytoplankton abundance followed by zooplankton peak was reported by earlier workers (Ramadhas, 1977; Divakaran *et al.*, 1982; Nair *et al.*, 1984).

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