

CMFRI

bulletin 44

Part One

JUNE 1989



NATIONAL SYMPOSIUM ON RESEARCH AND DEVELOPMENT IN MARINE FISHERIES

MANDAPAM CAMP
16-18 September 1987

Papers Presented
Sessions I & II

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

Central Marine Fisheries Research Institute
40
YEARS
1947-1987

EXPLOITATION OF JUVENILES OF GREEN TIGER PRAWN, *PENAEUS (PENAEUS) SEMISULCATUS*, ALONG PALK BAY AND ITS IMPACT ON THE PRAWN FISHERY OF THE REGION

P. E. Sampson Manickam, M. R. Arputharaj and P. Vedavyasa Rao
*Central Marine Fisheries Research Institute, Mandapam Regional Centre,
 Mandapam Camp*

ABSTRACT

The green tiger prawn, *Penaeus (Penaeus) semisulcatus*, contributes to over 50% of the total prawn catch landed along the Palk Bay coast. They are caught by the indigenously developed trawl-like bottom nets and trawl nets operated by non-mechanised and mechanised fishing vessels within the 12 metre depth zone. With the increasing demand for prawns by the export trade, intense fishing for juvenile prawns which inhabit the seagrass ecosystem near the shore is taking place all along the coast. The results of the survey carried out on this exploitation pattern are reported in the paper.

Fifty villages from Adirampattinam in the north to Thangachimadam in the south serving as bases for the operation of 2,500 indigenous fishing crafts are involved in the fishery. They are operated mainly during night and the area of operation is the 3-4 metre depth zone from the shore. The gear used is basically a miniature two-seam bottom trawl net without otter boards. The mouth opening of the net is maintained by two sticks provided at the wings of the net. The cod-end mesh size of the gear ranges from 5mm to 25mm. Depending on the size of the boat, either a single net or two nets are operated. Wind power using 1 to 3 sails is utilized for effective trawling. Besides this, juvenile prawns are also caught by small trawl nets tied to hip and dragged along the bottom very near the shore by two persons.

The prawn catch, the bulk of which is composed of juvenile *Penaeus semisulcatus*, is found to vary from 2 kg to 10 kg per day. The size of the exploited *P. semisulcatus* ranges from 31 mm to 100 mm total length with the dominant size group at 45-70 mm. Besides prawns, each unit also takes about 5 kg of seagrass and seaweeds per haul.

Although the operation of bottom trawl nets by sail boats for prawns in this region is known since one and half decades, such intensive fishing by indigenous crafts and gears in the very near shore waters throughout the year is a recent development. As the catch is composed exclusively of small sized juvenile prawns and since the nets are operated in the seagrass beds which form the nursery grounds for the prawn resources, the impact of this exploitation on the overall *P. semisulcatus* resource in the region is discussed.

INTRODUCTION

The Palk Bay extending from Point Calimere to Dhanushkodi with a coast line of about 274 km on the southeast coast of India is a large embayment. It is shallow and contains congenial habitat for penaeid prawns that are commercially exploited. With the initiation of operation of mechanised fishing boats with trawl nets in the early sixties and establishment of shore and base facilities at certain centres such as Remeshwaram, Mandapam, Kottaipattinam, Jegathapatnam and Mallipattinam, the prawn fishery of the region gradually expanded to produce at present about 6,840 tonnes of prawns annually.

Over the years, this expanding fishery witnessed certain changes in the exploitation pattern, species composition and gear deploy-

ment. In the sixties, the principal species in the prawn fishery of the Palk Bay was *Metapenaeus affinis* (James and Adolph, 1965). Since the early seventies, *Penaeus semisulcatus* formed the major species contributing to about 89% of the prawn catch of the area (Nandakumar, 1980). Similarly, besides the conventional bottom trawl nets operated by small mechanised boats, several indigenously developed nets, simulating the trawl nets and operated by non-mechanised boats have been introduced to capture prawns. While these crafts and gears have until recently been capturing the adult prawns in the Bay, considerable number of these units are in recent times being employed to capture juvenile *P. semisulcatus* inhabiting the near shore waters. This situation has stemmed from the increasing demand for prawns in the export trade, the

increasing fishing pressure and the fluctuating production trend. As the large scale exploitation of the juvenile *P. semisulcatus* would affect the overall stock of the species in the Bay and since the information on such exploitation is of vital importance in the rational management of the resource, a survey is carried out on the juvenile prawn fishery of this area. The results of this survey are presented and discussed in this paper.

MATERIAL AND METHODS

The survey was conducted during January-May, 1987. 77 fishing villages along the Palk Bay coast from Thangachimadam in the Rameshwaram island in the south to Point Calimere in the north were visited. During the visit, information on the number and type of the boats employed in the juvenile prawn fishery, size of the nets and mesh size and modes of their operation and characteristics of the fishing ground such as nature of the bottom, depth and availability of seagrass was collected.

To study the species and size composition of the catch, random samples of prawns weighing about one kg, were collected from the boats operating at four ecologically different grounds of: 1) less than 2 m depth having profuse vegetation of seagrass; 2) 2 to 4 m depth with seagrass beds; 3) 4 to 5.5 m deep with patchy seagrass beds and 4) 4 to 9 m deep with muddy bottom. Prawn samples were also collected from the nets with different mesh size operating in these grounds.

The size of prawns presented in the paper relates to the total length measured from the tip of rostrum to tip of telson.

SURVEY AREA

The Palk Bay, bordered by a more or less semicircular coastline is a shallow, flat basin, the maximum depth not exceeding 13 m to a considerable distance from the shore. About 12 rivers drain to the sea along this coast, particularly during the north-east monsoon season. The most important of these rivers are Vaigai, Vellar, Ambuliar, Maharaja Samudram and branches of Cauvery draining at Muthupet area. The coastline between Devipatnam and

Adirampatnam is beset with several creeks in between the villages, where mangrove vegetation of varying intensity is available. Similarly, the coast between Adirampatnam and Point Calimere has several mudflats besides the extensive mangrove, including the well-known Muthupet mangrove swamp.

On the basis of the topographical features and the nature of the sea bottom in the inshore region, the Palk Bay coast can be divided into three regions. The northern part of the coast extending from Point Calimere to Kollukkadu is characterised by muddy bottom upto about 5.5 m depth zone; the central part from Kollukkadu to south of Devipatnam has extensive seagrass beds near the shore while southern region from Devipatnam to Thangachimadam in the south has intermittent sandy and muddy bottom except for a 5 km stretch on either side of Mandapam, where the sea bottom is beset with seagrass beds and coral patches.

Although the information on the hydrographical features of the waters of the Palk Bay is available mainly from the work of Murty and Varma (1965), several studies have been carried out on the physico-chemical conditions and primary and secondary production of Mandapam area (Jayaraman, 1954; Prasad 1958; Nair et al., 1973). These investigations have shown that the Bay of Bengal waters entering through the Palk Strait greatly influence the hydrological parameters such as temperature, salinity, surface density and dissolved oxygen of the ecosystem. The near shore waters is generally characterised by relatively higher temperature, lower salinity and density than the offshore waters. The inshore regions of Palk Bay are also found to have high levels of primary production. These features, as well as the presence of seagrass beds afford congenial habitat for the juvenile penaeid prawns to grow.

The current-pattern and the wind flow over the Palk Bay show regular seasonal cycle corresponding to the south-west and north-east monsoons. In the southern part of the Bay, the predominant current is south easterly from May to September. In October and from February to the end of April the current is found to be

TABLE : 1

Name of the landing Centre		No of non-mechanised sail boats Involved in the fishery			Total
		Large (11-14 m)	Medium(7 10 m)	Small(below 6 m)	
1. Akkalmadam	(S)	—	200	—	200
2. Devipatnam	(P)	40	100	56	196
3. Thirupalaikudi	(P)	150	50	—	200
4. Morepannai	(P)	71	62	—	133
5. Karangadu	(P)	66	30	—	95
6. Mullimunai	(P)	120	6	—	126
7. Pudupatnam	(E)	44	23	—	67
8. Soliakudi	(E)	25	—	15	40
9. Nambuthalai	(S)	125	—	—	125
10. Thondi	(P)	97	56	30	183
11. Valasaipatnam	(E)	15	—	—	15
12. Narambal	(2)	22	—	—	22
13. Demodaranpatnam	(E)	41	10	—	51
14. Pasipatnam	(E)	120	25	40	185
15. Theerthanathandam	(E)	5	—	—	5
16. Puththukuda	(E)	45	—	—	45
17. Arasanagiri	(E)	—	—	4	4
18. Puthoor	(S)	131	67	—	198
19. Gopalapatnam	(P)	49	—	—	49
20. Iyenpatnam	(E)	27	—	—	27
21. Kottaipatnam	(E)	34	—	—	43
22. South Pudukudi	(P)	42	—	—	42
23. North Pudukudi	(E)	75	—	—	75
24. Ammapatnam	(S)	12	—	—	12
25. Thulasapatnam	(S)	62	—	—	62
26. Nsrth Ammapatnam	(E)	70	—	—	70
27. Krishnajipatnam	(E)	16	—	—	16
28. Prathabharamanpatnam	(E)	20	—	—	20
29. Kattumavadi	(E)	35	—	—	35
30. Sembumadevipatnam	(E)	90	—	—	90
31. Vallabhanpatnam	(E)	15	4	—	19
32. Somanathanpatnam	(E)	19	—	—	19
33. Puthutheru	(E)	9	15	—	24
34. Manthiripatnam	(E)	11	15	—	26
35. Senthalaipatnam	(E)	73	—	—	73
36. Sembaipatnam	(E)	68	—	—	68
37. Karanguda	(E)	11	—	—	11
38. Oththaiveedu	(S)	2	—	—	2
39. Kazhumanguda	(E)	44	—	—	44
40. Setnubhava Chatram	(S)	30	—	—	30
41. Pillayarathidal	(P)	4	—	—	12
42. Manora colony	(S)	1	—	—	1
43. Chinnamani	(S)	15	—	—	15
44. Pudupatnam	(S)	20	5	—	25
45. Kollukadu	(E)	16	—	—	16
46. Allathikadu	(S)	15	—	—	15
Total :		2001	676	145	2822

(E) - Villages, where all the fishermen are engaged in the capture of prawns throughout the year. (27)

(P) = Villages, where only some of the fishermen are involved in the fishery throughout the year. (9)

(S) = Villages, where fishermen are involved in the fishery only during peak fishing season. (10)

variable, while in December and January, the main current is south westerly across the Gulf.

VILLAGES INVOLVED IN THE JUVENILE PRAWN FISHERY

Of the 77 fishing villages surveyed, fishermen of 46 villages are found to exploit the juvenile *P. semisulcatus* either through out the year or during October-December which forms the peak fishing season for the species. On the basis of involvement of fishermen in the fishery the 46 villages are further classified into three categories, namely: 1) villages where all the fishermen are engaged in the capture of prawns throughout the year (27 villages); 2) villages where only some of the fishermen are involved in the fishery throughout the year (9 villages) and 3) villages where fishermen are involved in the fishery only during the peak fishing season (10 villages), (Table 1). It may be noted that most of the villages in the lower half of the coast are engaged in the fishery throughout the year. At one of the villages in the southern coast, Akkalmadam, the fishermen go for prawn fishing only during April-October. During the other months, they migrate to Gulf of Mannar as the wind flow becomes unfavourable for the operation of sail in this coast.

The availability of prawns throughout the year in the fishing ground and the monsoonal winds blowing over the Bay favour round the year operation of sail boats particularly in the western region of the coast. The lean season found during February-April coincides with the less breezy transit period from north-east to south-east monsoon, when the wind direction is also found to be erratic.

Fishing for juvenile *P. semisulcatus* is generally carried out during night. In the day time the fishermen go for crab and or cephalopod fishing.

CRAFTS AND GEARS EMPLOYED IN THE FISHERY

Crafts

Non-mechanised, flat bottom, wooden, plank-built boats are employed exclusively in the juvenile prawn fishery of the area. In the

46 villages surveyed at present, 2,822 boats are engaged in the fishery. Of these, 2,001 larger boats measure 11-14 m, 676 medium size boats are 7-10 m long and 145 smaller boats measure less than 6m (Table 1). The design and construction of these different size boats are basically similar.

Sails and wind energy are used for the propulsion of the boats and the operation of nets. The larger boats use upto three sails, the medium size boats two and the smaller boats one. The larger boats, in the lower half of the west coast (from Devipatnam to Pasipatnam), operate 2 nets while in the upper region, they use only one net. All the other boats use only one net. Though 2,822 boats are involved in the fishing, only 1,126 boats (970 larger, 112 medium and 44 smaller) are engaged in the fishing throughout the year and the rest only in the seasonal fishing.

The boats are constructed mainly at Thirupalaikudi, Thondi and Adirampatnam. The construction cost of the larger boat (14 m size) is found to be about Rs 25,000 and of the medium size about Rs 9,000/-.

Gears

The gear operated by the sail boats is locally known as '*Thallu valai*' and essentially resembles in its design a small two seam shrimp trawl without otter boards. The size of the net varies from 10 m to 18 m. Generally, the 18 m long net is operated by the larger boats (14 m); while the net of 12 m size by the medium boats or in the twin net operation by the larger boats. The smaller nets of 10 m size are mainly used in the medium as well as smaller boats.

The net is made up of blue HDPE twines. The webbing used for the net vary at different part of the net. The body and the wing are fabricated by 0.75 mm twine with mesh size of 10 to 20 mm in the former and 25 to 35 mm in the latter. The cod-end which is relatively longer as compared to the size of the net is made of 1 mm twine with mesh size varying between 7 mm and 15 mm. 6 to 8 mm diameter ropes of HDPE material are used for head and foot-ropes of the net. An iron chain weighing about 8 to 10 kg is provided at the foot-rope. The chain is tied to the foot-rope at 20 cm interval all

along its length. But in certain villages, the chains are provided after leaving a few metres on either side of the foot-rope. The head-rope contains 6 to 7 floats. A float as well as a sinker is attached to the cod-end. The warp rope used is generally of 20-25 mm thickness, made of HDPE. To facilitate proper spread of the net, spreader sticks ranging from 45 cm to 90 cm in length and 25 mm in diameter are used. The cost of the nets ranges from Rs. 500 to Rs. 1,000/- depending on the size of the net. Often, the nets are made utilising the used pieces of trawl nets.

Operation of nets

In the single net operation, the 'Thallu velai' is rigged from any one of the lateral sides of the boat. In order to facilitate maximum coverage of the area and mouth opening of the net during operation, one wooden pole is tied at the front and another similar pole at the rear part of the boat. To the tip of these poles, the warp ropes are tied securely and the net is shot into the water. In the twin net operation, two nets of same size are kept side by side and the inner warp rope of each of the net is tied together so as to form a single warp line, thus the two nets while in operation have only three warp lines. As in the case of single net operation; the outer warp ropes are tied to the front and rear portion of the boat and the central warp line at the middle. The entire combination of nets is thus balanced on a cross beam.

The nets are generally dragged parallel to the coast for one hour duration at a speed of about 1 km/hr. As the nets are operated at the side, the boat moves laterally forwards. Irrespective of size of the boat and the net, these units are operated by two persons, generally an adult male and a boy of 12-15 year old, for single net operation.

Besides the above gear, smaller nets less than 10 m long with almost the same design, but having a scare line attached to the warp rope are operated in shallow waters, by two fishermen or fisherwomen, wading in the water with the warp attached to their waist. In recent times, this gear is gaining popularity and increasingly used in certain areas of the coast.

THE FISHERY

Species composition

An analysis of the catches landed by the units operating within 5.5 m depth zone over the seagrass beds showed that juveniles of *P. semisulcatus* contributed about 95% of the prawn landings. At a few centres such as Devipatnam, Mullimunai, Narambal and Soliakudi, *Penaeus latisulcatus*, *Metapenaeus burkenroadi* (35-78 mm) and *Metapenaeopsis stridulans* (38-66 mm) were also encountered in the catches along with *P. semisulcatus*. However, the percentage contribution of these species was only about 5-10% of the total prawn catch. In the other centres, the catch was exclusively composed of *P. semisulcatus*.

At Eripurakkara and Point Calimere which are on either side of Muthupet swamp, the species composition of the catch was totally different. At these centres, the catch was composed of *Metapenaeus dobsoni* (43-73 mm), *P. merguensis* (88-123 mm), *Parapenaeopsis stylifera* (51-108 mm) and *P. indicus* (78-114 mm) in that order of abundance, although the same type of gears are employed. *P. semisulcatus* was not encountered in the catches of this area.

Size composition

The overall size range of *P. semisulcatus* population exploited by the non-mechanised sail boats operating 'Thalluvelai' between the shore and 9 m depth zone was found to be between 23 mm and 128 mm. The bulk of the catch was formed of juvenile prawns measuring between 33 mm and 68 mm, with a modal size at 38-43 mm.

The analysis of the size composition of prawns landed at 11 fishing villages showed that the exploited population of *P. Semisulcatus* at Devipatnam, Mullimunai, Pudupatnam, Soliakudi, Valasaipatnam and Narambal was similar in size. In all these centres the modal size was 53 mm, within the major size group of 43-63 mm and the size range of 23-123 mm. However, at Pasipatnam, it was formed of smaller size prawns measuring between 23 mm and 58 mm with a modal size at 33 mm. This was mainly due to the large scale operation of

manually operated nets in the very shallow waters of less than 1.5 m. In contrast, the prawn catches landed at Puththukuda, Krishnajibatnam and Kazhumanguda were found to be composed of juveniles of relatively larger size 48-103mm. Still larger size prawns (58-128) were exploited from Akkalmadam.

Analysis of size composition of prawn catches obtained from different grounds (Fig. 1) having extensive seagrass beds, patchy seagrass areas and muddy bottom and at different depths between the shore and 9 m depth zone showed that *P. semisulcatus* ranging in size from 23 mm to 73 mm with a modal size at 38 mm predominated in the shallow waters (less than 2 m), characterised with extensive seagrass beds. In the slightly deeper zone (2-4 m) with seagrass vegetation, the dominant group of prawns caught had the modal size at 53 mm within

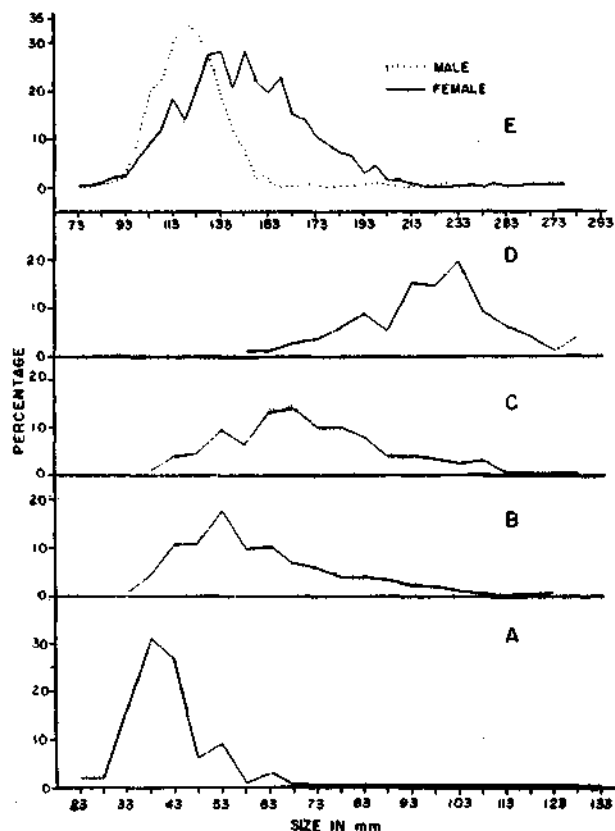


Fig. 1. Size distribution of *Penaeus semisulcatus* from different grounds.

(A) from less than 2 m depth having extensive seagrass beds; (B) from 2 to 4 m depth with seagrass vegetation; (C) from 4 to 6 m depth with patchy seagrass bed; (D) from 4 to 9 m depth muddy bottom; (E) from the open water by trawl fishing.

the size range of 33-123 mm. In the depth zone between 4 and 6 m, having patchy seagrass bottom, the prawns measuring from 38 mm to 128 mm with the modal size at 68mm formed the bulk of the catch. In the muddy grounds of 4 to 9 m deep, relatively larger prawns (size range 58-128 mm, modal size 103 mm) predominated in the catch.

To find out whether the nets with different cod end mesh size of 7 mm, 10 mm and 15 mm operated in the region selectively catch the prawns, the size composition of the catches obtained by these nets were analysed (Fig. 2). It was found that although, the size of the prawns caught by the nets having 7 mm 10 mm and 15 mm cod end mesh was 38-98, 33-108 mm and 38-123 mm mm respectively, the modal size was at 53 mm irrespective, of the difference in the mesh size.

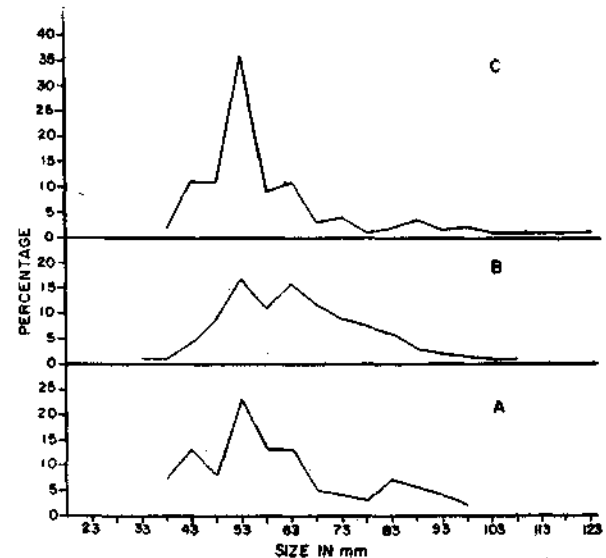


Fig. 2. Size distribution of *Penaeus semisulcatus* caught by nets having different cod end mesh sizes, (A) 7 mm cod end mesh size; (B) 10 mm cod end mesh size; (C) 15 mm cod end mesh size.

Estimation of total prawn catch and its disposal

Reliable information on the total quantity of juvenile prawns exploited by the non-mechanised units in the area surveyed is not available. As the survey is carried out only for a short period such information could not be collected. However, by actual observation of the catches landed at the time of visit to the different villages and by enquiry, it is estimated that the total catch of prawns realised per boat

during a night's operation is about 2-3 kg in the lean fishing season of February-April. During the peak fishing season, the catch of prawns amounts to 10 to 20 kg per boat. On the basis of this information and considering the number of units involved in the fishery throughout year and in the seasonal fishing and other relevant information gathered on the magnitude of the fishery during the survey, it is estimated that about 4,775 t of juvenile prawns are caught annually along the region surveyed at present.

The prawn catch is disposed off locally. In the case of the boats not owned by the fisherman, 1/3 of the catch is taken by the owner of the boat. Besides, in certain cases, he purchases the remaining catch also on a prefixed rate. In the other cases, the prawns are collected by the agents of processing units, who advance money once or twice a year. Although, the price of prawns varies from season to season and is size dependant, it is reported that even the tiny prawns of 50 mm size fetch Rs. 10-15 per kg.

DISCUSSION

The Palk Bay and the Gulf of Mannar on the southeast form the major fishing area for *Penaeus semisulcatus* along the Indian coast. Two identifiable commercial prawn fisheries exist in the area. One is a trawl fishery by about 1,200 mechanised vessels based mainly at Rameswaram, Mandapam and Mallipattanam centres. Although, *P. semisulcatus* forms the main species in this fishery, other important species caught along with this include *Metapenaeus affinis*, *M. monoceros*, *Penaeus indicus*, *P. merguianis*, *P. monodon*, *P. canaliculatus*, *Metapenaeopsis stridulans*, *Parapenaeopsis stylifera*, *P. uncta*, *P. maxillipedo*, *P. tenella*, *Trachypenaeus pescadorensis*. (Nandakumar, 1983). The trawl fishing is by and large carried out in the open waters beyond the coral reefs of the Bay. The other fishery is by non-mechanised boats employing indigenous gears whose catch is almost exclusively formed of *P. semisulcatus*. It is only in recent years that this fishery which is carried out in the shallow near shore waters, received the momentum.

The shallow flat grounds and the ecological factors such as higher temperature, relatively lower salinity and extensive seagrass beds in the near shore waters of the Bay afford congenial habitat for both juvenile and adult *P. semisulcatus*. The size distribution of the species obtained from different grounds shows that the juvenile prawns occur predominantly in the shallow waters of less than 2 m deep. As they grow to larger sizes, they move to and occupy deeper waters and the adults which support the trawl fishery inhabit the open waters of the Bay. This indicates that the juveniles inhabiting the shallow grounds constitute the main sources of recruitment to the adult fishery in the deeper grounds. Further, the size distribution of the species from different villages also shows that relatively smaller juveniles are abundant in the catches landed from the areas which have higher concentration of seagrass sites, while the catches obtained from the grounds devoid of seagrass or with lesser concentration are composed of larger size prawns. This spatial variation in the distribution of different sizes of the species vis-a-vis the nature of the habitat indicate that shallow waters of the Palk Bay where seagrass abound, form the nursery ground for the species. This observation agrees with the earlier observations by Basson *et al.* (1977), Price (1979 a & b), Mohamed *et al.* (1981), Tom *et al.* (1984) and Manisseri (1986) that the postlarvae and juveniles of *P. semisulcatus* are dependent on seagrass beds which form an important nursery area for the species. As a corollary to the seagrass areas in the Palk Bay coast, there are several mangrove systems in the adjacent coastal zone from Devipattanam to Sembai-pattanam. This ecosystem would also play an important role in the nursery phase of the species in this part the coast.

Although nets with different mesh size (7 mm to 15 mm) at the cod end are employed in the fishing, significant variation in the size composition of prawns caught by these nets has not been observed. This is mainly due to the fact that appreciable quantity of seagrass gets entangled in the net and blocks the effectiveness of the different cod end mesh sizes. It is also observed that the operation of these nets causes considerable destruction of

seagrass vegetation, as about 5 to 10 kg of seagrass are removed from the system during each operation of these units. The destruction of the seagrass beds is also likely to affect the populations of dugong and green turtles which feed on sea grass.

The survey carried out at present has indicated the large number of boats and varieties of gears which are suitably modified to suit the local grounds, involved in the exploitation of the juvenile *P. semisulcatus* and its magnitude. Lured by the high price even for tiny prawns, offered by the processing industry the farmers and labourers including even the women folk engaged in agriculture are also involved in this fishery in certain villages.

As the exploitation by non-mechanised fishing vessels is mainly concentrated on the juvenile resource in the nursery areas and since these juveniles form the main source of recruitment to the adult fishery in the open and more deeper waters, it is natural to expect that large scale exploitation of juveniles would adversely affect the dynamics of the overall *P. semisulcatus* resources in the area. Besides, the destruction being caused to the seagrass beds during the operation of nets would in the long-range lead to adverse ecological changes in the nursery habitat. Although the relationship between the mangroves, seagrass and the prawn catches cannot be established in the present study, it is now well known that any change in these habitats as well as indiscriminate exploitation of juvenile stock have obvious implications for the management and future prospects of the prawn resources of the area (Staples *et al.*, (1985). In this context, it is interesting to note that the catches of adult *P. semisulcatus* in the trawl fishery of the area has been showing a gradual decreasing trend from 4,711 t in 1982 to 2,999 t in 1985. Detailed studies on the relationship between the density of juvenile prawns and seagrass system on the one hand and between the juvenile and adult stocks on the other, are necessary to elucidate the implication of these effects on the dynamics of the resource in the area.

As the exploitation of the juvenile prawns in the Palk Bay is being carried out by artisanal fishermen, its regulation and/or management

would involve consideration of social and economic implications besides the biological and fishery aspects. In this context, the possibilities of retrieval of smaller specimens caught by these nets in live condition as seed for further aquaculture in the coastal grow-out system are worth further consideration.

ACKNOWLEDGEMENT

Authors are grateful to Dr. P.S.B.R. James, Director, C. M. F. R. I., for his guidance and encouragement during the course of this work. They are also thankful to Shri M. S. Muthu, Head of Crustacean Fishery Division, C.M.F.R.I., for his valuable suggestions.

REFERENCES

- BASSON, P. W., BURCHARD, J. E., HARDY, J. T. AND PRICE, A. R. G. 1977. Biotopes of the western Arabian Gulf: marine life and environments of Saudi Arabia. Aramco, Bahrain, Saudi Arabia. 284 pp.
- JAMES, P. S. B. R. AND ADOLPH, C. 1985. Observations on trawl fishing in the Palk Bay and Gulf of Mannar in the vicinity of Mandapam. *Indian J. Fish.*, 12A (2) : 530-545.
- JAYARAMAN, R. 1954. Seasonal variations in salinity, dissolved oxygen and nutrient salts in the inshore waters of the Gulf Mannar and Palk Bay near Mandapam, (S. India). *Ibid.*, 1 : 345-364.
- MANISSERI, MARY K. 1986. On the fishery of *Penaeus semisulcatus* and its distribution in relation to depth along Tinnevely coast, Southern India. *Ibid.*, 33 (4) : 402-412.
- MOHAMED, K. H., EI-MUSA, M. AND ABDUL-GHAFFAR, A. R. 1981. Observations on the biology of an exploited species of shrimp, *Penaeus semisulcatus* de Haan, in Kuwait. *Kuwait. Bull. Mar. Sci.* 2 : 33-52.
- MURTY, A. V. S. AND UDAYA VARMA, P. 1965. The hydrographical features of the waters of Palk Bay during March,

1963. *J. Mar. biol. Ass. India*, 6 (2) : 207-216.
- NAIR RAMACHANDRA, P.V., SYDNEY SAMUEL, JOSEPH, K. T. AND BALACHANDRAN, V. K. 1973. Primary production and potential fishery resources in the seas around India. *Proc. Symp. on living resources of the seas around India*, Special publication, CMFRI., pp 184-198.
- NANDAKUMAR, G. 1980. Observations on the prawn fishery of the Mandapam area. *Indian J. Fish.* 27 (1 & 2) : 257-260.
1983. Change in species composition of prawns in the trawl fishery at Mandapam. *J. mar. biol. Ass. India*, 20 (1 & 2) : 181-183.
- PRASAD, R. R. 1958. Plankton calendars of the inshore waters at Mandapam, with a note on the productivity of the area. *Indian J. Fish.*, 5 (1) : 170-188.
- PRICE, A. R. G. 1979 a. Temporal variations in abundance of penaeid shrimp larvae and oceanographic conditions off Ras Tanura, western Arabian Gulf. *Estuarine Coastal Mar. Sci.*, 9 : 451-465.
- 1979 b. Saudi Arabian Gulf shrimp resources. *Proc. Saudi Biol. Soc.*, 3 : 293-302.
- STAPLEŠ, D. J., VANER, D. J. AND HEALER, D. S 1985. Habitat requirements of juvenile penaeid prawns and their relationship to off shore fisheries. *Second Aust. Nat. Prawn Sem. NPS 2*, Cleveland, Australia, pp 47-54.
- TOM, M., SHLAGMAN, A AND LEWINSTON, C. 1984. The benthic phase of the life cycle of *Penaeus semisulcatus* de Haan (Crustacea Decapoda) along the southeastern coast of the Mediterranean. *PSZNI : Mar. Ecol.* 5 : 229-241.