

LARVAL INGRESSION OF PENAEID PRAWNS IN THE ESTUARIES OF GOA

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The abundance and distribution of larvae of four species of penaeid prawns, namely, *Metapenaeus dobsoni* (Miers), *M. monoceros* (Fabricius), *Penaeus merguensis* de Man and *Parapenaeopsis styliifera* (Milne Edw.) were studied by sampling at different stations in Mandovi and Zuari estuaries of Goa. Larvae were more abundant in the stations nearer the mouth than in the upper reaches. *M. dobsoni* was most abundant with the larvae more or less equally distributed in these estuaries. Larvae of *M. monoceros* penetrated more into the Zuari estuary than into Mandovi. The distribution of larvae of *P. merguensis* was mainly restricted to the mouth stations in the latter, while in the former these larvae had a wider distribution in the interior. Although *P. styliifera* is reported to be strictly marine, the early larval stages of this species were present in the mouth stations.

As indicated by the maximum larval abundance, the peak breeding of all the species seems to be in the postmonsoon months. In Mandovi estuary, the larvae had the primary peak in January and two minor peaks, one in December and the other in March-April. In Zuari estuary, while the minor peaks occurred in the same months, the main peak was in November. Species-wise difference in peak abundance was also noticed.

Larvae of all the species were more abundant and enjoyed a wider distribution in Zuari estuary than in Mandovi. In the case of postlarvae, a higher abundance was noticed in Mandovi estuary. The influence of salinity and other physical factors in the distribution of larvae in these estuaries are also discussed.

INTRODUCTION

Prawn larvae in their early stages are carried into the estuaries and backwaters by water movements. Consequently, the estuarine and backwater prawn fishery is constituted mainly by the growing juveniles. Panikkar and Aiyar (1939), Menon (1955) and George (1959, 1962) determined the breeding seasons of some of the penaeid prawns of the Indian coasts. Rao (1972) studied the seasonal abundance of penaeid larvae in the inshore waters of Cochin. George (1970), Mohamed (1970) and Rao (1970) have summarised the work done so far on the larvae of most of the commercially important species of penaeid prawns. But information is lacking on their distribution in the estuaries of Goa, although these prawns are increasingly exploited in these waters. The present paper deals with some of the aspects of the larval ingressions of the commercially important penaeid prawns into the Mandovi and Zuari estuaries of Goa.

MATERIAL AND METHODS

Zooplankton samples were collected by making surface tows using a HT net from 7 fixed stations located at points extending from mouth to upstream

In Mandovi and Zuari estuaries (Fig. 1). Samples were collected at fortnightly intervals from October 1972 to May 1973. Collections could not be made during

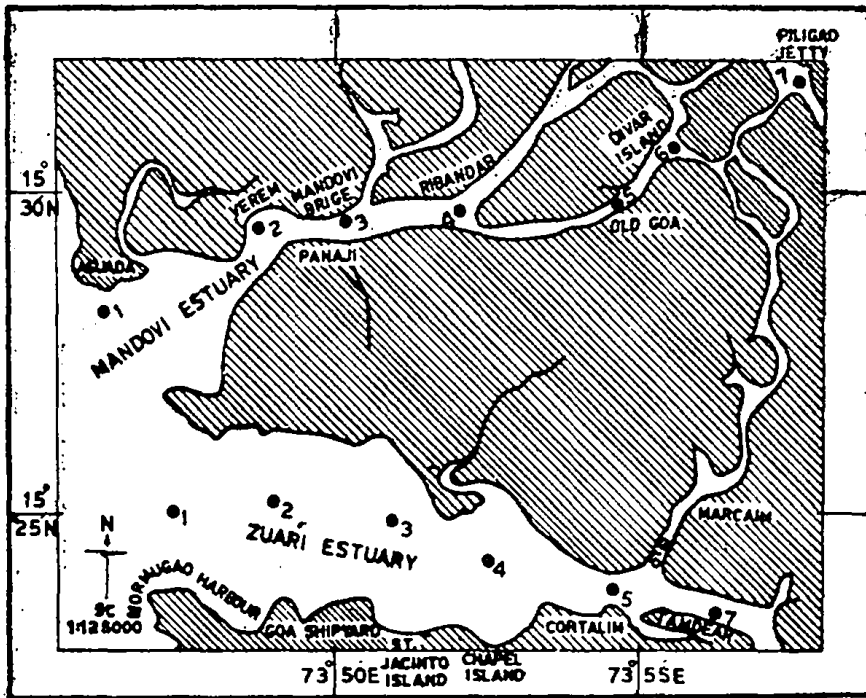


Fig. 1. Map showing station positions

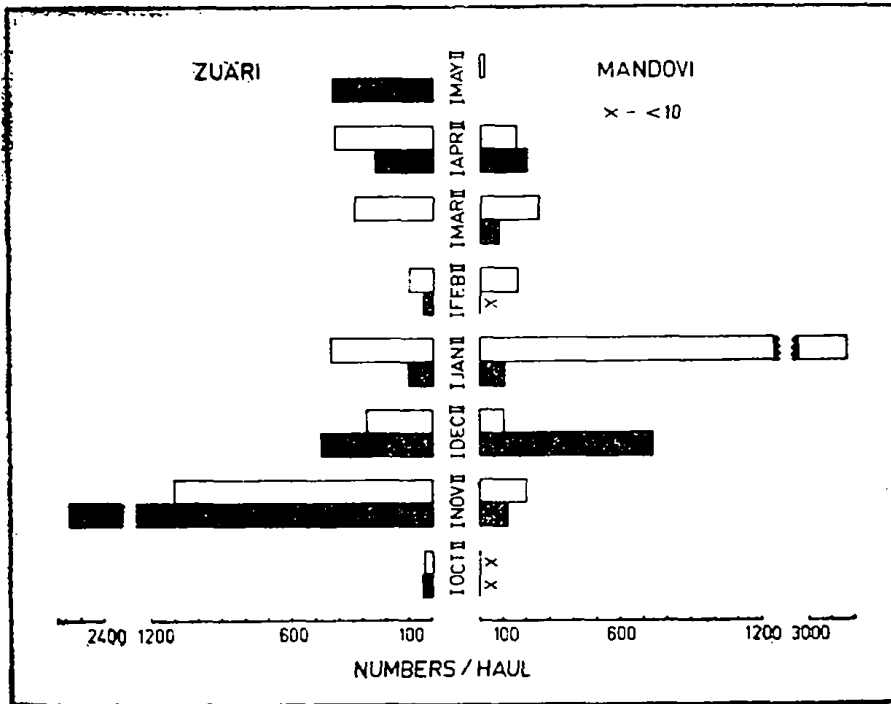


Fig. 2. Abundance of penaeid larvae in Mandovi and Zuari estuaries in different months

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monsoon season (June-September) as the navigational channel in the Mandovi estuary was closed due to sand bar formation. Surface water samples were collected from all the stations for salinity determination.

Penaeid larvae were sorted and identified using the larval characters described by Menon (1951), Mohamed *et al.* (1968), Raje and Ranade (1972 a and b) and Rao (1973).

RESULTS

Salinity:

The salinity of the waters ranged from almost nil in the monsoon season to $> 30 ‰$ in the premonsoon season. Salinity was always high at the mouth. The lowest salinity value of $2.02 ‰$ was recorded at stn. 7 in the Mandovi estuary in early October. This progressively increased and by late May, it was $31.14 ‰$. Salinity was comparatively high in Zuari estuary than in Mandovi and the minimum recorded value was $17.61 ‰$ at stn. 7 in late October. The lower value of salinity in the upstream stations of the Mandovi was also due to the draining of a number of rivulets into this estuary.

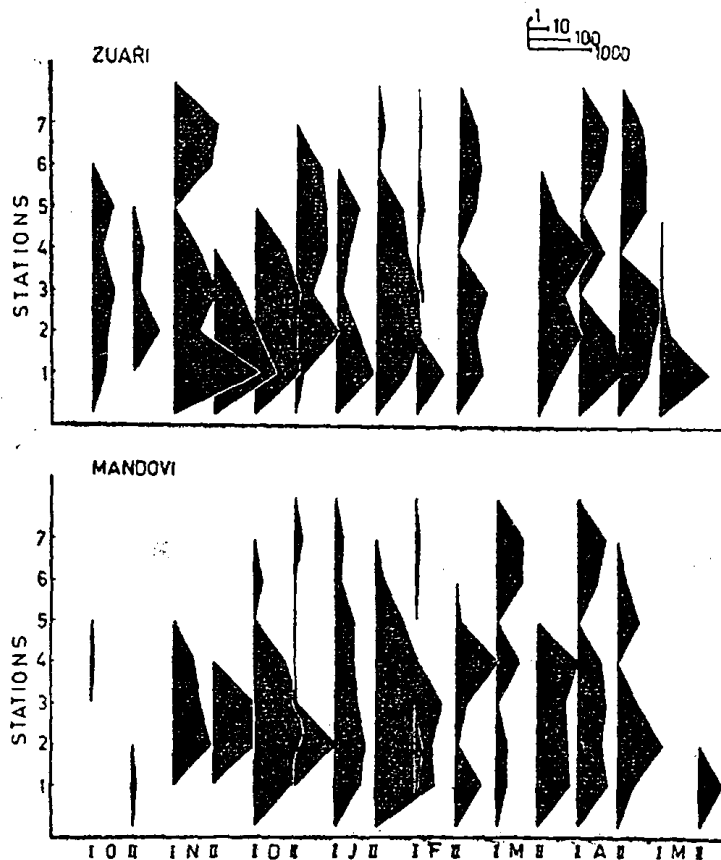


Fig. 3. Station-wise abundance of penaeid larvae in the estuaries in different months

Relative abundance and distribution of larvae in the estuaries:

Larvae of four species of penaeid prawns, viz., *Metapenaeus dobsoni* (Miers), *M. monoceros* (Fabricius), *Penaeus merguensis* de Man and *Parapenaeopsis styli-fera* (Milne Edwards) were present in the samples. The pattern of distribution of larvae was almost similar in both the estuaries, larger numbers nearer the mouth and smaller numbers in the upstream. Larvae of *M. dobsoni* were dominant in these estuaries followed by *M. monoceros*. Larvae of both the species were recorded almost throughout the period of observation.

In general, larvae were more abundant in Zuari than in Mandovi estuary (Fig. 2). A departure from this trend was noticed only in late January when

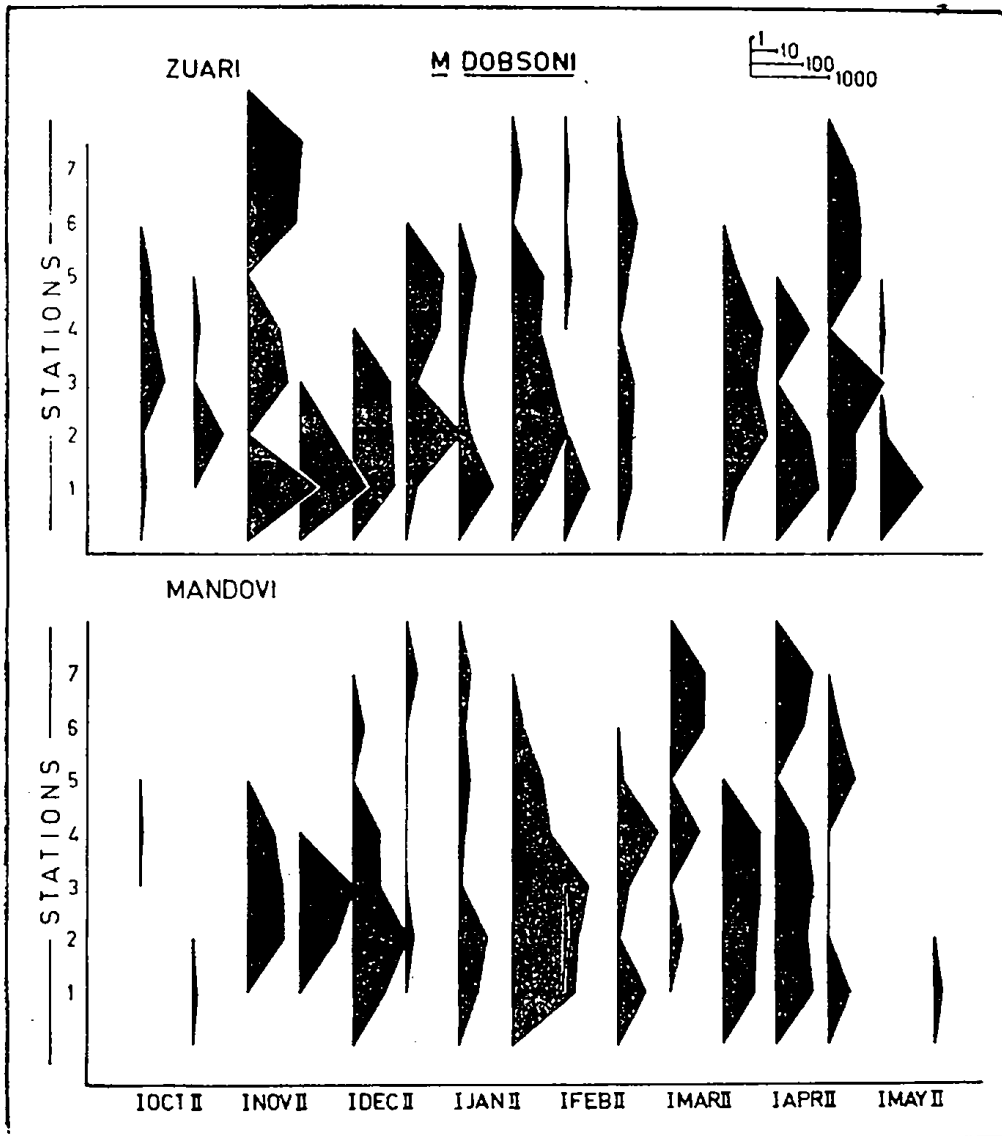


Fig. 4. Abundance and distribution of larvae of *Metapenaeus dobsoni* in the estuaries in different months

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3152 larvae were recorded in Mandovi as against 437 in Zuari estuary. The larval abundance showed three peaks in these estuaries. In Mandovi estuary, the primary peak was in late January (3152 nos) followed by a secondary peak in early December (734 nos) and a tertiary peak in March-April (250 & 352 nos respectively). In Zuari estuary, the major peak was recorded in November (3650 nos). The Secondary peak in December in the Mandovi estuary continued to late January in this estuary (437 nos) and the tertiary peak in March-April continued to early May (427 nos).

Station-wise abundance of larvae is presented in Fig. 3. Larvae were mostly distributed near the mouth and decreased in abundance towards upstream. In Mandovi estuary, larvae were almost absent beyond stn. 4 till the end of December and in May. In other months also, their number was negligible in the upper reaches. But larvae enjoyed a wider distribution in Zuari estuary (Fig. 3).

Species abundance and distribution:

a. *Metapenaeus dobsoni*

Abundance of the larvae of this species in different stations is shown in Fig. 4. In general, it was more in Zuari estuary. A variation from this general

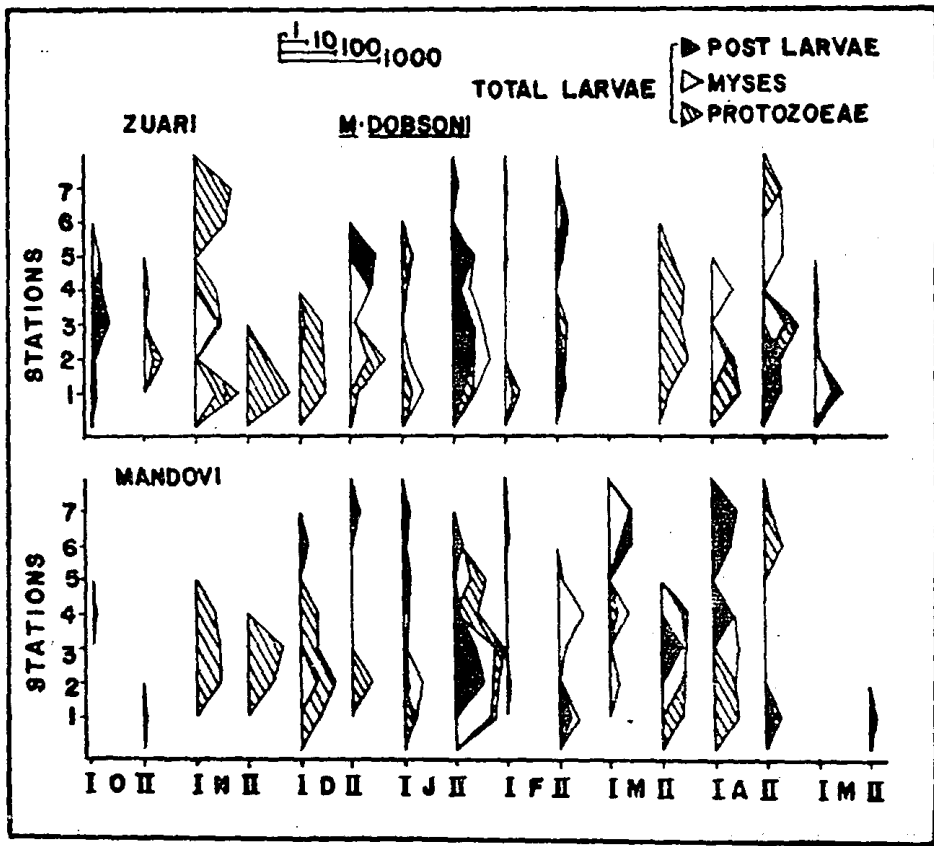


Fig. 5. Relative distribution of different larval stages of *Metapenaeus dobsoni* in the estuaries in different months

trend was seen in late January when 1833 larvae were recorded in Mandovi as against 237 in Zuari. The number of larvae near the mouth was more than in the mid and upstream stations. In October/November, very few larvae of this species were present in Mandovi estuary. Their number increased thereafter, attained a minor peak (194 nos) in early December, a major peak (1833 nos) in late January and another minor peak in late March-early April (130 & 170 nos respectively). In January, the larvae were distributed throughout the estuary. Zuari estuary had the maximum number of larvae in November (1270 nos). The subsidiary peaks were observed in December (308 nos), late January (237 nos) and late March-April (141 & 320 nos respectively).

Protozoae were present throughout the period of observation, but the maximum number was noticed in late January in Mandovi and in November in Zuari (Fig. 5). Mysis stages were next to protozoae in abundance and the

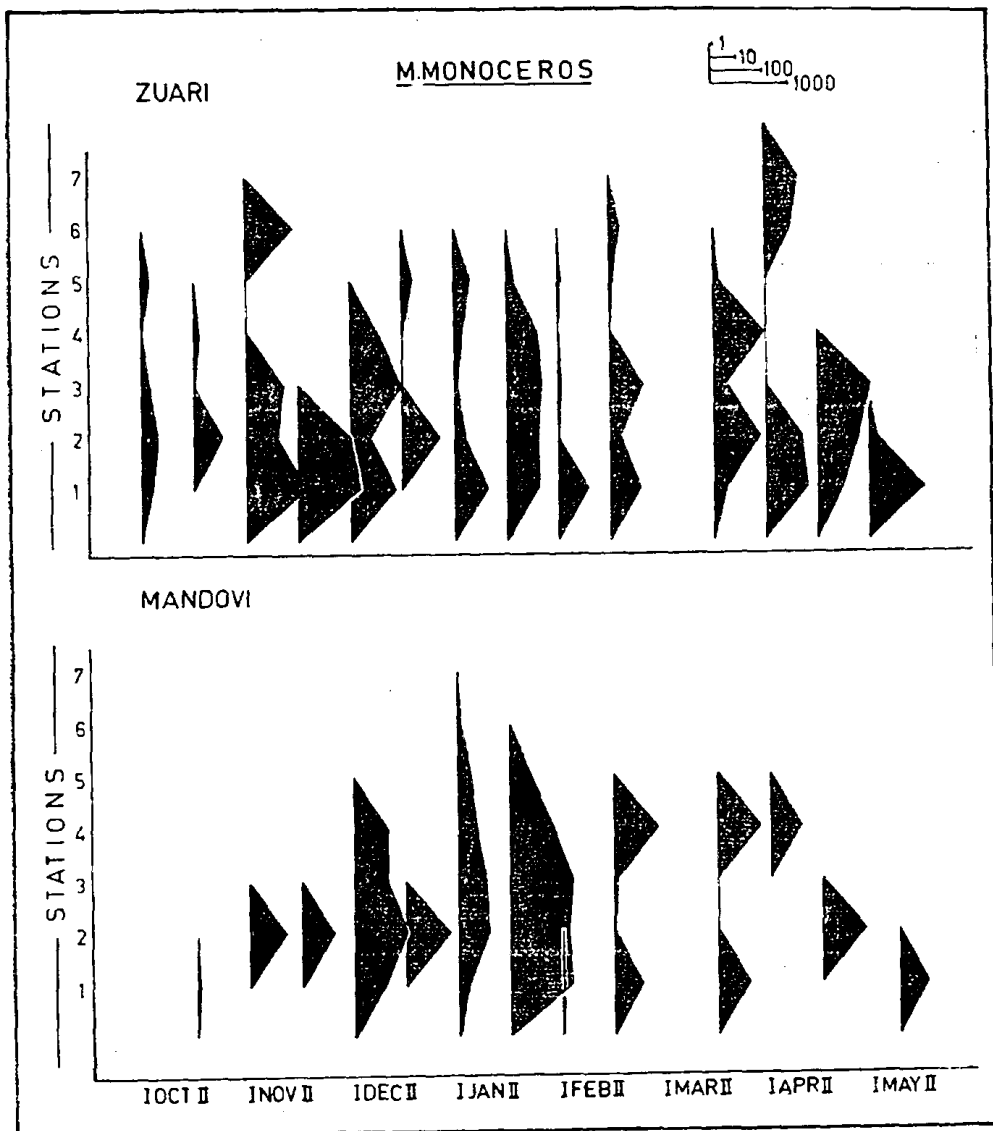


Fig. 6. Abundance and distribution of larvae of *Metapænaeus monoceros* in the estuaries in different months

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maximum number was recorded in late January in both the estuaries. Postlarval abundance showed two peaks in Mandovi, one in late January (96 nos) and the other in early April (70 nos). In Zuari, one was in late December (44 nos) and the other in late January (46 nos).

b. *Metapenaeus monoceros*

Larvae of this species also enjoyed a wider distribution in Zuari estuary (Fig. 6). Their distribution was restricted to the mouth stations in Mandovi and from stations beyond 4, they were seldom recorded. In Zuari also, their number in mid and upstream stations was less. Their peaks in these estuaries were similar to that of *M. dobsoni*. The maximum number of 1088 larvae was recorded in late January in Mandovi and 860 in November in Zuari.

Protozoae of this species were dominant in late January in Mandovi and in late November in Zuari. Mysis stages, though not present always, outnumbered protozoa in late January in Mandovi. In Zuari, they occurred abundantly in early May. Compared to *M. dobsoni*, postlarvae of this species entering the estuaries were negligible as the maximum numbers recorded in Mandovi and Zuari during the period of observation were only 7 and 5 respectively (Fig. 7).

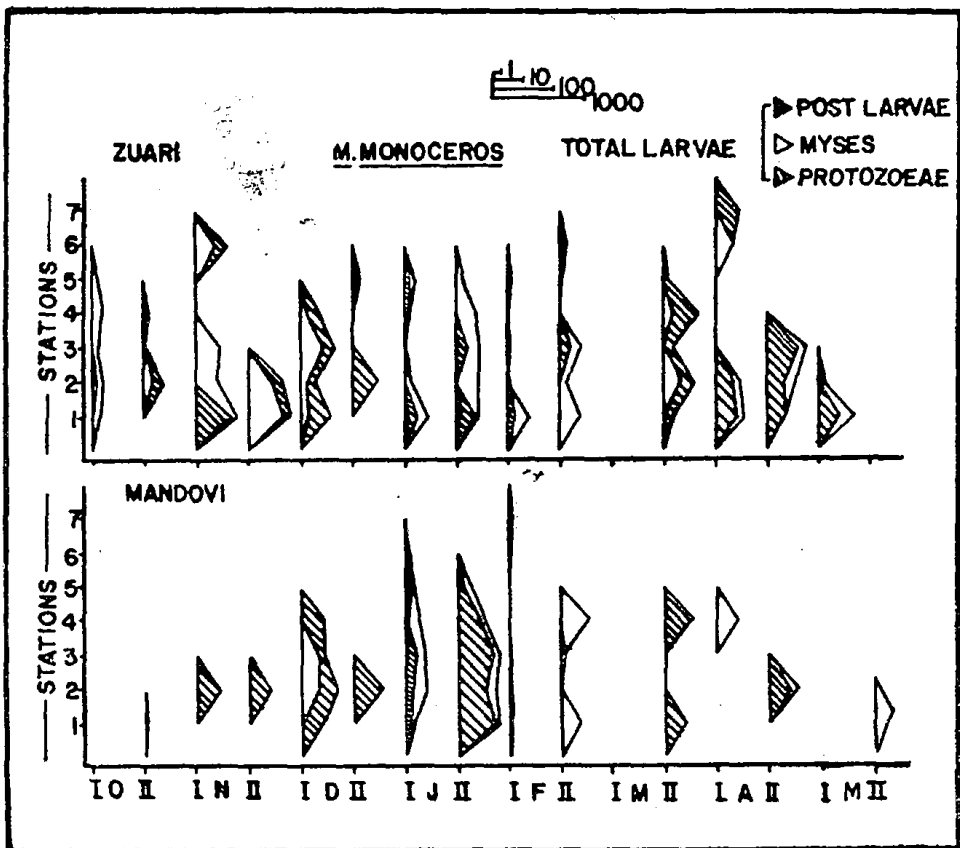


Fig. 7. Relative distribution of different larval stages of *Metapenaeus monoceros* in the estuaries in different months

c. *Penaeus merguensis*

Larval distribution of this species (Fig. 8) closely followed that of *M. monoceros*, but the number of larvae recorded was lesser. Like the other species, larvae of this species were abundantly distributed in Zuari estuary. Larvae appeared in the collections from Mandovi in late November and they were mostly restricted to the mouth and attained a peak in early December (200 nos). This was followed by subsidiary peaks in late January (95 nos) and in late April

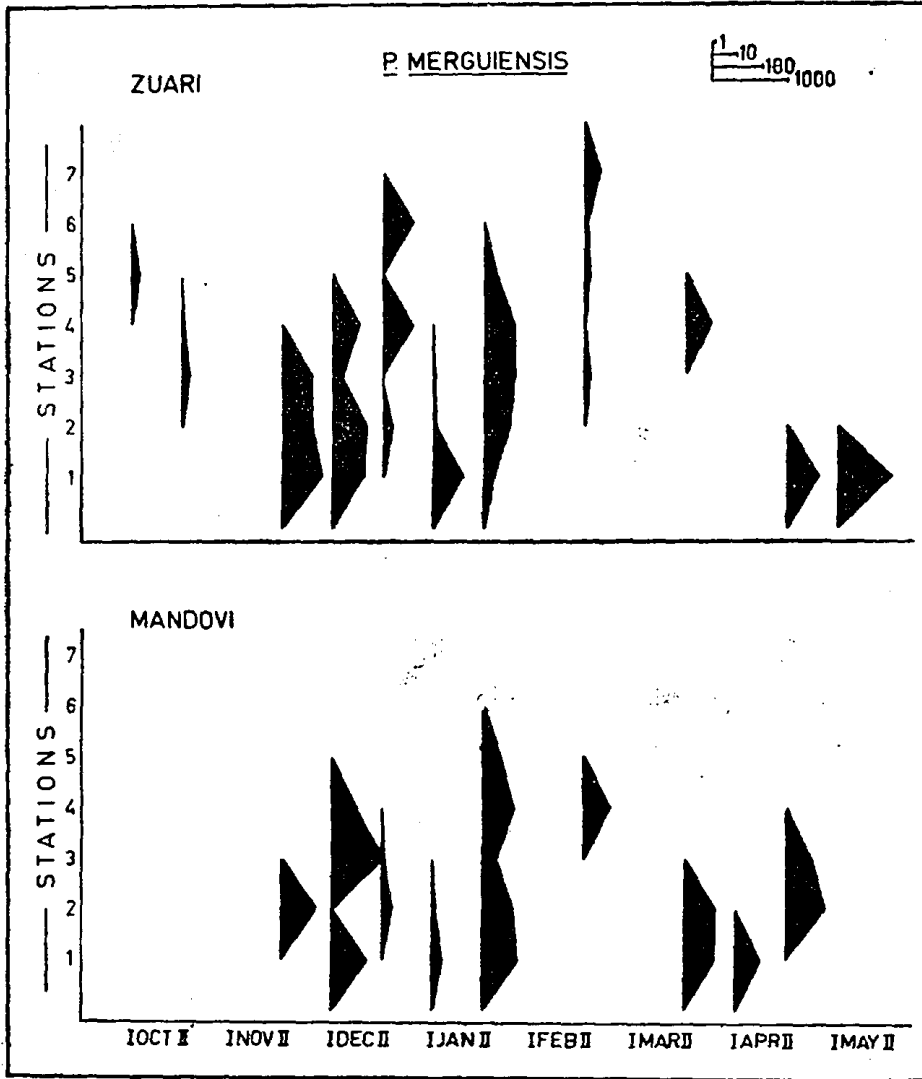


Fig. 8. Abundance and distribution of larvae of *Penaeus merguensis* in the estuaries in different months

(60 nos). Again, they were absent in some of the samples of the premonsoon season. In Zuari, late November (100 nos) and early May (140 nos) were their two main peaks of abundance. The secondary peaks were in early December (76 nos) and in late January (68 nos). In this estuary also, larvae were not always present in the collections.

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Protozoae were abundant in early December in both the estuaries and, mysids in April-May. Postlarvae were collected in small numbers on few occasions only (Fig. 9).

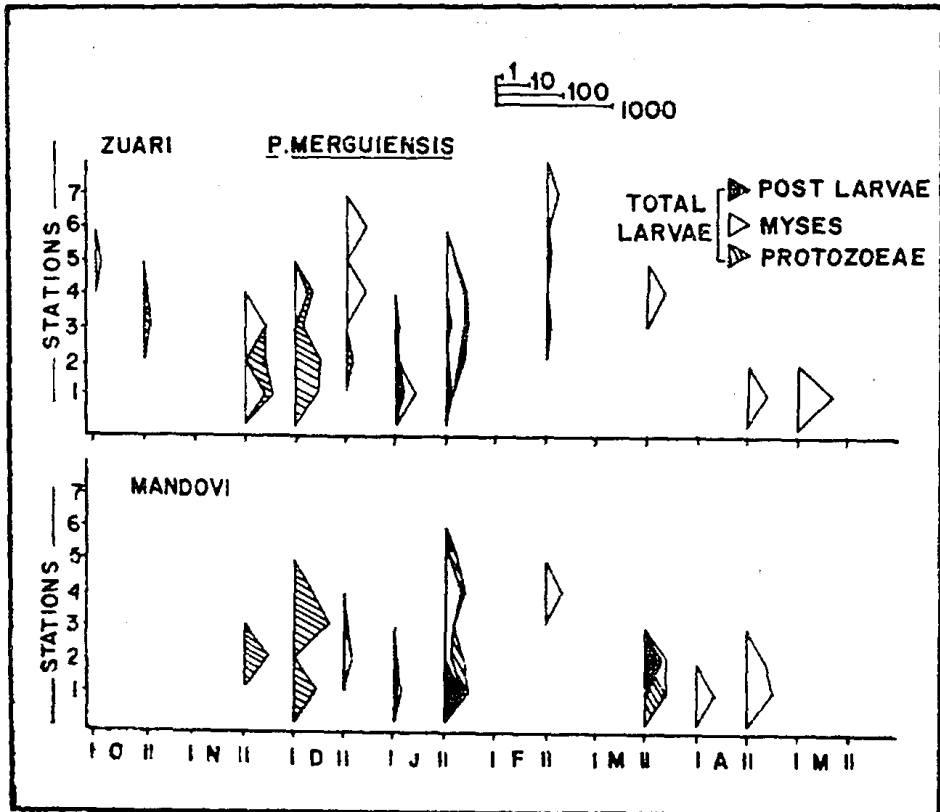


Fig. 9. Relative distribution of different larval stages of *Penaeus merguensis* in the estuaries in different months

d. *Parapenaopsis stylijera*

In Mandovi estuary, larvae of this species were present in smaller numbers near the mouth for a short period (December to May). Maximum numbers were recorded in early December (130 nos) and in late January (136 nos). In Zuari, they occurred for a comparatively longer period and penetrated into the middle stations also in smaller numbers. Early November recorded the maximum number with 1340 larvae followed by early May with 91 larvae (Fig. 10).

Unlike other species, only protozoae and early mysis of this species were collected; 1110 out of 1430 larvae recorded in early November in Zuari were of mysis stage I (Fig. 11).

Spawning seasons:

Spawning seasons of these four species of penaeid prawns were studied based on the abundance of their larval stages in the estuaries. *M. dobsoni* appears to breed continuously as protozoa were present in both the estuaries throughout the period of investigation (Fig. 5). But intensive breeding was in the post-monsoon season (October-January) with peaks in November and in late January.

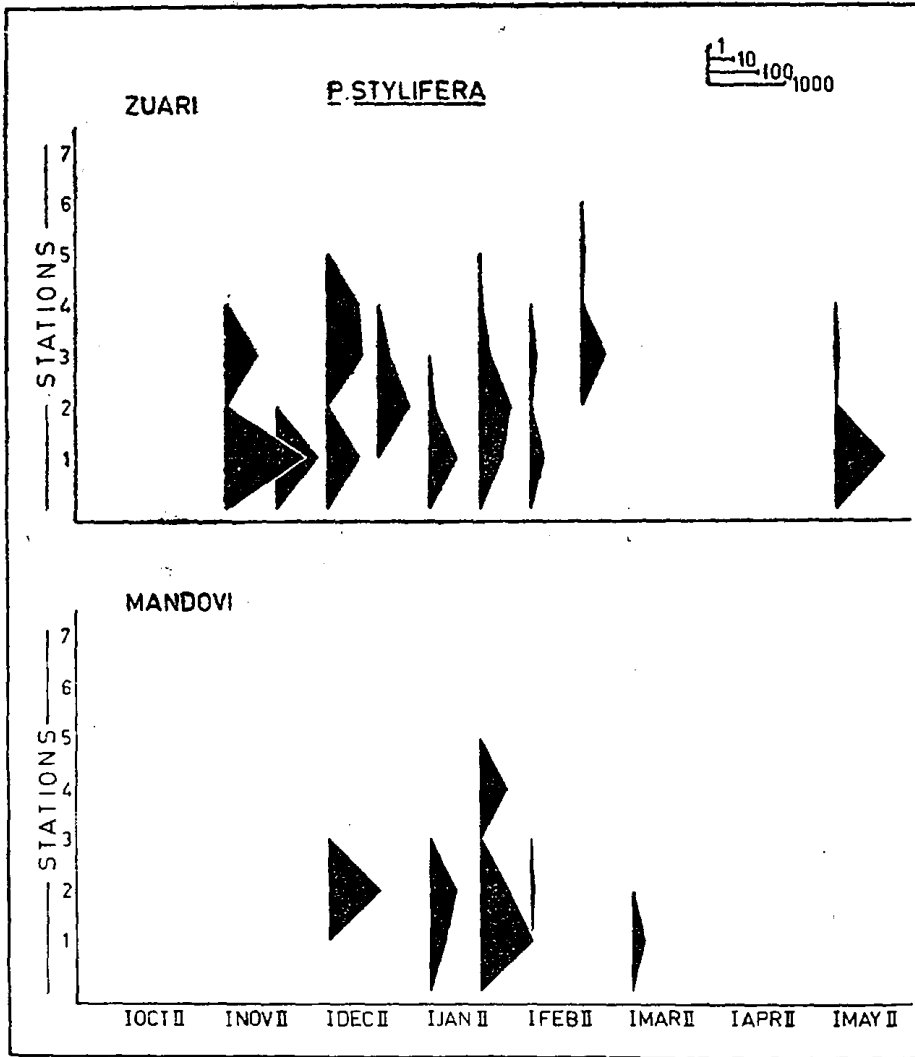


Fig. 10. Abundance and distribution of larvae of *Parapenaecopsis styliifera* in the estuaries in different months

Year-round breeding was noticed in *M. monoceros* also (Fig. 7) with two peaks, similar to *M. dobsoni*. *P. merguensis* does not seem to breed throughout the year, but breed mostly during the postmonsoon season (early December and late January). In the premonsoon season also a subsidiary peak was noticed in late April-early May (Fig. 9). *P. styliifera* breeds during postmonsoon (November-January) with a peak breeding activity in early November (Fig. 11).

DISCUSSION

The penaeid larvae are passively brought into the estuaries and backwaters. Their entry is influenced by the prevailing tides and currents. The mouth of the Zuari estuary is wider and opens in such a position that more neritic water with larvae penetrates this estuary during flood tide and conse-

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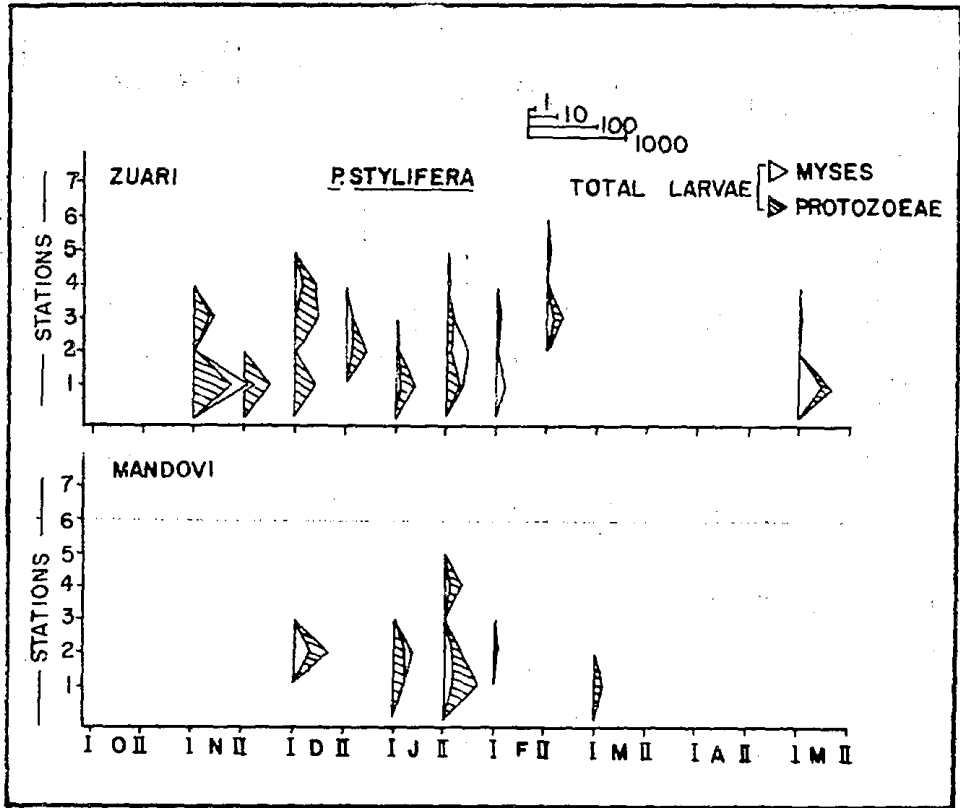


Fig. 11. Relative distribution of different larval stages of *Parapenaeopsis styliifera* in the estuaries in different months

quently more larvae are brought in. This would explain the difference in the total number of larvae recorded in these two estuaries.

The current at the mouth of these estuaries is weaker than that at the mid and upstream areas (Cheriyān *et al.*, 1975 and Varma *et al.*, 1975). This may be one of the reasons for the abundance of larvae near the mouth. That salinity alone does not play an important role in the distribution of penaeid larvae is evident from the fact that even when the salinity values of the mid and upstream stations were almost the same as those of mouth stations, they were found abundantly near the mouth region. As observed by Rao (1972), these larvae are euryhaline as they were distributed in the upper reaches also where the salinity was at times lower.

The penetration of early larval stages of *P. styliifera* into these estuaries is noteworthy. *P. styliifera* is a marine species (Menon, 1952) and the larvae have not been reported from brackish water areas (Rao, 1970). The absence of its larvae in the backwaters and inshore waters of Cochin was attributed by Rao (1970) to their inability to tolerate low saline waters. In the estuaries of Goa also, they were mostly found distributed near the mouth region where the salinity was higher. The peak breeding periods of this species in Goa region agrees with the previous reports from southwest coast of India by George *et al.* (1968) and Rao (1968). However, continuous breeding was not noticed here.

Year-round breeding has been reported in *M. dobsoni* (Kesteven and Job, 1957; George, 1962, 1970; George et al., 1968 and Rao, 1968) and in *M. monoceros* (George, 1962, 1970). Presence of early larvae of these species in the estuaries of Goa throughout the year also suggests that these species breed continuously. The peak breeding season of these species varies slightly from place to place (Menon, 1953; George, 1962; George et al., 1968 and Rao, 1968).

Information is lacking on the spawning seasons of *P. merguensis*. But, a closely allied species, *P. indicus* breeds throughout the year in Cochin region with a principal breeding peak from October to December and a secondary one from May to August (Rao, 1972). In *P. merguensis*, breeding seems to be discontinuous and the peak breeding was observed in December and May. The major breeding season for all the species in Goa region appears to be the postmonsoon season.

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