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DIEL VARIATIONS AND RELATIVE ABUNDANCE OF PLANKTONIC LARVAE IN COLEROON ESTUARINE COMPLEX, SOUTHEAST COAST OF INDIA*

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ABSTRACT

The present study deals with the diel variations of larval forms in the surface and bottom waters at two stations in the Coleroon Estuarine Complex situated at Lat. 11°21′ N ; Long. 79° 09′ E. The data were obtained for 36 hrs of sampling made at 6 hours intervals. Both surface and bottom water samples were analysed for dissolved oxygen, salinity, pH, alkalinity and nutrients.

The number of larvae ranged between 956 organisms/m³ (1745 hrs at low tide) and 2592 organisms/m³ (2345 hrs at high tide) in the surface water and between 914 organisms/m³ (1745 hrs at low tide) and 3542 organisms/m³ (2345 hrs at high tide) in the bottom at Station I. At Station II, it ranged from 1052 organisms/m³ (1815 hrs at low tide) to 3492 organisms/m³ (0015 hrs at high tide) in the surface water and from 977 organisms/m³ (1800 hrs at low tide) to 5058 organisms/m³ (0015 hrs at high tide) in the bottom water.

The larval forms collected belonged to prawn, polychaete, fish, crab, copepod, cirripede, lamellibranchs and gastropods. The percentage composition of prawn larvae was found to be high both in surface (418/during high tide, 1215 hrs at Station II) and bottom (67.2/during low tide, 0615 hrs at Station II) waters. Further, the density of the larvae was high at midnight (2345 hrs) and low during evening hours (1745 and 1815 hrs). Between stations, Station II was found to have a large number of larval forms than Station I. Dissolved nutrients were also found to be more at Station II when compared to Station I. It was inferred that larval recruitment in Coleroon Estuary occurs mainly due to the influx of Pitchavaram mangrove waters at low tide and coastal water at hightide, during night.

The variations in the environmental parameters in relation to the densitites of larval forms at the two stations were analysed statistically and discussed.

INTRODUCTION

INFORMATIONS on the meroplanktonic component of the estuarine and nearshore biotopes are very essential for aquaculture practices. Seasonal variation and relative abundance of invertebrate larvae of Vellar Estuary and nearshore waters of Porto Novo was studied by Srikrishnadhas *et al.* (1975). While Goswami and George (1978) have studied the diel variations in occurrence of penaeid larvae in estuarine and nearshore waters of Goa on the west coast, the present paper deals with the diel variations and relative abundance of larvae of Coleroon estuarine complex on the east coast with a view to assess the larval resources.

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Materials and Methods

Two stations were fixed for the present study in Coleroon Estuary (Lat. 11°21'N; Long 79°49'E). Station I was fixed in the mouth of the Coleroon Estuary to study the influence of neritic waters on the density of larval abundance and Station II was fixed at a place where the main canal from Pichavaram admixes with Coleroon Estuary and 4 km away from Station I (Fig. 1). The depth of buoy was attached to the top of the plankton net ring and an iron weight was hung from the bottom end for planktonic larval sampling. The question of admixture of surface plankton with the bottom plankton at the time of sampling was avoided to the maximum extent by taking out the net from the bottom quickly. Plankton samples were preserved in 5% neutral formalin and the quantitative analysis of the larval population was made. Larvae of prawn

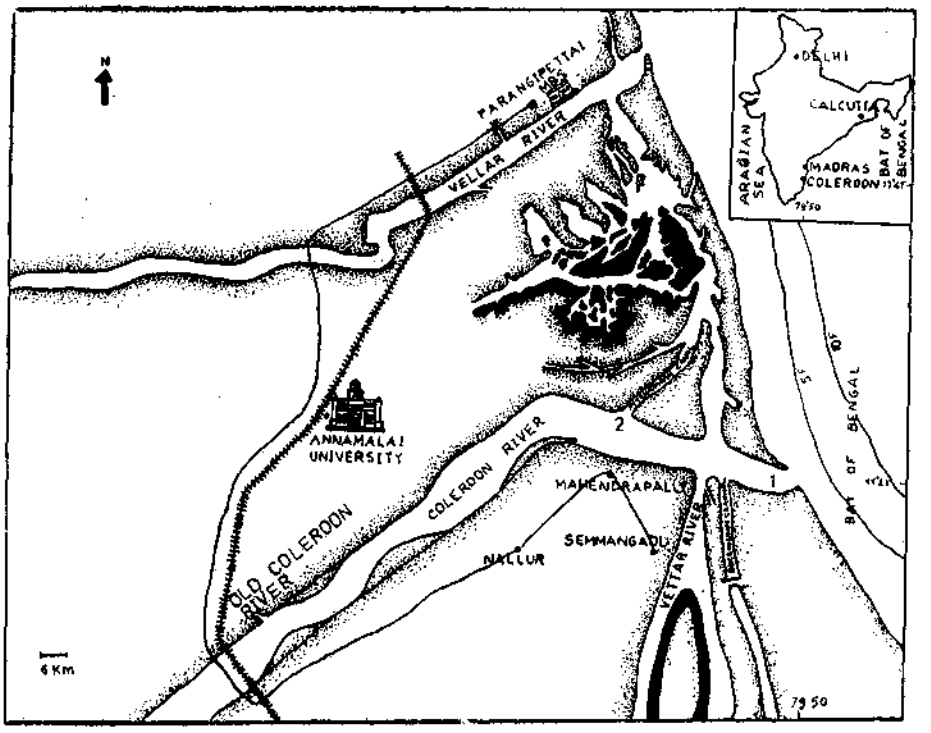

Fig. 1. The Coleroon estuarine complex in the southeast coast of India.

the stations I and II during high tide was 4.9 m and 5.4 m repsectively. Surface and bottom water samples were collected with a clean plastic bucket and Mayer's water sampler respectively. The surface plankton samples were collected by towing the plankton net with a mesh size of 158 μ (No. 10) bolting silk. The usual closing tow net could not be operated due to the shallow nature of the estuary. A

were identified by using the key for larval characters given by Mohamed *et al.* (1968). The fish eggs and larvae were identified upto generic level and the polychaete larvae upto family level. The water samples from both surface and bottom were analysed for dissolved oxygen, salinity, pH and nutrients using the methods described by Strickland and Parsons (1972).

Results and Discussion

Environmental parameters

The fluctuations in temperature, salinity, dissolved oxygen, pH, nitrite, nitrate, reactive silicate, inorganic phosphate and total phosphorus observed for 36 hours are given in Figs. 2-5.

The total number of larvae recorded in stations I & II were 26,417 /m³ and 34,242 /m³ respectively. Of the total number of larvae recorded for Station I, 19,116 /m³ were collected during high tide and 7,301 /m³ during low tide. The increase in larval numbers during high tide were observed for stations I and II. This observation is in confirmity

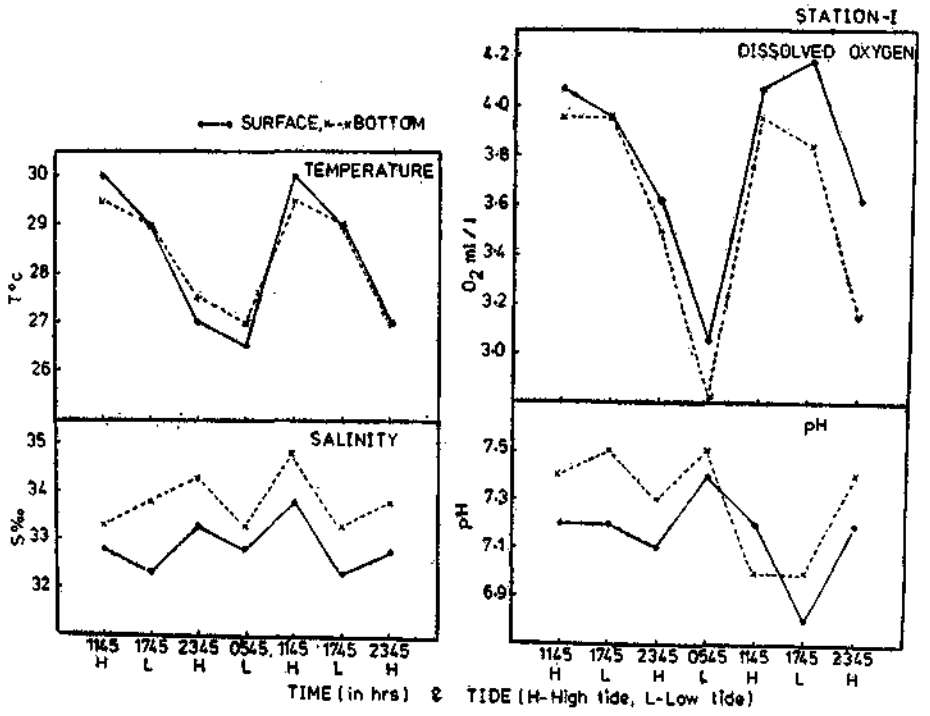

Fig. 2. The fluctuations in surface and bottom temperture, salinity, dissolved oxygen and pH at Station I.

Quantitative study

The number of larvae collected at Station I was varying from 956/m³ to 2592 /m³ in surface water and it ranged from 914 /m³ to 3542 /m³ in bottom water (Fig. 8).

At Station II, the larval numbers varied between 1052 /m³ and 3492 /m³ and from 977 /m³ to 5058 /m³ for surface and bottom waters (Fig. 9) respectively.

with the findings of Jegadeesan (1986) from Coleroon Estuary. Likewise Gajbhiye *et al.* (1983) observed that the tidal flow seems to influence the larval ingression of decapods in to Mandovi and Zuari Estuatries with peak during high tide. Goswami and George (1978) also had reported about the maximum ingression of the larvae took place at high tide and during premonsoon months in Goa waters. Srikrishnadhas and Ramamoorthi (1982) had

observed such increase in polychaete larvae during high tide in Vellar Estuary.

The larvae were grouped into prawn, crab larvae, polychaete larvae, fish eggs, fish larvae, bivalve veliger larvae, gastropod veliger larvae, copepod nauplii, cirripede larvae and 'other larvae'. The group 'other larvae' includes coelenterates and alima larvae which occur in less numbers (Fig. 6 and 7).

974 /m³ in surface water, whereas in bottom water it varied from 107 /m³ to 2,093 /m³ at Station I.

The Station II showed a maximum of 1,344 /m³ and a minimum of 253 /m³ in surface water. In bottom water it varied between 148 /m³ and 3,398 /m³.

The prawn larvae collected for this study

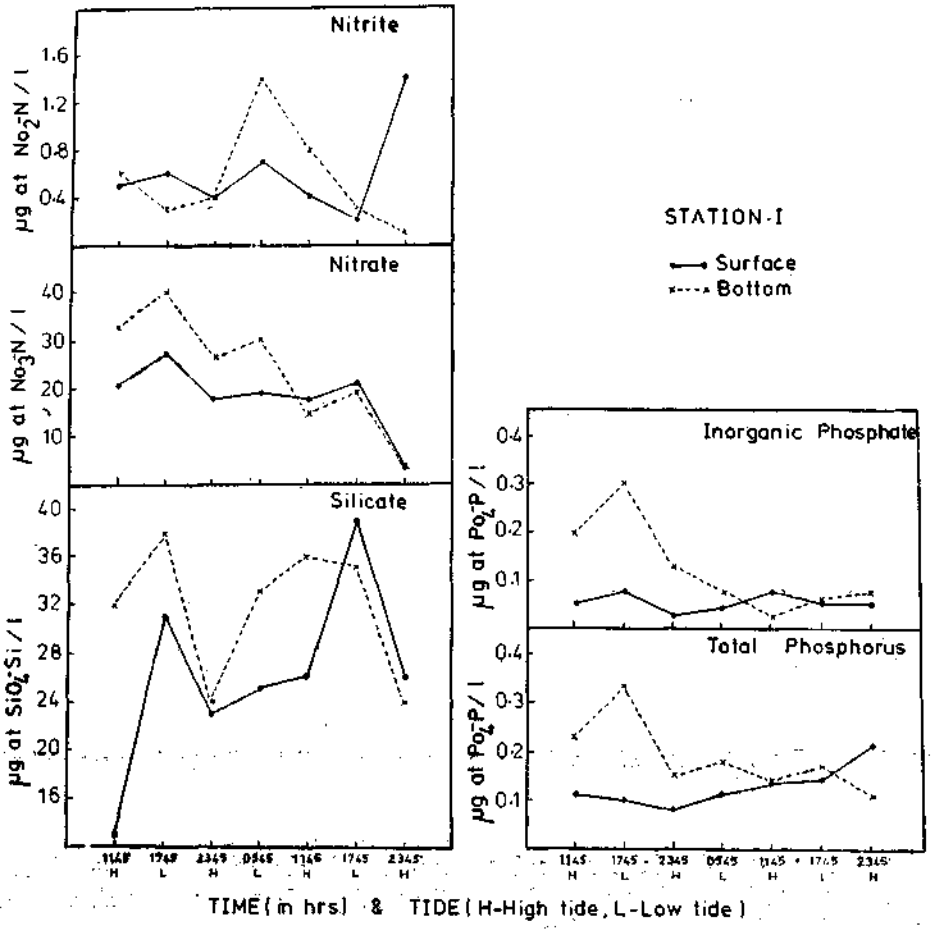

FIG. 3. The fluctuations in surface and bottom nitrite, nitrate, silicate, inorganic phosphate and total phosphorus at Station I.

Prawn larvae

The prawn larvae were found to be in abundant when compared to other larval groups and their numbers ranged from 241 /m³ to include protozoea, mysis and post larval stages. Only the post larval stages were identified upto species level. Larvae of seven species of prawn were recorded in stations I and II. *viz Penaeus*

indicus, *P. monodon*, *P. semisulcatus*, *P. merguiensis*, *Metapenaeus monoceros*, *M. dobsoni* and *M. brevicornis*. The total number of prawn larvae recorded varied between 9,883/m³ (Station I) and 13,970/m³ (Station II) in this study.

A large number of prawn larvae was observed during midnight collections and small numbers were noticed in evening hours.

At Station II, the maximum and minimum numbers observed were 87/m³ and 334/m³ in surface water and 95/m³ and 293/m³ in bottom water respectively.

Like prawn larvae, the crab larvae were also found to be abundant in midnight collections and low numbers were observed in the evening. The fluctuations of crab larvae were found to be associated with the flood and ebb tides and

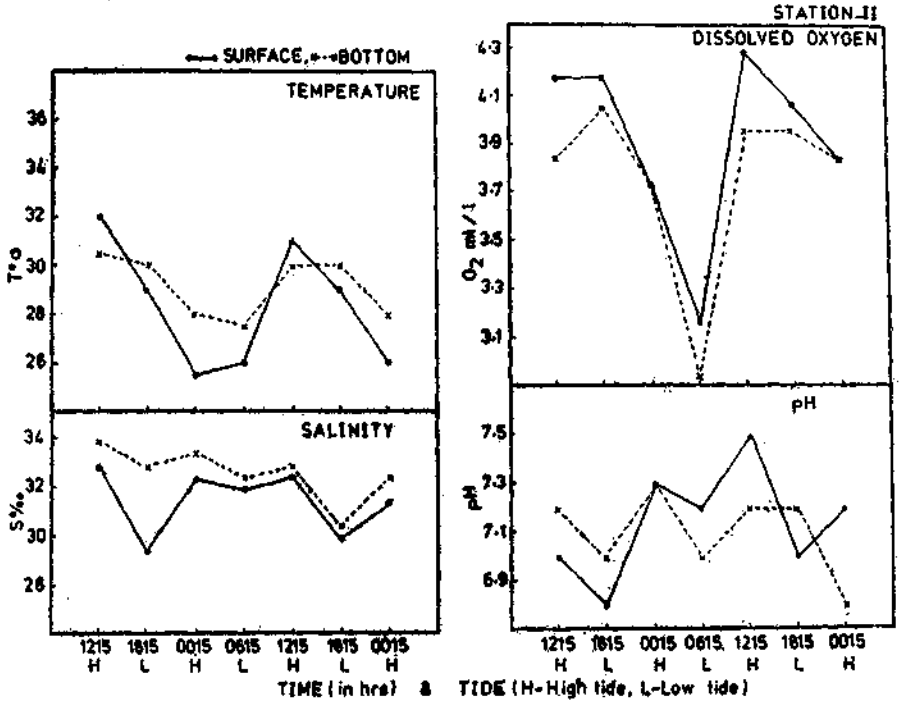

FIG. 4. The fluctuations in surface and bottom temperature, salinity, dissolved oxygen and pH in Station II.

Also the bottom water collections showed a high number of prawn larvae than that of the surface water. The high numbers of prawn larvae were found to be associated with high tides.

Crab larvae

At Station I, the crab larvae varied between 56/m³ and 121/m³ in surface water and it ranged from 69/m³ to 152/m³ in bottom water, it is in affirmity with the views of Cronin and Forward (1979) who made similar observations.

Decapod larvae varied from 44% (Station I) to 48.17% (station II). Prawn larvae were the abundant forms among decapods contributing 37.4% and 40.8% in both stations I & II.

Madhupratap *et al.* (1981) reported that in Andaman Sea, the decapod larvae and adults

contributed to 2.5% of the total zooplankton counts with maximum density of 540/100 m³. Goswami (1985) reported that decapod larvae contributed to 8.04% in the coastal waters from Vengurla to Malpe of the west coast of India.

Polychaete larvae

At Station I, the polychaete larvae were found to vary between 35/m³ and 243/m³ and from 42/m³ to 218/m³ in surface and bottom waters respectively

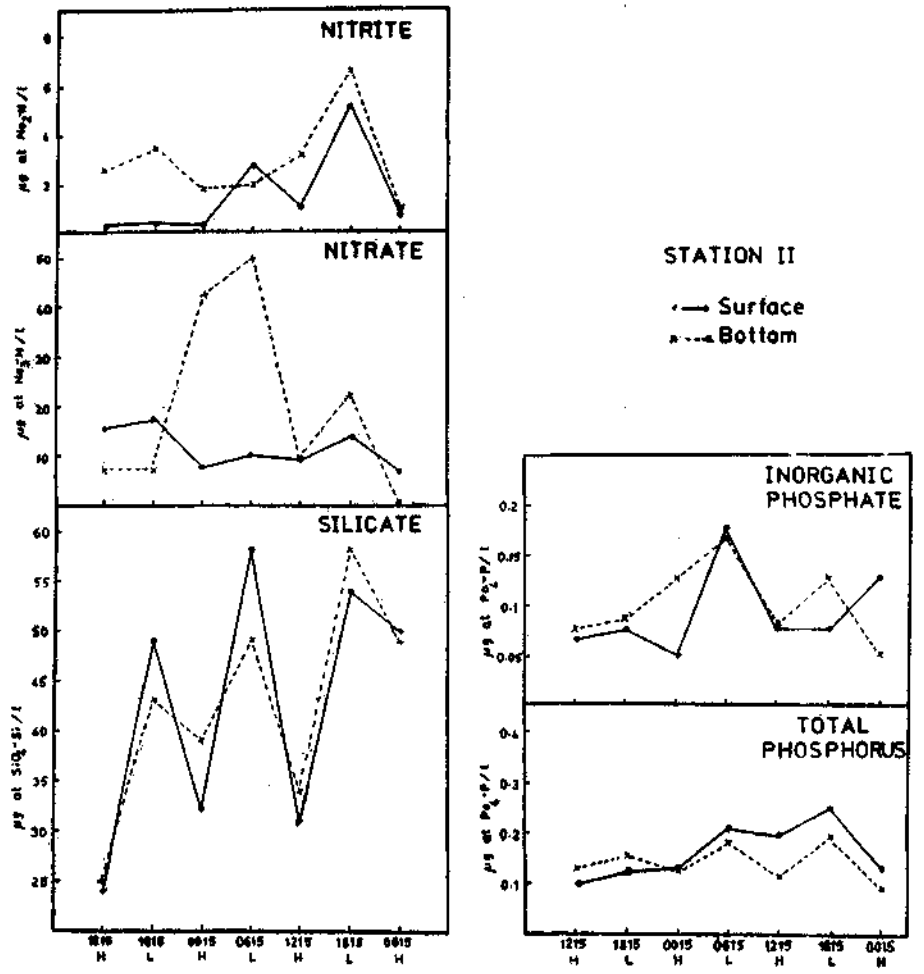

FIG. 5. The fluctuations in surface and bottom nitrite, nitrate, silicate, inorganic phosphate and total phosphorus at Station II.

Gajbhiye *et al.* (1984) reported that decapods contributed from 0.28% to 7.28% of the total population off Versova, Bombay and the per centage composition varied from 0.74%—61.15% of the total zooplankton in Malad Creek, Bombay.

At Station II, the larvae varied from 48/m³ to 195/m³ and between 20/m³ and 265/m³ in both surface and bottom waters respectively.

The polychaete larvae were found to be more in numbers (2,081) at Station I than at

Station II (1,718). At Station I, the polychaete larvae collected from surface and bottom water accounted for 45.99% and 54.01% of the total polychaete larvae collected. At Station II, the surface and bottom water polychaete larvae collected. At Station II, the surface and bottom water polychaete larvae accounted for 44.5% and 55.5% respectively.

The polychaete larvae contributed to 7.9% and 5% of the total larval collections made at Stations I and II. In general an increasing trend in polychaete larval numbers were observed during high tide, as noticed by Srikrishnadhas and Ramamoorthi (1982) from Vellar Estuary. The percentage composition of the polychaete larvae observed in the present

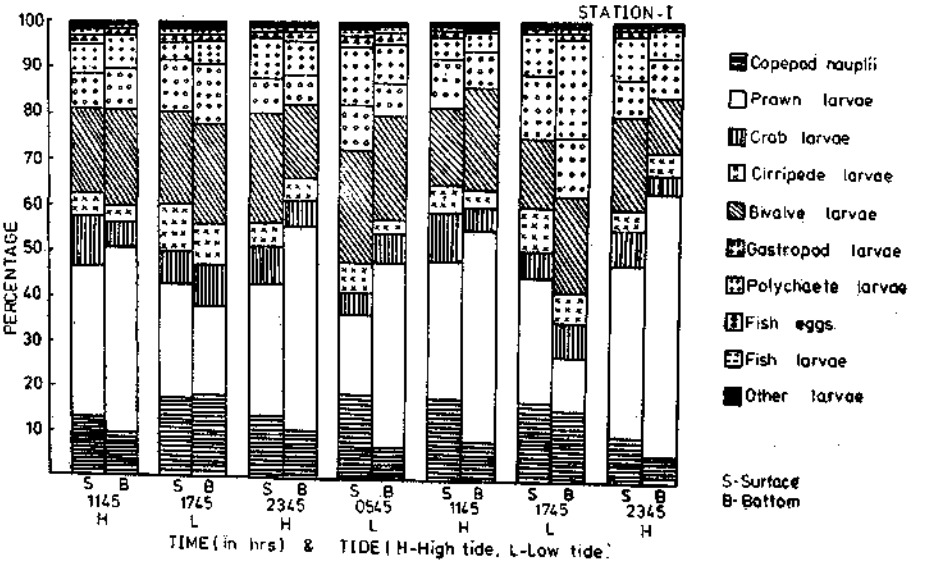

FIG. 6. The percentage distribution of larval groups in time and tide at Station I.

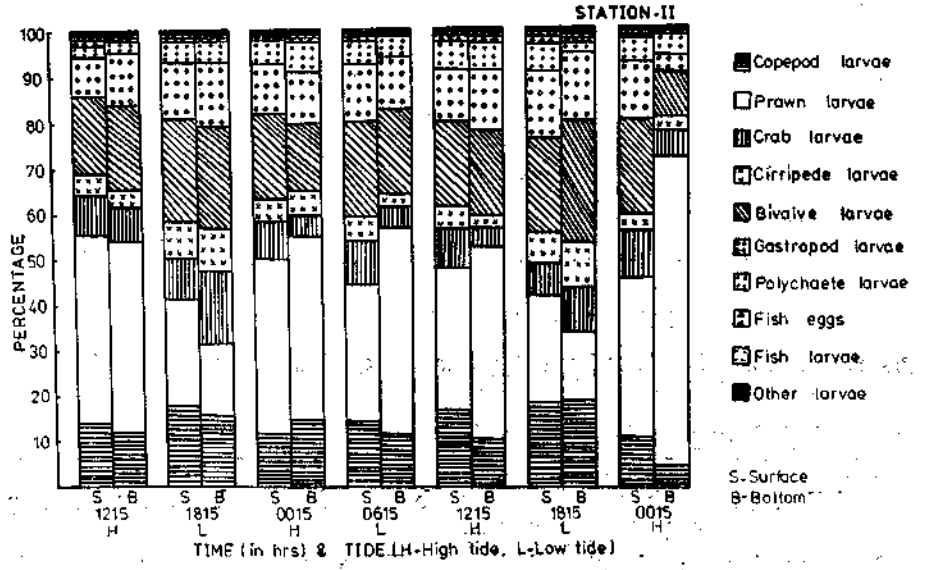

FIG. 7. The percentage distribution of larval groups in time and tide at Station II.

study was comparatively less than those of Srikrishnadhas and Ramamoorthi (1982) who reported an average of 14.29% to 53.84% in Vellar Estuary. They also further reported an increase in numbers of polychaete larvae during night which is in confirmity with the observations made in the present study.

Fish eggs and larvae

At Station I, the number of fish eggs varied between 10/m³ and 43/m³ and from 12/m³ to 62/m³ in surface and bottom waters respectively. The number of fish larvae recorded in surface water was ranging from 7/m³ to 28/m³ and in bottom water it varied between 8/m³ and 29/m³.

The percentage composition of eggs varied from 0.95% (Station II) to 1.6% (Station I) and larvae from 0.54% (Station II) to 0.9% (Station I).

The number of fish eggs and larvae was found to be more at Station I than at Station II, since, the latter is located in the upstream. This may be due to the entry of large mass of saline waters from the sea into the estuary

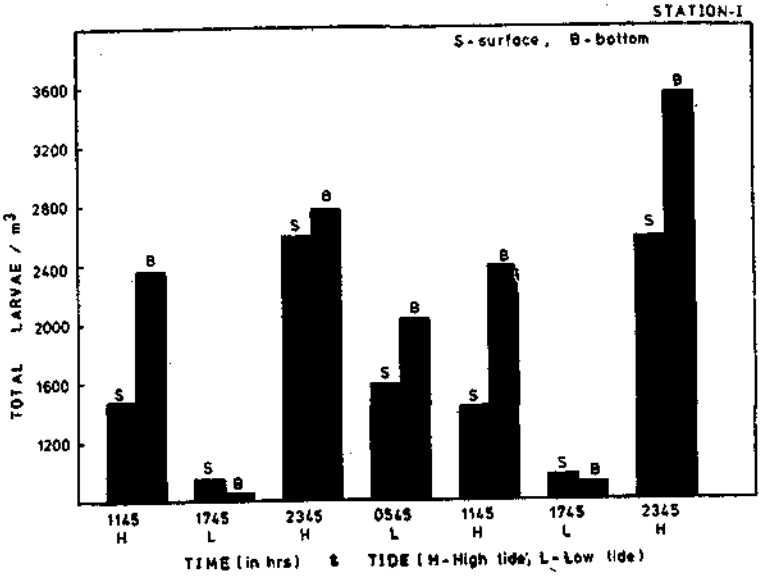

FIG. 8. Abundance of larvae in time and tide at Station I.

At Station II, the surface water fish eggs were ranging between 7/m³ and 25/m³ and it ranged from 5/m³ to 57/m³ in bottom waters. The fish larvae recorded were ranging between 7/m³ and 24/m³ and from 4/m³ to 21/m³ in surface and bottom water respectively.

The bottom water was found to have the fish eggs of advanced developing stages than that of the surface water, which is in concordance with the observation made by Franz (1910) and Remott (1921). The midnight and early morning collections showed high numbers of fish eggs and larvae.

causing ingression of eggs and larvae during high tide. Similar trend was observed by Thangaraja (1982). Earlier observations of Krishnamurthy and Prince Jeyaseelan (1981) reported that the water from Pichavaram mangroves which receeds into Coleroon Estuary during low tide would not bring many fish eggs and larvae as the Pichavaram mangrove water itself had very low number of

fish eggs and larvae. Thus the lowest numbers of fish eggs and larvae observed at Station II may be attributed to the above reasons.

Gajbhiye *et al.* (1982) reported that in Versova, the fish eggs and larvae varied from 0.003% to 2.36% of the total plankton. Gajbhiye *et al.* (1984) made observations in variations of fish eggs from 0.01-2.61% and of fish larvae 0.003-0.43% in Malad Creek, Bombay. Gajbhiye *et al.* (1984) had also reported that percentage composition was raised from 0.02 to 0.74% for eggs and larvae respectively.

Bivalve larvae

The bivalve larvae accounted for 19.3% of the total larvae collected and ranked next to the prawn larvae at Station I. The number of larvae varied from 142/m³ to 626/m³ and between 186/m³ and 527/m³ in surface and bottom waters respectively.

At Station II, the bivalve larvae accounted for 17.46% of the total larvae collected and ranked second to the prawn larvae. The larvae in surface water varied between 238/m³ and 682/m³ and at bottom it ranged from 253/m³ to 589/m³.

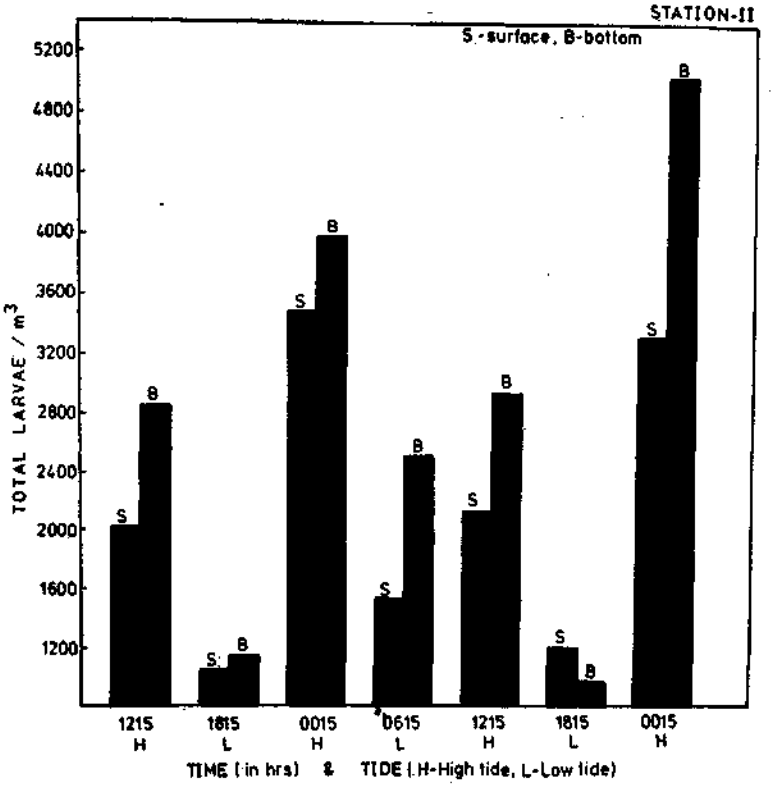

FIG. 9. Abundance of larvae in time and tide at Station II.

Gastropod larvae

The larvae in surface water ranged from 108/m³ to 208/m³ and it varied between 110/m³ and 292/m³ for bottom at Station I.

At Station II, the number of larvae ranged from 127/m³ to 407/m³ and between 143/m³ and 435/m³ in both surface and bottom waters respectively.

The bivalve and gastropod veliger larvae were found to be abundant during midnight and high tide collections like other larvae. The trend similar to this was observed by Gajbhiye *et al.* (1984). The bivalve and gastropod veliger larvae together formed 28.1% and 27.96% of the total larvae collected at stations I and II.

Copepod larvae

Copepod nauplii were found to be more at Station II (4,205) than at Station I (3,025). At Station I, the numbers varied from 167 to 356/m^3 and between 135/m^3 and 297/m^3 in surface and bottom waters respectively. The Station II showed variations from 185 to 408/m^3 and between 179 and 589/m^3 in both surface and bottom waters respectively. The midnight collections showed an increase in numbers of copepod nauplii and it formed 11.5% and 12.28% of the total larval collections at stations I and II.

Cirripede larvae

At Station I, it varied between 74 and 133/m^3 and it ranged from 62 to 172/m^3 in surface and bottom waters respectively.

At Station II, the larval numbers ranged from 81 to 168/m^3 and between 72 and 216/m^3 in surface and bottom waters respectively.

Station II showed a higher number (1,571) than that of Station I (1,418). Like the other larvae it was also abundant in midnight collections.

Other larvae

This group formed about 0.8% and 0.46% of the total larval collections comprised of mainly the alima larvae and sphenopus larvae and appeared in more numbers during the night times. Gajbhiye *et al.* (1984) reported that 0.33% was 'other group' larvae of the total zooplankton off Versova (Bombay). The present study showed a higher value than the observations made by Gajbhiye *et al.* (1984).

From the present study, it is seen that the prawn larvae were abundant at Station II in the mid reaches of the Coleroon Estuary.

The Station I which is closer to the mouth showed large number of protozoeal and mysis stages of prawns than in Station II, where postlarvae were in high numbers. Crab larvae were also remarkably high in numbers at Station II in the mid reaches of the estuary, than at Station I. The high density of prawn larvae and crab larvae recorded at Station II may be attributed to the influx of nutrient rich water from Pitchavaram mangroves during low tide.

The polychaete larvae, fish eggs and fish larvae were more at the mouth of the estuary than in the mid reaches.

It is suggested from the present observation that time of collection for prawn larvae, fish eggs and fish larvae, should be between midnight and before dusk, that too during high tide.

The Coleroon Estuary—the unexploited virgin estuary has had rich seed potential resources which could be used for aquaculture practices in this region.

The river side flood bank of this estuary could be taken up for fish and prawn farming by the fisher folk around this region.

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