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DISTRIBUTION OF PRAWN SEED ACCORDING TO WATER DEPTH IN SHALLOW AREAS OF COCHIN BACKWATERS

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ABSTRACT

In order to study the distribution and abundance of seed of *Penaeus indicus, Melapenaeus dobsoni* and M. *monoceros* according to depth gradient in the shallow water areas of Cochin backwaters, two sampling stations were selected and sampling for seed and sediment was carried out using a QSS (quantitative seed sampler) from different depth zones during premonsoon, monsoon and postmonsoon period of 1988. As a whole the average prawn seed density was $14/m^2$ for *P. indicus,* $16/m^2$ for *M.dobsoni* and $6/m^2$ for *M. monoceros.* Seed of *P. indicus* found to be more concentrated at 10 and 30 cm depth zones where substratum was sandy. But in the case of *M. dobsoni* and *M. monoceros* the seed were abundant at deeper zones of 60 and 90 cm where soil was silty or clayey in texture. Percentage of organic matter in the soil did not show any important role in determining the depth variation in the abundance of seed of penaeids. The size-wise distribution of the seed is also discussed.

INTRODUCTION

Availability of adequate quantity of the seed of desired species in time and space is one of the prime factors that determines the success of prawn culture. Estuaries and backwaters are the important sources of prawn seed in nature. In this aspect the Cochin backwater system in Kerala is the largest nursery ground for penaeid prawns along the southwest coast of India. Detailed studies about immigration and behavioural pattern of postlarvae and early juveniles of penaeids show that they are more concentrated along the edge and shallow areas of the backwaters than in the deeper areas (Kurian and Kuttyamma, 1978; Suseelan and Kathirvel, 1982; Anon., 1980). Moreover, commercial seed collection is mostly done by velon screen, push nets, drag nets and midnapore shooting nets in these shallow areas (Chakraborti *et al.*, 1977; Rao, 1983). Therefore this area is vital from the point of view of seed exploitation and needs studies at microlevel. In case any difference in distribution exist either size-wise or number-wise according to gradient in substratum, it would be a valuable information for seed collectors. The present paper embodies the results of an investigation carried out in the Cochin backwaters on variations in the distribution and abundance of penaeid prawn seed in accordance with increase in depth from water edge up to 90 cm.

MATERIALS AND METHODS

Two sampling stations were selected, one at Kannamaly, south of barmouth and the other at Manjanakad in the north (Fig.l). The two stations were almost equidistant from the Cochin barmouth. At each station fortnightly sampling for seed and soil was carried out from 10, 30, 60 and 90 cm depth zones using a Quantitative Seed Sampler (Mathew *et al*, 1980) covering three seasons

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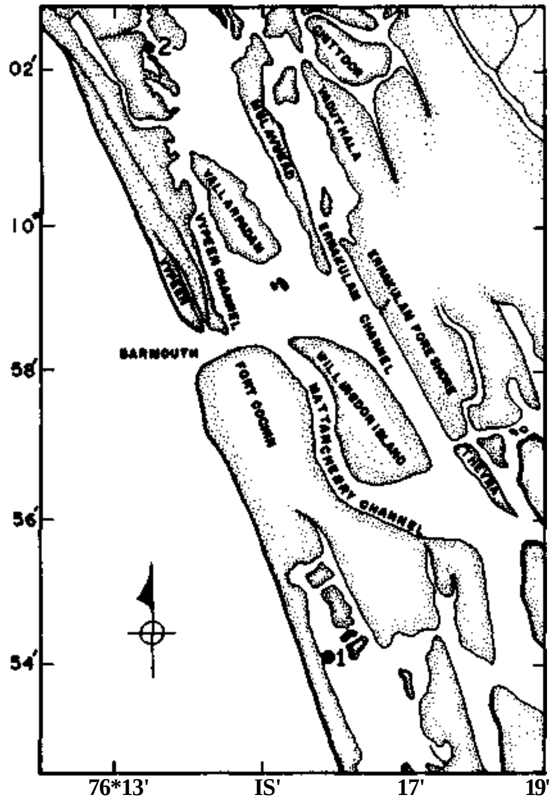


FIG. 1. Location of sampling stations 1 (Kannamaly) and 2 (Manjanakad) in the Cochin backwater.

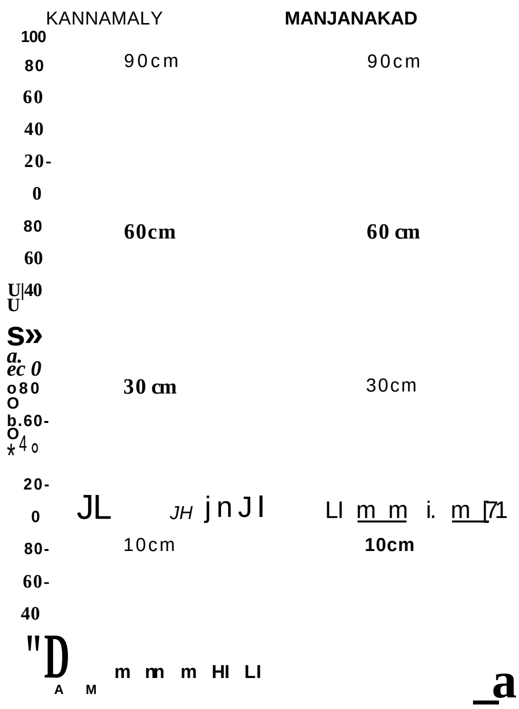
namely premonsoon (April, May), monsoon (June, July, August) and post monsoon (September, October). For ensuring reasonable distance between sampling depths, the stations were fixed in such part of the estuary where the water depth increased gradually from the water edge towards the estuary giving at least 10 m distance between the first and the last sampling depth zone. In fact such are the areas preferred for commercial seed collection. Prawn frys belonging to the size range 10-50 mm were considered as seed in the present study. Chemical analysis of sediment was carried out by following standard methods.

Since the different behavioural patterns of the seed in the various depth zones are controlled to a great extent on the substratum conditions, more emphasis has been given in the paper to evaluate such conditions rather than to the hydrological. However, a monthwise consideration of the hydrological features and their influence on the prawn seed have been dealt with in another paper by the same authors (Sosamma and Mathew, 1989)

RESULTS AND DISCUSSION

The prawn seed encountered during the study period were those of P. *indicus, M. dobsoni* and M. *monoceros.* The average density of seed obtained at both the stations during the entire period of investigation was $14/m^2$ for P. *indicus*, $16/m^2$ for *M. dobsoni* and $6/m^2$ for M. *monoceros.*

Seed of P. *indicus* were found to be more concentrated from the water edge upto 30 cm depth zone irrespective of seasonal changes in the environment at both the stations (Fig.2). Substratum studies in the present experiment showed that 10 cm depth zone had minimum percentage of organic matter in the soil than other depth zones considered. Among animals like penaeids which are so closely associated with the bottom, it appears that nature of the substratum may have an important influence on its distribution. Many observations attest to this, for it is common knowledge among shrimp fishermen and others that these species are often found in certain types of bottom only (Rulifson, 1981). However, whether the nature of substratum independent of the food supply or any habitat with abundant food supply are the determining factors for the distribution and abundance of prawn seed is not known. The possibility of species attraction to bottom type has not been investigated, especially for Indian penaeids. In the present study the

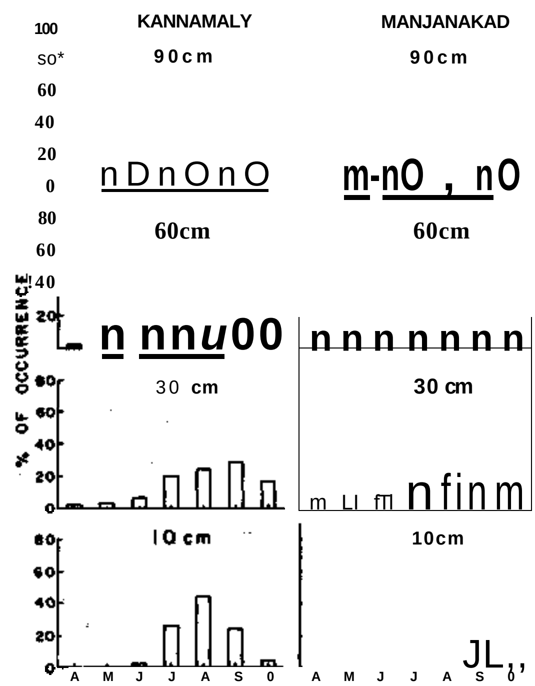


Fie. 2. Monthly variation in the abundance of seed of *Penaeus indicus* at different depth zones.

seed of *P. indicus* were more aggregated on the soil of sandy texture than that of clayey nature. Rajyalakshmi (1972) and Victor Chandrabose *et al*, (1972) also reported that the seed of *P. indicus* were available in soft sand of shallow margin of estuary.

In the case of *M. dobsoni* the seed were more abundant at 30, 60 and 90 cm depth zones during premonsoon season at both the stations (Fig. 3). During this time the percentage of clay or silt content was more at the above depth zones than 10 cm depth. But during monsoon season the seed migrated even upto 10 cm depth zone at higher percentage than deeper depth zones. The percentage of silt/clay in the soil was found to be comparatively high at 10 cm depth during this season when compared to that during premonsoon. This increase in the clay content may be due to heavy fresh water run off. Again during postmonsoon, the seed of M. *dobsoni* gradually invaded the deeper zones. These results showed that the seed of *M. dobsonoi* had anaffinity towards clayey soil than sandy soil.

On the whole the 30 and 60 cm depth zones were preferred by the seed of M. *monoceros* in most of the months at both the stations irrespective of seasonal variations (Fig. 4). Those depth zones had a texture of



Fic. 3. Monthly variations in the abundance of seed of *Metapenaeus dobsoni* at different depth zones.

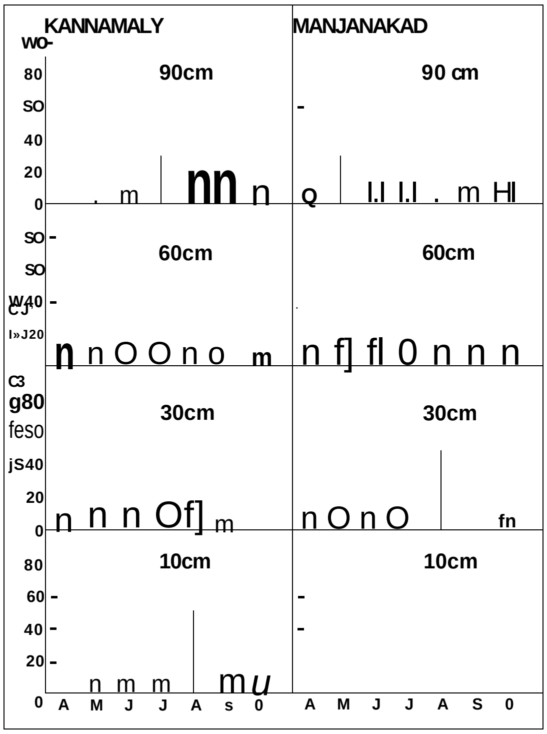


FIG. 4. Monthly variations in the abundance of seed of *Metapenaeus monoceros* at different depth zones.

silty-sand at both the stations. This result showed that seed of M. *monoceros* had an affinity to soil of silty-sand texture.

Results of laboratory experiments conducted by Willianis (1958) showed that distribution of the shrimps on different substrate was not random. He proved that *Penaeus duorarum* occurred most often on shell-sand. *P. azetecus* and P. *setiferus* were found most frequently on the softer, muddier substrate-loose peat, sandy mud and muddy sand. Rulifson (1981) reported that sandy mud was selected most frequently by P. *azetecus and P. setiferus.* The feed content in the bottom materials may be confounding factor, but the present results indicated attraction to substrate aside from the possible attraction to food.

The present study further revealed that smaller ones are more abundant at shallower depths. In the case of seed of P. *indicus,* individuals of size range 21-40 mm were more abundant at 10 to 30 cm depth zone at both the stations (Figs. 5 & 6). Larger ones were absent even at 60 and 90 cm depth zones.

In the case of *M. dobsoni* at Kannamaly, seed of 10-20 mm and 21-30 mm were more at 10 cm depth zone and 31-40 mm at 60 cm depth zone (Fig. 5). At the same time at Manjanakad, seed of size groups 10-20 and 21-30 mm were more abundant at 10 cm depth zone. But the seed of 31-40 mm were more at 60 cm depth zone (Fig. 6). The seed of 41-50 mm were more at 60 and 90 cm depth zones than shallower depths. This clearly

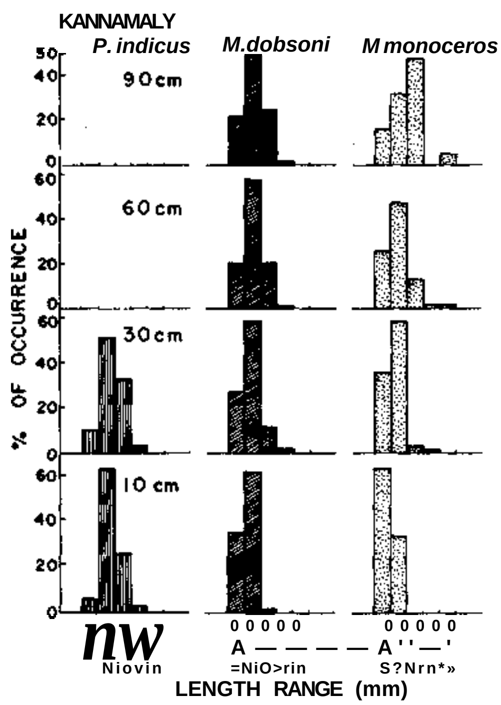


FIG. 5. Percentage composition of different size groups of seed of P. *indicus, M. dobsoni* and M. *monoceros* at different depth zones at Kannamaly.

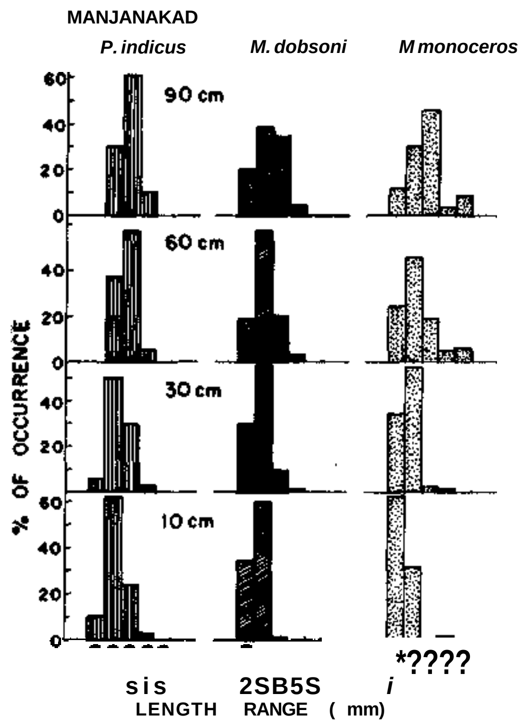


Fig. 6. Percentage composition of different size groups of seed of *P. Indicus*, *M. dobsoni* and *M. monoceros* at different depth zones at Manjanakad.

showed that smaller size of *M. dobsoni* preferred relatively shallow depth zone and as they grew larger they moved down to the deeper areas. Less predation, high productivity *etc.* of the shallow water area may be the reason for this pattern of distribution in the estuarine system.

Seed of *M. monoceros* also showed definite pattern in its depth preference in accordance with the body size. At Kannamaly, seed of 10-20 mm were more at 30 cm depth zone (Fig. 5). At the same time that of 20-30 mm were equally distributed at 30 and 60 cm depth zones. Seed of 31-40 mm were more concentrated at 30 and 60 cm depth zones and that of 41-50 mm size group were concentrated at 60 and 90 cm depth zones only. Here also seed of smaller size groups preferred shallow depth zones and that of larger ones preferred deeper zones.

This depth preference as obtained during the present studies may be due to competition between the seed of different species of penaeids for space and food. At Kannamaly, during premonsoon season, *P. indicus* contributed cent per cent at 10 cm depth zone (Fig. 7). But during monsoon season the percentage abundance of P. *indicus* was found to be less and minimum value of *7%* observed during August. During that time, seed of *M. dobsoni* migrated to 10 cm depth zone at a higher percentage. Again during the post-monsoon the relative occurrence of the seed of P. *indicus* increased to 75% during October.

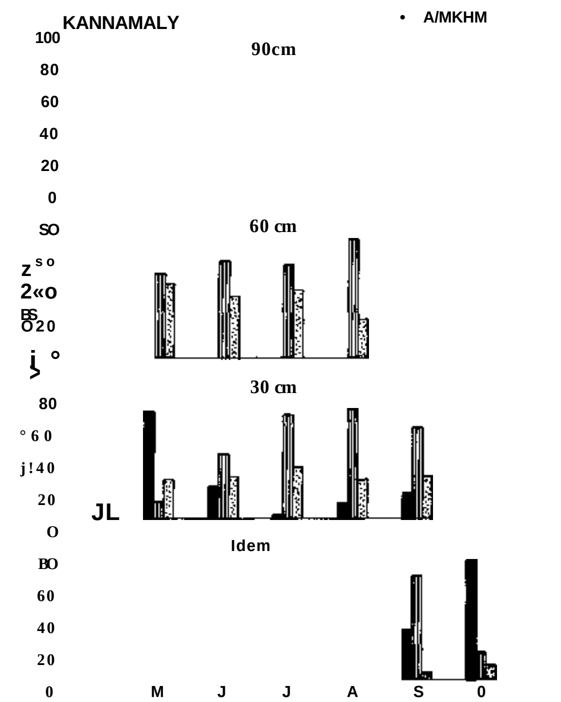
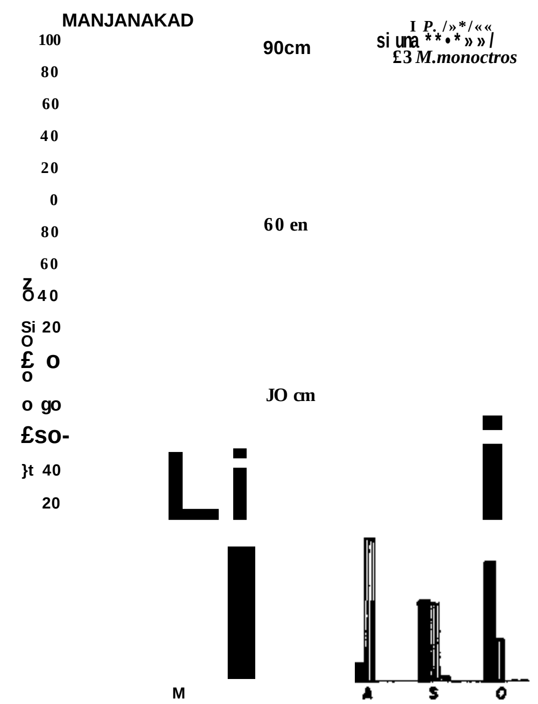


FIG. 7. Relative abundance of seed of *P. indicus*, M. *dobsoni* and *M. monoceros* in different months at each depth zone at Kannamaly.

Simultaneously the percentage abundance of *M. dobsoni* was found to decrease at 10 cm depth zone as they returned to the 30 and 60 cm depth zones. At Manjanakad also the same type of relationship was observed between seed of P. *indicus* and *M. dobsoni* (Fig. 8).

At Kannamaly during premonsoon, *P. indicus* dominated over the other two species at 30 cm depth zone, *i.e.* 87% of total seed collected from this depth zone was P. *indicus* during April. But during monsoon season M. *dobsoni* and M. *monoceros* dominated over P. *indicus* in this depth zone. Again during postmonsoon season, the occurrence of seed of P. *indicus* gradually increased, from 2% " during July to 28%



Fic.8. Relative abundance ot seed ot *I', mdicus,* M. *dobsoni* **and** *M. monoceros* in different months **at** each **depth zone at Manjanakad.**

during October, but that of *M. monoceros* decreased simultaneously (67%). But the relative abundance of *M.dobsoni* remained almost the same. This pattern of distribution may be again due to competition between these two species for space and food coupled with substratum preferences as discussed earlier. The same pattern of distribution was observed at Manjanakad also(Fig. 8).

At 60 cm depth zone no significant relation was observed between *M. dobsoni* and M. *monoceros* at both the stations during the period of study.

But at 90 cm depth zone the relative abundance of seed of *M. dobsoni* decreased when that of *M. monoceros* increased at both the stations during pre and postmonsoon seasons, i.e., during May only the seed of *M.dobsoni* was collected from this depth zone. But during monsoon season, the abundance of M. *dobsoni* decreased to 63% in July, but simultaneous increase was observed in the case of *M. monoceros* (36%). Later during postmonsoon the contribution of seed of M. *dobsoni* once again increased to 86% in October with a simultaneous decrease in the abundance of *M. monoceros* which decreased to 13% during the same period. These results indicate that the abundance of seed of M. *dobsoni* was negatively related to that of M. *monoceros.*

At Manjanakad also almost the same relationship was observed at 90 cm depth during the period of study. The cent per cent contribution of M. *dobsoni* during premonsoon decreased to half during peak monsoon season. The rest consisted of *M. monoceros.* I^atcr during postmonsoon, M. *dobsoni* formed three fourth of the total seed collected at 90cm depth zone. The rest was by M. *monoceros.* Here also the abundance of seedof *M. dobsoni* was negatively related to that of M. *mono-*

ceros. This negative relationship between seed of *M. dobsoni* and *M. monoceros* may be due to their competition for the same ecological niche.

The organic matter content of the estuarine sediments are very important from the point of view of distribution and abundance of the bcnthic organisms. In the present study an attempt was made to estimate the organic matter content in the soil at the respective depth zones. The percentage of organic matter varied from 0.97 to 6.68% at the above two stations (Figs. 9 & 10). Murthy and Veerayya (1972) reported that organic matter content varied from 0.1 to 6.0% in Vembanad Lake. The organic matter content

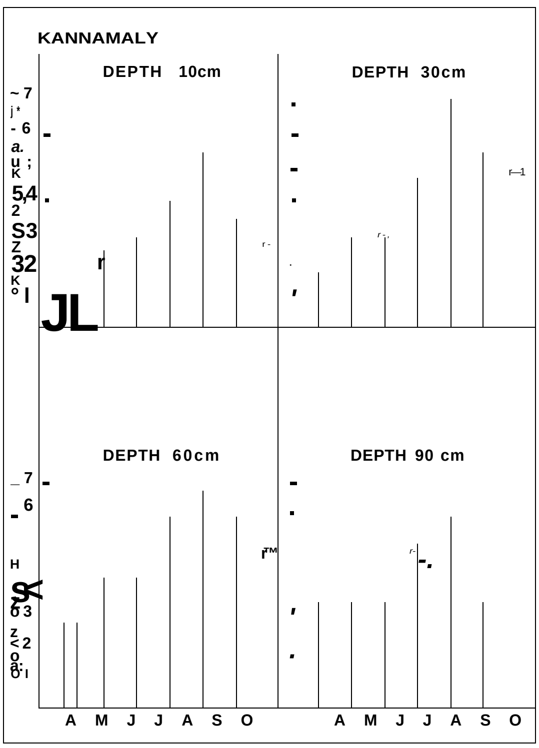


FIG. 9. Monthly variations in the percentage composition of organic matter in the soil at each depth zone at Kannamaly.

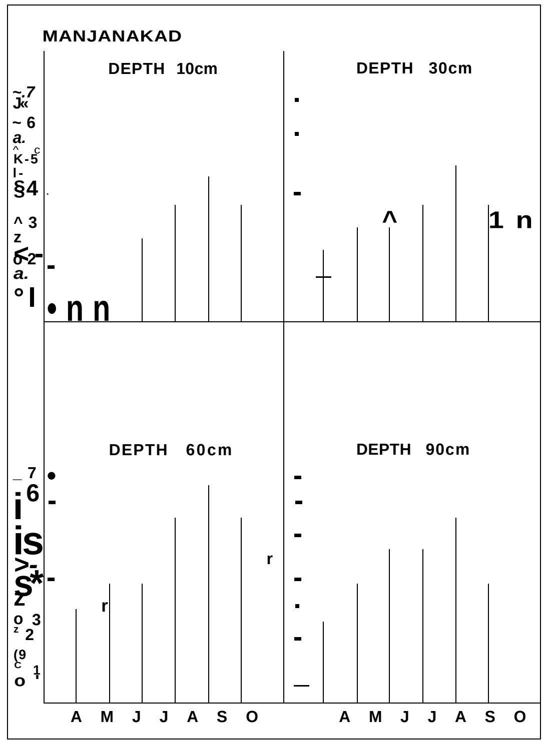


FIG. 10. Monthly variations in the percentage composition of organic matter in the soil at each depth zone at Manjanakad.

of the estuarine sediment is mainly from two sources, i.e., run off matter from the land and organic productivity of the overlying waters. Low percentage of organic matter was observed during premonsoon at both the stations. This reached a maximum level during monsoon. The high values observed during monsoon season may be due to heavy land run off at the two stations. This confirms the result obtained by Sankaranarayan and Panampunnayil (1979) and Sivakumar *et al.* (1983).

The percentage of organic matter in the soil showed depth wise variations also. The 10 and 90 cm depth zones had respectively the minimum and maximum organic matter at both the stations. The texture of soil depends upon the quantity of organic matter in it. Substratum studies showed that 10 cm depth zone had a sandy texture which indicated minimum organic matter content. But as depth increased from 10 and 90 cm the percentage of silt and clay was found to increase and that of sand decreased simultaneously (Table 1). Murthy and Veerayya (1972) reported that fine grained sediments (silty clay and clayey silt) had higher organic matter content than the sand or silty sand. The present study also showed that the fine grained sediment at 90 cm depth zone had relatively high organic matter content than sandy soil at 10 cm depth zone.

TABLE 1. *Monthly variations in the percentage composition of sand, silt and clay in different depth zones at Kannamaly and Manjanakad*

10 cm	**Kannamaly**			**Manjanakad**		
Month	**Sand**	**Silt**	**Qay**	**Sand**	**Silt**	**Clay**
April	**84.50**	**7.2**	**8.20**	**90.77**	**3.0**	**5.02**
May	**81.09**	**6.8**	**12.10**	**89.17**	**3.8**	**7.02**
June	**90.98**	**3.8**	**5.02**	**98.20**	**1.6**	**0.20**
August	**76.01**	**10.0**	**13.98**	**96.56**	**1.0**	**2.44**
September	**81.56**	**8.0**	**10.43**	**97.40**	**1.6**	**1.00**
October	**88.89**	**6.0**	**5.10**	**97.90**	**1.1**	**1.84**
30 cm	**Kannamaly**			**Manjanakad**		
Month	**Sand**	**Silt**	**Qay**	**Sand**	**Silt**	**Clay**
April	**80.14**	**2.0**	**19.63**	**88.42**	**4.0**	**8.37**
May	**78.57**	**10.0**	**14.27**	**84.22**	**6.0**	**9.78**
June	**87.25**	**8.8**	**9.10**	**95.10**	**2.3**	**2.60**
July	**87.10**	**7.2**	**5.70**	**94.60**	**4.0**	**1.40**
August	**62.31**	**2.4**	**13.68**	**91.16**	**2.0**	**4.00**
September	**79.84**	**10.6**	**9.58**	**92.48**	**4.0**	**3.52**
October	**85.64**	**8.0**	**6.36**	**96.36**	**2.6**	**1.04**
60 cm	**Kannamaly**			**Manjanakad**		
Month	**Sand**	**Silt**	**Qay**	**Sand**	**Silt**	**Qay**
April	**74.59**	**4.0**	**21.40**	**79.60**	**6.6**	**13.80**
May	**75.57**	**10.2**	**16.55**	**82.80**	**6.2**	**11.00**
June	**73.77**	**10.0**	**16.20**	**91.70**	**4.3**	**4.00**
July	**81.30**	**9.3**	**9.40**	**90.30**	**4.5**	**5.20**
August	**60.51**	**23.4**	**16.08**	**93.80**	**2.2**	**6.84**
September	**77.58**	**13.2**	**9.21**	**86.70**	**5.6**	**7.69**
October	**80.93**	**10.0**	**9.06**	**90.93**	**6.0**	**3.06**
90 cm	**Kannamaly**			**Manjanakad**		
Month	**Sand**	**Silt**	**Clay**	**Sand**	**Silt**	**Qay**
April	**70.98**	**12.6**	**16.41**	**74.65**	**8.0**	**17.34**
May	**77.84**	**11.6**	**11.40**	**79.36**	**6.4**	**14.24**
June	**67.31**	**11.5**	**21.18**	**82.80**	**8.2**	**9.00**
July	**71.30**	**14.1**	**14.60**	**84.50**	**7.6**	**7.90**
August	**50.75**	**28.0**	**21.24**	**80.08**	**4.0**	**6.92**
September	**63.89**	**20.0**	**16.10**	**80.30**	**10.0**	**9.69**
October	**69.31**	**14.2**	**16.48**	**80.91**	**10.23**	**8.87**

The present studies showed that the seed of penaeids were more aggregated along the shallow water edge than deeper zones. A comparison between prawn seed abundance and organic matter showed a negative relationship. This result shows that the low organic matter content at 10 cm was adequate for the prawn seed. This also proved that it is the substratum which is more important for the prawn seed than an abundant supply of food.

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REFERENCES

ANON. 1980. Assessment of fry resources of cultivable prawns at selected centres in Kerala and Karnataka. *CMFRI Project Report,* 84pp .

CHAKRABORTI, R.K., M. SUBRAMANYAM AND D.B. PAKRASI 1977. A note on the collection and segregation of prawn seed for selective stocking. */. Inland Fish. Soc. India,* 9:181-183.

KUTTYAMMA, V.J. AND CV. KURIAN 1978. Prawn fry resources in the Kayamkulam Lake. *Proc. First Natn. Symp. on Shrimp Farming, Bombay,* 16-18 August, 1978: 49-53.

MATHEW, K.J., K. RENGARAJAN, G.S.D. SELVARAJ AND K.N. GOPALAKRISHNAN 1980. A sampling device for quantitative assessment of prawn and fish seed resources in the estuarine areas. *Proc. Symp. Coastal Aquaculture,* MBA/January, 1980, Part I: 302-307.

MURTHY, P.S.N, AND M. VEERAYYA 1972. Studies on the sediments of Vembanad Lake. Part I. Distribution of organic matter. *Indian J. Mar. Sci.,* 1:45-51.

RAJYALAKSHMI, T. 1972. The prawn and shrimp nursery areas in the estuaries and lakes on the east coast of India- a review and discussion. *Proc. Seminar on Mariculture and Mechanised Fishing, Govt. Tamil Nadu* : 42-47.

RAO, R. MALUKARJUNA 1983. Shrimp seed resources of India. *Proc. Natn. Symp. Shrimp Seed Production and Hatchery Management, Cochin,* 21-22 *January,* 1983: 49-67.

RUUFSON, R.A. 1981. Substrate preference of juvenile penaeid shrimp in estuarine habitats. *Contib. Mar. Sci. Univ. Texas.,* 24 : 35-52.

SANKARANARAYANAN, V.N. AND S.U. PANAMPUNNAYIL 1979. Studies on organic carbon, nitrogen and phosphorus in sediments of the Cochin backwaters. *Indian]. Mar. Sci.,* 8 : 27-30.

SIVAKUMAR, V., G.S. THANGARAJ, R. CHANDRAN AND K. RAMAMORTHI 1983. Seasonal variations in carbon, nitrogen and phosphorus in sediments of the Vellar estuary, Porto Novo. *Bull. natn. Inst. Oceanogr.,* 16 (2): 175-181.

SOSAMMA EASO AND K.J. MATHEW 1989 . Seasonal variations in the abundance of penaeid prawn seed in relation to environmental parameters in the seed grounds of Cochin back waters. *Indian]. Fish.,* 36 (2): 125 - 132.

SUSEELAN, C AND M. KATHRIVEL 1982. Prawn seed calendars of cochin backwaters. *Proc. Symp. Coastal Aquaculture., MBAI, \ :* 173-182.

VICTOR CHANDRABOSE, S., V. VENKATESAN AND D. SUNDERA RAJAN 1978. Prawn seed resources of the Adya arestuary at Madras. *Natn. Symp. on Shrimp. Farming, 16-18 August, 1978,* Bombay.

WILLIANIS, A.B. 1958. Substrate as a factor in shrimp distribution. *Limn, and Oceanogr.,* 3(3): 283-290.