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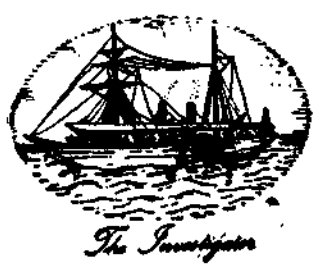

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DISTRIBUTION OF SPECIES OF PRAWNS IN THE BACKWATERS AND ESTUARIES OF INDIA WITH REFERENCE TO COASTAL AQUACULTURE

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ABSTRACT

Several of the species of prawns of marine origin as well as some of the species of freshwater origin have a common brackishwater phase in their life history. As a result of this many of these species occur in large numbers in all the estuaries and backwaters of India in their postlarval and juvenile stages. The distribution of these species in the major brackishwater environments of the country has been studied with reference to their composition and seasonal abundance. The most common species which are suitable for culture purposes are *Penaeus indicus, P. monodon, P. semisulcatus, P. merguiensis, Metapenaeus dobsoni, M. monoceros, M. affinis, M. brevicornis* and *Parapenaeopsis sculptilis* among the penaeid prawns and *Macrobrachium rosenbergii, M. malcolmsonii, M. idella, M. equidens, M. rude, Palaemon styliferus* and *P. tenuipes* among the palaemonid prawns. Although *P. indicus*, one of the species very much in demand for culture, is found in almost all the estuaries, it occurs in maximum abundance in the southwest and southeast coastal regions. *P. monodon*, which grows to the largest size among the penaeid prawns, is most commonly distributed in the estuaries of middle and northern regions of the east coast. *M. dobsoni* is the dominant species in the backwaters of the southwest coast.

In general the postlarval and early juvenile stages of these prawns are encountered almost throughout the year. However, October-May is found to be the peak season of abundance in the brackishwater areas of the west coast and southeast coast, while January-April and August-December are the peak seasons in the estuaries of the middle and northern regions of the east coast. The penetration and spatial distribution of different species in relation to salinity conditions of Vembanad Lake have been traced during their peak season of abundance.

INTRODUCTION

IT IS a matter of common knowledge that most of the commercially important penaeid prawns of marine origin have a brackishwater phase in their life history. Some of the freshwater palaemonid prawns also share the same characteristic of having a brackish water phase. While the former use the estuarine waters as a nursery ground for the young ones after the breeding of the adult in the sea, the latter use these waters for the breeding purposes and early development of the larvae. So the distribution of the various species of prawns in the estuaries and brackish waters becomes important in the context of culture of these species especially with reference to the availability of their young ones to be used for stocking purpose. Information on the distribution of the different species in these environments in some of the estuaries like Cochin Backwaters, Hooghly-Matlah Estuary and others is available in the studies made by Menon and Raman (1961), George (1962 a ; 1962 b), Ramamurthy (1963; 1972), Gopalakrishnan (1971), Mohamed and Rao (1971), Rao and Kathirvel (1971), Rajyalakshmi (1972), Sampson Manickam and Sreenivasagam (1972), Evangeline (1975), Rao

(1975), Achuthankutty *et al.* (1977), Deshmukh (1977), Suseelan (1977), Goswami and George (1978) and Suseelan and Kathirvel (1979).

The present contribution deals with the occurrence and distribution of these prawns in all the important estuarine systems of the country. An attempt is also made to trace the penetration and spatial distribution of different species of Vembanad Estuary with special reference to the salinity conditions prevailing in the summer months.

Species Commonly Occurring in the Brackishwater Environments

Sixteen species of prawns belonging to the family Penaeidae, 4 species to Sergestidae and 7 species to Palaemonidae have been found to occur commonly in the various estuarine environments along the coasts. They are listed in Table 1 along with their common English names and the maximum size attained in the natural brackishwater ecosystems.

Among these species, considering the size attained and other biological features adapted to brackishwater habitats 11 species of penaeids namely, *P. indicus*, *P. monodon*, *P. semisulcatus*, *P. penicillatus*, *P. merguiensis*, *M. dobsoni*, *M. monoceros*, *M. affinis*, *M. brevicornis*, *M. kutchensis* and *P. sculptilis* and 7 species of palaemonids, namely, *M. rosenbergii*, *M. malcolmsonii*, *M. idella*, *M. equidens*, *M. rude*, *P. styliferus* and *P. tenuipes* are important from the point of view of large scale culture.

Distribution of Species

The distribution of common species of prawns available in the important brackishwater areas of the maritime states of India is shown in Table 2.

Areawise distribution

In the estuaries and backwaters of Kerala, *M. dobsoni* ('thelli chemmeen') is the most dominant species contributing to the capture as well as the traditional culture fisheries. Other important species are *P. indicus*, *P. semisulcatus*, *M. monoceros*, *M. affinis*, *M. rosenbergii*, *M. idella* and *M. equidens*. While *P. indicus* and *M. monoceros* are available in fair abundance along with *M. dobsoni* in all the brackishwater areas, *P. semisulcatus* is commonly encountered only in Ashtamudi and Cochin Backwaters particularly in the deeper muddy grounds. Early juveniles of *P. indicus* are often met with in enormous numbers in shallow areas near the shore. Many species of prawns are known to utilize Netravathy and Aghanashini Estuaries of Karnataka as their nursery grounds of which *M. dobsoni* is the predominant one. *P. indicus* in the former environment and *P. merguiensis* in the latter are the other two important cultivable species that are available in association with *M. monoceros*. The Zuari and Mandovi Estuaries of Goa harbour several species, the most common being *M. dobsoni*, *M. monoceros*, *P. merguiensis* and *M. rosenbergii*. The brackishwater creeks of Maharashtra and Gujarat are more or less similar in regard to the occurrence and composition of prawn species. Most of the species available in the coastal waters are drawn into these environments along with tide. *M. monoceros* in Maharashtra and *M. kutchensis* in the Kutch region of Gujarat are the most important species. Other species of common occurrence are *P. merguiensis*, *P. penicillatus* and *P. sculptilis* among penaeids and *P. tenuipes* among non-penaeids. The estuaries of Tapti and Narmada rivers are good breeding grounds for *M. rosenbergii*.

The east coast, in general, is richer in having more number of estuaries than the west coast and all of them are excellent nursery areas for many species of prawns. Invariably in all

TABLE 1. *Species of prawns commonly occurring in the brackishwater environments of India*

Name of species	Common name	Maximum size (mm) attained in estuaries and backwaters
FAMILY PENAEIDAE		
Penaeus indicus H. Milne Edwards	Indian white prawn	160
P. monodon Fabricius	Jumbo tiger prawn	230
P. semisulcatus de Haan	Green tiger prawn	150
P. merguiensis de Man	Banana prawn	160
P. penicillatus Alcock	White prawn	150
P. latisulcatus Kishinouye	Brown prawn	100
P. canaliculatus (Olivier)	Striped prawn	100
Metapenaeus monoceros (Fabricius)	Speckled prawn	100
M. affinis (H. Milne-Edwards)	Jinga prawn	80
M. dobsoni (Miers)	Flower tail prawn	90
M. brevicornis (H. Milne-Edwards)	Yellow prawn	100
M. burkenroadi Kubo	Green tail prawn	90
M. kutchensis George, George & Rao	Ginger prawn	100
Parapenaeopsis sculptilis (Heller)	Rainbow prawn	110
P. hardwickii (Miers)	Spear prawn	120
P. stylifera (H. Milne-Edwards)	Kiddi prawn	100
FAMILY SERGESTIDAE		
Acetes indicus H. Milne-Edwards	Jawla paste shrimp	40
A. erythraeus Nobili	Tsivakihini paste shrimp	35
A. sibogae sibogalis Achuthankutty & George	—	30
A. cochinensis Rao	—	20
FAMILY PALAEMONIDAE		
Macrobrachium rosenbergii (de Man)	Giant river prawn	320
M. malcolmsonti (H. Milne-Edwards)	Monsoon river prawn	230
M. idella (Hilgendorf)	Slender river prawn	120
M. equidens (Dana)	Rough river prawn	100
M. rude (Heller)	Hairy river prawn	130
Palaemon styliferus H. Milne-Edwards	Roshna prawn	90
P. tenuipes (Henderson)	Spider prawn	80

TABLE 2. *Distribution of species of prawns in the brackishwater environments of the maritime States of India*

Maritime States	Environment	Common species of prawns	Period of occurrence	Peak period of abundance
KERALA	Ashtamudi Lake	*Metapenaeus dobsoni*	Throughout the year	October-May
		Penaeus semisulcatus	September-May	November-April
		P. indicus	Throughout the year	October-May
		P. latisulcatus	October-May	November-April
		M. monoceros	Throughout the year	October-April
		Acetes erythraeus	Occasional	December-April
		Macrobrachium idella	Throughout the year	June-August

TABLE 2 (*Contd.*)

Maritime States	Environment	Common species of prawns	Period of occurrence	Peak period of abundance
	Cochin Backwaters	*M. dobsoni*	Throughout the year	August-January
		P. indicus	-do-	December-May
		M. monoceros	-do-	February- May & August-November
		P. semisculcatus	December-June	January-March
		M. affinis	Throughout the year	March-August
		P. monodon	Occasional	March-May
		P. canaliculatus	December-May	March-May
		Parapenaeopsis stylifera	February-May	March-May
		Acetes indicus	Occasional	December-May
		A. erythraeus	Occasional	December-May
		M. idella	Throughout the year	June-October
		M. rosenbergii	Occasional	June-October
		M. rude	Occasional	June-October
		M. equidens	Occasional	June-October
	Korapuzha Estuary	*M. dobsoni*	Throughout the year	December-May
		M. monoceros	-do-	December-April
		P. indicus	November-August	April-May
		P. monodon	Occasional	—
		P. stylifera	Occasional	March-May
		A. indicus	Occasional	March-May
KARNATAKA	Nethravathy Estuary	*M. dobsoni*	Throughout the year	October-November
		P. indicus	Throughout the year	January-March
		M. monoceros	Throughout the year	February & October-November
		P. merguiensis	Throughout the year	January-February
		P. monodon	Occasional	—
		M. affinis	Occasional	—
	Aghanashini Estuary	*M. monoceros*	Throughout the year	October-January
		M. dobsoni	Throughout the year	November-March
		P. merguiensis	Throughout the year	December-February
GOA	Zuari Estuary	*M. dobsoni*	Throughout the year	January-April
		M. monoceros	Occasional	January-April
		P. indicus	October-June	February-May
		P. merguiensis	Occasional	January-May
		P. stylifera	Occasional	February-May
		M. rosenbergii	Occasional	May-September
	Mandovi Estuary	*M. dobsoni*	Throughout the year	July & January-March
		M. Monoceros	Occasional	January-March
		P. merguiensis	Occasional	January-May
		P. stylifera	Occasional	March-May
		M. rosenbergii	Occasional	May-September
MAHARASHTRA	Creeks of Bombay area	*M. monoceros*	Throughout the year	February-April & October-December
		P. merguiensis	Occasional	December-May

TABLE 2 (*Contd.*)

Maritime States	Environment	Common species of prawns	Period of occurrence	Peak period of abundance
		P. penicillatus	Occasional	October-December
		M. affinis	Occasional	—
		M. brevicornis	Occasional	—
		A. indicus	Occasional	
		Palaemon tenuipes	Occasional	April-May
		P. styliferus	Occasional	—
		Parapenaeopsis hardwickii	Occasional	—
		P. sculptilis	Occasional	June-September
GUJARAT	Narmada & Tapti Estuaries	*M. monoceros*	Throughout the year	October-November
		P. sculptilis	Throughout the year	June-September
		P. tenuipes	Occasional	—
		P. penicillatus	Occasional	—
		M. rosenbergii	Occasional	May-October
	Rann of Kutch and creeks	*M. kutchensis*	July-October	August-October
		P. merguiensis	Occasional	January-May
		M. brevicornis	Occasional	January-May
		M. monoceros	Occasional	—
		P. penicillatus	Occasional	—
		P. tenuipes	Occasional	—
TAMIL NADU	Manakkudy Estuary	*P. indicus*	Throughout the year	February-April & June-July
		M. dobsoni	Throughout the year	February-March & September-November
		M. monoceros	Throughout the year	February-May & September-November
		P. monodon	Throughout the year	April & September-November
	Malattar Estuary	*P. indicus*	Throughout the year	—
		M. monoceros	Throughout the year	—
		M. affinis	Throughout the year	—
	Killai backwaters	*P. indicus*	Throughout the year	November-March
		M. monoceros	Throughout the year	October-December
		M. dobsoni	Throughout the year	October-December
		P. monodon	Throughout the year	November-December
		M. rosenbergii	August-March	October-December
	Kovelong Backwater	*P. indicus*	Throughout the year	December-March
		M. monoceros	Throughout the year	July-November
		M. dobsoni	Throughout the year	June-November
		P. monodon	Throughout the year	December-March
	Pulicat Lake	*P. indicus*	Throughout the year	March-April & October-November
		M. monoceros	Throughout the year	—
		P. monodon	Throughout the year	—
		P. semisulcatus	Occasional	—
		M. dobsoni	Occasional	—
		P. canaliculatus	Occasional	—

TABLE 2 (*Contd.*)

Maritime States	Environment	Common species of prawns	Period of occurrence	Peak period of abundance
ANDHRA PRADESH	Godavari Estuary	*M. monoceros*	Throughout the year	October-December
		M. dobsoni	Throughout the year	October-December
		P. indicus	Throughout the year	February-April & October-December
		P. monodon	-do-	October-February
		M. brevicornis	-do-	March-May & November-December
		M. affinis	-do-	July-September
		P. merguiensis	-do-	October-December
		A. indicus	Occasional	—
		P. tenuipes	July-November	July-October
		M. malcolmsonii	Occasional	August-November
		M. rosenbergii	Occasional	August-October
		M. rude	Occasional	August-November
	Konada Estuary	*M. monoceros*	Throughout the year	August-October
		M. dobsoni	-do-	September-October
		P. indicus	-do-	May-June & August-September
		P. monodon	Occasional	—
ORISSA	Chilka Lake	*P. indicus*	Throughout the year	February-April & July-October
		P. monodon	-do-	March-September
		P. semisulcatus	-do-	January-April & June-October
		M. monoceros	-do-	March-April & July-October
		M. dobsoni	Occasional	—
		M. affinis	Occasional	—
		M. rosenbergii	Occasional	—
		M. rude	Occasional	—
		M. malcolmsonii	Occasional	—
WEST BENGAL	Hooghly Matlah Estuarine system	*M. brevicornis*	Throughout the year	July & October-December
		P. styliferus	August-January	September-December
		P. sculptilis	February-December	February-June
		P. tenuipes	Occasional	October-December
		P. indicus	Throughout the year	January-April & August-September
		P. monodon	Throughout the year	February-May & August-September
		P. semisulcatus	Occasional	—
		P. canaliculatus	Occasional	—
		M. monoceros	Occasional	—
		A. indicus	Occasional	—
		M. affinis	Occasional	—
		M. rosenbergii	Occasional	July-October
		M. malcolmsonii	Occasional	July-October
		M. rude	Occasional	July-October
		P. stylifera	Occasional	March-May

the major brackishwater environments of Tamil Nadu like Killai Backwaters, Kovelong Backwaters and Pulicat Lake, including the Manakkudy Estuary situated on the extreme southwest coast, *P. indicus* is the principal species which some times forms more than 90% of the commercial catches. Other species of importance are *M. dobsoni*, *M. monoceros*, *P. monodon* and *M. rosenbergii*. The Godavary Estuary in the south and Konada Estuary in the north of Andhra Pradesh Coast are mostly inhabited by *M. monoceros*, in close association with *M. dobsoni* and *P. monodon*, in all gradients of salinity. *P. indicus* and *M. brevicornis* also occur in appreciable quantities in the lower estuary and *M. rosenbergii* and *M. malcolmsonii* in the upper reaches. The northernmost region of this coast bordering Orissa and West Bengal has the maximum number of estuaries in the country and they harbour large varieties of species both endemic as well as immigrants. The prawn fauna of Chilka Lake is chiefly represented by *P. indicus*, *P. monodon* and *M. monoceros* which are highly suitable for culture. Good concentrations of these species are known to exist in the central and northern sections of this environment. The Hooghly-Matlah estuarine complex of West Bengal, with its vast mangrove swamps and net work of rivers, supports abundant resources of penaeid as well as palaemonid prawns. While the marine zone of this ecosystem is mainly occupied by stenohaline species like *M. brevicornis*, *P. sculptilis* and *P. styliferus*, the middle and upper zones serve as good nurseries for more euryhaline penaeids like *P. monodon* and *P. indicus* and a few of the cultivable carideans like *M. rosenbergii*, *M. malcolmsonii* and *M. rude*.

Seasonal Distribution and Abundance

Since prawns are continuous breeders their postlarvae and young ones are encountered in estuarine areas throughout the year with peak seasons of abundance. Considerable variations exist among species as to their peak period of abundance which coincide with their peak breeding seasons. In the case of seasonal estuaries the opening and closing of bar mouth affect the postlarval ingress into nursery grounds and eventually result in wide fluctuations in their abundance. Salinity and other environmental parameters also play important roles in limiting the distribution of species in time and space.

It is evident from Table 2 that, in the case of penaeid prawns, October-May is the peak season of occurrence for most of the species in the brackishwater areas of the west coast and southeast coast. In the creeks of Kutch, however, the maximum abundance of *M. kutchensis* is recorded during the monsoon period of August-October (Ramamurthy, 1963). On the middle and northern regions of east coast, two peaks — one in January-April and the other in August-December are common to majority of the species. Among palaemonid prawns the marine species *P. tenuipes* and *P. styliferus* ascend creeks and estuaries in abundance during April-May in the northwest coast and September-December in West Bengal. Those species belonging to the genus *Macrobrachium* migrate from rivers to low saline habitats for breeding and occur in large numbers in estuarine areas during the monsoon period.

Occurrence and Spacial Distribution of Penaeid Prawns in Vembanad Estuary in Relation to Salinity

It is noticed that the penetration of the different species of penaeid prawns into the interior parts of the brackishwater areas is dependent to a certain extent on salinity. In order to understand the nature of this penetration of these species into the brackishwaters the Vembanad Estuary was selected to make a detailed

study. The extensive backwaters connected with this estuary is important from the point of view of occurrence of large quantities of juveniles of cultivable species of prawns and possibility of collection of these juveniles for stock-

occurrence of different species in relationship with the salinity of the area based on the year round studies indicates that different species have different levels of penetration into the saline areas of the estuary.

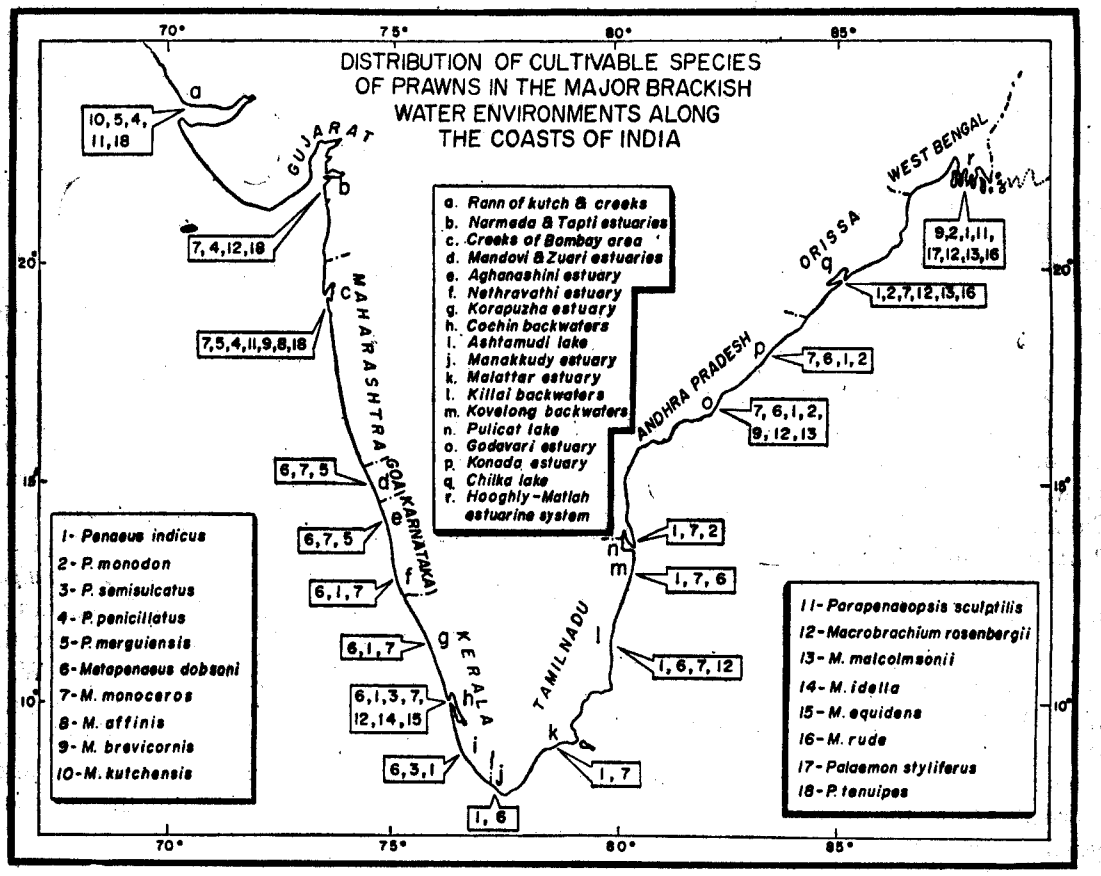

Fig. 1. Distribution and relative abundance of cultivable species of prawns in the different estuarine systems along the coast of India.

ing and culturing. Therefore the study would also elucidate the extent of availability of these juveniles towards the interior of the estuarine area.

Regular monitoring studies on the recruitment of these prawns into these backwaters have been carried out at fixed stations for the past several years. Analysis of the data on the

It can be seen from Fig. 2 that among the eight species of penaeid prawns commonly occurring in this environment *P. indicus*, *P. monodon*, *M. dobsoni* and *M. monoceros* are the most tolerant to low salinity conditions thriving well in salinities below 5‰. Species such as *P. semisulcatus*, *P. canaliculatus* and *M. affinis* are relatively less euryhaline in nature and they

penetrate into areas of moderate salinities. The occurrence of *P. stylifera* is very much restricted to high saline conditions, the minimum salinity at which it was recorded being 25.32‰.

In the Vembanad Estuary a series of sampling by experimental fishing was conducted between Ernakulam Channel at the mouth of the estuary and Pathiramanal about 55 km south during the peak summer period (February-April) of

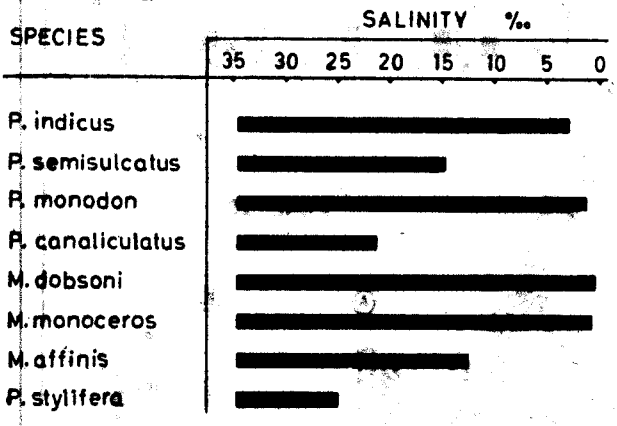

Fig. 2. Penetration of penaeid prawns into the Vembanad Estuary in relation to salinity.

1977-79, when the salinity was at its maximum throughout this environment. Prawn samples were collected from near the shore by operating a velon screen drag net of 2 × 1 metre size having 49 meshes/cm^2, and from the deeper region by a specially designed try-net (small trawl net) measuring 4 metres in overall length, 5.4 m head rope, 5.4 m foot rope, with mesh size of 8 mm throughout. At each sampling the drag net was operated for two minutes in shallow areas near the shore and the try-net for 10 minutes in the middle channel during the forenoon period. Salinity of the water from where prawn samples were collected was also recorded at each time of observation. Altogether 21 drag net hauls at 6 stations namely Ramanthuruth (8), Panavalli (3), Anchuthurthu (4), Pallippuram (2), Thanneermukkom (1) and Kaippuram (3) and 30 trynet hauls at 3 stations, namely Thevara (8), Vaikom (12) and Pathiramanal (10) were taken during this investigation (Fig. 3).

The salinity showed a gradual declining pattern towards south upto Thanneermukkom bund and thereafter suddenly dropped to almost nil. Based on the different salinity conditions observed at the sampling stations, the estuary is divided into the following three topographical zones :

Zone I. Cochin Barmouth to Kumbalam south. This zone can be termed as the marine zone which is characterised by higher salinities ranging from 22.4‰ to 34.5‰.

Zone II. Kumbalam south to Thanneermukkom bund. This is the gradient zone where the salinity is quite unstable and shows progressive decline from 21.9‰ at north to 9.3‰ at south.

Zone III. Thanneermukkom bund to Pathiramanal. This upper zone is nearly fresh water in character with salinities ranging between 0.6‰ and 2.6‰.

Eight species of penaeid prawns namely *P. indicus, P. semisulcatus, P. monodon, P. canaliculatus, M. dobsoni, M. monoceros, M. affinis and P. stylifera* were recorded during this survey and their postlarvae and juveniles were collected in varying degrees of abundance. The occurrence and relative abundance of the prawns in the three zones are shown in Fig. 3. It is evident that in Zone I all the eight species are represented, with *P. indicus* as dominant species near the shore and *M. dobsoni* in the deeper areas. The species recorded from Zone II included *P. indicus, M. dobsoni, M. monoceros* and *M. affinis*, of which the first two species were the most common. Although distributed throughout this zone, the abundance of *P. indicus* in the near-shore areas was relatively of a

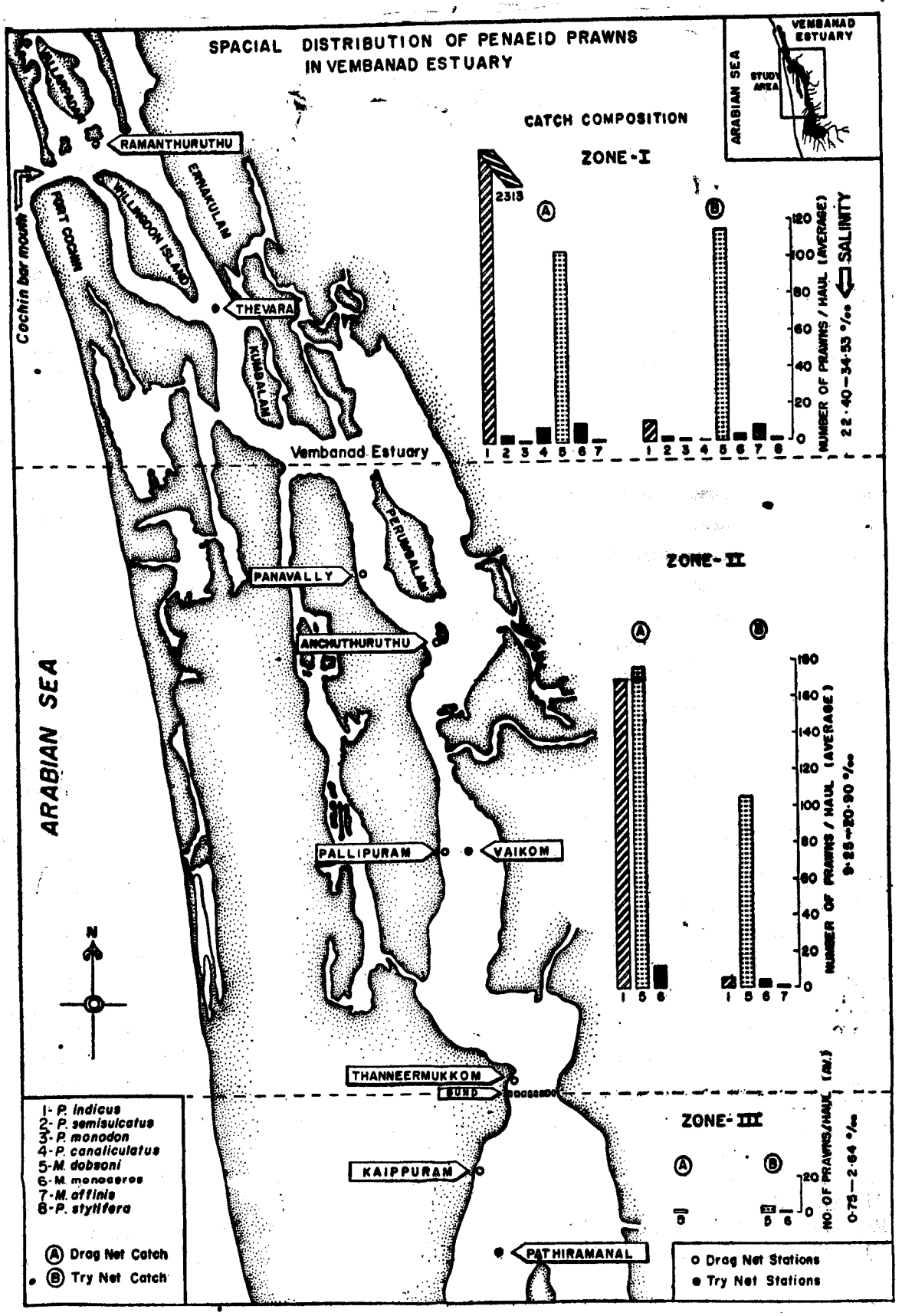

Fig. 3. Spacial distribution of penaeid prawns in the Vembanad Estuary.

lesser magnitude when compared to that of the previous zone. *M. dobsoni* out-numbered *P. indicus* at most of the stations of this zone, while *M. affinis* was only rarely encountered in the try net collections. In Zone III, penaeid prawns were extremely rare. Here, *P. indicus* and the other related species were totally absent. *M. dobsoni* and *M. monoceros*, however, were seen to survive in this part of the estuary on account of their ability to survive very low salinity conditions.

CONCLUSION

In general, from the distribution, pattern and occurrence of different species in the various estuaries and backwaters along the coast of India it would appear that the juveniles of *Penaeus indicus*, the Indian white prawn which is in great demand from the industry is the most common in most of the estuaries of the east and southwest coasts. *Metapenaeus dobsoni*, the species, which is quantitatively the most important, is dominant in the estuaries of the middle and southern regions of both east and west coasts. *Metapenaeus monoceros* is one of the species which is invariably found in all the estuaries although not in very large quantities. From the point of view of culture *P. indicus* seems to be the most suitable species, particularly in the southwest coast.

Although the postlarval and early juvenile stages of most of the important penaeid prawns occur throughout the year in these brackishwater areas, peak seasons are observed. While October-May appears to be the peak season of their occurrence in the brackishwater areas of the west and southeast coasts, October-December is the main season in the estuaries of the middle and northern regions of the east coast.

Study on the occurrence of the different species in different zones of the Vembanad Estuary in relationship to salinity indicates the tolerance of the species to lower salinities. Only two species namely *M. dobsoni* and *M. monoceros* are encountered in the zone of very low salinity. *P. indicus* also penetrates to very low salinity areas but only upto zone II. With reference to culture of these prawns this is of considerable significance since the availability of seeds in sufficient quantities is an important criterion in the selection of sites for culture activities.

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