

## LARVAL DISTRIBUTION OF SERGESTID SHRIMP *ACETES* IN THE ESTUARINE SYSTEM OF GOA

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### ABSTRACT

Larval stages of *Acetes* were recorded throughout the year in the estuarine system of Goa with their peak abundance during November-December and March-April. Protozoae were the dominant larval component, contributing to 74.84%. Mandovi estuary recorded 41.17% of the total larvae whereas Zuari estuary and Cumbarjua canal had 37.40% and 21.43% respectively. Seasonal abundance showed that about 60% of the larvae occurred during the premonsoon period.

### INTRODUCTION

The sergestid shrimp, *Acetes* is widely distributed in the coastal waters and estuaries of the west and east coasts of India (Ganapathi and Subramanyam, 1964; Jones, 1967; Kunju, 1969). But they support a substantial fishery only in the Maharashtra coast where about 16% of the crustacean landing is constituted by them (Banerji, 1969). Many of the Asian and African countries have realised the food value of these tiny shrimps and are exploiting them commercially. Omori (1975) has summarised the data available on the fishery of *Acetes* in various countries. In India, the potential resources of these shrimps have not been assessed and very little effort is being made to exploit them commercially.

The success of any fishery is mainly dependant on the survival of its larval stages and a proper knowledge of the various aspects of larval behaviour and ecology is very essential for assessing the potential fish resources. In the case of *Acetes*, very little is known about the larval stages except for the development of only four species (Soejima, 1926; Menon, 1933; Ikomaitsu, 1953; Rao, 1968; Pillai, 1973). These shrimps occur abundantly in the coastal waters and estuaries of Goa but are not exploited commercially. In this paper the results of a study made on the larval distribution of *Acetes* in the estuarine system of Goa are presented.

### MATERIAL AND METHODS

Observations were made at 12 stations distributed in the Mandovi-Cumbarjua canal-Zuari estuarine complex of Goa (Fig. 1), from June 1971 to May 1972. Surface zooplankton samples were collected during the high tide at fortnightly intervals by towing an HT net for 5 minutes at each station. The samples were preserved in 5% formaldehyde. Larval stages of *Acetes* were sorted out from these samples and recorded as number per haul. Temperature and salinity were measured at all the stations.

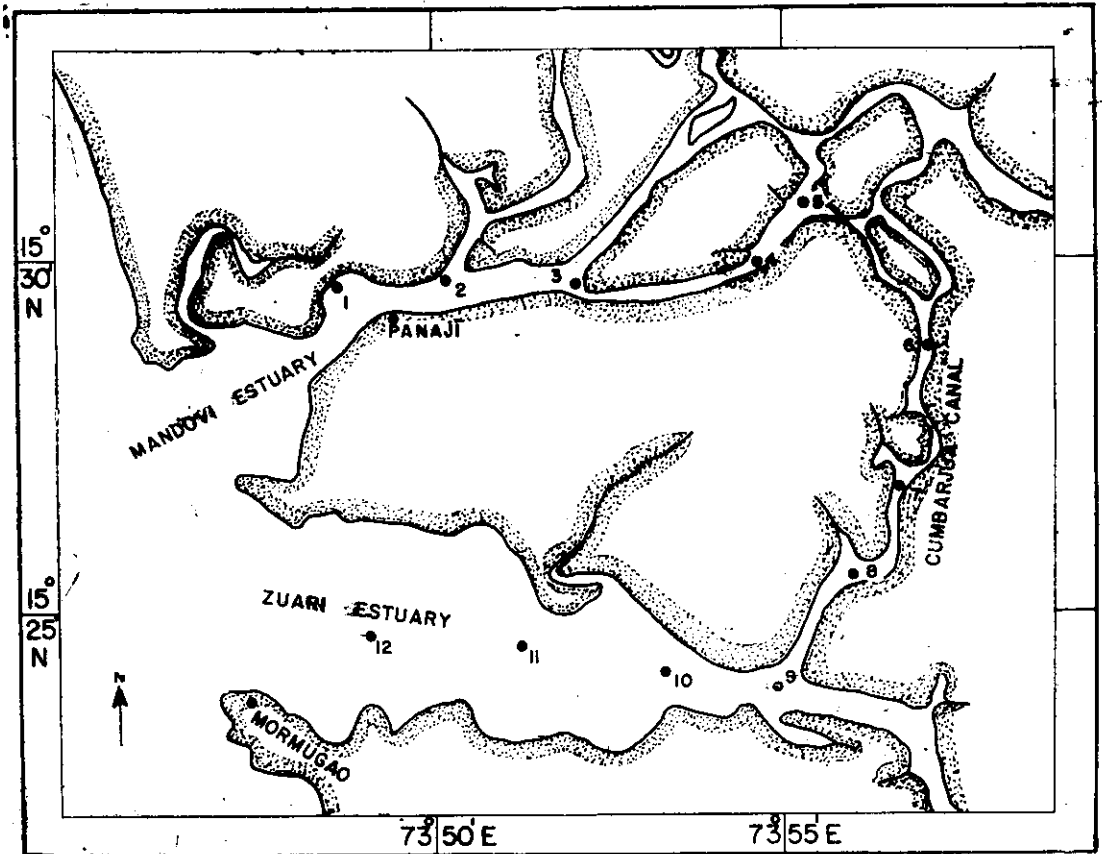


Fig. 1. Map showing the station positions.

## RESULTS

### *Distribution of larval components*

Month-wise distribution of the larval stages of *Acetes* in the estuarine system is given in Table I. During the monsoon season (June–September), only postlarval stages were present in very small numbers. In November and December, all the three stages, namely protozoa, mysis and postlarva occurred in appreciable numbers. There was a decline in their abundance in January and February. But again from March to May they were distributed in fairly large numbers. Protozoal abundance had two peaks, one in November–December and the other in March–April. Mysis and postlarval stages also showed similar peaks of abundance, but they were relatively less in number (Table I).

### *Larval distribution at different stations*

Total abundance of different larval components at 12 stations is tabulated in Table II. Of a total of 20,594 larvae recorded during the course of the present investigation, protozoa amounted to 74.84%. Mysis and postlarval stages contributed to

Table I. Month-wise distribution of larval stages of *Acetes*. All values indicate total numbers at all stations in each fortnight (I, II). Figures in parenthesis indicate mean number/haul.

Larval stages	June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
Protozoa	—	—	—	—	—	—	—	—	—	—	4450 (371)	160 (13)	1014 (85)	30 (3)	—	1*	—	1*	1510 (126)	1*	2210 (184)	5694 (475)	322 (27)	19 (2)
Mysis	—	—	—	—	—	—	—	—	—	—	730 (61)	180 (15)	112 (9)	145 (12)	7*	—	—	—	155 (13)	98 (8)	340 (57)	686 (13)	156 (13)	34 (3)
Postlarva	—	5*	—	—	1*	8*	18 (2)	2*	—	—	1140 (95)	140 (12)	68 (6)	98 (8)	30 (3)	32 (3)	3*	1*	135 (11)	363 (30)	50 (4)	286 (24)	144 (12)	15 (1)

\* collected only from one station.

Table II. Station-wise distribution of larval stages of *Acetes*. All values indicate total numbers. Figures in parenthesis indicate mean number/haul.

Larval stages	Mandovi		Cumbarjua		Zuari		Total No.	%							
	1	2	7	8	10	11									
Protozoa	1252 (52)	2261 (94)	1119 (47)	565 (24)	1404 (59)	1074 (45)	1268 (53)	24.30	2300 (96)	564 (24)	1398 (58)	657 (27)	31.92	15412	74.84
Mysis	148 (6)	295 (12)	201 (8)	101 (4)	146 (6)	157 (7)	149 (6)	17.10	172 (7)	279 (12)	378 (16)	437 (18)	47.90	2643	12.83
Postlarva	258 (11)	249 (10)	150 (6)	72 (3)	52 (2)	61 (3)	101 (4)	8.43	111 (5)	108 (5)	194 (8)	1102 (46)	59.79	2539	12.33

12.83 and 12.33% respectively. In other words, protozoa occurred more than 3 times the other two stages together whereas mysis stages were slightly more than the postlarval stages.

As regards their distribution at different stations, it can be seen from Table II that protozoa did not show much preference to any station. They were distributed in large numbers at all the stations except at the stations 4, 10 and 12 where the larvae were relatively less abundant. Fairly uniform distribution was seen in the case of mysis stages also. Nevertheless, Zuari estuary had the maximum number especially at the stations 11 and 12. In the case of postlarval stages, the distribution was slightly different in that the lower and middle reaches of the two estuaries had more larvae than upper reaches and the canal. But again, the station 12 which is at the mouth of Zuari estuary recorded about 47% of the total postlarvae.

#### *Seasonal distribution of larvae in the estuaries and the canal*

Larval abundance, irrespective of the seasons, showed that 41.17% of the total larvae were from the Mandovi estuary, 37.40% from Zuari estuary and 21.43% from the Cumbarjua canal. It can also be seen from the Table II that protozoa occurred more in Mandovi estuary (43.78%) followed by Zuari estuary (31.92%) and Cumbarjua canal (24.30%). In the case of mysis and postlarval stages, the distribution pattern was different. Both these stages occurred more in Zuari estuary (47.90 and 59.79% respectively). Mysis stages in Mandovi estuary accounted for 35% and in the canal only 17.10%. On the other hand, postlarval stages recorded a meagre 8.43% in the canal as against 31.78% in Mandovi estuary.

**Table III.** Season-wise abundance of larval stages of *Acetes*. All values indicate total number for each season.

Larval stages	Monsoon			Postmonsoon			Premonsoon		
	Mandovi	Cumb- arjua	Zuari	Mandovi	Cumb- arjua	Zuari	Mandovi	Cumb- arjua	Zuari
Protozoa	—	—	—	1526	144	3985	5221	3602	934
Mysis	—	—	—	147	54	973	778	398	293
Postlarva	7	—	25	158	45	1307	642	169	186
Total	7	—	25	1831	243	6265	6641	4169	1413

The larval components were grouped according to seasons, namely monsoon (June–September), postmonsoon (October–January) and premonsoon (February–May). These have been given in Table III. It can be seen from this table that during the monsoon season, no larval stages were found in the canal whereas the estuaries had only a few postlarval stages. During the postmonsoon season, they occurred in larger numbers in Zuari estuary which was dominated by protozoa. The other two components also were recorded in larger numbers from this estuary. On the other hand Mandovi estuary had a total of only 1831 larvae and the canal, a meagre 243 larvae. This trend was reversed during the premonsoon season when the highest number was recorded from Mandovi, largely consisting of protozoa stages. Cumbarjua canal

recorded the second highest number of larvae of which the protozoa contributed the major share. Zuari estuary recorded the lowest number of larvae. It is also evident from the table that about 60% of the larvae recorded were during the premonsoon. This is particularly true with protozoa stages whose share during this season was 63.30%. Mysis too had the highest number (55.58%) during this period. Only the postlarvae showed the maximum (59.54%) during the premonsoon season.

#### DISCUSSION

In the tropical estuarine system under investigation, the hydrological parameters are largely influenced by the southwest monsoon which is markedly reflected from the salinity. During the monsoon season, salinity declined considerably and ranged between 0.12 and 25.39‰. But it was always slightly higher in Zuari estuary than in Mandovi estuary. During the postmonsoon months, the fluctuation in salinity was very large (4.91 to 34.41‰). At the mouth and middle reaches of the estuaries it was higher than that of the upper reaches and the canal. Premonsoon season brought stability in salinity and no clear cut gradient was seen. Temperature, on the other hand, in the estuarine system showed very little variation in any season ( $28^{\circ}\text{C} \pm 2.5$ ).

Specific identification of the larvae could not be done as the larval descriptions of only 3 species are available from Indian waters (Menon, 1933; Rao, 1968; Pillai, 1973). In the present collections some of the larval stages showed similarity to the descriptions of *A. erythraeus* and *A. indicus*. But most of them were different from those described by the earlier authors. It is quite possible that many of them might be the larval stages of *A. orientalis* (Achuthankutty and Nair, 1976) which occur abundantly in Goa waters.

Although the spawning seasons of different species could not be studied with the help of the present data, a general picture could be drawn. The presence of larvae during the monsoon season suggests that spawning of these shrimps continues during this season also. Maximum larval abundance especially protozoa stages indicates that November–December and March–April are the two main spawning periods. From the distribution of the adults in the Goa region, it can be inferred that *A. indicus* and *A. orientalis* might be the major contributors of the larvae. These two species occur abundantly in the inshore waters and estuaries.

Temperature and not salinity has been found to be a critical factor for the larvae of *Sergestes lucens* reared in the laboratory (Omori, 1971). In the estuarine system of Goa, temperature variations are not very large and hence this factor may not be critical in tropical waters. Since the larval stages of *Acetes* occur in the estuarine system, in varying numbers, throughout the year, it can be deduced that these larvae can also tolerate wide fluctuations in salinity.

It has been reported that during the breeding season adults appear in large shoals in coastal waters (Kunju, 1969). The presence of large shoals of both adults and larvae, in the estuarine system of Goa, therefore, suggests the possibility of their breeding in the estuaries.

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