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Further observations on the spatial distribution and population characteristics of 'karikkadi' prawn *(Parapenaeopsis stylifera)* along the kerala coast during monsoon season

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ABSTRACT

Additional information regarding the offshore migration of 'karikkadi' *(Parapenaeopsis stylifera)* during the southwest monsoon period along Kerala coast and its relevance to the management of the local shrimp fishery is reported based on the results of special shrimp surveys conducted during July-August, 1990. In a total of 42 bottom trawling operations conducted between 30 and 90 m depth,'karikkadi' was recorded upto 80 m depth thereby extending the known 'bathymetric' limit of its migration further deep in the study area. The maximum catch was recorded off Cochin at 47 m depth which was far beyond the limit of territorial waters. Biological characteristics such as size frequency distribution, sex ratios, mean size variations and abundance of spawning population are indicated and discussed.

The kiddi shrimp *Parapenaeopsis stylifera* has emerged as an important coastal resource of India which is exploited mainly by shrimp trawlers. It is purely a littoral species attaining a maximum size of about 145 mm in total length (Holthuis, 1980). Indo-west Pacific in distribution, this species supports a major fishery in Pakistan and India. Being an important commercial species, fairly good amount of work has been done on its biology and life history from Indian waters, the notable contributions being those of Shaikhmahmud and Tembe (1958, 1960, 1961) and Kagwade (1980) from Bombay, Ramamurthy (1980) from Mangalore and Menon (1953), George and Rao (1967), George *et al.* (1963, 1968), Rao (1968, 1970, 1972) and Kurup and Rao (1974) from Kerala coast. Unlike most of the other commercial species, *P. stylifera* completes its entire life cycle in the marine environment.

In Kerala, *P. stylifera,* commonly known as 'karikkadi' in Malayalam, plays an important role in the coastal fishery particularly during the monsoon period. Till the commencement of monsoon trawling along this coast about two decades ago, the individual contribution of this species to the prawn landing of the state was of a low-order.

Realising the prospects of shrimp fishing during the monsoon season and also with the development of suitable infrastructure facilities, the trawlers began to operate during the monsoon period from the two major fishing centres, namely, Sakthikulangara (Quilon) and Cochin Fisheries Harbour in the seventies. The subsequent years witnessed tremendous increase in trawl fishing at these centres during the monsoon period, which was mainly targeted for 'karikkadi[1]. Thus, monsoon trawling became a characteristic feature of Kerala coast while in all the other regions of the west coast trawler operations remained less active or totally suspended during this period. The annual prawn production at these two centres increased rapidly over the years as a result of monsoon trawling, with exceptionally high catch rates of 'karikkadi' when compared to other seasons of the year. Of late, monsoon trawling along this coast has brought in a number of social problems as a section of fishermen oppose intensive shrimp trawling in the coastal waters on various grounds. The alleged encroachment of trawl operators into the nearshore areas occupied by traditional fishermen and the apprehension of large-scale destruction of breeders and young ones of finfish and shellfish due to monsoon trawling have led to frequent social conflicts making marine fishery management in the state highly problematic during the past few years. All these developments necessitated authentic scientific data on the spatial distribution and population characteristics of exploited stock of'karikkadi' and other associated resources that support the controversial trawl fishery. Keeping this in view, the Central Marine Fisheries Research Institute organised a series of experimental shrimp trawling surveys along the continental shelf, initially off Cochin using the departmental vessel R/V *Skipjack* and later throughout the west coast as part of the survey programmes of FORV *Sagar Sampada.* The findings emerged from these surveys were reported by Suseelan *et al.* (1988, 1989, 1990). Contrary to the existing belief that *P. Stylifera* is a permanent resident of the inshore waters, the above surveys have revealed that 'karikkadi' performs extensive migration to offshore areas during the southwest monsoon period (June-August). This seasonal shifting of 'karikkadi' stock to offshore waters has great relevance in the context of ban on trawling and other fishing regulations being enforced by the Government of Kerala during the monsoon season. The factors influencing the migration of 'karikkadi' are not clearly known. Information is also lacking as to how deep the species migrates or its latitudinal extent on the Kerala coast. In order to fill up the above gaps in our knowledge on the behaviour of 'karikkadi', the FORV *Sagar Sampada* undertook four cruises for experimental fishing along the Kerala coast during July-August, 1990 and the results are presented in this paper.

Outline of survey

During the cruises 74, 75, 76 and 77, which were performed between 6.7.1990 and 26.8.1990, *Sagar Sampada* surveyed the area extending from 08°25'N to 12°30'N for the karikkadi resou-rce. A total number of 42 bottom traw-ling operations were conducted during these cruises at different bathy-metric stations between 30 and 90 m depth using fish trawls. The positions of trawling stations are shown in Fig.l. Of the total number of 42 hauls, 15 were taken

during cruise-74, 18 during cruise-75, 4 during cruise-76 and 5 during cruise-77. Details of the trawling operations conducted during the different crusises are given in Table 1. The duration of most of the hauls taken ranged from 30 minutes to one hour.

Results

Out of the 42 bottom trawls taken, as many as 32 hauls recorded catch in varying quantities ranging from 4 to 7,000 kg constituted mostly by fish. During the cruise-74 in July, 11 hauls recorded positive with the highest catch of 2,700 kg taken off Tanur at Station-22. The number of positive hauls during cruise-75 was 16. The maximum catch observed during this cruise amounted to 7,000 kg each at station-18 and 22 between Ernakulam and Tanur in July. During the remaining two cruises undertaken in August, 5 hauls recorded catch out of the 9 hauls taken. The highest catch of 5,000 kg was obtained at station-7.

Occurrence and catch rates of 'karikkadi'

Out of the 42 bottom trawl operations, seven hauls contained the 'karikkadi', the details of which are given in Table 2. Four of the positive hauls for this species were taken between Quilon and Cochin and three between Calicut and Kasaragod. Fig. 2 shows the spatial distribution and abundance as revealed

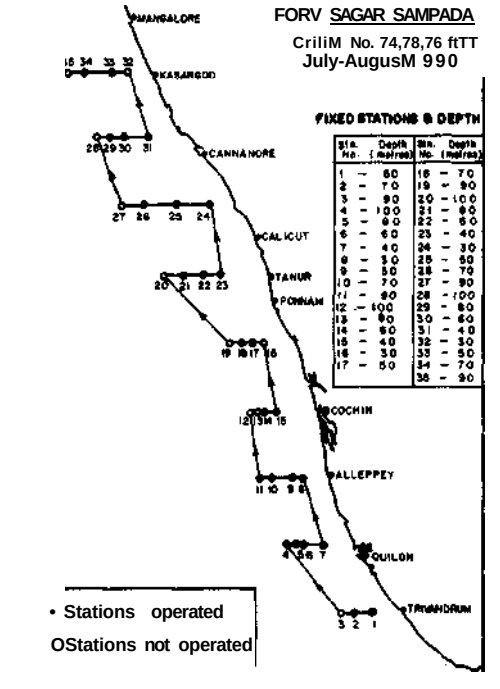

Fig. 1. Map showing trawling stations of the 'karikkadi' cruises.

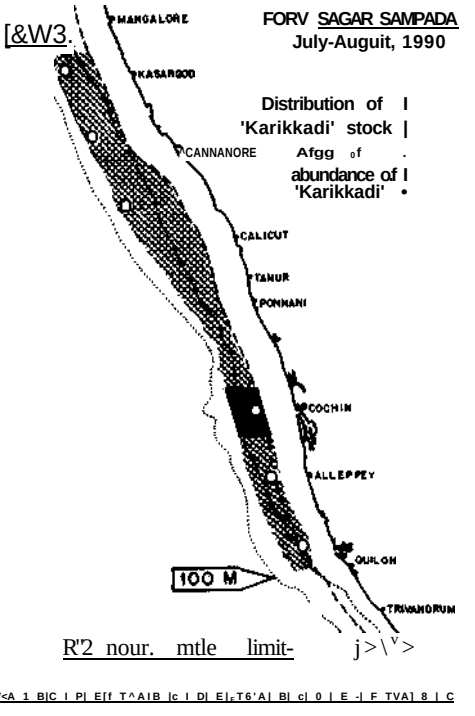

Fig. 2. Spatial distribution and productive area of 'karikkadi' along the Kerala coast as revealed by the surveys of FORV *Sagar Sampada* during July-August 1990.

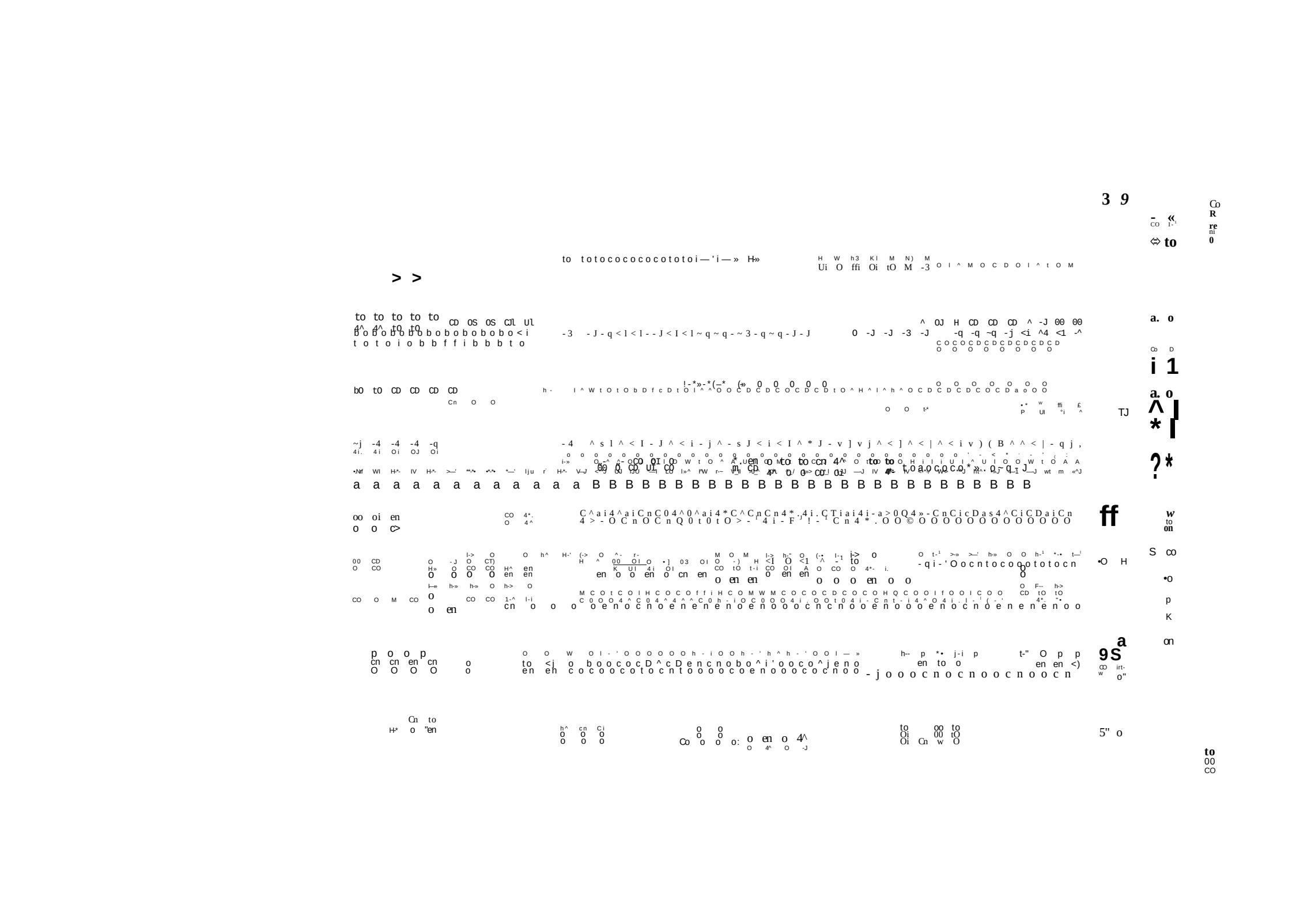

TABLE 2. *Catch (kg), catchlhr (kg) and catch composition (%) of prawns in the positive hauls*

Cruise No.	Stn. No.	Species composition	*P. stylifera*	*M.monoceros*	Total prawns
74	15	C:	80.00		80.0
		C/hr:	18.00		18.8
		%:	100.00		
74	26	C:	0.04	1.00	1.04
		C/hr:	0.94	1.00	1.04
		%:	3.80	96.20	
75	15	C:	148.00		148.00
		C/hr:	197.33		197.33
		%:	100.00		
75	7	C:	4.00		4.00
		C/hr:	3.01		3.01
		%:	100.00		
75	9	C:-	6.40		6.40
		C/hr:	6.40		6.40
		% :	100.00		
75	34	C:	0.30		0.30
		C/hr:	0.33		0.33
		% :	100.0		
77	29	C:	2.00		2.00
		C/hr :	4.00		4.00
		%:	100.00		

by the present survey. South of Cochin the species was represented in the depth range 44-51 m at catch rates varying between 3 kg and 197 kg/hour of trawling. The highest catch was recorded off Cochin at 47 m depth. The catch rates gradually declined towards south. In the areas north of Cochin, 'karikkadi' was encountered between 60 and 80 m depth in minor quatities ranging from 0.04 kg to 4 kg/hour of trawling. Maximum catch rate of 4 kg was recorded at 80 m depth off Connanore.

The penaeid prawn *Metapenaeus monoceros* was the only species of prawn caught along with 'karikkadi' during this survey. This species was recorded only in a single haul taken at 60 m depth north of Calicut, where it formed as much as 96 % and 'karikkadi' 4 % of the total prawn catch of 1.04 kg.

Biological observations on 'karikkadi'

Size frequency analysis of catch (Table 3) indicated a size range of 46 to 100 mm total length for males and 46 to 125 mm for females. The females were comparatively larger in size than males. At 44 m depth, the catch consisted of smaller sizes (46-75 mm) in both sexes. In still deeper waters (47-80 m), majority of the prawns belonged to the size groups 76-90 mm for males and 76-105 mm for females. Distribution of haul-wise mean sizes of prawns did not show any noticeable trend with increase in depth. Females outnumbered males by 5 to 30 %. In one haul taken at 47 m, however, males dominated over females by 5 %. The abundance of spawning population was very low being 0-8 % per haul, except in one haul taken at 51 m depth in which 33 % of the females were found to be in spawning condition.

Discussion

The survey conducted by *Sagar Sampada* during July-August 1990 has yielded confirmatory evidence to the earlier finding of CMFRI regarding the offshore migration of *Parapenaeopsis stylifera* during the southwest monsoon season. The survey indicated that the movement of 'karikkadi' stock extends upto 80 m depth along the Kerala coast, though the catch rates recorded in depths beyond the 50 m line were comparatively poor (0.3 to 18.0 kg/hr). The earlier surveys conducted using R/V *Skipjack* (Suseelan *et al.*, 1988, 1989) had shown that 'karikkadi' stock shifted from coastal waters upto a maximum depth of 60 m during the southwest

monsoon period. The occurrence of 'karikkadi' at 80 m depth off Kasaragod during the present survey of *Sagar Sampada* is recorded for the first time along the Kerala coast.

Seasonal migration of prawn stocks between inshore and offshore fishing grounds has been reported from Indian coasts by Banse (1959), George *et al.* (1968) and Kunju (1968) besides the observations of Suseelan *et al.* (1988, 1989, 1990). On the southwest coast, George *et al.* (1968) observed that soon after the monsoon, when the trawl fishing commenced by September/October, large sized penaeid prawns including *P. stylifera* moved into the shallower depth of 9-27 m. This movement, which they presumed to be taking place from the deeper waters was a sort of recolonization of the grounds, the prawns having deserted these grounds earlier during the physico-chemical disturbances brought about by the monsoon and the upwelling. Referring to the observation of Banse (1959) these authors presumed that the effect of upwelling during the monsoon period drove the prawns into the deeper waters. The data available with them, however, did not indicate upto what depth the prawns were pushed out or at what level they remained during that period. By taking into account the comparatively poor catch returns coupled with the predominance of smaller size groups occurring in the trawl fishery at Cochin and Sakthikulangara immediately after the cessation of the monsoon fishing season (June-August), Suseelan *et al.* (1990) ruled out the

TABLE 3. *Size frequency (Nos. observed), sex ratio, mean size and spawning population of* P. stylifera *recorded at different depths during the 'karikkadi' survey of FORV* Sagar Sampada

Size class (mm)	Depth in meters											
	44		47		50		51		60		80	
	M	F	M	F	M	F	M	F	M	F	M	F
41-45												
46-50		1										
51-55		3										
56-60		3										
61-65		7		2								
66-70		13	5	1	2				2	1	6	1
71-75		6	12	6	6	1	4		5	1	4	9
76-80			13	19	18	6	9	3	14	10	25	14
81-85			35	22	52	13	27	21	16	10	45	24
86-90			22	19	36	49	11	21	3	18	37	62
91-95			10	12	4	60	2	24		18	6	77
96-100			9	4	1	68		24		5	1	36
101-105				2		42		10		1		5
106-110				1		16		1		1		1
111-115						9						1
116-120						1						
121-125								1				
Total	27	33	106	88	119	266	53	105	40	65	124	230
Sex ratio (%)	45.0	55.0	54.6	45.4	30.9	69.1	34.4	65.6	38.1	61.9	35.0	65.0
Mean size (mm)	62.8	65.0	83.8	84.5	83.5	95.6	82.8	92.1	79.6	87.8	83.0	90.0
Spawners (%)		nil		2.3	-	3.0	-	33.0	-	7.7		3.0

M - Male, F - Female

possibility of a return migration of 'karikkadi' stock to the inshore fishing grounds. They further inferred that prolonged exposure of these prawns to the unfavourable hydrographic conditions prevailing in the offshore waters during the monsoon period would lead to destruction of stock due to natural mortality and therefore suggested that shrimp fishing in the deeper waters beyond the territorial waters may be advantageous to the fishery during this period.

A perusal of the depthwise distribution of length-frequency and mean sizes of'karikkadi' recorded during the present survey (Table 3) would indicate that relatively larger prawns occupy deeper waters (47-80 m) than the smaller ones (44 m). However, there is no consistency in the occurrence of the larger prawns in deeper waters so as to derive a positive correlation between size and depth. The distribution of sex ratios, depicts a pattern in which females are invariably more in the population than males in deeper waters. The reason for this sex disparity is a matter to be investigated by more systematic surveys.

One of the objections raised against the operation of bottom trawls along the Kerala coast during the monsoon period is the popular notion that monsoon trawling would adversely affect the breeding and early life stages of 'karikkadi' and eventually lead to its low production in the fishery. The poor representation of spawners in the trawl catches of *Sagar Sampada* during July-August does not lend support to this view.

The present survey is limited to only two months of the monsoon period and it does not yield conclusive results regarding the migration of *P. stylifera* and the factors responsible for it during the monsoon period. It would appear that a more systematic survey extending over a longer period should throw more light on these aspects.

References

Banse, K. 1959. On the upwelling and bottom trawling off the southwest coast of India. *J. mar. biol. Ass. India,* 1(1) : 33-49.

George, M. J. and P. V. Rao 1967. Distribution of sex ratios of penaeid prawns in the trawl fishery of Cochin. *Proc. Symp. Crustacea.* Part II. Marine Biological Association of India, p. 698-700.

George, M.J., K. Raman and P.K. Nair 1963. Observations on the offshore prawn fishery of Cochin. *Indian J. Fish.,* **10A(2)** : 460-499.

George, M.J., S.K. Banerji and K.H. Mohamed 1968. Size distribution and movement of the commercial prawns of the southwest coast of India. *FAO Fish. Rep.,* (57), Vol. 2, p. 265-284.

Holthuis, L.B. 1980. FAO species catalogue. Vol.1. Shrimp and prawns of the world. An annotated catalogue of species of interest to fisheries. *FAO Fish. Synop.,* (125), Vol. 1, p 1-271.

Kagwade, P.V. 1980. Maturity size of the female population of certain commercial prawns from Bombay. *Indian J. Mar. Sci.,* 9(4) : 294-295.

Kunju, M.M. 1968. Some aspects of the biology of *Solenocera indica* Nataraj. *FAO Fish. Rep.,* (57), Vol. 2, p. 467-486.

Kurup, N.S. And P.V. Rao 1974. Population characteristics and exploitation of the important marine prawns of Ambalapuzha, Kerala. *Indian J. Fish.,* **21(1)** : 183-210.

Menon, M.K. 1953. Notes on the bionomics and fishery of the prawn *Parapenaeopsis stylifera* (M. Edw.) on the Malabar coast. *J. Zool. Soc. India,* 5(1) : 153-162.

Ramamurthy, S. 1980. Resource characteristics of the penaeid prawn *Parapenaeopsis stylifera* in Mangalore coast. *Indian J. Fish.,* 27(1&2) : 161-171.

Rao, P.V. 1968. Maturation and spawning of the penaeid prawns of the southwest coast of India. *FAO Fish. Rep.,* (57), Vol. 2, p. 285-302.

Rao, P.V. 1970. A synopsis of biological data on penaeid prawn *Parapenaeopsis stylifera* (H. Milne Edwards) 1837. *FAO Fish. Rep.,* (57), Vol. 4, p. 1525-1605.

Rao, P.V. 1972. Seasonal abundance of larvae and postlarvae of the commercially important penaeid prawns in the inshore waters of Cochin. *Indian J. Fish.,* 19(1&2) : 86-96.

Shaikhmahmud, F.S. and V.B. Tembe 1958. Study of Bombay prawns : The reproductive organs of *Parapenaeopsis stylifera* (M. Edw.). *J. Univ. Bombay,* 27(3) : 99-111.

Shaikhmahmud, F.S. and V.B. Tembe 1960. Study of Bombay prawns : The seasonal fluctation and variation in abundance of the commercially important species of Bombay prawns with a brief note on their size, state of maturity and sex ratio. *Indian J. Fish.,* 7(1) : 69-81.

Shaikhmadmud, F.S. and V.B. Tembe 1961. A brief account of the changes in the developing ovary of penaeid prawn *Parapenaeopsis stylifera* (M. Edw.) in relation to maturation and spawning cycles. *J. Univ. Bombay,* 29(3-5) : 62-77.

Suseelan, C, G. Nandakumar, K.N. Rajan, A.Nandakumar, K.Chellappan and C. Nalini 1988. The distribution of *Parapenaeopsis stylifera* in the shelf waters off Cochin from a fishery management perspective. *Symposium on Tropical Marine Living Resources,* Cochin, India, 12-16 January, 1988. *Abstracts,* p. 36.

Suseelan, C, K.N. Rajan and G. Nandakumar 1989. The Karikkadi fishery of Kerala. *Mar. Fish. Infor. Serv., T&E. Ser.,* No. 102, p 4-8.

Suseelan. C, G. Nandakumar and K.N. Rajan 1990. Results of bottom trawling by FORV *Sagar Sampada* with special reference to catch and abundance of edible crustaceans. *Proc. First workshop Scient. Resul. FORV Sagar Sampada,* 5-7 June 1989, p. 337-346.