

## Fishery of the speckled shrimp *Metapenaeus monoceros* (Fabricius) along Cochin coast.

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### Abstract

The speckled shrimp *Metapenaeus monoceros* (Fabricius) was one of the important constituents of the prawn landings by shrimp trawlers from the inshore waters of Cochin occupying third position in abundance during 1991-'93. The average annual landing of this species at Cochin Fisheries Harbour was 192 tonnes with catch per unit effort of 3.67 kg. Between 1991 and '93, the catch and catch rate increased by 5.33 and 37.97% respectively. As the speckled shrimp is nocturnal, success of its fishery depends on trawling during nights in grounds of 30-45 meters depth range. The fishing season extends from December to May with peak availability during March -May. Annual migration of *M. monoceros* during peak monsoon months of July and August to deeper grounds of 55-90m was observed during the study period. Seven to twelve months old speckled shrimp was the major contributor to the fishery.

### Introduction

Prawn fisheries of India have been studied by many research workers and information on the biology and fishery characteristics of important species from different states along both coasts of our country are available. A general account on the prawn fisheries of India, fishing methods and prawn culture practices were given by Ramamurthy and Muthu (1969), Kurian and Sebastian (1976) and George (1988). A descriptive account on the present status of prawn fishery of India along with a review on the investigations carried out so far on the biology of commercially important prawns was given by Rao (1986). An overview of crustacean fishery resources of India during 1984-'92 was made by Suseelan and Pillai (1993).

Following the encouraging results of exploratory cum commercial trawling op-

erations of the Indo-Norwegian Project, which started off the Kerala coast in 1953, an organised commercial fishery by mechanised vessels began at Cochin in 1958. Sakthikulangara and Cochin are the two major fishing harbours of Kerala, where maximum number of trawlers land their catches. In Kerala, till eighties, fishery of *Metapenaeus monoceros* was seasonal. However, substantial increase in its catch had been noticed from 1990 onwards, due to the advent of multiday fishing, changes in fishing pattern-involving shrimp trawling in deeper grounds and introduction of night fishing etc. Practically there is no information on the fisheries biology of this species from the deeper grounds off Kerala. Hence an account on the fishery of *M. monoceros* based on the observations of the trawl landings at Cochin Fisheries Harbour during 1991 -1993 is given here.

## Material and methods

Cochin Fisheries Harbour was selected for collecting the details on the fisheries biology of the speckled shrimp from in-shore waters. The fish landing centre was visited twice a week and data on shrimp catch, effort expended, species composition by weight were estimated based on sampling 10-20 % of the trawlers operated. Using the raising factor  $N/n$  where 'N' is the number of units landed on the day and 'n' is the units observed, total weight of resource on the sampling day was estimated on the basis of sampling units. The monthly estimates were obtained by raising the estimated resource on the observation day to the number of fishing days in the month. In the similar way the total monthly fishing effort in terms of fishing hours was also estimated. The number of trawlers went for fishing for the day is taken as boat days. The commercial trawlers at Cochin do not maintain any record on the fishing ground and catch etc. Hence the details on area of operation, depth of operation, fishing hours and number of hauls were collected on enquiry from the crew. A random sample of about 2 kg of *M. monoceros* was collected every week for biological studies. The collected sample was separated sex-wise and total length from tip of the rostrum to tip of telson was taken for males and females separately.

## Craft and gear

The mechanised trawlers based at Cochin Fisheries Harbour and operating off Cochin for shrimp fishery, varied in

size between 9 and 17 m and powered by 25 to 90 BHP engines. Shrimp trawl nets of varying sizes and designs depending on the size of the mechanised vessels are used for exploitation of prawns along the Kerala coast. The gear being used by the mechanised vessels are mainly four seam or two seam shrimp trawl nets of 12-33 m head-rope length. During the eighties the size of the cod end mesh of shrimp trawl net varied between 20 and 25 mm. However, during this study period the mesh size of the cod end was reduced to 15-20 mm.

## Fishing grounds, fishing seasons and fishery

The shrimp trawling ground, off Cochin lies mainly between latitudes 9°50'N and 10°10'N covering a distance of about 35 km along the coast. The bottom is muddy and facilitates easy operation of the trawl net. Whenever the prawn catch was poor in the usual grounds, the trawlers operated upto Ponnani in the north and Thottapapally in the south. (Lat. 09° 15' N - 10° 46' N and Long. 75° 33' E - 75° 45' E (north) and 75° 52' E - 76° 12' E (south)).

In general, trawling season along the Kerala coast commences by about September and lasts till the end of May and the operation is suspended during monsoon period. However shrimp trawling is most active during southwest monsoon season at Cochin and Sakthikulangara. At Cochin, the trawl fishing during non-monsoon period was mainly restricted to the coastal waters upto about 25m depth. These vessels used to make single day

cruises starting from the base early in the morning and returning in the afternoon after taking 3 or 4 hauls. From the middle of seventies, the boats were operated during monsoon as the catch rate of prawns was much higher than other seasons. During the southwest monsoon period (June-August) the vessels gradually move out to deeper waters and operate between 30 and 60 m (Suseelan *et al.*, 1992, 1993). The Government of Kerala imposed a ban on trawling during monsoon from 1988 onwards regularly for a period of about 1 - 1 ½ months. From 1990 onwards, a change in fishing pattern was observed in the trawl fishery operation off Cochin. To meet the demands of developing market for cuttlefishes and squids for export purposes, some of the trawlers diversified their activities and started going for fishing in deeper waters upto 60m to catch mainly cuttlefishes. To minimise the fuel consumption as well as to avoid long distance travelling to the fishing ground daily, each fishing trip was extended from the regular single day to 2-3 days. Fish trawls were operated during day to catch cuttlefishes and squids and shrimp trawls during night for netting prawns mostly in 30-60 m depth range. By the end of 1992 most of the vessels went for 2-3 day fishing trips and fished for prawns, cuttlefishes and squids. When prawn catch in the shallow waters of 15-20 m was good, the trawlers combined fishing of this depth range along with earlier mentioned fishing. Thus, during the period of study (1991-93), the commercial trawlers at Cochin operated

in the inshore regions between 15-60 m as per the availability of shellfish resources in general, depending on seasonal variations. On an average about 200 trawlers are operated from Cochin Fisheries Harbour every day.

#### General trend of the prawn fishery

The month wise details on prawn landings, effort (boat trips), prawn catch per unit effort per day (CPUE) of Cochin Fisheries Harbour during 1991-93 are given in Table 1. The total effort (boat trips) for 1991 was estimated as 59,640, with an average monthly effort of 4,970 boat trips. During 1992, the number of trawlers operated came down to 52,099 showing a decrease of 12.6 %, with monthly average effort as 4,342 boat trips. The effort expended during 1993 when compared with 1992, further went down to 45,509, which showed a reduction of 12.7%. The average monthly effort in 1993 was 3,792. In general, trawlers in appreciable numbers operated for shrimp fishery from January to May during 1991-93. Maximum numbers of vessels were operated in the month of May in all three years. When the effort as an average during 1991-93 was taken into account, the number of boat trips between January and May hovered around 5,000 per month showing an increasing trend from January onwards till May (Fig.1.). The minimum effort expended was in July, mainly due to the trawling ban implemented in the state. The average monthly effort during the remaining period of August-December was 3,755 boat trips.

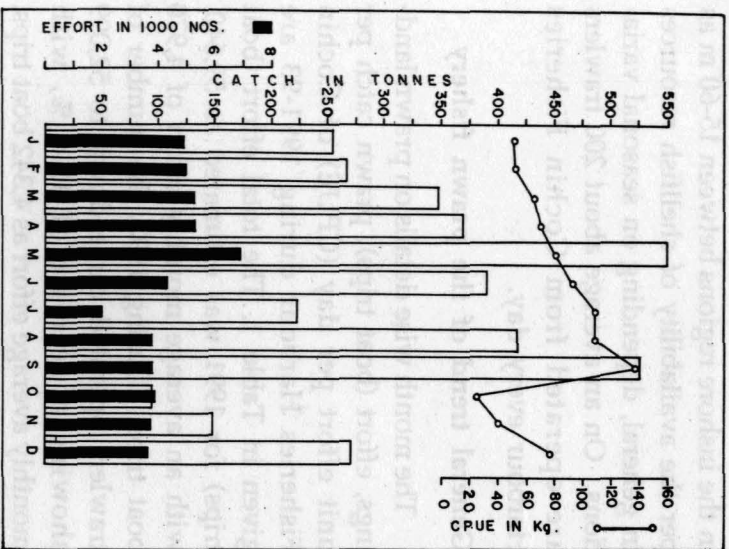


Fig. 1. The average monthwise prawn catch (t), CPUE (Kg) and effort (boat trips) of prawn landings at Cochin Fisheries Harbour during 1991-93

The prawn catch landed by trawlers in 1991 at Cochin Fisheries Harbour amounted to 5,471 t with an average monthly landing of 456 t. (Table 1). The average CPUE for the year was 91.7 Kg. In 1992, eventhough, the effort in comparison with 1991 decreased only by 12.6%, the prawn catch went down by 45.4 % to 2,987 t and the average monthly prawn landings amounted to 249 t. The average annual CPUE also decreased to 57.3 kg in 1992. In spite of further reduction of fishing effort to the extent of 12.7 % in 1993, the annual prawn landings (3,136 t) showed an increase of 148 t (4.9 %) with an average monthly landing of 261 t.

Table 1. Prawn landings (kg) fishing effort (boat trips) and prawn catch per unit effort (CPUE) by shrimp trawlers during 1991-93 at Cochin Fisheries Harbour

Year	Particulars	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1991	Effort	6254	5445	5717	6745	6853	5109	1878	3770	5033	3284	5218	4334	59640
	Catch	241121	337134	295753	414812	449723	562641	264882	1016166	946899	153892	358695	429544	5471262
	CPUE	38.55	61.92	51.73	61.50	65.62	110.13	141.04	269.54	188.13	46.86	68.74	99.11	91.74
1992	Effort	4998	5021	5605	5216	7070	4660	1463	3190	3836	5106	2803	3131	52099
	Catch	204547	212236	336720	347470	593058	403139	4372	10993	611990	130084	14972	117841	2987422
	CPUE	40.93	42.27	60.07	66.62	83.88	86.51	2.99	3.45	159.54	25.48	5.34	37.64	57.34
1993	Effort	3408	4560	4441	3852	6790	3019	2813	4534	2534	3346	2996	3216	45509
	Catch	320415	252034	414207	351760	609918	209580	400194	223947	13002	3194	71898	265474	3135623
	CPUE	94.02	55.27	93.27	91.32	89.83	69.42	142.27	49.39	5.13	0.95	24.00	82.55	68.90

During 1991-93 prawn landings of the monsoon season (June-September), contributed to 40.3 % of average annual prawn catch. October -November was found to be the lean period of prawn fishery, with 6.3 % contribution to the total prawn catch. The prawn fishery got momentum again from December and its yield showed an upward trend till May (Fig.1). The percentage composition of prawn catch for these 6 months (December-May) in the average annual prawn landings of 1991-93 amounted to 53.4 %. Eventhough annual variations are noticed in the shrimp fishery at Cochin, success of the monsoon fishery determines the total yield of the respective years (Table.1).

### Species composition

Penaeid prawns exclusively constituted the prawn fishery of Cochin. The species composition of the prawn catch in the trawl fishery for the entire three years study period is shown in Table 2. The prawn landings at Cochin Fisheries Harbour during 1991-93 consisted of the following penaeid species i.e. *Parapenaeopsis styliifera* (51.3 %), *M. dobsoni* (36.4%), *M. monoceros* (4.9 %), *Penaeus indicus* (4.9 %), *Trachypenaeus curvirostris* (1.5 %), *P. semisulcatus* (0.3%), *P. canaliculatus* (0.3 %), *M. affinis* (0.3 %) and *P. monodon* (0.05 %). Thus the speckled shrimp *M. monoceros* was one of the important contributors to the prawn fishery of Cochin and occupied third position in abundance during 1991-93. The percentage composition of *M. monoceros* in the

**Table 2.** Species composition of prawns (kg) with percentages in parenthesis in trawl landings at Cochin Fisheries Harbour during 1991-93

Year	1991	1992	1993	1991-93
<i>M. monoceros</i>	205783 (3.76)	154634 (5.18)	216746 (6.91)	577163 (4.98)
<i>M. dobsoni</i>	1501895 (27.45)	1077788 (36.08)	1644131 (52.43)	4223814 (36.43)
<i>M. affinis</i>	5712 (0.10)	15155 (0.51)	8487 (0.27)	29354 (0.25)
<i>P. indicus</i>	262909 (4.81)	178064 (5.96)	133052 (4.24)	574025 (4.95)
<i>P. monodon</i>	925 (0.02)	2467 (0.08)	1883 (0.06)	5275 (0.05)
<i>P. canaliculatus</i>	9527 (0.17)	12908 (0.43)	7179 (0.23)	29614 (0.25)
<i>P. semisulcatus</i>	19004 (0.35)	11269 (0.38)	9154 (0.29)	39427 (0.34)
<i>T. curvirostris</i>	79515 (1.45)	31555 (1.05)	59060 (1.89)	170130 (1.47)
<i>P. styliifera</i>	3385992 (61.89)	1503582 (50.33)	1055931 (33.68)	5945505 (51.28)
<b>Total prawns</b>	<b>5471262</b>	<b>2987422</b>	<b>3135623</b>	<b>11594307</b>

prawn landings at Cochin was 3.8 in 1991, 5.2 in 1992 and 6.9 in 1993.

### Fishery of *M. monoceros*

The details on month wise catch, catch composition in total prawns and CPUE of *M. monoceros* during 1991-93 are shown in Table 3. The annual landings of this species was 206 t in 1991 which went down to 155 t in 1992, but made a good recovery in 1993 with landings of 217 t. The general declining trend in total prawn catch during 1992 was reflected in the landings of *M. monoceros* also. The average annual CPUE also reduced from 3.5 kg in 1991 to 2.9 kg in 1992. Eventhough,

Table 3. Monthwise catch, catch per unit effort (in kg) and percentage composition in total prawns of *M. monoceros* in trawler landings at Cochin Fisheries Harbour during 1991-93

Months	Particulars	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1991	Catch	15987	24734	26320	33501	35460	1895	432	482	6485	114	34660	25713	205783
	%	6.63	7.34	8.90	8.08	7.88	0.34	0.16	0.05	0.68	0.07	9.66	5.99	3.76
	CPUE	2.56	4.54	4.60	4.97	5.17	0.37	0.23	0.13	1.29	0.35	6.64	5.93	3.45
1992	Catch	14178	25921	30706	21750	32050	5420	302	512	206	216	331	23042	154634
	%	6.93	12.21	9.12	6.26	5.40	1.34	6.91	4.66	0.03	0.17	2.21	19.55	5.18
	CPUE	2.84	5.16	5.48	4.17	4.53	1.16	0.21	0.16	0.05	0.04	0.12	7.36	2.97
1993	Catch	32150	21617	39005	37248	26292	8666	246	11046	12714	424	1162	26176	216746
	%	10.03	8.58	9.42	10.59	4.31	4.14	0.06	4.93	97.78	13.27	1.62	9.86	6.91
	CPUE	9.43	4.74	8.78	9.67	3.87	2.87	0.09	2.44	5.02	0.13	0.39	8.14	4.76

reduction in boat trips persisted in 1993 (12.7 % in comparison with 1992), the catch (217 t) and catch rate (4.7 kg) of speckled shrimp during this year showed an increase of 40.2 % and 60.3 % respectively. When fishery for the entire study period (1991-93) was considered, catch of the speckled shrimp increased by 5.3 % (11 t) and catch rate by an impressive 37.9 % (1.3 kg). The month of peak fishery when maximum catch of the species was recorded at Cochin Fisheries Harbour remained as May in 1991 and '92, but changed to March in 1993. The percentage composition of speckled shrimp varied between months as well as between years, depending on the success of its fishery in comparison with the availability of other penaeid prawns in the trawl fishery. As *M. monoceros* is nocturnal, success of its fishery depends on shrimp trawling during night time in fishing grounds of 30-45 m depth range. The fishing season for this species was December-May in all the three years of study period. During 1991, in addition to the regular fishing season, good quantities of *M. monoceros* (35 t) were caught in the month of November. The lean period of fishery was observed to be June - November during 1991 - 93. This was mainly due to the operation of trawlers, during day time for fishing *P. stylifera* and fishes in the monsoon season (June-September); and for cuttlefishes and squids in October-November period. However, in 1993, appreciable quantities of *M. monoceros* were caught during August (11 t) and September (13 t) due to shrimp trawling

in nights on certain days. During 1991-93, minimum catch of this species was observed in the months of July and November. The average annual catch of *M. monoceros* was 192 t with CPUE of 3.7 kg. The average monthly landings of this species amounted to 16 t.

General trend of the fishery during this period of study is shown in Figure 2. The fishery for the speckled shrimp started after regular monsoon period, from November/December and the fishing season extended till May. The month of December with an average catch of 25 t (12.9 % of average annual catch) gave the real start to the speckled shrimp fishery in the inshore waters of Cochin. The fishing

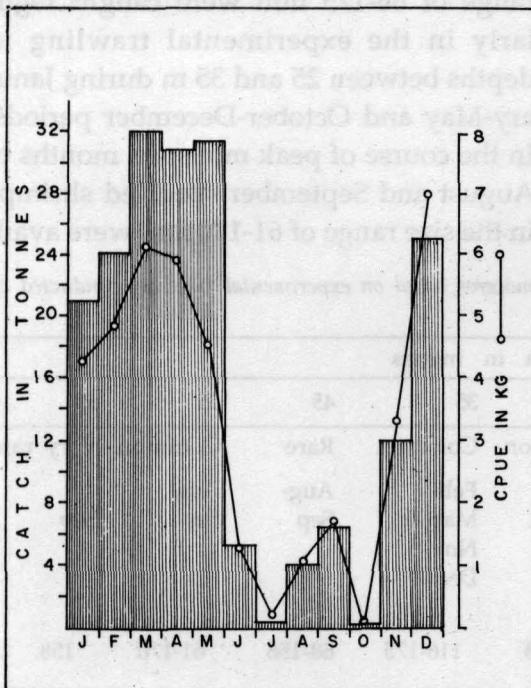


Fig. 2. The average monthwise catch (t) and catch per unit effort (kg) of *M. monoceros* landed by trawlers at Cochin Fisheries Harbour during 1991-93

season continued with a moderate dip in January but gained further momentum with increase in landings from February to reach an average monthly catch exceeding 30 t in the next three months till May. The peak season of the *M. monoceros* fishery was March-May when 48.9 % of average annual landings of this species was caught by shrimp trawling. The declining trend in the fishery started from June, when only moderate catch of the speckled shrimp was fished out, mainly during the first fortnight of the month just before the actual monsoon effect was felt with heavy rainfall and turbulent sea. The fishery of *M. monoceros* was generally poor during June-October period and the minimum catch was recorded in the months of July and October. The catch rate was higher than the annual average (3.7 kg) during January-May and in December.

#### Seasonal movement of *M. monoceros*

The month wise details on the availability of the speckled shrimp in different depths during 1991-93 along with the size distribution of the species are shown in Table 4. The present study on *M. monoceros* fishery in the inshore waters off Cochin showed that this species usually moved out every year during peak monsoon period from their normal grounds in the depth range of 30-45 m to deeper regions of 54-75 m in July and continued to do so, still further up to 90 m depth in August. The speckled shrimp started moving back to their usual grounds in September, which was proved by their occurrence in 40-50 m depth in appreciable quantities

**Table 4.** Depthwise distribution of *M. monoceros* in the shrimp grounds off Cochin

Year	Particulars	Jan-Jun	Jul	Aug	Sep-Oct	Nov-Dec
1991	Depth (m)	30-42	54-63	55-70	40-42	30-45
	Size range (mm)	66-195	81-150	76-165	71-185	76-185
1992	Depth (m)	30-45	64-70	73-80	40-50	33-40
	Size range (mm)	76-185	86-165	81-185	81-175	86-170
1993	Depth (m)	30-42	70-75	80-90	40-50	30-40
	Size range (mm)	81-195	81-165	106-175	106-195	76-185

during this month. During the three year period of observation, the size range of *M. monoceros* during November-June, July-August and September-October was 66-195, 76-185 and 71-195 mm respectively. Significant variations in size distribution of this species in different depths were not observed, thus revealing the existence of seasonal movement of this species belonging to all size groups in the fishing grounds off Cochin every year.

The details collected on board the Research Vessel *Skipjack*, regarding distribu-

tion of *M. monoceros* during 1986-88 are given here to corroborate the conclusions made on the seasonal movement of this species. The details collected on the availability of the species at different depths along with sexwise size distribution are given in Table 5. *M. monoceros* in the size range of 66-175 mm were caught regularly in the experimental trawling in depths between 25 and 35 m during January-May and October-December periods. In the course of peak monsoon months of August and September speckled shrimps in the size range of 61-170 mm were avail-

**Table 5.** Depthwise distribution and size range of *M. monoceros* based on experimental trawling conducted off Cochin

Particulars	Depth in meters						
	5	15	25	35	45	55	65
Availability	Rare	Rare	Common	Common	Rare	Common	Very rare
Period of availability	Jan, Apr & Dec	Jan-May & Dec	Jan-May & Oct-Dec	Feb-May & Nov-Dec	Aug-Sep	Aug-Sep	Sep
Size range (mm)							
Females	46-102	56-133	66-163	116-175	68-156	61-170	158
Size range ((mm)							
Males	62-100	61-115	66-145	101-145	110-127	76-140	-
Percentage of mature females	-	13.19	39.45	18.24	-	2.78	-

able rarely in 45 m depth but they were common in 55 m grounds. Thus the experimental trawling in the shrimp grounds off Cochin in different depths brought to light the following facts. The shrimp trawling grounds of 25-40 m depth range off Cochin are natural habitat for *M. monoceros* and the bottom condition of this ground is muddy. Availability of this species was better when trawling was carried out after sun set in comparison with daytime operations. During the peak monsoon, *M. monoceros* was commonly found in 55 m depth, showing a seasonal movement to deeper grounds. This species showed a shoreward movement and returned back to the regular habitat by October.

#### Structure of exploited population

The length range of females and males of *M. monoceros* for the entire period of this study was 66-195 and 71-160 mm respectively. The size distribution showed wide variations between months. Juveniles were present in the catch throughout the year.

The average annual contribution of adults and juveniles (not differentiating them as males and females) to the fishery was 92.2 and 7.8 % respectively during 1991-93. Based on the earlier study on age and growth of *M. monoceros* along Kerala Coast (Nandakumar, 2000), it was observed that seven to twelve months old speckled shrimps dominated the trawl fishery forming between 78.4 and 80.8% in females and between 87.5 and 94.9 % in males during 1991-93.

#### Discussion

Prawn fishery along the Kerala coast has been studied by various research workers and most of the studies so far carried out have been from Cochin and neighbouring areas. George (1959, 1961) and George *et al.*, (1963) observed that *M. monoceros* was available in stray numbers in the near shore catch of indigenous gears as well as in the landings of trawl nets operated off Cochin. The details on the prawn landings of trawl fishery of Ambalapuzha -Purakkad region in 10-35 m depths were reported by Kurup and Rao (1974) and Kurup (1986) and their studies showed no significant catch of the speckled shrimp in the landings. The non-availability of this species in the inshore waters off Cochin and Ambalapuzha regions in the earlier years was due to the operation of nets in daytime mostly in lesser depths. Shrimp trawling that was done during daytime alone in the earlier years was carried out from 1990 onwards during nights in 30-45 m depths. Eventhough, several species of prawns were encountered, *P. stylifera*, *M. dobsoni*, *M. monoceros* and *P. indicus* formed the main contributors in the order of abundance and they together formed 97.6 % of the prawn catch landed at Cochin Fisheries Harbour during 1991-93 which agrees well with the earlier studies on prawn fisheries of Kerala by Suseelan *et al.* (1989, 1992, 1993). The present study had shown that *M. monoceros* was one of the important contributors to the prawn fishery off Cochin occupying the third position. The average annual landings of

the speckled shrimp at Cochin Fisheries Harbour was 192 t with CPUE of 3.7 kg and the slight reduction in the catch in 1992 was in accordance with the general trend of the regular prawn fishery. Between 1991 and '93 the catch and catch rate of the speckled shrimp increased by 5.3 and 37.9% respectively.

As *M. monoceros* is nocturnal, success of its fishery depends on the shrimp trawling during nights in their normal habitat of 30-45 m grounds. The fishing season was generally observed between December and May with the peak availability during March-May period when about half of the annual landings of speckled shrimp was recorded. The trawling ban during June-August for a limited duration, did not affect the annual landings of this species since its catch during this period was generally found to be negligible due to day fishing. Changes in bottom hydrography brought about by upwelling during monsoon have significant effect on the demersal fisheries of the West coast of India (Banse, 1959; Damodaran, 1973). The present studies have revealed the existence of annual movement of *M. monoceros* during peak monsoon months (July-August) from their normal habitat, to deeper grounds of 55-90 m and again during the post monsoon months (September-October) in the reverse direction, back to the usual grounds along the Kerala coast. These movements of speckled shrimp occur possibly due to upwelling. The movement to deeper grounds during monsoon months was cor-

related by the availability of this species in 55-60 m grounds off Ratnagiri during July 88 and in 60 m depth in August '90 off Calicut in the experimental trawling carried out by FORV *Sagar Sampada* (Suseelan *et al*, 1990, 1994).

Females of 66-195 mm and males of 71-160 mm in total length contributed to the *M. monoceros* catch landed by shrimp trawlers at Cochin Fisheries Harbour during 1991-93. Adults predominated the catch throughout the study period with average annual contribution of 92.2%. The trawl landings of *M. monoceros* at Cochin Fisheries Harbour was predominated by 7-12 months old speckled shrimps during the present period of observation.

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