MARINE FISHERIES INFORMATION SERVICE

No. 65
OCTOBER, NOVEMBER
DECEMBER
1985

Technical and Extension Series

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
COCHIN, INDIA

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the National Marine Living Resources Data Centre (NMLRDC) and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

Abbreviation – *Mar. Fish. Infor. Serv. T & E Ser.*, No. 65: 1985

CONTENTS

THE PRAWN FISHERY OF THE SOUTH KANARA COAST WITH EMPHASIS ON THE UNUSUAL CATCHES OF *METAPENAEUS DOBSONI* BY PURSE SEINES AND TRAWLS DURING THE FIRST HALF OF SEPTEMBER, 1983

K. K. Sukumaran

Mangalore Research Centre of C.M.F.R.I., Mangalore

Introduction

The large scale introduction of purse seines along the South Kanara coast in late seventies, and the subsequent addition in the following years, were mainly intended to exploit the vast pelagic resources of this region. Prawns, being demersal in habit, were seldom caught in purse seines except in a few sporadic cases. However, the unexpected heavy catches of prawns in purse seines, particularly in the beginning of the fishing season, ie., in the first few days of September, have been a boon to a large number of purse seiners since the last two to three seasons. The commencement of the 1983–'84 fishing season witnessed bumper catches of prawns *(Metapenaeus dobsoni)*, particularly in purse seines, breaking all previous records. The unprecedented catch of *M. dobsoni* in purse seines necessitated intensive monitoring of the data in order to find out whether there was any overfishing during this period resulting in the depletion of the resources. With this in mind, a programme was worked out to collect all basic data from important centres in South Kanara. The data from Mangalore (Bunder), and Malpe (Fisheries Harbour) were collected on a day-to-day basis, while Gangolli where the prawn landing was generally poor during this period, was observed only on a few occasions and the catch data was collected mostly on enquiry. Based on the above studies, an appraisal of the prawn fishery of the South Kanara coast by purse seiners during the first half of September, 1983 has been attempted here. The prawn landings by shrimp trawlers during the above period have been incorporated in order to make the study more comprehensive as well as to get a clear picture of the prawn landings in this area. Since *M. dobsoni* formed the bulk of the prawn catch, a brief account on its resource is also included.

Fishing operations

The craft and gear employed in purse seine fishery together with its mode of operation along the South Kanara coast have been mentioned by Dhulkhed *et al. (Mar. Fish., Infor. Serv. T & E Ser., No.* 37, 1982). Similarly, the trawl unit and its operation have been reported by Sukumaran *et al. (Mar. Fish. Infor. Serv. T & E Ser., No.* 44, 1982).

During this period, fishing was mostly carried out within 18 m depth. The units operating from Mangalore fished north of Mangalore, off Panambur, Suratkal, Mulky, Hejamadi, Padubidri, Kaup etc. from 1st to 9th September. There was a peak in the prawn catches in the first few days and a gradual decline was noticed from 4th to 9th September. There was a second peak from 10th onwards lasting up to 15th September. During the second peak, most of the fishing for prawns was carried out south of Mangalore (off Uppala, Kasaragod, Kanhangad etc.). At Malpe, except on 5th September, fairly good catch of prawns was obtained up to 7th September. The units were operated south of Malpe, and the fishing area was extended up to Kaup. It was found that a large number of purse seines and trawl units belonging to other centres like Hangarkatta and Gangolli were operated from Malpe during this period.

Each purse seiner, generally made one to four hauls per day, each lasting 1–3 hours. Each unit was found to engage one carrier boat during this period, for transporting the catch after one or two hauls.

Prawn production during the first half of September, 1983

It is estimated that around 1,939.0 t of prawns landed in the South Kanara coast during the first half

of September, 1983 as against 1,187.2 t of prawns landed during the corresponding period of 1982 (Table 1). This showed an increase of about 63.3% in prawn landings. During this period, the prawn catches were so unprecedented that it alone accounted for about 34% of the 11 years annual average landings of prawns of Karnataka for the period 1971-81.

Table 1. *Estimated prawn landings in tonnes by mechanised units at Mangalore, Malpe and Gangolli during the first half of September,* 1983 *(September,* 1982 *data is also given for comparison)*

Centre	1983	1982	increase during 1983 (%)
Mangalore	1,318.4	710.3	85.6
Malpe	565.5	430.9	31.2
Gangolli	55.1	46.0	19.8
Total	1,939.0	1,187.2	63.3

A. Gear-wise analysis of the prawn landings

1) *Purse seiners*: The purse seines alone accounted for 76.3% of the prawn landings in South Kanara during this period (Fig. 2 A) and the catch amounted to 1,479.3 t (524.6 kg /unit). Out of this, the bulk of the catch was obtained at Mangalore (1,165.2 t and 853.6 kg/unit) forming 78.8% (Fig. 1 A) of the prawn landings by purse seiners in South Kanara. (The estimated prawn catch at Mangalore by purse seiners during 1983-'84 season amounted to 1,244.0 t of which 94% was obtained in September itself). Malpe accounted for 20.7% (306.3 t and 214.9 kg/unit) of the prawn catches (Table 2). Other than 7.8 t (8.8 kg/unit) of prawns landed on 11-9-1983, practically there was no catch of prawns by this gear at Gangolli.

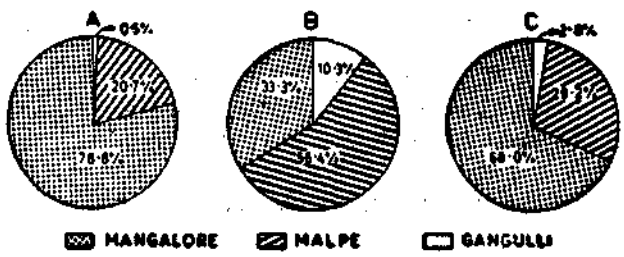


Fig. 1. Percentage contribution of prawns at Mangalore, Malpe and Gangolli (A – Purse seine; B - Trawl; C - All gear).

2) *Shrimp trawlers* : The prawn landing by mechanised trawlers was estimated at 459.7 t (62.9 kg/unit) forming 23.7% of the total prawn landings in South Kanara during the first half of September, 1983 (Table 3, and Fig. 2 A). Out of this, 153.2 t (79.8 kg/unit) were landed at Mangalore forming 33.3% of the prawn catches by this gear (Fig. 1 B). It could be seen that the prawn landings at Malpe was considerably higher than those obtained at Mangalore and Gangolli and accounted for 56.4% (259.2 t and 61.3 kg/unit). At Gangolli, it was comparatively poor than the other two centres and contributed only 10.3% (47.3 t and 40.8 kg/unit) of the prawn landings by this gear.

B. Centre-wise analysis of the prawn landings

1) *Mangalore (Bunder)*: It is seen that the highest catch was realised at Mangalore which contributed 68.0% of the prawn landings in South Kanara during this period (Fig. 1 C). The prawn catch was to the tune of 1,318.4 t (Table 1) of which 88.4% was obtained by purse seiners and the rest by mechanised trawlers (Fig. 2 B).

2) *Malpe (Fisheries Harbour)*: Malpe accounted for 29.2% of the prawn landings (Fig. 1 C) amounting to 565.5 t (Table 1). Of this, purse seiners contributed 54.2 % and the rest by shrimp trawlers (Fig. 2 C).

3) *Gangolli* : Among the three centres under study, the prawn landing at Gangolli was the lowest, being 55.1 t (Table 1) forming only 2.8% of the total prawn landings in South Kanara (Fig. 1 C). Out of this, 85.8% was caught by shrimp trawlers and the rest by purse seiners (Fig. 2 D).

Table 2. *Estimated landings of different category of prawns in tonnes by purse seines at Mangalore, Malpe and Gangolli during the first half of September,* 1983

Centre	No. of units operated	*M. dobsoni*	*P. indicus*	Total	% of prawns in total purse seine catch
Mangalore	1,365	1,139.5	25.7	1,165.2	48.2
Malpe	1,425	297.2	9.1	306.3	4.9
Gangolli	920	7.6	0.2	7.8	not known
Total	3,710	1,446.0	35.0	1,479.3	
%		97.6	2.2		

Table 3. *Estimated landing of different category of prawns in tonnes by shrimp trawlers at Mangalore, Malpe and Gangolli during the first half of September,* 1983

Centre	No. of units operated	*M. dobsoni*	*P. indicus*	*P. monodon*	*P. stylifera*	Total	% of prawns in total trawl catch
Mangalore	1,920	140.8	11.1	—	1.2	153.2	55.2
Malpe	4,225	235.0	11.2	0.3	12.7	259.2	40.5
Gangolli	1,158	19.5	4.3	—	23.5	47.3	not known
Total	7,303	395.3	26.7	0.3	37.4	459.7	
%		86.0	5.8	0.1	8.1		

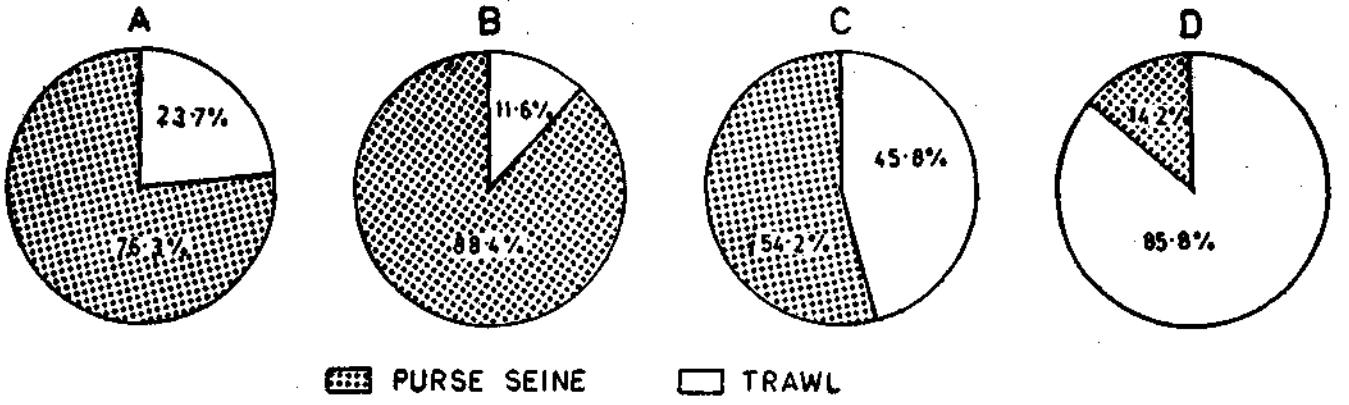


Fig. 2. Distribution pattern of prawns in purse seines and trawls during the first half of September, 1983, (A-South Kanara; B-Mangalore; C-Malpe; D-Gangolli).

C. Species-wise analysis of the prawn landings

1) *Species composition of prawns in purse seine catches*: *M. dobsoni* and *Penaeus indicus* were the only two species recorded in the prawn catches by purse seines during this period.

In purse seines, *M. dobsoni* was the most abundant species contributing to the bulk of the prawn catches. It formed 97.6% of the prawn landings in South Kanara by purse seiners (1,446.3 t) (Table 2). The highest catch of this species was obtained at Mangalore (1139.5 t), followed by Malpe (297.2 t). The catch at Gangolli was low (7.6 t).

P. indicus formed 2.2% of the prawn landings by purse seiners (35.0 t). The highest catch of 25.7 t was obtained at Mangalore (Table 2) followed by Malpe (9.1 t). The landing of this species at Gangolli was negligible (0.2 t).

2) *Species composition of prawns in trawl catches*: Unlike in purse seines, the prawn catch by shrimp trawlers was constituted by a number of species. *M. dobsoni* was the chief species as in purse seines, followed by *Parapenaeopsis stylifera, Penaeus indicus* and *P. monodon* in the order of their abundance.

M. dobsoni was the most predominant species forming 86.0% (395.3 t) of the prawn landings by shrimp trawlers (Table 3). It is seen that the best catches of this species by this gear were obtained at Malpe (235.0 t). The landing of this species was 140.8 t and 19.5 t at Mangalore and Gangolli respectively (Table 3).

P. stylifera was the second important species but forming only 8.1% of the prawn landings by trawlers (37.3 t). Maximum catch was recorded at Gagolli (23.5 t) followed by Malpe (12.7 t). This species was poorly represented at Mangalore (1.2 t) (Table 3).

P. indicus formed 5.8% of the prawn landings in South Kanara by shrimp trawlers. The catch was to the tune of 26.7 t of which 11.2 t were landed at Mangalore, 11.2 t at Malpe and the rest (4.3 t) at Gangolli (Table 3).

P. monodon was available only at Malpe on 1-9-1983 (0.3 t) (Table 3).

D. Catch value

Based on the auctioning rates of individual species of prawn in the landing centres on each day of observation, the catch value with respect to prawns has been estimated at Rs. 30.0 million for whole South Kanara during the first half of September, 1983, out of which Mangalore alone accounted for 71.7% (Rs. 21.5 million) (Table 4). The contribution of Malpe towards the total value was only Rs. 7.9 million (26.3%), whereas, that of Gangolli was the lowest being 0.6 million (2.0%).

A gear-wise analysis of the catch value indicated that purse seines alone accounted for 77.7% (Rs. 23.3 million) and the rest (Rs. 6.7 million) by trawlers (Table 4).

Studies on the resources of *M. dobsoni*

Since the prawn fishery was largely supported by *M. dobsoni* during this period, some of its resource characteristics have been studied in detail and an account is given below.

Size distribution

The fishery of *M. dobsoni* was exclusively supported by large sized prawns during this period. At Mangalore, the size ranged from 83 to 108 mm and 93 to 128 mm for males and females with modal sizes at 93 mm and 113 mm respectively in purse seine catches, while, in the trawl catches the size ranged from 83 to 108 mm with mode at 98 mm for males and 93 to 123 mm with mode at 113 mm for females.

At Malpe, the size ranging from 83 to 103 mm and 93 to 123 mm for males and females with modal sizes at 98 mm and 113 mm respectively represented the purse seine fishery, whereas, the trawl fishery was supported by sizes ranging from 83 to 103 mm with mode at 93 mm in males and 78 to 123 mm with mode at 108 mm in females.

The gear-wise size distribution of *M. dobsoni* at Mangalore and Malpe is given in Fig. 3. It is seen that there was no marked difference in the size distribution in different gears except the higher modal sizes noticed in males in the trawl fishery at Mangalore. However, at Malpe, the modal sizes for males and females in trawl catches were small as compared to those of purse seines.

It is interesting to note that *M. dobsoni* was mostly represented by one year class and above during this period, and 0-year class was seldom found in the catch.

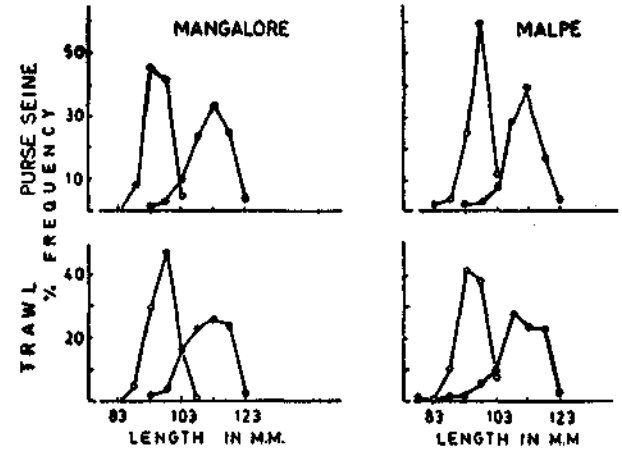


Fig. 3. Size frequency distribution of *M. dobsoni* in purse seines and trawls at Mangalore and Malpe during the first half of September, 1983.
(open circles indicate males and closed circle, females)

Table 4. *Value of prawns landed at Mangalore, Malpe and Gangolli by purse seiners and shrimp trawlers during the first half of September*, 1983 *(in Rupees)*

Centre	Purse seine	Trawl	Total	% of catch value (centre-wise)
Mangalore	1,89,67,820	25,79,270	2,15,47,090	71.7
Malpe	42,69,070	36,77,530	79,46,600	26.3
Gangolli	98,200	4,55,000	5,53,200	2.0
Total	2,33,35,090	67,11,800	3,00,46,890	
% of value (gear-wise)	77.7	22.3		

Centre-wise age composition data is given in Table 5 which indicated that 95 to 97% was comprised by one year olds, 2 to 3% by two year olds and 1 or less than 1% by O-year prawns. It is seen that there was not much difference in the age structure of *M. dobsoni* in trawls and purse seines at these centres.

Table 5. *Age composition * of M. dobsoni (in percentage) in purse seines and trawls at Mangalore and Malpe during the first half of September,* 1983

	Mangalore			Malpe		
	0-year	1-year	2-year	0-year	1-year	2-year
PURSE SEINE						
Males	0.4	99.3	0.3	0.7	99.3	—
Females	1.1	95.0	3.9	1.2	95.2	3.6
TRAWL						
Males	0.2	98.9	0.9	0.4	99.6	—
Females	1.6	95.6	3.4	5.5	92.1	12.4

* Males up to 85 mm, 86 - 105 mm and above 106 mm; Females upto 95 mm, 96 - 120 mm and above 121 mm for 0 - year, 1 - year and 2 - year classes respectively.

Sex ratio

The sex ratio in percentage in respect of *M. dobsoni* for purse seines and trawls at Mangalore and Malpe is given in Table 6. It could be seen that males and females were distributed more or less equal in trawl catches at Mangalore and Malpe, whereas, females dominated in purse seines at these centres (61.8 and 82.0% respectively). The preponderance of females in higher proportions in purse seine catches may be attributed to the behavioural pattern of females to come out of the bottom layers during night, possibly for spawning, which in turn was removed by purse seines in the early hours of the day. This is further supported by the fact that a purse seine sample of 100 prawns collected from Mangalore on 1-9-1983 had only two males and the rest were all females.

Table 6. *Sex ratio distribution (in percentage) of M. dobsoni in purse seines and shrimp trawlers at Mangalore and Malpe during the first half of September,* 1983

	Mangalore		Malpe	
Sex	Purse seine	Trawl	Purse seine	Trawl
Males	38.2	49.0	18.0	47.1
Females	61.8	51.0	82.0	52.9

Maturity

In *M. dobsini,* spent and spent recovering females were noticed fairly in large quantities (Table 7). In addition, mature and impregnated females were also found in considerable numbers at both centres. All these suggested peak spawning in this species during this period. The maturity distribution in purse seine and trawl at these centres showed more or less a similar pattern.

Table 7. *Distribution of various maturity stages of M. dobsoni in purse seines and trawlers at Mangalore and Malpe during the first half of September,* 1983 *(figures denote percentage)*

	Mangalore		Malpe	
Maturity stages	Purse seine	Trawl	Purse seine	Trawl
Immature	15.9	18.6	15.9	27.1
Maturing early	15.4	17.0	3.5	10.1
Maturing late	18.1	10.5	4.5	19.0
Mature	8.7	6.5	9.7	11.8
Spent/spent-recovering	41.9	47.4	66.4	32.1
Impregnated	35.4	23.0	25.7	30.2

Soft-prawns

It is seen that in a sample analysed on 7-9-1983, 46.9% of females was in soft condition and the rest with hard shells. (similar data for the other days not available). It is interesting to note that practically all males were with hard shells. The presence of soft females in fairly large numbers indicated that females might have underwent moulting probably after spawning. This conclusion is based on the occurrence of large number of spent and spent recovering females during this period (Table 7). This also suggested that males might have undergone moulting first and females at a subsequent period as recorded in other crustacens. By the time the females underwent moulting and become soft, the males might have hardened their shells and were ready for impregnation. The occurrence of good number of impregnated females also supported this view (Table 7).

Survival rate, S and the total instantaneous mortality coefficient, Z

Since the fishery of *M. dobsoni* during the first half of September, 1983 was supported largely by one year

class and above, which were fully recruited age groups, the survival rate, S, was calculated based on the age composition data of this prawn by employing the formula,

$$S = n_2/n_1$$

where, the n1 and n2 are the number of prawns per unit of effort in the same fishing season in different age groups, ie., 1 year and 2 year olds respectively. From the S value, the total instantaneous mortality coefficient, Z, could be obtained by the relation,

$$S = e^{-Z}$$

This can be rewritten in the following form,

$$-Z = \log_e S$$

$$Z = -\log_e S$$

It is seen that the Z values for purse seines and trawls at Mangalore were 3.64 and 3.80, while these values for Malpe were 3.47 and 4.34 respectively (Table 8).

Table 8. *Age composition (c.p.u.e. in numbers), survival rate, S, and instantaneous total mortality coefficient, Z of M. dobsoni in purse seines and trawls at Mangalore and Malpe during the first half of September,* 1983

	Mangalore		Malpe	
	Purse seine	Trawl	Purse seine	Trawl
1-year	49,775	7,272	11,226	5,707
2-year	1,301	162	46	74
S	0.026	0.022	0.031	0.013
Z	3.64	3.80	3.47	4.34

It could be seen that there is not much variation in the Z values of purse seines and trawls of these centres. These values also indicated that this prawn was heavily exploited during this period.

Conclusion

Even before the advent of purse seiners there was fairly good catches of prawns by shrimp trawlers in September atleast during some years. But the introduction of purse seines has resulted in bumper catches of *M. dobsoni* in September, when the fishing season commenced. Though purse seines were introduced with an intention to exploit the vast pelagic resources available along the Karnataka coast, its contribution towards the exploitation of Prawn of this area, has been considerably high, atleast in September. It is a fact that 76% of the prawn catch during the first half of September, 1983 was obtained by purse seines, whereas, the shrimp trawlers which are supposed to be the principal gear for exploiting the prawn resources, could contribute only 24% of the prawn landings during this period. The unprecedented catch of prawns in purse seines might possibly be due to the fact that the resource of *M.dobsoni* was found to be very close to the shore. Moreover, the behavioural pattern of females to come off the bottom for spawning and remain in the column waters for considerable amount of time as they were fully exhausted, might have helped the mechanised fishery, particularly purse seiners, to exploit them heavily. The huge size of the purse seine nets helped to encircle large areas and fish the 'accumulated stock' resulted out of the closed season (June–August) due to monsoon.

The heavy catches of *M. dobsoni* in September after the closed season revealed some interesting facts and suggested the following.

i) The closed season helps in replenishment of the resources.
ii) It results in the accumulation of stock.
iii) It provides sufficient protection for younger prawns to feed and grow to larger sizes.
iv) The closed season is a natural way of conservation of the resources and results in better yields in a short period, than during the regular fishing season.

The most striking feature was that the fishery of *M. dobsoni* during this period, was exclusively consisted of larger sizes. (On the other hand, the purse seine fishery during January–February, 1984 was supported by relatively smaller sized prawns of this species with modal sizes at 73 mm and 93 mm as against the present 98 mm and 113 mm respectively obtained for males and females.

This species was heavily exploited by purse seines and trawlers resulting in unprecedented catches during the first half of September, 1983. It is pertinent to ask whether this has any adverse effect on the resource. Generally, when a resource is subjected to heavy exploitation by different types of gears, it may lead to the depletion of the resource. Although there has been wide fluctuations in the catch of *M. dobsoni* in September, during various seasons, the present studies indicated that the intensive fishing during September may not lead to any conservatory problems. These prawns have already reached their maximum size (prawns larger than

the presently reported ones have not been recorded any time in the fishery) and hence in the fag end of their life. In addition, they might have spawned atleast three to four times before they attained the present size. It is reasonable to assume that they may possibly die of natural mortality if not exploited at that size. This has been further supported by the occurrence of dead and decayed prawns in trawl catches during this period, as well as the large scale occurrence of shells of dead prawns along the beaches of this region towards the fag end of the monsoon season. Therefore, it is not likely to pose any serious conservatory problem, atleast in the near future. However, a close monitoring of the situation is essential.

The author is extremely thankful to Dr. E.G. Silas, former Director, Central Marine Fisheries Research Institute, Cochin, for his guidance and keen interest shown throughout the course of this investigation. Thanks are also due to Dr. M. J. George for critical reading of the manuscript and suggesting improvements.

NIGHT TRAWLING FOR PRAWNS AT MANGALORE ENCOURAGING*

Introduction

Exploitation of prawn resources by mechanised trawling has been intensified since the beginning of seventies due to the ever-increasing demand for prawns for export. Even among prawns, there has been greater demand for larger varieties since they fetch very high price. This is prompting more and more entrepreneurs to go in for different types of fishing for catching large sized prawns. Trawl fishing during night time is one such method at present adopted by trawler owners of Mangalore area and this has been found to yield promising results. Since there is considerable disparity in effort, catch and catch composition of prawns of day and night boats, an appraisal of the trawl fishery has been attempted here with special reference to day and night fishing, based on the data collected from Mangalore during the fishing season, 1982-83.

Fishing operations

The crafts and gears employed in trawl fishery along South Kanara coast have been mentioned by Sukumaran *et al. (Mar. Fish. Infor. Serv. T & E Ser., No.* **44**: 1982).

The trawling season generally starts in September and continues up to May end or early June. During 1982-'83, however, the fishery lasted up to the middle of June. Fishing operations will remain suspended during the southwest monsoon period.

Generally, trawlers set out for fishing in the early morning and return by afternoon, sometimes landing even up to 15 or 16 hrs. The boats engaged in day fishing are comparatively smaller in size (less than 9.75 m) and usually fish within 25 m depth zone. These units make 1 to 3 hauls per day, each lasting 2 – 3 hours. Apart from these vessels, there are a good number of larger boats (above 9.75 m) engaged in night fishing, upto a depth zone of 55 m. These units generally set out for fishing in the evening and return after 1-2 days' night fishing. These night units usually make 2 hauls per night, each lasting 4 to 5 hours. In order to keep the prawns and quality fishes in good condition, these boats generally carry 2-3 large ice boxes.

Around 415 trawl units are operating from Mangalore (Bunder). Not less than 40 purse seine boats were also found to engage in night trawling since the pelagic fishery failed during this season. In addition, a good number of shrimp trawlers belonging to neighbouring centres also operated from this centre during certain period of the year.

*Prepared by K. K. Sukumaran, Mangalore Research Centre of CMFRI, Mangalore.

Since there was considerable disparity in effort, catch and catch composition of prawns in day and night landings, the study was made under two broad headings namely, night fishing for prawns and day fishing for prawns.

Night fishing for prawns

Effort

Night fishing started in the middle of November and continued up to May, with a peak in April, 1983 (Fig. 1). Altogether, 9,221 units were operated for night fishing with maximum in March, 1983. The night units formed around 20% of the total trawl units operated from Mangalore during 1982–'83 (Fig. 2 A). If the efforts in actual fishing hours were taken into consideration, altogether 90,569 hours were spent in night fishing with maximum in April, 1983 (20,580 hrs). Out of the annual effort in hours (2,71,230 hrs), night fishing accounted for 33.4% (Fig. 2 B).

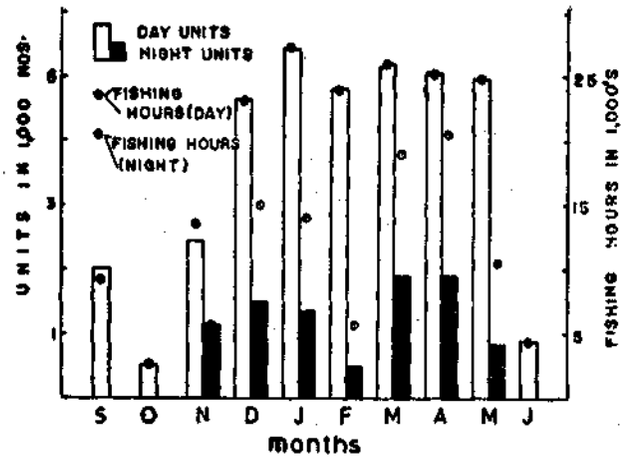


Fig. 1. The distribution of fishing effort in various months at Mangalore during 1982–'83.

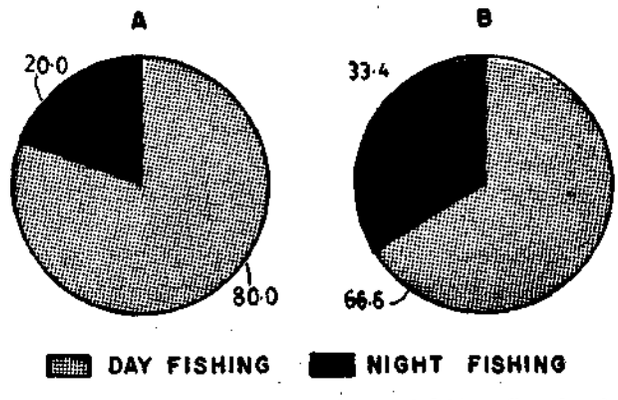


Fig. 2. The distribution pattern of annual fishing effort for day and night trawling at Mangalore during 1982–83. A-fishing trips; B-Actual trawling hours.

Catch and catch composition

In the annual trawl landings during 1982-'83, night fishing contributed around 36% (Fig. 6 B). The trawl catch can be divided into two groups, ie., prawns and by-catches.

The annual prawn catch amounted to 331.0 t (3.6 kg/hr) which formed 9.8% of the trawl landings by night fishing (3,389.2 t) at Mangalore during this period (Fig. 3 B). Though maximum effort was expended in March and April, 1983, the highest catch was obtained in December, 1982 (79.4 t) (Fig. 4). The prawn catch was low in November, 1982 and February, 1983.

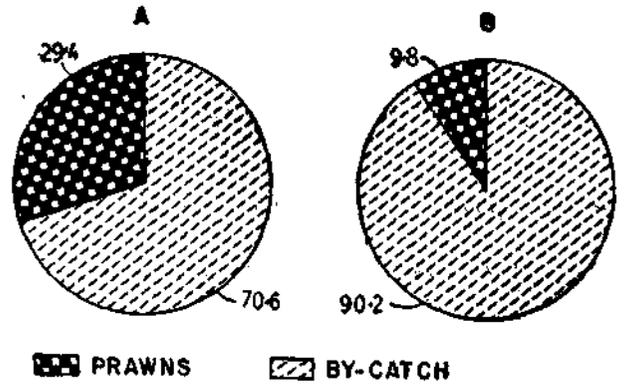


Fig. 3. Distribution pattern of prawns and by-catches in the shrimp trawlers at Mangalore during 1982–'83. A - Day catch; B-Night catch.

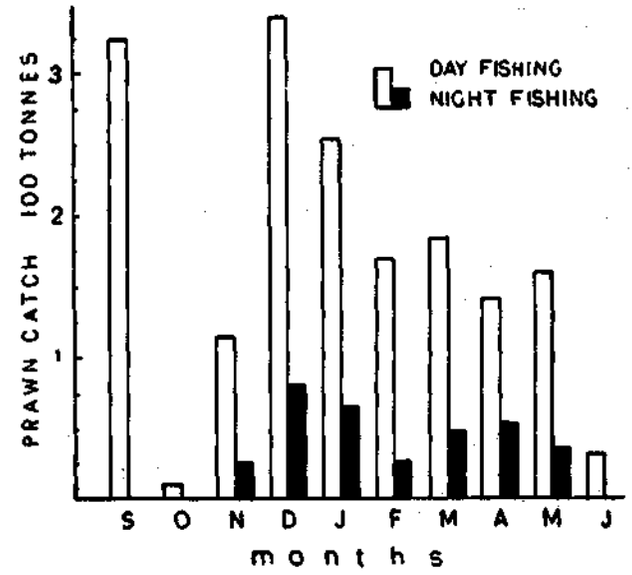


Fig. 4. Prawn landings by day and night trawling in various months at Mangalore during 1982–'83.

The prawn catch was composed of larger species, such as, *Metapenaeus monoceros, Penaeus indicus, P. monodon* and *M. affinis* in the order of their abundance. The percentage composition of different category of prawns is given in Fig. 5 A.

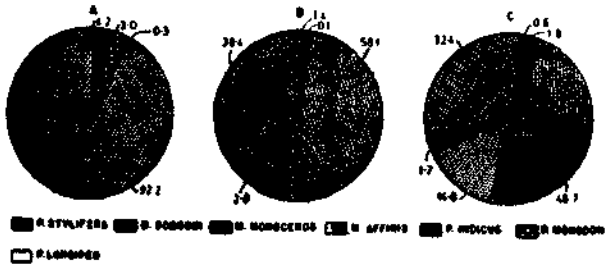


Fig. 5. Species composition of prawns landed by shrimp trawlers at Mangalore during 1982–'83. A-Night catch; B-Day catch; and C-Day and night catch combined.

M. monoceros ('brown shrimp'): This prawn formed the bulk of the prawn catch (92.2%) by night boats, and the catch amounted to 305.9 t with a catch rate of 3.4 kg/hr for the whole season. Landings of this prawn was fairly high during December–January (Table 1).

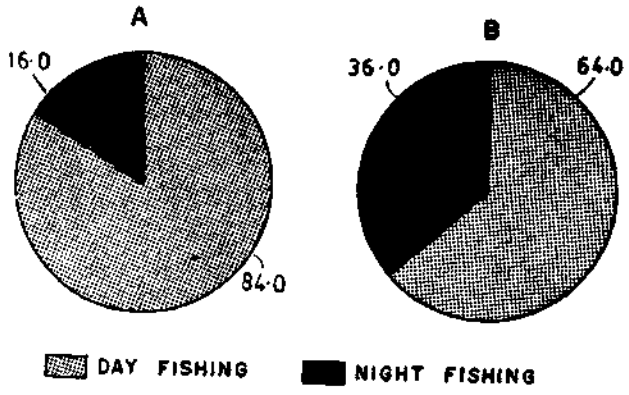


Fig. 6. Distribution pattern of prawns and total trawl landings by night fishing and day fishing at Mangalore during 1982–'83. A-Prawn landings; B-Total trawl landings.

P. indicus ('white shrimp'): This species contributed 4.2% of the prawn landings by night fishing, and the annual catch was 14.0 t (0.2 kg/hr). Maximum landings were obtained in January and May, 1983 (Table 1).

P. monodon ('tiger prawn'): It formed 3% and the catch amounted to 10.1 t (0.1 kg/hr). Maximum catch was obtained in April, 1983 (Table 1).

M. affinis ('brown shrimp'): The catch of this prawn was low (1.0 t), and contributed only 0.3% of the annual prawn landings by night fishing. Catches were recorded in November, 1982 and February, 1983 only (Table 1).

In addition to prawns, fairly large quantities of by-catches were also landed regularly by night fishing. These mainly included fishes (of different category), stomatopods, crabs, cephalopods and trash fish. A detailed account of the different fish groups of the by-catches landed by trawls in South Kanara has been given by Sukumaran *et al.* (1982). The catch details of these fish groups during 1982–'83 are also incorporated in Table 1 which show that quality fishes and trash fish together formed the bulk of the night catch.

Day fishing for prawns

Effort

During 1982–'83, altogether 36,330 units were operated for day fishing with maximum in January, 1983

Table 1. *Estimated monthwise landings (in tonnes) of different category of prawns and by-catches by night trawlers at Mangalore during* 1982–'83

Species/category	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
M. monoceros	24.4	75.4	61.3	23.7	43.5	46.1	31.5	305.9
M. affinis	0.2	—	—	0.8	—	—	—	1.0
P. indicus	0.2	2.5	3.5	0.7	2.1	3.5	1.5	14.0
P. monodon	0.3	1.5	1.0	1.0	2.0	2.5	1.8	10.1
Total prawns	25.1	79.4	65.8	26.2	47.6	52.1	34.8	331.0
Fishes	220.4	265.7	295.2	68.6	273.3	293.1	170.1	1586.4
Stomatopods	—	42.1	52.1	8.0	141.7	24.3	—	268.2
Cephalopods	17.7	12.0	5.5	6.0	13.6	18.0	2.5	75.3
Trash fish	—	179.3	174.9	90.4	266.6	301.3	115.8	1128.3
Monthly total	263.2	578.5	593.5	199.2	742.6	688.9	323.2	3389.2

(5,473 units) (Fig. 1). The day units formed around 80% of the total effort expended for trawling during this period (Fig. 2 A). Out of the 2,71,230 hours of trawling, day fishing alone accounted for 1,80,661 hours (66.6%) (Fig. 2 B).

Catch and catch composition

In the annual trawl landings, day fishing alone contributed about 64%. The prawns formed 29.4% of the trawl landings by day fishing (Fig. 3 A), amounting to 1,736.8 t (9.6 kg/hr) (Table 2). Although maximum effort was expended in January, 1983, the best catches were obtained in December, 1982 (339.8 t) followed by September, 1982 (326.2 t) (Fig. 4). As usual, the prawn catch was low in October, 1982.

It is interesting to note that the species composition of prawns in the day catches was quite different from night catches. The percentage composition of different category of prawns in day catches is given in Fig. 5 B.

P. stylifera ('karikadi'): This was the chief species, contributing to 58.1% of the prawn landings by day fishing. The annual catch amounted to 1,004.5 t (5.1 kg/hr). This species was available throughout the season except September, and the maximum landings were recorded in December, 1982 (294.0 t) (Table 2).

M. dobsoni ('poovalan'): This prawn was the second important species forming 38.4% of the prawn landings, and the annual catch amounted to 667.7 t (3.7 kg/hr). The highest catch was recorded in September, 1982 (310.8 t) when the season started, and nil catch in October, 1982 (Table 2).

M. affinis: The catch of this species was only 34.7 t (0.2 kg/hr) forming 2% of the annual landings by day fishing. The maximum landings were recorded in April, 1983 (11.3 kg/hr) (Table 2).

P. indicus: The annual catch amounted to 23.5 t (0.1 kg/hr) forming 1.4% of the prawn landings by day fishing for the whole season. The catches were fairly good in the first week of September, 1982 when the fishery commenced (Table 2).

P. monodon: The landings of this prawn was negligible (0.1 t).

Parapenaeus longipes: This species was caught only in May, 1983 and the catch amounted to 1.8 t (0.1%).

In addition, prawns like, *Trachypenaeus curvirostris, Metapenaeus moyebi, Parapenaeopsis acclivirostris, Solenocera crassicornis, Nematopalaemon tenuipes* and *Exhippolysmata ensirostris* also occurred in stray numbers.

By-catches included fishes, stomatopods, crabs and cephalopods, and are described by Sukumaran *et al.* (1982). Details of the by-catches are given in Table 2.

Table 2. *Estimated month-wise landings (in tonnes) of different category of prawns and by-catches by day trawlers at Mangalore during* 1982–'83

Species/category	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
M. dobsoni	320.8	—	21.5	45.8	80.8	84.4	44.2	33.2	43.0	4.0	667.7
M. affinis	—	0.2	0.2	—	0.1	3.0	6.5	11.3	9.6	3.8	34.7
P. stylifera	—	9.9	92.7	294.0	173.0	81.0	133.5	94.2	102.1	24.1	1004.5
P. indicus	15.4	—	0.2	—	0.2	0.9	0.4	3.9	2.3	0.2	23.5
P. monodon	—	—	0.1	—	—				—	—	0.1
P. longipes	—	—	—	—	—	—	—	—	1.8	—	1.8
Total prawns	326.2	10.1	114.7	339.8	254.1	169.3	184.6	142.6	158.8	32.1	1732.3
Fishes	122.1	69.4	222.2	291.9	379.4	378.6	225.0	279.2	469.1	46.6	2483.5
Stomatopods	—	—	8.2	223.9	259.1	417.1	362.9	134.3	102.5	4.6	1512.6
Crabs	—	—	—	3.6	47.3	32.6	13.4	30.3	15.6	1.5	144.3
Cephalopods	—	—	2.2	—	5.7	3.0	0.8	17.0	5.3	—	34.0
Monthly total	448.3	79.5	347.3	859.2	945.6	1000.6	786.7	603.4	751.3	84.8	5906.7

Annual prawn landings

The annual prawn landings by trawl fishery, when day and night catches were put together, amounted to 2,063.3 t (7.6 kg/hr), which formed 21.9% of the annual trawl landings during 1982–'83 (Fig. 7). It is seen that 84% of the prawn catch was contributed by day fishing and the remaining by night fishing (Fig. 6 A). Though prawns landed throughout the season, the highest catches were recorded in December, 1982 (Fig. 8). Taking an overall picture of the day and night fishing, *P. stylifera* was the most abundant species contributing 48.7% followed by *M. dobsoni* (32.4%), *M. monoceros* (14.8%), *P. indicus* (1.8%), *P. monodon* (0.6%) and *M. affinis* (1.7%) (Fig. 5 C).

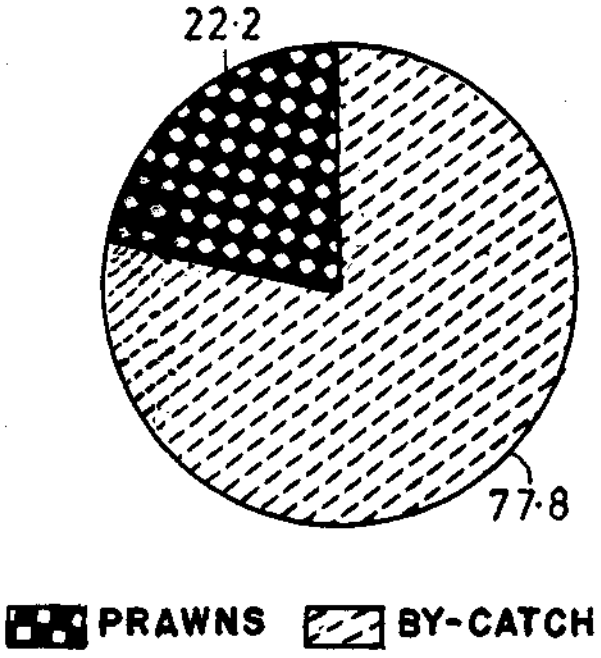


Fig. 7. Distribution pattern of prawns and by-catches in shrimp trawlers at Mangalore 1982–'83.

Annual income

Based on the auctioning rates of individual species of prawns (average) and by-catches during different months at the landing centre, the gross income for 1982–'83 has been calculated to Rs. 30.0 million, out of which Rs. 15.6 million (51.9%) was obtained from night fishing and the rest from day fishing (Fig. 9 B). Out of the gross income, prawns alone accounted for 26.3 million forming 87% of the return (Fig. 9 C) of which night fishing contributed Rs. 13.4 million (50.8%) and the rest from day fishing. Thus, although night fishing contributed only 16% of the annual prawn catch, the income from sale proceeds was more than that obtained from day fishing (Fig. 9 A).

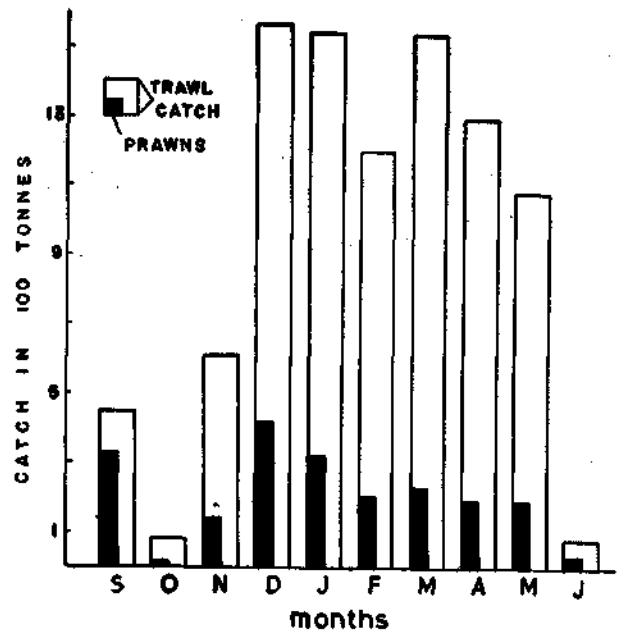


Fig. 8. Monthwise prawn catch and total trawl landings at Mangalore during 1982–'83.

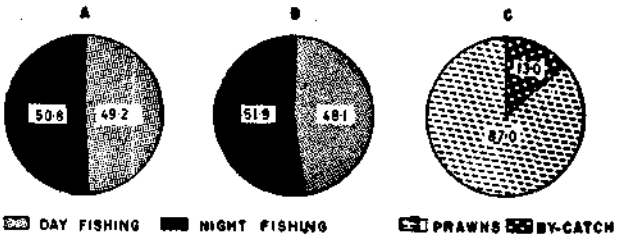


Fig. 9. Annual income of shrimp trawlers at Mangalore during 1982–'83. A-Income from prawns; B-Income from day and night catch; and C-Income from prawns and by-catches.

From this data, the average income per trip has been worked out for day and night fishing units separately for 1982–'83. It is seen that the average income per trip was Rs. 397.00 and Rs. 1,690.00 for day (average 5 hrs fishing) and night fishing boats (average 10 hrs fishing) respectively.

Discussion

Despite increased effort the mechanised prawn fishery at Mangalore declined year after year during the latter half of seventies, and the prawn catch was the lowest during 1980–'81 (675.7 t). As compared to a moderate catch of 984.6 t during 1981–'82, the following year (1982–'83) witnessed a record catch of 2,063.3 t (this is exclusive of 449.0 t of prawns landed by purse

seiners). The prawn landings increased by 110% during 1982–'83 as compared to the previous season along with substantial increase in effort during this season (effort increased by 33% in units and 76% in actual fishing hours). This is mostly brought about by the increased operation of the vessels for night fishing.

As regards income also, there has been considerable increase, The gross income has increased from Rs. 21.3 million during 1981–'82 (Sukumaran *et al.*, 1982) to Rs. 30.0 million during 1982–'83. Out of this, prawns alone accounted for 87% of the value, although it formed only 22% of the trawl landings.

The present studies also indicated that the average income per day of night fishing boats was considerably higher than that obtained by day units, thereby suggesting that night fishing was more profitable. The addition of more and more boats for night fishing in the recent years also point to the profitability of night operations in comparison with day operations.

OCCURRENCE OF MATURING FEMALES OF KURUMA PRAWN, *PENAEUS JAPONICUS* IN THE MARICULTURE FARM AT MUTTUKADU*

In December, 1983 about 2,000 numbers of seed of *Penaeus japonicus* (average size: 42.2 mm) collected from wild were stocked in a 0.4 ha pond (No. A-4) at the Mariculture Farm, Muttukadu, Madras. Though supplementary feed was provided, the growth of stocked prawns was not appreciable and in a period of six months the prawns attained an average size of 109.7 mm only. Even after repeated drag netting during the night hours, complete stock could not be harvested, as the species was known for its burrowing habit. In the following months, few individuals were seen moving along the inner edge of the pond A-4, during the night hours.

On 10-11-1984, six hauls by drag net were made in Pond A-4 between 21.30 and 22.30 hrs which yielded 23 larger specimens. Among the netted prawns, 11 were males and the rest 12 were females. The size range for males and females was 140 to 158 mm (20 to 31 g in weight) and 156 to 174 mm (32 to 48 g in weight) respectively. The average size for males was 152.0 mm and that of females 159.2 mm. All the males were mature, as the white mass was seen at the base of fifth walking legs. In the case of females, all the specimens were found to have developing ovaries, when they were seen against the light. By judging from the width of the ovary seen, most of the prawns could be placed in stage I and II of ovarian development. A specimen measuring 163 mm in total length was dissected out to examine the status of ovary. The anterior and middle portions of the ovary were cut and preserved in Bouin's fluid and buffered formalin for histological studies.

Plankton hauls were made inside the pond A-4 in the early hours on 11-11-1984 to look for prawn larvae. The analysis of plankton indicated only the presence of mysids (dominant item), small medusae, copepods and copepodites and larvae and adults of the fish, *Allanetta forskali*.

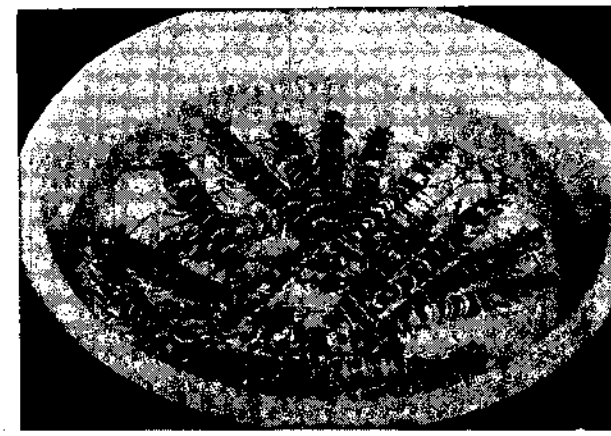


Fig. 1. Female kuruma prawns matured in Muttukad Fish Farm, Madras.

*Prepared by M. Kathirvel, Madras Research Centre of CMFRI Madras.

All the specimens were transported alive by bicycle to Kovalam Field Laboratory on the night of 10th November itself and placed in two half-tonne pools having sandy bottom. The salinity of the water used was 26.0‰. Figs. 1, 2 and 3 show the photographs of the larger specimens of *P. japonicus*, the dissected out specimen and the prawns with various developmental stages of ovary.

Later a total of 10 prawns (7 females and 3 males) were housed in a one-tonne fibre glass tank having a sandy bottom and sea water of 30‰ over which illumination by a pair of tube light was provided as a means to induce further ovarian development. The capture and subsequent transfer to the laboratory tanks resulted in the absorption of ovary in some of the specimens. Artificial illumination for a period of 14 hr/day was given to induce the growth of the ovary.

In the night of 17-11-1984 another attempt was made to obtain more specimens of kuruma prawn by drag netting and this resulted in the collection of three females; one with developing ovary (TL 180 mm; CL 49 mm) and the other two with impregnation. They were put along with those stocked earlier in the pools for carrying out unilateral eye stalk ablation.

The salinity (‰) of surface water recorded in pond A-4 where the field culture of *P. japonicus* took

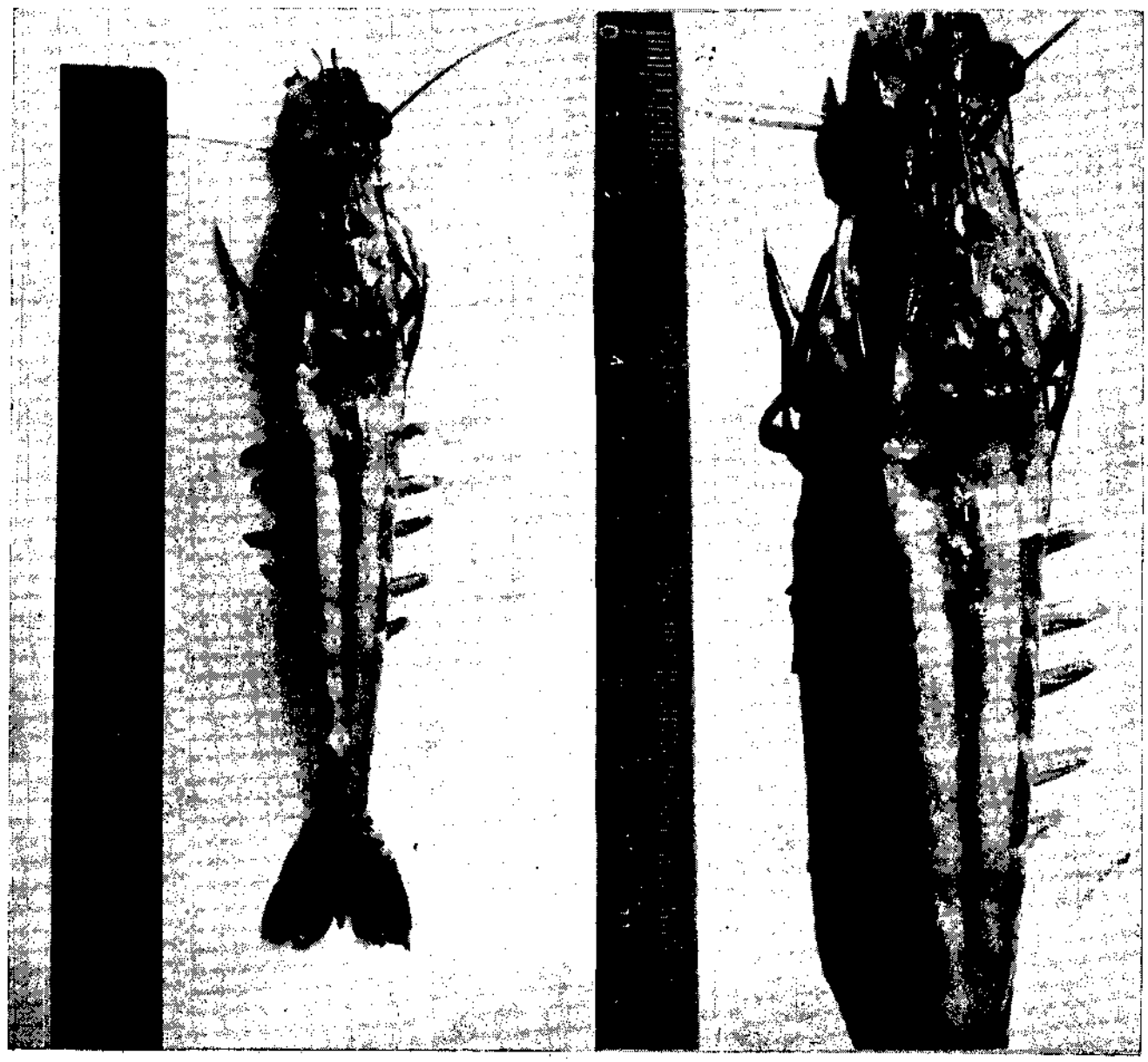


Fig. 2. Dorsal view of ovary from a sacrifised specimen and close-up view of ovary.

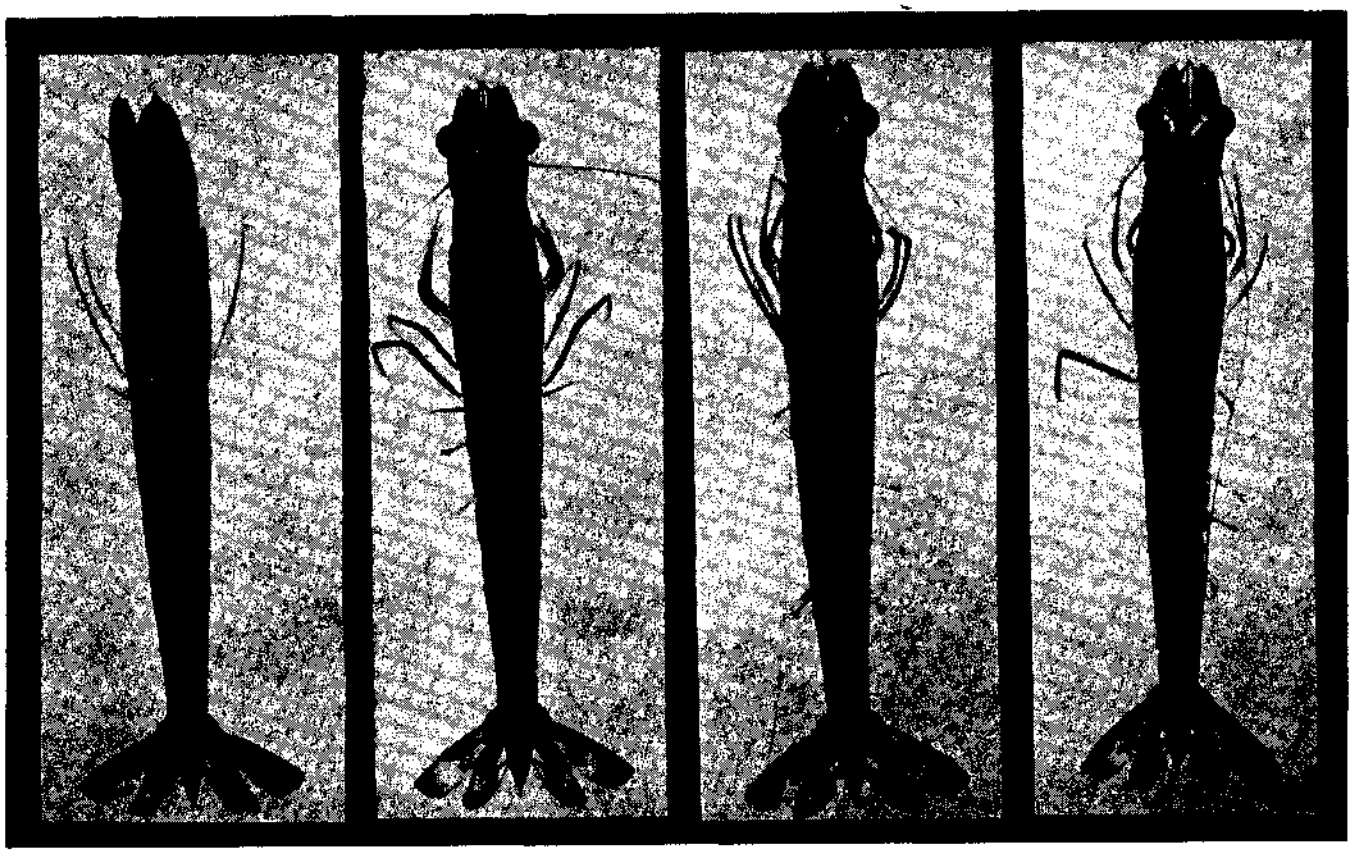


Fig. 3. *Penaeus japonicus* - Females with various stages of ovarian-development.

place during December, 1983 to October, 1984 is given below.

Month	Minimum	Maximum	Average
December '83	16.92	17.86	16.07
January '84	14.58	19.83	16.26
February	13.68	15.19	13.68
March	15.19	18.68	17.49
April	19.17	24.99	24.92
May	25.92	29.23	28.76
June	25.74	28.15	30.79
July	28.64	31.08	28.57
August	29.64	33.39	30.39
September	26.43	31.08	29.46
October	18.76	25.16	21.87
November 10th: 20.12‰			
*November 14th: 14.00‰			

*After heavy rains during 12–13th November.

It has been observed that the salinity in pond A–4 gradually raised from March '84 onwards and reached the peak during June–August and afterwards it lowered. The values of the salinity at the bottom of the pond are likely to be more, perhaps by one or two parts than at the surfaces. Earlier records of maturing/matured penaeid prawns of India in low saline waters include *Metapenaeus dobsoni* from open backwaters of Cochin and perennial culture fields of Vypeen Islands, Kerala and *Metapenaeus moyebi* from Pulicat Lake on the Madras coast. The present observation enlists *Penaeus japonicus* with those prawns attaining maturity in low saline waters, or to say precisely in confined waters.

AN UNUSUAL BUMBER CATCH OF WHITE PRAWN, *PENAEUS INDICUS* FROM KOVALAM BAY NEAR MADRAS*

Introduction

In the history of the fishing village, namely, Kovalam (lat. 12°47'N long. 80°15'E), formerly known as Covelong, situated 35 km south of Madras City, heavy landings of the Indian white prawn, *Penaeus indicus* caught with gill net have occurred for the first time during 16th–20th December, 1984. The inshore sea off Kovalam is a cove or a small bay, from which the village's name could have been derived as 'Covelong' (Fig. 1). The bottom of the bay is rocky covered by sand to a height of about 1m and there are a number of projected rocks scattered around the bay which prevent trawling in this ground. Usually, prawns are caught by the traditional gill net (single layer) during the post monsoon months (January–June) and the catch composed of larger-sized (150 to 180 mm) white prawns and rarely tiger prawns (*P. monodon*) of 190 to 250 mm. From April, 1984 onwards, sporadic fishing with the newly introduced 'Trammel net' was carried out. In this net, there are three layers, the middle one having smaller mesh (45 mm) and outer layers with larger mesh (400 mm). Unlike the traditional gill net locally known as 'Aravalai' (45 mm mesh size), the bottom of the trammel net has lead as weights at regular intervals of 15 cm, so that the net can get buried to a depth of 10 cm in the silt-sand bottom of the fishing ground. The overall length and breadth of this three-layered net is 120 to 200 m and 2.5 to 3.0 m respectively. This net is locally called as 'Mani valai.'

Fishing

It all started on 16–12–1984 when 50 units of catamaran belonging to Kovalam, Karikkattukuppam and Chemenjeri engaged in operation of trammel nets from 0600 to 1600 hrs landed white prawns at a rate of 2 to 8 kg per unit. The news of gill netting of white prawns spread to the nearby fishing villages and also as far as Thevanampatnam, north of Cuddalore (about 121 km south of Kovalam) which resulted in large scale

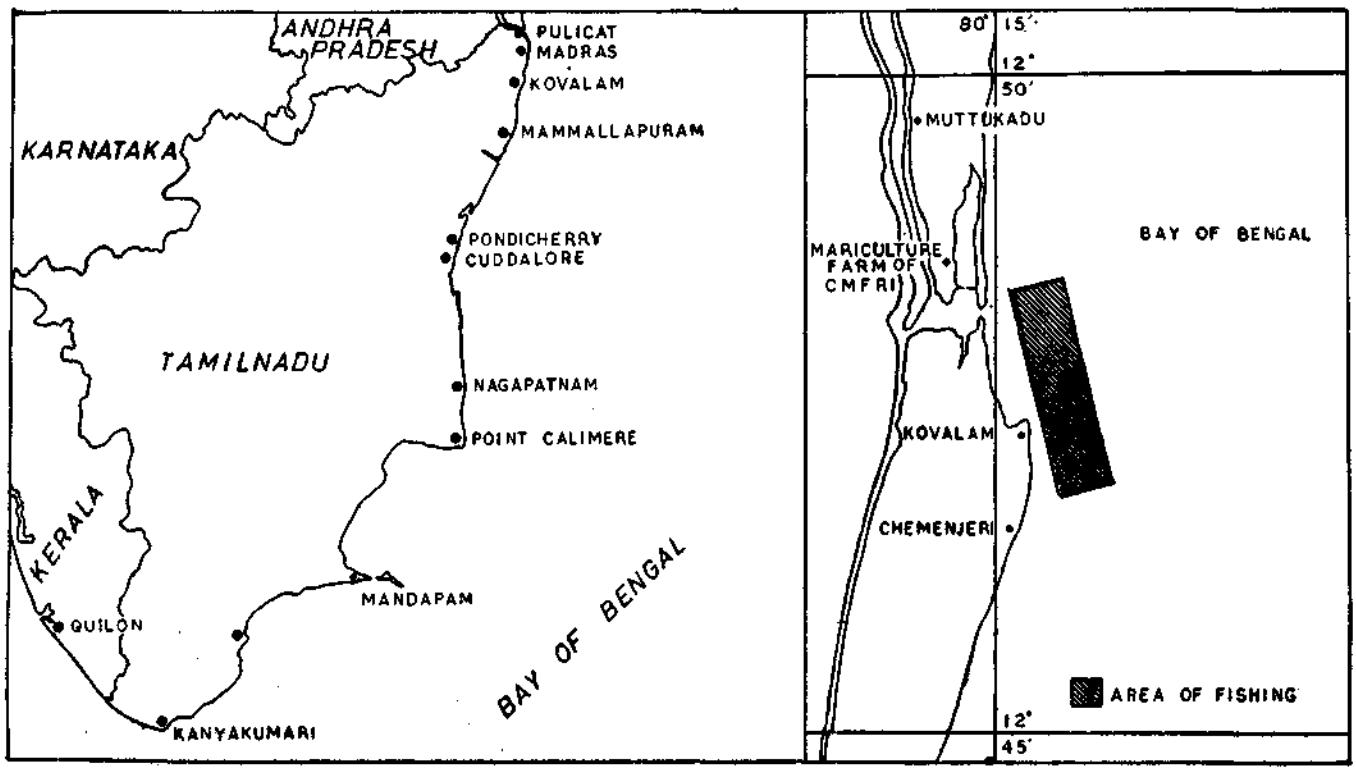


Fig. 1. Map showing Tamilnadu coast and Kovalam Bay.

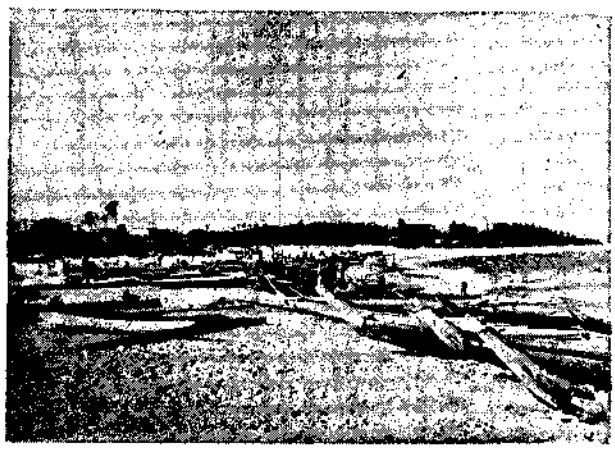
*Prepared by M. Kathirvel, V. Selvaraj, A. Ramakrishnan, S. Palanichamy, K. Shahul Hameed, P. Poovannan and M. Bose, Madras Research Centre of CMFRI, Madras.

gill net operations by hundreds of catamarans for four days, from 17th to 20th December, 1984. The landings of white prawn were examined randomly to assess the overall catch. Date-wise particulars of units operated, estimated catch and catch per unit are given below.

Date	No. of units operated	Estimated catch (in tonnes)	Catch (kg) per unit (range)
16–12–'84	50	0.250	2 to 8
17–12–'84	300	4.620	5 to 30
18–12–'84	560	7.448	7 to 25
19–12–'84	412	1.160	1 to 8
20–12–'84	60	0.200	¼ to 5
Total	1382	13.678	¼ to 30

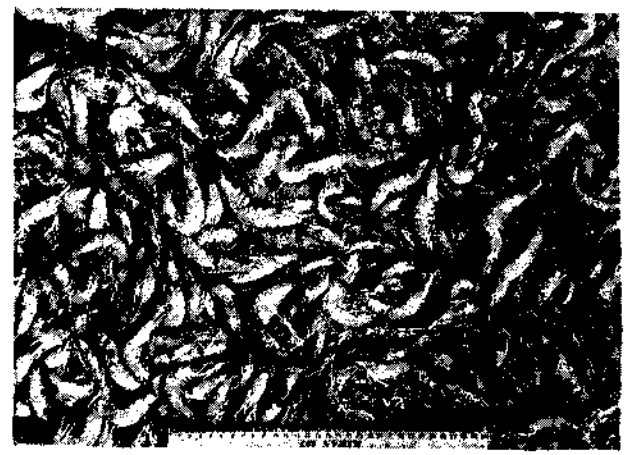
On the sixth day (21–12–'84), 45 units of trammel nets were operated at Kovalam but there was virtually no landing of prawns.

Suspecting a southerly migration of prawns, enquiries were made in different fishing villages between Kovalam and Mammallapuram (formerly known as Mahabalipuram). It was learnt from the fishermen of Devanerikuppam (15 km south of Kovalam) and Mammallapuram (18 km south of Kovalam) that heavy landings of *P. indicus* ranging from 10 to 30 kg per unit occurred on 20–12–'84 and 21–12–'84. When the fishermen at Nochikuppam (30 km north of Kovalam) were contacted, it was learnt that fishing by trammel net for *P. indicus* was intensified during 11th to 15th December, '84, as the return of catch was heavy. All these fishermen expressed their opinion that white prawns were moving southerly, close to the coast, taking advantage of the prevailing southerly wind and current.



Photograph No. 1. Landing of white prawns by cattamarans at Kovalam, Madras.

In this heavy fishing at Kovalam, fishermen from Thevanampatnam (121 km south of Kovalam) to Royapuram (northern part of Madras city) participated. They transported their catamarans by lorries to Kovalam. The news of white prawn catch was conveyed even to the far off fishermen through postal communication by their friends and relatives from Kovalam and nearby villages.



Photograph No. 2. A heap of prawns caught from Kovalam Bay near Madras.

Analysis of random samples

Random samples were collected on 2nd (17th Dec.), 4th (19th Dec.) and 5th (20th Dec.) day of fishing for biological observations. The catch was exclusively composed of *Penaeus indicus* and stray specimens of *Metapenaeus dobsoni* and few fishes like carangids and sciaenids. The sex-wise size distribution of *P. indicus* on the sampling days is given in Fig. 2. The overall size range for *P. indicus* was between 99 and 160 mm. In the second day of fishing (17–12–'84), the dominant size group observed for male and female was 116–120 mm and 126–130 mm respectively, which was seen at 126–130 mm for both sexes on 4th day (19–12–'84) of fishing. However, the dominant size was reduced to 121–125 mm for both sexes on the final day of fishing (20–12–'84). Among the sexes, females dominated during 2nd and 5th days of fishing, while males were more in number on 4th day of netting. Female specimens above 125 mm showed either spent or early maturing stage. Fully matured females were rare in the catch. On the contrary, few female specimens of *M. dobsoni* encountered were either impregnated or fully matured or both. The size range for *M. dobsoni* was 71 to 85 mm.

Disposal of catch

There are two main prawn traders, for procuring prawns and onward transmission to processing plants

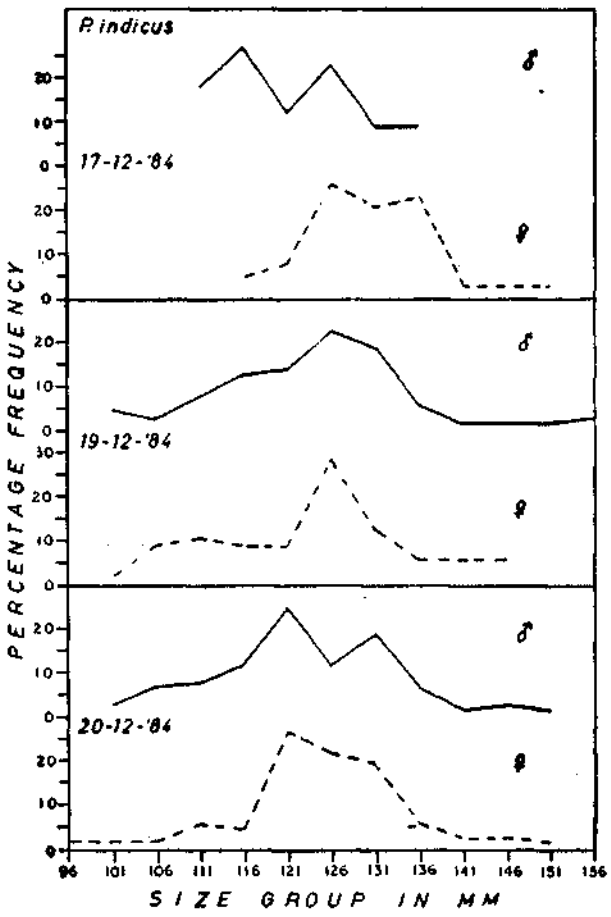


Fig. 2. Size distribution of male and female of *P. indicus* in the random samples analysed.

located in Madras city, one at Kovalam village itself and the other at Chemenjeri, situated 1 km south of Kovalam. Both were engaged in prawn business for more than two decades and so far they have not witnessed such spurt in white prawn landings from this region. First day, they offered Rs. 55/- per kg of beheaded prawns and the count per kg was 90. As these agents started sending large quantities of prawns everyday to a few particular processing plants, from whom they had drawn finance, it was beyond these factories' daily capacity of processing prawns. The companies were forced to keep excess prawns in cold storage and started processing them after 2 or 3 days; by which time, part of the stored prawns became deteriorated. Hence, they offered only Rs. 45 per kg to their respective agents stationed at Kovalam and Chemenjeri, who in turn paid Rs. 35 to 40 per kg to the fishermen. However, a marginal gain was achieved by the prawn merchants. Apart from these two local agents, prawn merchants from Madras city also purchased the white prawns at the seashore itself.

Remarks

Along the Indian coast, schooling and migration of *P. indicus* supporting a seasonal lucrative fishery have been reported at Kanyakumari district (George and Mohamed 1967; Suseelan 1973; Anon. 1975) and at Manappad-Tinnaveli coast (Mannisseri and Manimaran 1981). Recent mark-recapture experiments on *P. indicus* have also established the fact that a longer migration of tagged white prawns took place from Cochin, (place of release) to Ovari - Manappad fishing villages on the southeast coast (Tinnaveli coast), covering a distance of 330–380 km in 68 to 103 days at a rate of 3.5 to 5.5 km/day (Anon., 1982). These observations indicated a southerly migration of white prawn along the Kerala, Kanyakumari and Tinnaveli coasts. The present observation also indicated a similar southerly movement of large schools of white prawns, as evidenced by the heavy fishing along the Madras coast during 11-15th December, followed by intensive fishing at Kovalam bay during 16th–20th December.

While studying the white prawn fishery along the Kanyakumari district, Suseelan (1973) observed a southward migration of shoals from Colachel to Manakkudy, covering a distance of 32 km in 3–4 days. The southward migration of white prawns during the present study was in conjunction with the prevailing southerly current along the coast. According to Ganapati and Murthy (1954), the southerly current intensified during the northeast monsoon, particularly in December along the Madras coast, to about 2½ knots hr within 14 miles from the coast, beyond which it lowered to 1 knot. The size group which contributed to this unusual fishery was 121–130 mm, aging approximately 4–5 months, a probable brood from the second peak spawning (July–September), as mentioned for *P. indicus* in the Madras region (Anon., 1975).

REFERENCES

ANON. 1975. *Report of the All India Co-ordinated Research Project – Studies on marine prawn biology and research, CMFRI, Cochin:* 1-124.

ANON. 1982. *Mar. Fish. Infor. Serv. T & E Ser., No.* **45.**

GANAPATI, P. N. AND V.S.R. MURTHY 1954. *Mem. in Oceanogr., Andhra Univ. Ser., No.* **49**: 125-142.

GEORGE, M. J. AND K. H. MOHAMED 1967. *Proc. Indo-Pacif. Fish. Coun., 12th Sess., Sect. II:* 210-219.

MANISSERI, MARY, K. AND C. MANIMARAN 1981. *Indian J. Fish.*, **28**: 208-216.

SUSSELAN, C. 1973. *Proc. Second Workshop on the All India Co-ordinated Project – Studies on marine prawn biology and resources*: 1-6.

HEAVY LANDING OF *PARAPENAEOPSIS STYLIFERA* (M. Edw.) AT BOMBAY DURING POST-MONSOON 1984*

New Ferry Wharf is a major fish landing centre in Greater Bombay where fishing activity generally resumes in September after a period of lull during the south-west monsoon. This centre accounted for an annual (July–June) average of 7,530 tonnes of penaeid prawns of which *Parapenaeopsis stylifera* constituted 59.6%. The peak period of fishery for this species was observed to occur during September–December. The month-wise catch in tonnes and CPUE in kg in parenthesis (fishing trip is unit effort) during this period of different years are given below.

Year	Sept.	Oct.	Nov.	Dec.	Total
1979	188.6	388.7	317.6	821.4	1716.3
	(91.7)	(186.2)	(162.6)	(352.8)	(202.2)
1980	189.8	703.3	1166.2	967.5	3026.8
	(92.7)	(292.8)	(507.5)	(377.6)	(325.1)
1981	324.9	439.3	531.6	168.3	1464.1
	(209.7)	(191.5)	(245.1)	(73.2)	(176.1)
1982	1246.2	515.8	206.6	305.9	2274.5
	(501.9)	(180.7)	(115.3)	(107.5)	(228.0)
1983	530.1	1881.1	409.6	421.7	3242.5
	(276.0)	(415.2)	(128.8)	(174.8)	(296.2)
1984	2548.9	1386.0	—	—	—
	(842.6)	(382.1)			

It could be seen that the peak of the fishery occurred in November or December during 1979-82 whereas in the subsequent years it was in September or October. During September, 1984, exceptionally heavy landings were recorded. The area of operations was off Bombay-Janjra-Murud (about 80 km coastline) in depths of 20 to 25 m. The size (total length) of *P. stylifera* ranged from 58 to 103 mm for males and from 63 to 118 mm for females with the modal size at 83 mm and 103 mm for the respective sexes. About 10% of females was found to be in mature condition. The male-female ratio was worked out to be 1:1.68. There was no significant departure in the biological features of the fishery from those of the earlier years.

The price of the species per tonne at the landing centre ranged from Rs. 4 to 6 thousand. During the glut period, there was heavy demand for ice at the landing site and as a result the price of ice per tonne shot up from Rs. 200 to 500. The catches were transported to Porbandar and Veraval factories in Gujarat since the supply was too large to be handled by the local processors.

It is of interest to note that during September, 1984 the best landings were observed from 14th to 28th when the catch per unit varied from one to 1.5 tonnes. Simultaneously at Sassoon Dock, another major base for trawlers in Greater Bombay, the catch per unit varied from one to three tonnes. The 'dol' (fixed bag net) netters of the Alibag zone (Raigad District) stretched about 50 km south of Bombay were also reported to have netted *P. stylifera* in abundance (1.5 to 1.8 tonnes per unit of two hauls) during 23rd to 28th September, 1984. The catch that was landed in that zone was transported to Ratnagiri/Goa, the price of raw material being of the range of Rs. 1.5 to 2 per kg. Further south, in the Mangalore area (Karnataka), heavy landings of *P. stylifera* were reported more or less synchronising with this period. (Personal communications from K. B. Waghmare, J. P. Karbhari and K. K. Sukumaran). The incidence of such huge catch all along the coast at about the same time was probably triggered by some oceanographic factors such as large scale upwelling of oxygen minimum layer which might have pushed the stock towards the shore. (Vide Ramamirtham, Fishery Oceanography, *CMFRI*; *20th Anniversary Souvenir*, 1967). Unfortunately no data are available on these aspects to confirm.

Thanks are due to the Fishery Resources Assessment Division of CMFRI for making the catch data available.

*Prepared by S. Ramamurthy and A. Y. Mestry, Bombay Research Centre of CMFRI, Bombay.

THE INDIAN WHITE PRAWN *PENAEUS INDICUS* IN THE PURSE SEINE CATCHES*

The sporadic occurrence of prawns consisting exclusively of *Metapenaeus dobsoni* ('Poovalan chemmeen') in the purse seine catch at Cochin mainly during pre-monsoon season has been reported earlier by Nair *et al.*, 1982 *(Mar. Fish. Infor. Serv. T & E Ser.*, **42**: 9-13). On 23-5-'84, while monitoring the purse seine catch at the Fisheries Harbour at Cochin a purse seine landed 1.2 tonnes of the Indian white prawn *Penaeus indicus* ('Naran chemmeen') which was auctioned for Rs. 70,000/-. Since the capture of the species in such huge quantities in purse seines is quite unprecedented and has not been reported earlier, the results of the observations are given in the present communication.

On 23-5-'84, a white prawn shoal was sighted by purse seine fishermen about 20 km SW of Cochin at about 30-35 m depth, while steaming to the purse seine fishing grounds. They immediately shot the net and got the bumper catch. The catch was composed mainly of fairly large sized prawns numbering 25-30/kg of females and 30-40/kg of males (head on). The size ranged from 145 to 185 mm with the dominant modes at 151-155 and 166-170 mm for females and 135 to 170 mm with the dominant mode at 150-155 mm for males (Fig. 1). In the purse seine catch the sexes were of almost equal distribution; the females constituting 50.4% of the population. The females consisted almost exclusively of specimens with late maturing and mature gonads.

The occurrence of fairly large sized *P. indicus* in abundance in the inshore waters during pre-monsoon and monsoon periods along the southwest coast is now well known. In the indigenous fishery of Cochin, which occurs towards the beginning of southwest monsoon period more or less similar size groups of the species contribute about 35% forming the second dominant item of prawn landed by boat seines and bottom-set gill nets (George *et al.*, 1980, *Mar. Fish. Infor. Serv., T & E Ser.*, **18**: 1-8). This spices, in slightly smaller size-range, is also known to support the characteristic mud bank fishery of Ambalapuzha-Thottappally region of Kerala coast in substantial quantities during monsoon period. In the trawl fishery of Sakthikulangara-Neendakara area the species occurs in peak abundance in June, and thereafter the fishery gradually declines, thereby indicating a temporary concentration of large sized prawns in the area. Further south, almost in the same period (monsoon), this species supports a lucrative seasonal fishery in the inshore waters of the coast of Kanyakumari District and it is believed that the recruitment into this fishery is taking place from the Kerala coast. This has later been confirmed by tagging experiments *(Mar. Fish. Infor. Serv., T & E Ser.*, **45**: 1-9). All these point to the fact that *P. indicus* evinces shoaling behaviour and large scale migration to the nearshore areas from the offshore waters during the monsoon period, which are the natural habitat for the larger sizes. Probably this behavioural pattern of the species is triggerred by environmental changes brought about by the upwelling phenomenon. In this context the present observation of unusual landings of fairly large sized *P. indicus* in abundance in the purse seines is especially interesting, which could have been the result of the large scale migration of the species into the columnar waters during premonsoon and monsoon.

Fig. 1. Catch of white prawn *Penaeus indicus* landed by purse seiner at the Fisheries Harbour, in Cochin.

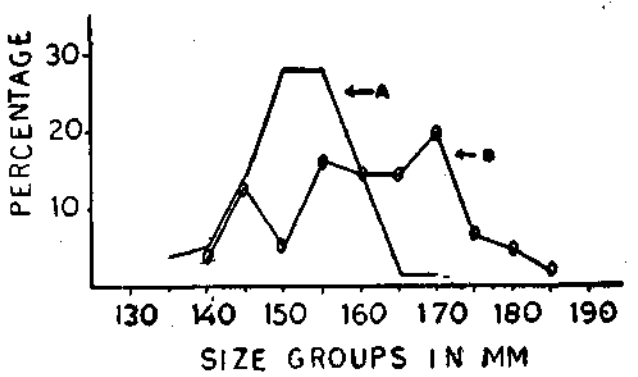


Fig. 2. Length-frequency distribution of *P. indicus* in purse seine catch at Cochin.

*Prepared by K. V. Somasekharan Nair and V. A. Narayanankutty, CMFRI, Cochin with the guidance of M. J. George and C. Suseelan.

GROWTH AND SURVIVAL OF TIGER PRAWN, *PENAEUS MONODON* IN THE SANDY BEACH PONDS AT CALICUT*

Introduction

Fast growing species of prawns which could yield short-term harvests are the most suitable species for intensive farming. At present there are about 35 species of penaeid prawns used for culture purposes in the different parts of the world. Of these, *Penaeus monodon* is one of the important species contributing to the traditional culture fisheries of the Southeast Asian countries and to the well established intensive or semi-intensive culture practices of the Indo-Pacific region. It is being cultured in Taiwan, Phillippines, Thailand, Malayasia, Indonesia, Bangladesh, India and Kuwait. In India, they are cultured in the 'Pokkali' paddy fields and perennial fields of Kerala, 'Bheries' of Sunderban area in West Bengal, salt pan reservoirs of the Godavari estuary in Andhra Pradesh and in some of the earthern ponds in the east and west coasts of India. But, nowhere culture of this species has been attempted in the polyethylene film-lined ponds made in the sandy beach. Therefore, the hardy and fast growing tiger prawn, which occurs in small quantities in Malabar area, was selected for culture experiment in a polyethylene lined sandy beach pond of the Central Marine Fisheries Research Institute between 17-7-'84 and 25-10-'84.

Material and methods

One newly lined pond with a water area of 200 m^2 and depth of 1 m was used for the experiments. Juvenile *P. monodon* with a mean size of 48.5 mm collected from Thiruvangoor and Perumthuruthi area of the Korapuzha estuary using a mosquito dragnet were used for the experiment. After the collection, the prawns were transported to the fish farm where they were conditioned overnight in plasticraft pools. The next day morning, the active young ones were selected, counted and stocked at a density of 5,000/ha. The stocking density could not be increased further due to nonavailability of juvenile *P. monodon* in the area. On 2-8-'84, ie., 16 days after stocking 200 numbers of *Mugil cephalus* collected from the same grounds with a mean size of 25.8 mm were stocked in the same pond at the rate of 10,000/ha after acclimatisation. The prawn was harvested after 100 days of rearing and the fish was allowed to grow further. Stocking and harvest details of the prawn are given in Table 1 and the growth of fish (upto the time of prawn harvest) is given is Table 2.

*Prepared by S. Lazarus and K. Nandakumaran, Calicut Research Centre of C.M.F.R.I., Calicut.

Table 1. *Stocking and harvest details of* P. monodon

Duration of the experiment (days)	:	100
Area of the pond (m^2)	:	200
Number of seed stocked	:	100
Rate of stocking (no./ha)	:	5000
Number of prawns harvested	:	83
Survival rate (%)	:	83
Quantity harvested (kg)	:	3.1
Mean size at stocking (mm)	:	48.5
Mean weight at stocking (g)	:	0.9
Mean size at harvest (mm)	:	165.6
Mean weight at harvest (g)	:	37.3
Increase in length per day (mm)	:	1.17
Increase in weight per day (g)	:	0.36

Table 2. *Growth of* Mugil cephalus *in the pond*

Date of sampling	Mean length (mm)	Mean weight (g)
† 2-8-'84	25.8	0.18
16-8-'84	69.3	4.50
31-8-'84	98.5	13.60
15-9-'84	121.4	23.50
29-9-'84	132.6	32.50
15-10-'84	145.3	39.60
25-10-'84	152.4	42.20

†Date of stocking.

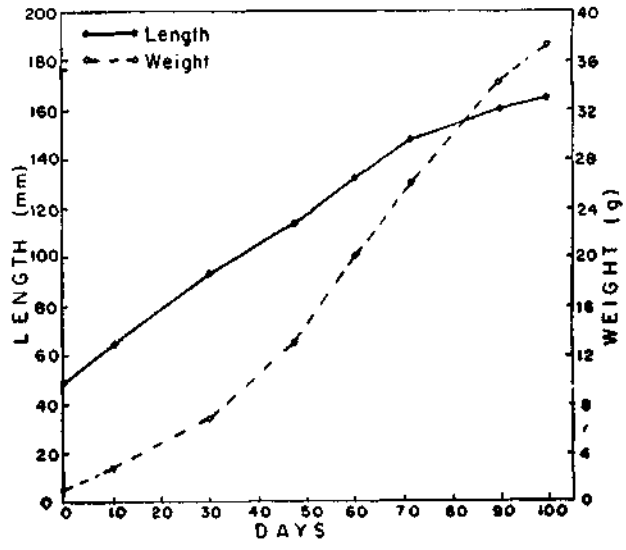


Fig. 1. Length-weight relationship of tiger prawn cultured in polyethylene film lined pond.

Water was pumped into the pond by using a 5 H.P. diesel pump. Periodical cleaning of the pond was done with a diesel pump by either pumping out the bottom water containing the debries or by siphoning out the water with a 3" flexible hose after thoroughly agitating the bottom water. A compounded feed made out of groundnut oil cake, prawn head powder and tapioca waste in a dough form was given once daily by keeping it in a tray which was kept in one of the corners of the pond near the bottom. The growth of the stock was recorded once in 15 days. Temperature, salinity, dissolved oxygen content and pH of the pond water were monitored twice weekly. The salinity ranged from 12.5 to 20.7‰ and the temperature from 28.0 to 35.5°C. The dissolved oxygen content and pH fluctuated between 3.8 and 4.6 ml/l and between 8.3 and 8.9 respectively.

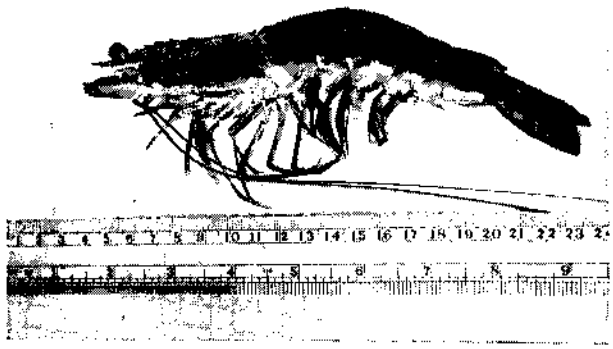


Fig. 2. Growth of *Penaeus monodon* in the pond.

Results and discussion

The growth trend of *P. monodon* in the pond is shown in Fig. 1. From the figure it is seen that the length increment was comparatively faster during the first two months and a half and slowed down considerably thereafter. The weight increment seemed to be slow during the first month as well as after the completion of the third month. However, the prawn showed an overall growth increment of 1.17 mm and 0.36 g per day thus attaining an average size of 165.6 mm and 37.3 g in 100 days Fig. 2. These results are encouraging when compared to the results obtained in Taiwan where almost at similar stocking densities (5,000–8,000/ha) a growth rate of 40 g in 90 days was achieved in ponds where *Chanos chanos* and prawns were grown together (Chen, 1976. *Fishing News (Books) Ltd., London,* 162 pp.) and in Madras (Santhome) *P. monodon* in a monoculture experiment at a stocking density of 20,000/ha and stocking size of 20.0–45.0 mm (42.3 mm average) reached only 32.26 g in 80 days of growth (Sundarajan *et al.*, 1979. (*Aquaculture:* 16 (1): 73-75).

Fig. 3. *Penaeus monodon* harvested from the polyethylene lined beach pond in Calicut.

The percentage of recovery in the present study was 83.0 Fig. 3. According to Krantz and Norris *(Proc. 6th Ann. Workshop, Maricult. Soc., Seattle, Washington, U.S.A.* pp. 27-31, 1975) survival of 60–80% can be expected under suitable rearing conditions with the absence of predators, suboptimal temperatures and salinities. Further, the present data on the growth rate and percentage of recovery suggest that the culture conditions maintained in the experimental pond at Calicut were suitable for obtaining better results.

Further, it is expected that better production rate can be achieved by increasing the stocking density to an optimum level which, however, could not be carried out due to scarcity of material during the present experiment. However, the data suggest that by increasing the stocking density to 2/m^2 as suggested by Venkatesan and Bose *(Proc. Symp. Coastal Aquaculture,* 1982, I: 146-150) and suitably altering the grow-out period, the production rate could be increased to a greater extent.

The authors wish to express their sincere gratitude to Dr. E. G. Silas, former Director, Central Marine Fisheries Research Institute, Cochin for his constant encouragement and suggestions. They are also thankful to Shri M. Kumaran, Officer-in-charge, for going through the manuscript.

Compiled and prepared by Dr. M. J. George, Dr. K. J. Mathew, Mr. G. Nandakumar & Miss Jancy Jacob
Published by Dr. M. J. George, Senior Scientist on behalf of the Director, Central Marine Fisheries Research Institute, Cochin-682 031 and printed at PAICO, Cochin-31