

# MARINE FISHERIES INFORMATION SERVICE



No. 76  
OCTOBER 1987

*Technical and Extension Series*

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

COCHIN, INDIA

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

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Abbreviation - *Mar. Fish. Infor. Serv., T & E Ser., No. 76: 1987*

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*Front cover photo:*

Green mussels growing on the dredger pantoons in Ennore Estuary, Madras. Ref: Article No. 3

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# MONSOON PRAWN FISHERY BY INDIGENOUS GEARS ALONG THE MANGALORE COAST

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## Introduction

The large scale introduction of purse seines, in the late seventies for catching the pelagic resources, has adversely affected the traditional fisheries by *rampani*, cast net, *kanthabale*, *pattabale* etc. resulting in their elimination from this coast due to their low catches and poor return. This has compelled practically all fishermen, who had been actively engaged in traditional fishery, to opt for purse seining. However, when all mechanised fishing operations remain suspended during the southwest monsoon period (June-August) along this coast, the indigenous gears are operated for catching prawns, mackerel etc. since they fetch attractive prices. The most interesting fact was that these gears generally caught large sized prawns, occasionally in large quantities, from nearshore waters. An appraisal of the prawn fishery by indigenous gears in the monsoon season during 1979-'85 is attempted in the present account.

## Fishing methods and season

Other than some subsistence fishery in the estuary, all fishing activities, along the Mangalore coast, remain suspended during the southwest monsoon period due to unfavourable weather conditions. Fishing operations are resumed on a small-scale in July or early August with the cast net operations. This is followed by the operations of gill nets like *kanthabale* and *pattabale*. Although these nets are primarily employed for catching prawns and mackerel, fishes belonging to other groups are also caught in appreciable quantities during this period. In addition, *kairampani* nets (small shore seine) are found to operate at certain centres to catch prawns and miscellaneous fishes. The introduction of *matabala* (small purse seine) in 1984 on a small scale and the subsequent addition in the following years have boosted the prawn landings during monsoon season.

The details of these indigenous gears except *matabala* are given by Prabhu *et al.* (1973) while studying the

resources of Ullal in relation to certain environmental factors. *Matabala* is a miniature version of purse seine net, measuring about 240 m in length and 10 - 12 m in width, with a mesh size of 11-18 mm, and operated from two canoes (6-6.5 m in length) fitted with outboard engines. The number of crew members vary from 16-30. Like purse seines, these units also engage a canoe for transporting a part of their catch.

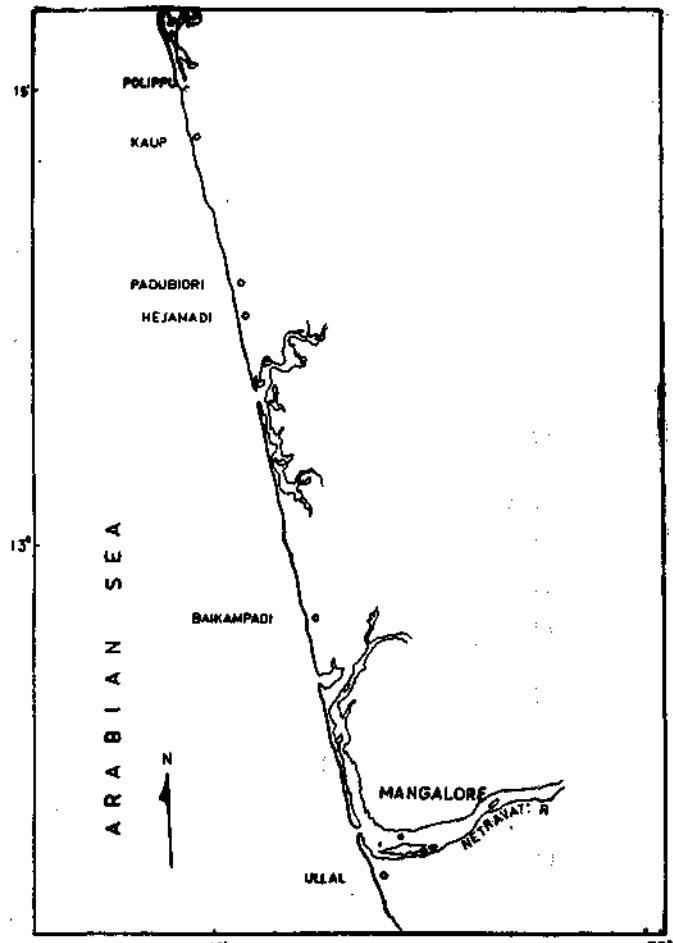


Fig. 1. The Mangalore coast showing the important fish landing centres for indigenous crafts.

These nets are operated all along the Mangalore coast at varying magnitudes during July–September when monsoon is not very active and sea conditions permitted fishermen to venture into the sea. Fishing is generally confined to nearshore waters within 15 m depth.

Although mud bank formations are a regular feature along the Alleppey–Quilon coast of Kerala, such a phenomenon has not been reported from this area. Hence, monsoon fishery is largely dependent on the weather conditions as well as the availability of shoals. Due to this, there has not been any consistency in the monsoon fishery. During the course of the present study, observations were made at Ullal, Bengre, Baikampady, Kulai, Polippu and Hejamadi where fishery was reported. Regular catch statistics were collected from Ullal and Baikampady only (Fig. 1).

#### Catch trends at Ullal and Baikampady

Prawn landings by indigenous gears generally occurred during July–September. The catch details for Ullal and Baikampady for 1979–'82 are given in Table 1.

*Ullal*: Fairly good landings of prawns were recorded in 1979 and 1980. There was no catch in 1981, 1983 and 1984. The maximum prawn landings were obtained in 1985. During 1979, the best catches were obtained in August (4,800 kg), whereas, in 1980, the catches were fairly high in July (9,105 kg). In 1982, the maximum prawn catch was recorded in September (3,748 kg), while in 1985, it was in July (61,569 kg).

Although cast net and *kanthabale* were operated at this centre, the former was found to be more productive contributing 90 to 95% of the prawn landings. *Matabala*, since its introduction in 1984 season, has dominated in the monsoon fishery contributing upto 100% of the prawn landings in 1985 at this centre.

*Baikampady*: The highest catches were recorded in 1981 when 8,780 kg of prawns were netted in a day. In 1979, prawns were caught only in September and the catch was negligible (40 kg). In the following year, prawn landings were fairly good in July and the catch amounted to 940 kg. In 1981, prawns were obtained only in September, while in 1982, landings occurred in August. During 1983 and 1984 seasons, there was

**Table 1.** Estimated prawn landings at Ullal and Baikampady by indigenous gears during 1979–'85

		ULLAL				BAIKAMPADY					
		<i>Kantha-bale</i>	Cast net	<i>Matabala</i>	Total	<i>Kantha-bale</i>	<i>Kairam-pani</i>	Cast net	<i>Pattabale</i>	<i>Matabala</i>	Total
1979	Catch (kg)	43	4,800	—	4,843	—	—	47	—	—	47
	Effort*	200	216	—		—	13	305	59	—	
	C/E**	0.21	22.22	—		—	—	0.15	—	—	
1980	Catch (kg)	948	10,426	—	11,374	—	72	1,119	—	—	1,119
	Effort	353	507	—		67	106	387	15	—	
	C/E	2.68	20.56	—		—	—	2.89	—	—	
1981	Catch (kg)	—	—	—	—	—	—	8,750	—	—	8,750
	Effort	—	—	—	—	—	—	420	—	—	
	C/E	—	—	—	—	—	—	20.8	—	—	
1982	Catch (kg)	—	1,974	—	—	951	—	9	2,053	—	3,013
	Effort	—	480	—	—	36	—	49	64	—	
	C/E	—	4.11	—	—	26.42	—	0.20	32.08	—	
1983 & 1984		No catch				No catch					
1985	Catch (kg)	—	—	61,569	61,569	—	—	—	—	1,540	1,540
	Effort	—	—	119		—	—	—	—	158	
	C/E	—	—	517.39		—	—	—	—	9.75	

\* Effort in numbers of units

\*\* C/E - catch per boat per day

no landings by these gears. In the following year, catches were obtained only in July.

Although cast nets, *pattabale* and *kanthabale* were operated, cast nets were found to be more productive contributing up to 95–100% of the annual prawn landings by the traditional gears.

### Species composition

**Ullal:** *Metapenaeus dobsoni* was the dominant species contributing 100, 99, 100 and 100% during 1979, 1980, 1982 and 1985 respectively. *Penaeus indicus* was caught only during 1980 and formed only 1% of the annual prawn landings by traditional gears.

**Baikampady:** *M. dobsoni* was the principal species contributing 80, 100, 100 and 94% of the prawn catch during 1979, 1980, 1981 and 1985 respectively. This species was not available during 1982 at this centre. *P. indicus* catch was negligible during 1979. In 1980 and 1981 also, this species was completely absent. However, in 1982, *P. indicus* catch was fairly high (3,013 kg).

In addition, penaeid prawns like *Parapenaeopsis styliifera* and *Penaeus monodon* were also caught in stray numbers.

### Size distribution

In *M. dobsoni*, the size ranging from 63 to 108 mm (modes at 88 and 98 mm) in males, and from 73 to 123 mm in females (modes at 83 and 108 mm) supported the fishery (Fig. 2).

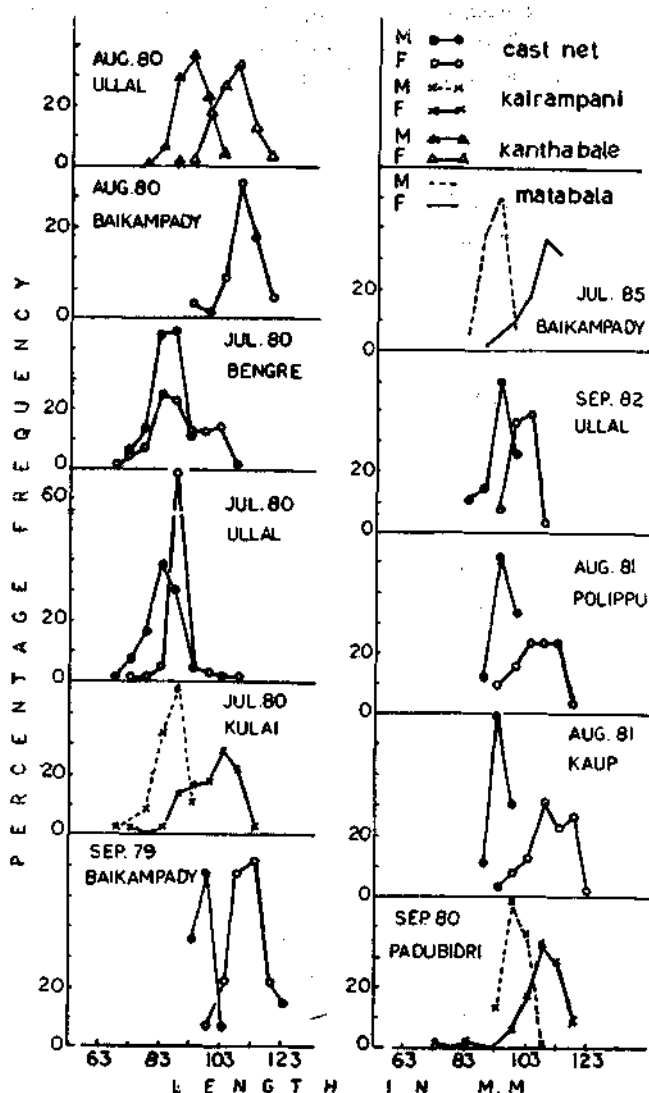


Fig. 2. Size frequency distribution in *M. dobsoni* caught in different indigenous gears at various centres.

Table 2. Sex ratio distribution in *M. dobsoni* and *P. indicus* at Ullal and Baikampady

	<i>M. dobsoni</i>				<i>P. indicus</i>			
	Baikampady		Ullal		Baikampady		Ullal	
	Male	Female	Male	Female	Male	Female	Male	Female
September, 1979	35.0	65.0 (CN)	—	—	—	—	—	—
July, 1980	52.5	47.5 (SS)	28.2	71.8 (CN)	—	—	—	—
August, 1980	—	100.0 (CN)	34.7	65.3 (KN)	—	—	—	—
September, 1980	59.3	40.7 (SS)	—	—	42.1	57.9 (KN)	—	—
August, 1981	20.4	80.0 (CN)	—	—	—	—	—	—
August, 1982	—	—	—	—	42.3	57.7 (PN)	—	—
September, 1982	—	—	50.0	50.0 (CN)	—	—	—	—
July, 1985	74.2	25.8 (MT)	38.2	61.8 (MT)	—	—	—	—

CN - Cast net; SS - Kairampani net; KN - Kanthabale; PN - Pattabale; MT - Matabala.

In *P. indicus*, the size ranged from 133 to 163 mm (modes at 143 and 158 mm) in males, and from 138 to 178 mm (modes at 153 and 168 mm) in females (Fig. 3).

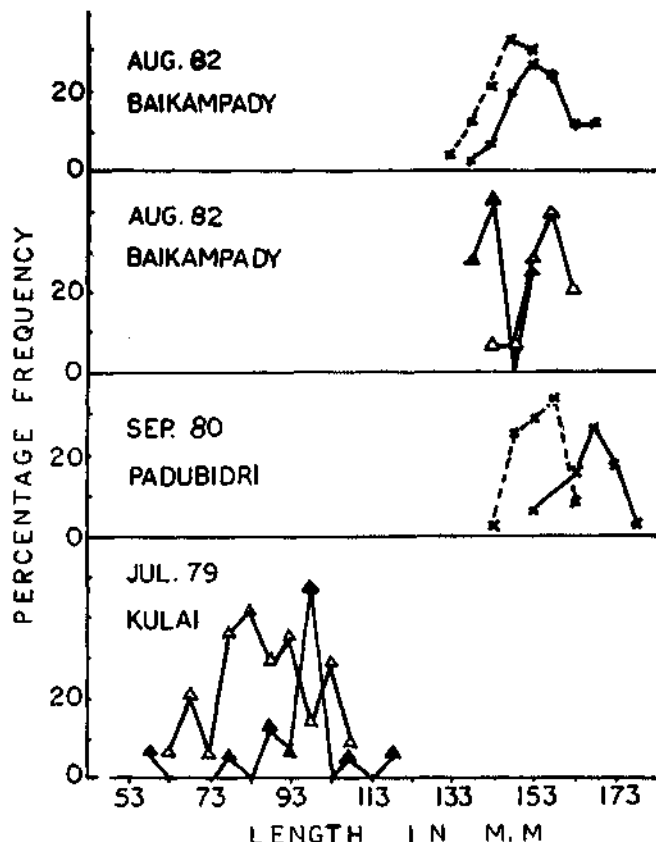


Fig. 3. Size frequency distribution in *P. indicus* caught in different indigenous gears at various centres.

However, in July 1979, smaller sizes ranging from 58 to 118 mm in males and from 63 to 108 mm in females were found to occur in the fishery at Kulai.

It is striking to note that the monsoon fishery was supported mainly by large sized prawns of *M. dobsoni* and *P. indicus*. There was no marked variation in the sizes of these prawns obtained in different gears at a particular centre during the same period. However, marginal variations were noticed in the size of *M. dobsoni*

in the same gear at different centres during the same period.

#### Sex ratio and maturity

Overall sex ratio indicated that females out-numbered males in *M. dobsoni* and *P. indicus*. In *M. dobsoni*, preponderance of females was very high in cast nets, whereas, males were more in *kairampani* nets (Table 2). In *matabala*, females were more at Ullal, but males dominated in the catch at Baikampady.

It is also seen that most of the females of *M. dobsoni* were in the spent condition.

#### General Remarks

The monsoon fishery by traditional gears is particularly significant since it gives certain amount of livelihood to fishermen at a time when all mechanised fishing activities remain suspended all along this coast. It is also interesting to note that the fishery was mostly supported by large sized prawns of *M. dobsoni* and *P. indicus*. Since it is off season, and prawns, generally, are of large size, they fetch exorbitant prices. The introduction of *matabala* in 1984 and the subsequent addition during the following seasons, have boosted the prawn landings to a large extent, along this coast.

During June-August, there is a gap in the biological data collected from the mechanised trawlers due to the suspension of mechanised fishing during this period. The indigenous fishery during the monsoon season is immensely helpful in providing some valuable data on the size composition, sex ratio, maturity etc. of *M. dobsoni* and *P. indicus* during this period, thereby enriching our knowledge on the resource characteristics of these prawns.

The author is grateful to Shri M. S. Muthu, Scientist S-3 and Head, Crustacean Fisheries Division, Central Marine Fisheries Research Institute, Cochin for going through the manuscript and suggesting improvements.



#### ERRATUM

The species of cat fish *Arius thalasinus* given in article 6 of MFIS 73, page 14, July, 1987 may be read as *Tachysurus dussumieri*.

— Editors



## HEAVY LANDINGS OF *STOLEPHORUS DEVISI* BY SHORE SEINES ALONG MADRAS COAST\*

Unusual heavy landing of *Stolephorus devisi* was observed in shore-seines operated during March, 1986 along the landing centres from Kottivakkamkuppam to Oyyalikuppam south of Mahabalipuram, southern-side of Madras. Though the fishery of these landing centres used to be contributed by substantial quantities of *Stolephorus* sp. this year it was unusual.

Occurrence of *Stolephorus* sp. in the shore-seine catches at Kovalam landing centre was observed from 21st March, 1986 onwards. To start with, it was about 350 kg per shore-seine but gradually increased on the

subsequent days to reach a maximum of 1,750 kg per unit per haul on 24th March, 1986 and thereafter the fishery declined slowly to 113.3 kg per unit on 27th March, 1986. The same trend of fishery was observed at Kottivakkamkuppam, Injambakkamkuppam, Panayurkuppam, Nainarkuppam, Pudukuppam, Nemelikuppam, Kokrimedukuppam and Oyyalikuppam landing centres also (Table 1). Anchovy fishery started at Kottivakkamkuppam on 18th March, 1986 itself, three days prior to the occurrence at Kovalam landing centre.

**Table 1.** Quantity of *Stolephorus devisi* landed by shore-seine in different landing centres

Landing centre	Date	No. of units operated	Estimated catch (kg)	CPUE (kg)
Kovalamkuppam	21-3-1986	3	1,050	350.00
	22-3-1986	5	2,810	562.00
	23-3-1986	6	6,210	1,035.00
	24-3-1986	6	10,500	1,750.00
	25-3-1986	5	5,200	1,040.00
	26-3-1986	4	2,430	675.00
	27-3-1986	4	780	195.00
Kottivakkamkuppam	18-3-1986	3	340	113.33
Injambakkamkuppam	25-3-1986	2	1,800	900.00
Panayurkuppam	22-3-1986	4	247	61.75
	23-3-1986	4	1,400	350.00
	24-3-1986	4	2,995	748.74
	25-3-1986	4	38	9.50
Nainarkuppam	21-3-1986	4	5,700	1,900.00
Pudukuppam	26-3-1986	2	6,000	3,000.00
Nemmelikuppam	24-3-1986	4	5,000	1,250.00
	25-3-1986	4	6,000	1,500.00
Kokrimedukuppam	21-3-1986	1	300	300.00
	22-3-1986	3	1,160	386.67
Oyyalikuppam	25-3-1986	1	55	55.00

\*Prepared by R. Thangavelu, M. Bose and P. Poovannan, Madras Research Centre of CMFRI, Madras.



The incidence of high catches with wider fluctuations was recorded for a period of 10 days between 18th and 27th March, 1986 from Kottivakkamkuppam to Oyyalikuppam landing centres. No anchovy fishery was observed after this period. Apart from the anchovies, silver bellies, mackerel and lesser sardines were also found in the catches in negligible numbers.

Though there was a demand for this fish on the first two days in the local market, it declined during later days. At Nainarkuppam 5,700 kg of anchovies were sold for Rs. 15,000/- on 21st March, 1986, while at Panayurkuppam 1,500 kg were sold for Rs. 4,000/- on 24th March, 1986. Since there was no demand at Kovalam market, all the anchovy catches were sun-dried on the sandy beach and later transported by lorries to



Fig. 1. Shore-seine catches of *Stolephorus* at Kovalam landing centre.

Madras. The dried fish was sold at the rate of Rs. 8/- per kg at the local market of Kovalam.

A random sample was collected from the shore-seine catches and analysed. The size ranged between



Fig. 2. Fisher-folk gathered around the catches.

55 and 85 mm and the modal size group was 70-74 mm which contributed to 30.95% of the catches. Males constituted 54.76% while females and indeterminates formed 42.86 and 2.38% respectively in the population. Immature and maturing gonads were observed to be common in both the sexes.

Gut content analysis showed that the food was in a semi-digested condition and also observed the presence of numerous sand grains in a majority of fishes. The food of *Stolephorus* was mainly constituted by copepods (*Paracalanus*, *Oithona* and *Euterpina* sp.). However, the other items like mysis, megalopa larva of crab, fish eggs, cypris larva of barnacle and tintinnids; with sporadic occurrence of phytoplankton such as *Coscinodiscus*, *Nitzschia*, *Rhizosolenia* and *Pleurosigma* were also observed. From the analysis of stomach contents and plankton of Kovalam Bay, it is evident that occurrence of such heavy catches during a shorter duration of 10 days along the landing centres of Madras coast was probably due to presence of its favourite food along the coastal areas.

Salinity and temperature were found to be 34‰ and 30°C respectively at Kovalam Bay. It was understood that the water current was gently moving towards north. No wave action was observed in the bay waters. The fact that the fishery started first at the northern point of Kottivakkamkuppam and then gradually shifted towards south indicates that the shoal was moving towards south against the water currents.



## OCCURRENCE OF MUSSEL SEED ON DREDGER PANTOONS IN ENNORE ESTUARY, MADRAS\*

Several species of fouling organisms settle and grow on ship hulls, pantoons, buoys, dredgers and other floating structures in the sea and in the backwaters and estuaries. At the mouth of Ennore Estuary, two dredgers are employed by the Ennore Thermal Power Station to regularly remove the sand. This is done to keep the bar-mouth open throughout the year so as to supply water to the cooling tower of the thermal power plant. The main dredger and its machine parts are supported by 2 rectangular side pantoons on either side, each of dimensions of 13 x 2 x 1.8 m (Fig. 1). There are also paired cylindrical pantoons located behind the dredger, each pair weighing 1.5 tonnes. The dredged sand alongwith a jet of water is forced through steel pipe line of 1/2 metre diameter, followed by vinyl pipe line. The latter rests on the pantoons arranged adjacent to one another at a distance of 1 to 2 metres. The pipe line system is of about 400 metres long. Each pantoon is a steel drum with a length of 3.5 metres and a diameter of 1.25 metres. The pantoon is partly immersed in the water and offers suitable surface for the settlement of fouling organisms.

The major fouling organisms observed on the pantoons were mussels, oysters and barnacles, of which the green mussel *Perna viridis* is the most dominant (Fig. 2). The pantoons are usually hauled up from the water during November every year for removing the fouling organisms and are re-floated in the water around February. Between February and November, heavy settlement of fouling organisms was noticed.

The extent of fouling on the pantoons can be understood from the abundance of the green mussels (Fig. 3). The total quantity of mussels on the pantoons was estimated by taking subsamples *i.e.*, the number and weight of mussels in 1/4 m<sup>2</sup>, sampled randomly and raising them for the total area of settlement. In November of 1985 and 1986, the mussels removed from the pantoons amounted to 8.5 million (25 t) and 8.6 million numbers (27 t) respectively. The former came from 56 cylindrical pantoons and four rectangular pantoons

and the latter from 48 pantoons. The size range of mussel recorded during 1985 was from 5 to 84 mm with modal groups of 15-19, 55-59 and 60-64 mm. In 1986, the size range was 5 to 69 mm, the modal groups being 10-14 and 55-59 mm. On both the occasions, young spat settled recently prior to removal of pantoons from water, constituted the bulk of the population to the extent of 64.4% in 1985 and 48% in 1986. Size range of this groups was from 5 to 29 mm which was ideally suitable for transplantation in mussel culture experiments. Details regarding the area of mussel spat settled, density, size range and modal size group are given in Table 1.

It is significant to note that millions of mussel spat are removed from the pantoons every year (Fig. 4) and thrown on the sandy beach. Shortage of mussel seed has been considered to be the major constraint in the intensification of mussel culture on industrial scale (Silas, E. G., *Bull. Cent. Mar. Fish. Res. Inst.*, 29: 51-56, 1980). The large quantities of mussel spat which are available can very well be used for mussel culture in the backwaters or lagoons.

The above observations reveal the high magnitude of mussel seed settlement which occurs in areas like Ennore, and these can be effectively collected by providing suitable spat collectors.

**Table 1.** Data on green mussel at the time of removal from the pantoons

Details	1985	1986
1. Number of pantoons	56 cylindrical and 4 rectangular	48 cylindrical and 4 rectangular
2. Total area with mussel (m <sup>2</sup> )	703	638
3. Estimated mussel (numbers) (weight in tonnes)	8,558,322 24,733	8,615,638 26,961
4. Number of mussel/m <sup>2</sup>	12,174	13,501
5. Weight of mussel/m <sup>2</sup> (kg)	35,183	42,258
6. Size range (mm)	5-84	5-69
7. Modal size groups (mm)	15-19 55-59 60-64	10-14 55-59
8. Mean size (mm)	32.0	33.0
9. Mean weight (g)	2.89	3.13

\*Prepared by P. V. Sreenivasan, R. Thangavelu, R. Sarvesan and P. Poovannan, Madras Research Centre of CMFRI, Madras - 600 105.

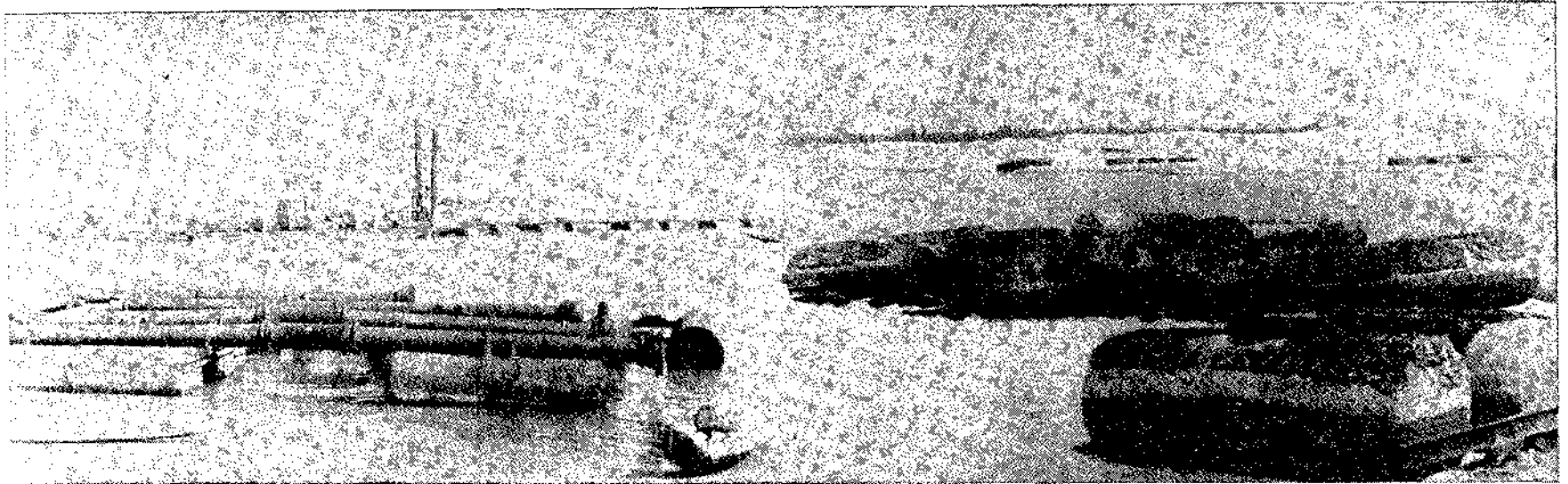


Fig. 1. The dredger and pontoons floated in Ennore Estuary.

Fig. 2. Dense growth of green mussels, barnacles and oysters on pontoons.



Fig. 3. A close-up view of the green mussels, oysters and barnacles on a pontoon.

Fig. 4. The encrusted organisms are being removed from the pontoons.

# CULTURE OF MILKFISH IN POLYETHYLENE FILM-LINED PONDS\*

## Introduction

The milkfish *Chanos chanos* is widely distributed in the subtropical and tropical regions of the world. It is euryhaline, hardy and fast-growing. Large scale culture of milkfish is undertaken both in brackish and seawater farms of Philippines, Indonesia and Taiwan.

In India interest in the commercial farming of milkfish has grown apace in recent years following many successful experiments conducted in earthen ponds and coastal pens. Considering the importance of converting the barren sandy beaches for aquaculture purposes an attempt was made at Calicut to culture the milkfish in ponds dug out in the sandy beach and lined with polyethylene film. Two sets of experiments were conducted in those ponds during the period June, 1983 to January, 1984. The culture experiments became highly successful and the harvest was shown to the fish farmers and general public by way of a harvest mela (Figs. 1-6).

## Preparation of ponds

The ponds were prepared as described by Lal Mohan and Nandakumaran (*Mar. Fish. Infor. Serv., T & E Ser., 26: 6-8, 1980*), during April-May before the onset of southwest monsoon. This period, because of its dry nature, facilitates quick drying of the ponds after dewatering and this in turn makes it easier for cleaning and repairing or changing the lining. Sea water was pumped into the ponds with a 5 H. P. diesel pump by tying the foot valve to a float anchored in the sea at a distance of about 90 m from the shore. Fresh water, when needed was pumped from a well by a 5 H. P. electrical pump. About 1.5 m water depth was maintained in the ponds throughout the period of experiment.

## Seed

Seed were collected from the tidal pools between Korapuzha and Kadalundi in the Malabar area, using an ordinary mosquito net. A total of 4,127 seed, ranging in size from 15 to 62 mm total length, were collected during July, '83 alone. Soon after the collection the seed were brought to the fish farm in plastic bins and acclimatised by keeping them in fibre glass tanks. After acclimatisation the healthy ones were counted and stocked in the ponds (A-D) as per the details given in Table 1. As the number of ponds was not sufficient to stock all the seed collected, some quantity was stored in a nursery pond for about three months during which two additional ponds were made ready. The stored seed, with stunted growth, were then released into these ponds (E and F).

## Feed

The stocked fish were fed with compounded feed made out of groundnut oil cake (30%), powdered tapioca

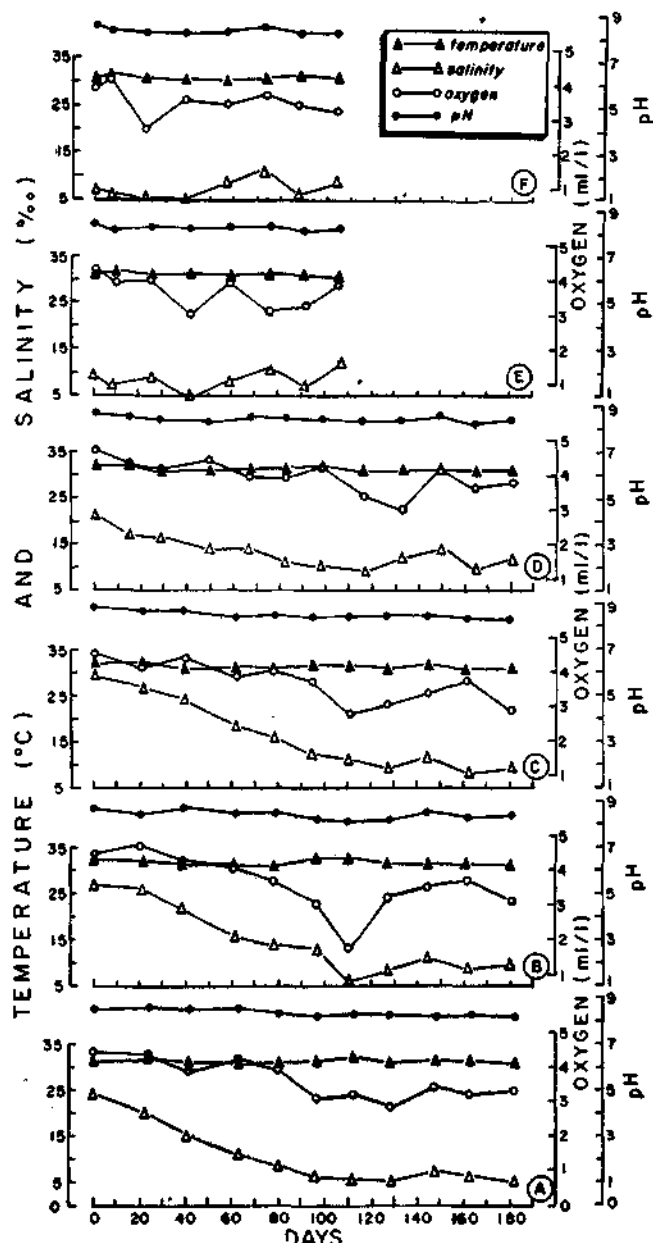


Fig. 1. Fluctuations in the values of environmental parameters recorded in the ponds.

\*Prepared by S. Lazarus and K. Nandakumaran, Calicut Research Centre of CMFRI, Calicut.

waste (30%), powdered prawn head (25%) and rice bran (15%). The feed ingredients were mixed up thoroughly, cooked well and allowed to cool before being served in a dough form in trays kept at the corners of the pond. Depending upon the size of the fish and feed requirement the quantity of feed to be supplied to the ponds was regulated. It varied from five times the body weight in the beginning of the experiment to 1/50 the body weight towards the end of the experiment in some of the ponds.

#### Environmental conditions of the culture ponds

Organic waste and other detritus found on the bottom of the ponds were removed periodically by siphoning out the bottom water with the help of 80mm flexible hose. The water loss by this and also due to evaporation was compensated by pumping water into the ponds. Estimation of dissolved oxygen, salinity and pH was made twice in a week and temperature noted twice daily at 1000 and 1400 hrs. Temperature fluctuated within a narrow range of 31.0–32.5°C in the ponds throughout the experiment. Maximum salinity values of 24.2, 27.3 and 29.2‰ were obtained in ponds A, B and C respectively at the beginning of the experiment and a minimum of 5.0, 9.1 and 6.1‰ respectively towards the end of the experiment. In the other three ponds, however, this difference was not significant. Dissolved oxygen values ranged between 2.6 and 4.7 ml/l in all except pond B in which it touched a lower value of 1.8 ml/l around 110th day of stocking. The pH values ranged between 8.1 and 8.9. The fluctuations in these values in the ponds are shown in Fig. 1.

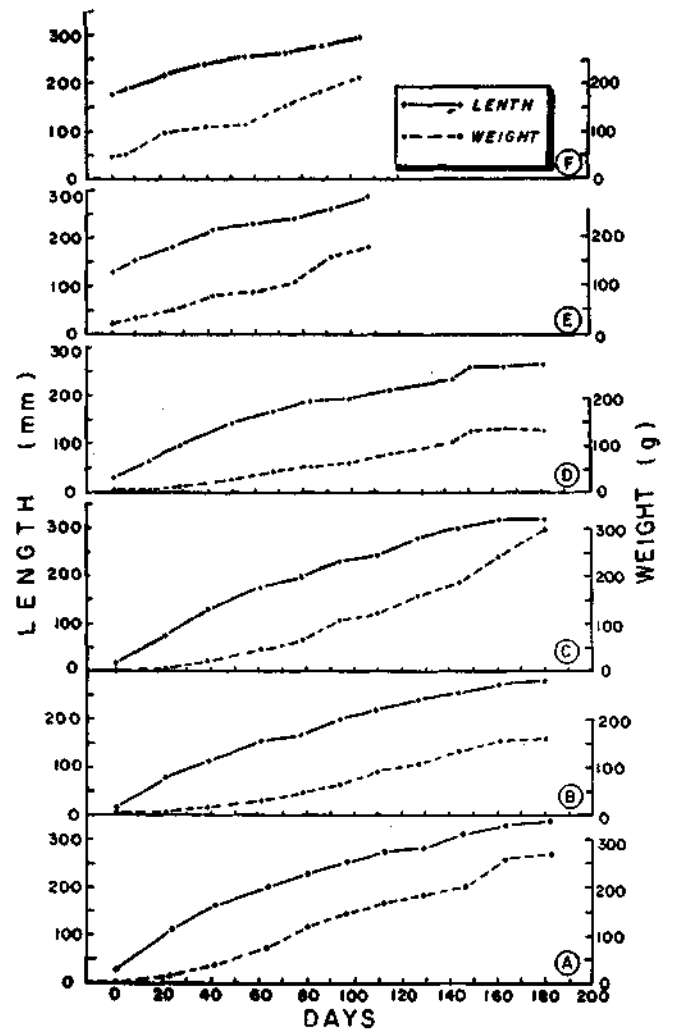


Fig. 2. Growth trends of fish in the different ponds.

Table 1. Ponds with stocking and harvest details of *Chanos chanos* stocked in 1983-'84

Ponds	A	B	C	D	E	F
Area (m <sup>2</sup> )	200	555	1000	220	300	135
Depth of water (m)	1.5	1.5	1.5	1.5	1.5	1.5
Number stocked	200	555	1000	440	300	34
Stocking density (No/m <sup>2</sup> )	1.0	1.0	1.0	2.0	1.0	0.25
Mean length at stocking (mm)	53.6	16.3	16.3	27.8	130.5	175.3
Mean weight at stocking (g)	1.30	0.045	0.045	0.20	22.5	43.0
Duration of the experiment (days)	182	180	180	181	107	104
Date of stocking	2-7-'83	4-7-'83	4-7-'83	15-7-'83	27-9-'83	30-9-'83
Date of harvest	31-12-'83	31-12-'83	31-12-'83	12-1-'84	12-1-'84	12-1-'84
Mean length at harvest (mm)	332.7	280.3	321.6	259.6	289.4	297.4
Mean weight at harvest (g)	271.4	156.7	256.7	130.4	182.2	209.8
No. of fish harvested	93	493	682	371	297	32
Survival (%)	46.5	88.8	68.2	84.3	99.0	94.1
Quantity harvested (kg)	25.2	77.3	175.1	48.4	54.11	6.8
Production rate (kg/ha)	1,260	1,392	1,751	1,882	1,367	503
Extrapolated level of production (kg/ha/year)	2,527	2,823	3,550	3,795	4,663	1,765

### Growth of fish in the ponds

Growth measurements were recorded once in a fortnight by taking a random sample with a cast net. Usually 20 to 30 fish were measured in live condition and were released back into the pond after measurement. Growth trends of fish in different ponds are indicated in Fig. 2. The growth of fish was very good in pond C, followed by ponds B and D. In ponds E and F the growth was poor when compared to the above three ponds. In pond A the growth rate was moderate. In ponds C and B the fishes with a mean size of 16.3 mm were stocked; in pond D it was 27.8 mm. Pond A had a slightly higher stocking size of 53.6 mm and pond E and F got respectively 130.5 and 175.3 mm. The instantaneous growth rate observed for the different ponds are: 1.8219 for pond C, 1.6438 for B, 1.4116 for D, 1.2155 for A, 0.5433 for E and 0.3727 for F. Thus, a decrease in the instantaneous growth of fish was noticed as stocking size increased.

### Survival of fish in the ponds

A maximum survival of 99.0% was observed after 107 days in pond E, which had 1.0/m<sup>2</sup> stocking density and 130.5 mm stocking size. This was followed by pond F having 94.1% survival after 104 days of stocking at 0.25/m<sup>2</sup> stocking density and 175.3 mm stocking size. Pond D with a higher stocking density of 2.0/m<sup>2</sup> and stocking size of 27.8 mm gave 84.3% survival rate after 181 days of stocking. In pond B and C, the survival rates were found at 88.8 and 68.2% respectively. These two ponds had same stocking density (1.0/m<sup>2</sup>), stocking size (16.3 mm) and culture period (180 days). Pond A gave a survival of only 46.5% even though the stocking density was 1/m<sup>2</sup> and stocking size 53.6 mm (Table 1).

### Production rate of fish from the different ponds

The production was good in all the ponds except pond F in which it was 503 kg/ha/104 days. Pond D with 2/m<sup>2</sup> stocking density gave the highest production of 1,882 kg/ha/181 days, which is followed by pond C with 1/m<sup>2</sup> stocking density (1,751 kg/ha/180 days). In ponds B, E and A the production rates were estimated as 1,392/kg/ha/180 days, 1,367 kg/ha/107 days and 1,260/kg/ha/182 days respectively. These ponds had the same stocking density of 1/m<sup>2</sup> even though they differed in the stocking size and period of experiment. The mean size at harvest was also remarkable in ponds A (271.4 g), C (256.7 g) and F (209.8 g). In the other three ponds the mean weight at harvest ranged between 130.4 and 182.2 g (Table 1).

### Economics of the culture operation

An attempt was made to study the economics of aquaculture operations in polyethylene film-lined ponds in order to estimate the input-output relationships of production (Table 2). It is seen that the greater part (about 80%) has been spent on feed and labour under operational cost. Even with the operational cost of Rs. 6,000/- a net return of Rs. 975/- has been obtained from 0.24 ha area within a period of 6 months. From this it appears that the need is to reduce the operational costs for the venture to be economically viable.

The present results appear to be better than those obtained elsewhere. With all its merits, however, milkfish culture in polyethylene film-lined ponds seems

**Table 2.** Economics of Chanos culture experiments conducted at Calicut during the year 1983-'84

(For six ponds (0.24 ha) for six months)

<b>1. Initial investment:</b>		<b>Rs.</b>
Pond construction		1,446
Pump sets		10,000
Hose		2,955
Sheet and lining		8,746
	<b>Total</b>	<b>23,147</b>
<b>2. Operational cost:</b>		
Feed		3,379
Seed		253
Diesel and oil		786
Kerosine		190
Labour		1,383
	<b>Total</b>	<b>5,991</b>
<b>3. Depreciation:</b>		
Pump sets		603
Hose		369
Sheet and lining		1,093
	<b>Total</b>	<b>2,065</b>
<b>4. Total cost:</b>		
Operational cost		5,991
Depreciation cost		2,065
Interest for initial investment (@ 10%)		1,158
	<b>Total</b>	<b>9,214</b>
<b>5. Returns:</b>		<b>387 kg</b>
<b>6. Value:</b>		<b>Rs. 6,966 (@ Rs. 18.00 per kg)</b>

Net returns without considering depreciation and interest for the initial investment for an area of 0.24 ha for 6 months: Rs. 975.00.

to be a labour-intensive and expensive operation. Although high production and survival rates have been obtained, the high operational cost has made the returns inadequate. Cost of labour accounts for about 23% of total operational expenses and cost of artificial feed accounts for about 56% of total expenditure. In order to achieve some reduction in these areas, a few suggestions are made here.

A major part of the labour was spent on pumping sea water and this operation was disrupted often due to the roughness of the sea. This can be avoided by selecting the farm site in places where the sea is always calm. Expenditure towards artificial feeding can be avoided by promoting the growth of natural feed in the ponds by way of fertilisation. There are reports which clearly indicate that the milkfish can grow better in ponds with natural feed than with artificial feed.

#### Remarks

While planning milkfish culture in polyethylene film-lined ponds the following aspects have to be borne in mind. (1) Seed collected from the wild should be well acclimatised to the pond condition before stocking

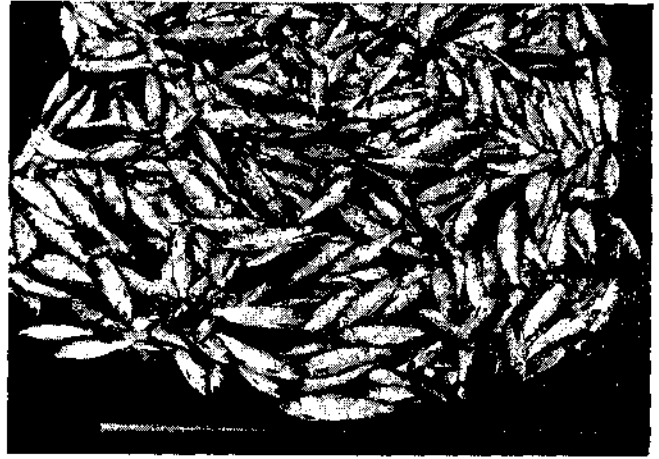


Fig. 3. A portion of the harvested milkfish.

in culture ponds so as to get maximum survival rate. (2) As the stocking size increases, the growth rate of fish decreases. So in order to get maximum growth and production it becomes necessary to stock the *chanos* at a smaller size, preferably when it is 15 to 25 mm size. (3) In the experiments a stocking density of  $1/m^2$  has given best result of growth, survival rate and production. (4) A harvesting period between 150 and 180 days after stocking seems to give the best returns.



## FORMATION OF SAND BAR AT MADRAS FISHERIES HARBOUR\*

Madras Fisheries Harbour was established in 1983 at a cost of Rs. 12 crores and 60 lakhs. It is enclosed by breakwaters on either side with a ground area of 24 hectares and water area of 48 hectares. It has a long jetty of 495 m length and a water depth of 6 m during the low tide. About 50 small trawlers can berth at this jetty. On an average about 150 trawlers go out for fishing from this fishing harbour daily. Regular dredging is done to keep the bar mouth always open.

In the beginning of July, 1986 sand started piling up in front of the outlet and by the end of first week, a sand bar of 2700 m<sup>2</sup> was formed (Fig. 1) leaving only a narrow channel through which only one vessel could pass at a time (Figs. 2-4). The number of trawler

units operated decreased to less than 100 during the period and consequently landing of fish also showed a corresponding decrease.

A meeting was organised by the fishermen on 23-7-'86 and a resolution was passed urging the authorities to take immediate steps to clear the sand. The Port Trust started dredging operations from 26-7-'86. By 15-8-'86 the sand was completely removed and normal fishing operations were resumed.

The exact cause for the formation of sand bar is not known. It might have formed due to strong current or drift. During the same period in a fishing village at Kovalam about 40 kilometres south of Madras there was heavy erosion of the coast and many coconut trees which were there for the past 30 or 40 years had fallen. Another unusual phenomenon during the same period was the heavy landing of mackerel in Madras.

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\*Prepared by D. B. James, P. Devadoss, S. Chandrasekar, Madras Research Centre of CMFRI, Madras.



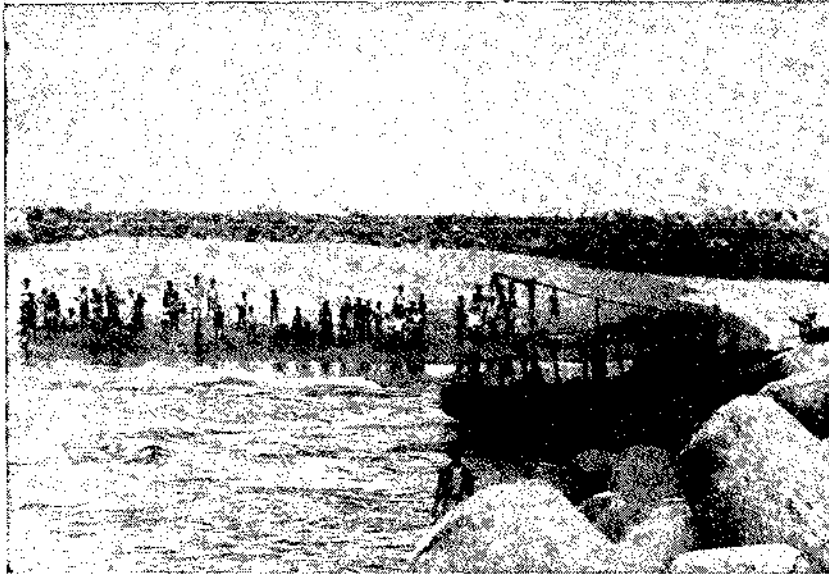


Fig. 1. The sand bar formed at Madras Fisheries Harbour.



Fig. 2. Another view of sand bar with a catamaran being dragged through the channel.



Fig. 3. A catamaran with a sail passing through the narrow channel.



Fig. 4. A fishing trawler passing through the channel.

## PRICE STRUCTURE OF THE COMMERCIALY IMPORTANT SPECIES OF PRAWNS AT MANGALORE\*

### Introduction

The mechanised trawling has received considerable importance in the last decade due to the increasing demand for prawns by the export industry. Even though prawns contribute less than 13.0% of the annual average trawl catch, they realise upto 75.0% of the return in value. Due to this, trawl fishery has been largely dependant on the availability of prawns. In other words, the maximum trawling activity could be observed when peak catches of prawns are available. Though data on catch, effort and biological parameters are being collected on a regular basis, no such data are available on the price structure of prawns of this area. The urgent need to monitor the price structure of commercially important prawns on a regular basis, has been felt for quite some time, since such information is highly essential for the better evaluation and judicious exploitation of this valuable resource. An account on the price structure of the commercially important species of prawns of Mangalore area during 1980-'86 is given in this article.

### Commercial species of prawns and their mode of auction

The trawl fishery is largely supported by smaller species like *Metapenaeus dobsoni* and *Parapenaeopsis stylifera*. In addition, larger varieties like *Metapenaeus monoceros*, *M. affinis*, *Penaeus indicus* and *P. monodon* occur in fairly good quantities during certain months of the year.

In the case of boats operating during day, generally the prawn catch is sorted out species-wise and kept in separate baskets before they return to the shore. But the boats operating during night bring their catches in iced condition. As soon as the boat is landed, the prawn catch is taken out and auctioned species-wise by The South Kanara District Co-operative Fish Marketing Federation, Mangalore, to fix the rate per kg, provided the unit is financed by it. If the catch is poor, it is auctioned as a lot. The rate fixed for a particular species at an auction is applicable to the concerned catch only. Now-a-days a good number of boats are financed by private parties who in turn take the entire prawn

**Table 1.** The price structure (Rs. per kg) during a six year period along with the months of highest and lowest rates for each species of prawns at Mangalore

Year		<i>M. dobsoni</i>	<i>P. stylifera</i>	<i>M. monoceros</i>	<i>M. affinis</i>	<i>P. indicus</i>	<i>P. monodon</i>
1980-'81	Max.	14.40	10.20	26.40	—	40.00	
	Min.	10.90	5.50	23.00	23.00	17.00	S
1981-'82	Max.	16.50	18.00	30.75	—	71.00	58.00
	Min.	13.00	7.70	26.00	—	32.50	42.50
1982-'83	Max.	20.00	12.90	39.00	38.00	76.00	85.00
	Min.	11.50	5.00	33.20	—	62.00	€8.00
1983-'84	Max.	19.00	14.00	49.00	—	65.00	71.70
	Min.	10.00	9.40	36.00	—	21.00	61.00
1984-'85	Max.	20.00	11.70	40.00	—	65.00	74.00
	Min.	15.50	8.10	21.00	—	18.00	54.00
1985-'86	Max.	21.60	17.00	59.00	—	89.30	87.50
	Min.	19.10	15.30	38.00	—	65.00	81.85

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

catch at a rate slightly lower than the rate fixed by the Federation.

Since there is considerable demand, the price of prawns shows an upward trend season after season. Generally the price for different category of prawns is regulated by the export industry depending on the demand in the foreign market. It is seen that the auctioning rates are always lower than the prices offered by the industry. Slight fluctuations noticed in the rates of a particular species may be attributed to the relative sizes and freshness of the lot auctioned.

#### **Price structure for different species of prawns**

The auctioning rates vary from species to species. Even within the species, marginal variations have been observed in the auctioning rates of the catches landed by different boats on the same day. The price structure during a six year period along with the months of

highest and lowest rates for each species of prawns at Mangalore is given in Table 1.

#### **General remarks**

It is well known that there is correlation among demand, supply and cost of any commercial product. In the case of prawns, on the otherhand, since the supply is always short of demand, the fluctuation in catch has little influence on the price. Moreover, prawns, being an export commodity, prices are always high. Generally exporters decide the maximum price of each species during a particular period. Due to this, any fall or increase in foreign demand will be directly reflected in the local price.

The author is thankful to Shri M. S. Muthu, Scientist S-3 and Head, Crustacean Fisheries Division, Central Marine Fisheries Research Institute, Cochin for kindly going through the manuscript and suggesting improvements.



## UNUSUALLY HEAVY LANDING OF KING SEER FISH AT NEW FERRY WARF, BOMBAY\*

Unusually large quantity of King seer fish *Scomberomorus commerson* (Lacepede) was landed at New Ferry Wharf fishing jetty at Bombay. The landing of King seer fish, locally known as 'Surmai', started in late

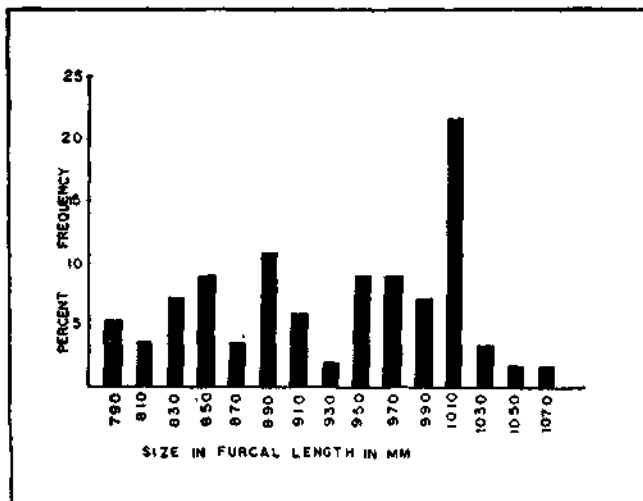


Fig. 1. Size distribution of *S. commerson*.

\*Prepared by V. D. Deshmukh and M. Shriram, Bombay Research Centre of CMFRI, Bombay.

September and lasted till early November for about a month. In October, 1986 alone, the landing of this species was estimated to be 2,112.4 tonnes, constituting 26.6% of the total fish catch for the month. The quantity landed during this short period was far greater than the annual average landing of 526.4 tonnes for the past



Fig. 2. Part of the heavy catch of King seer fish landed at New Ferry Wharf, Bombay.

three years, which also included the landing of *S. guttatus*, usually a dominant species.

The catch was landed by the trawlers operating at 50–60 m depth off Bassein, an area 60 km north of Bombay. The fishes were caught by means of hooks of size 10–15 cm, baited with pieces of *Saurida tumbil* and *Nemipterus japonicus*. About 3–4 hooks were operated from each vessel. Each hook yielded 40–50 King seer fishes per day during the fishing period. On an average, 612 kg of King seer fish were landed by each trawler, but on certain days their catch exceeded 2.5 tonnes per boat trip.

The size of the fish varied from 790 to 1070 mm in furcal length with a dominant mode at 1010 mm

(Fig. 1). The weight of fish ranged from 3.1 to 9.7 kg. Examination of few degutted specimens revealed that the ovaries of females were in the spent stage. Their guts were full and showed presence of *Saurida tumbil*, *Nemipterus japonicus*, *Apogon* sp. etc. The presence of spent ovaries and full stomachs and their falling impulsively to the bait may suggest that this shoal was returning after spawning and had voracious feeding behaviour.

Due to the unusually large catch the price of King seer fish, which is otherwise quite high (Rs.15–20 per kg) fell to mere Rs. 4–6 per kg. However, this unusual catch benefitted the fishermen by an additional income of about Rs. 3,000 per trip. Most of the catch was bought by the processors for filleting and whole freezing.



## THE INDUCED MATURATION AND LARVAL REARING OF THE KING PRAWN *PENAEUS LATISULCATUS* KISHINOUE UNDER CONTROLLED CONDITIONS\*

### Introduction

The King prawn *Penaeus latisulcatus* Kishinouye, one of the large-sized penaeid prawns, attains a maximum size of 203 mm in total length. Stray occurrence of its juveniles in the estuaries and backwaters and adults in the inshore seas has been reported from the Indian coasts. However, it supports a fishery of considerable magnitude in Thailand and Australian waters. The eggs and larvae of the species have been successfully reared under controlled conditions in Japan (Shokita, S., *Biol. Mag. Okinawa*, 6: 34-36, 1970) while a semi-commercial hatchery for seed production has been set up in Australia (Pownall, P.C., *Aust. Fish.*, 32 (12): 2-4, 1973 and 33 (5): 11-14, 1974).

Based on the collection of early juveniles of King prawns from the bar mouth area of Kovalam backwater (Lat. 12°46' N; Long. 80°18' E) during May-June 1986, culture of the species was taken up at the Mariculture farm of the Institute, Muttukadu, 36 km south of Madras.

After rearing for two and a half months, a few grown-up specimens were transported to the field laboratory at Kovalam, where the female specimens were subjected to eye ablation treatment. The results of induced maturation, subsequent spawning and larval rearing of the King prawn are presented here.

\*Prepared by: M. Kathirvel, V. Selvaraj, S. Palanichamy and A. Ramakrishnan, Madras Research Centre of CMFRI, Madras.

### Broodstock

On the night of 2nd August, 1986, 8 specimens (three impregnated females and five matured males) of the King prawn were collected from the culture pond at Muttukad and transported to Kovalam laboratory and stocked in a one-tonne rectangular fibreglass tank having a layer of (5 cm) fine sand spread over three-fourth of the floor, to suit the burrowing habit of the species. The size of the specimens is given below:

Sl. No.	Total length (mm)	Carapace length (mm)	Total weight (g)	Sex
1	114	28	11.37	Female
2	112	27	11.10	„
3	108	26	10.66	„
4	111	24	10.63	Male
5	105	23	8.73	„
6	118	27	13.15	„
7	112	24	10.79	„
8	99	22	8.27	„

After acclimatising in the broodstock tank for two days, the right eye of the females was removed by using an electrocautery apparatus on 5-8-1986. The broodstock tank was covered with a black plastic sheet throughout the course of the experiment to prevent the penetration of light. Every day, prawns were fed once, at a rate of 20% of their body weight, with fresh backwater

clam (*Meretrix casta*) meat at 1730 hrs. The unutilised feed was removed the next day morning. Also, the sediments from the bottom of the tank were siphoned out daily. The little amount of water drawn out along with the sediments was replaced by fresh filtered seawater. Other than this no exchange of water was done. To maintain the pH in the range of 8.0 to 8.2 sodium carbonate was added at a rate of 15 g/m<sup>3</sup> per day for 3 days continuously and thereafter at an interval of 2 days. The salinity of the seawater used in the broodstock tank varied from 33.00 - 34.12‰. The temperature (at 1000 and 1500 hrs) and pH values recorded daily in the broodstock tank during 5-8-1986 to 3-9-1986 are shown in Fig. 7.

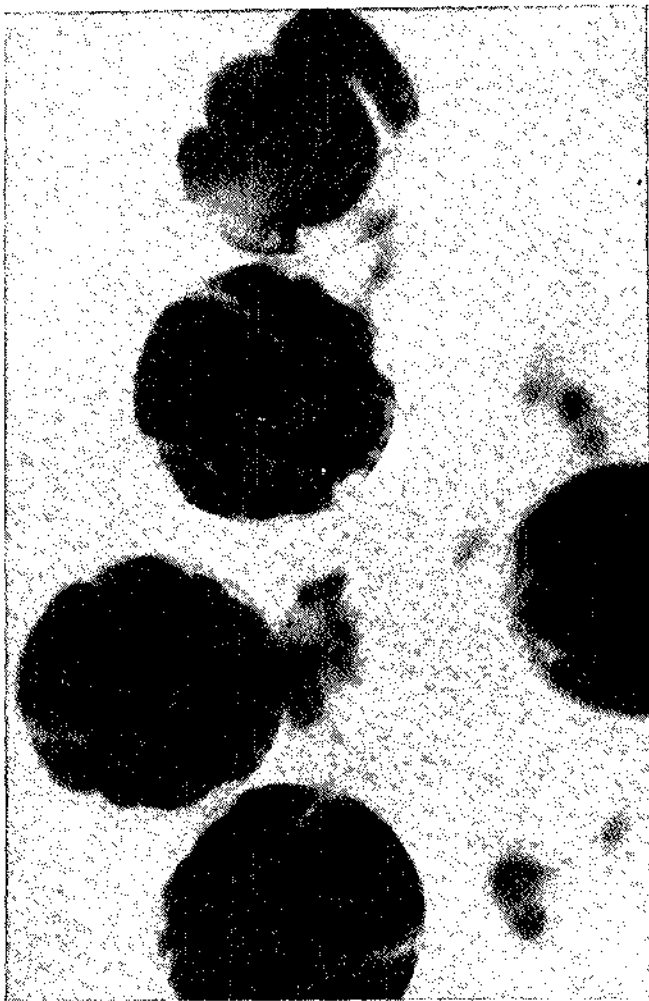


Fig. 1. Eggs with developed nauplius.

#### Moulting, mating and spawning

All the females (Sl. No. 1 to 3) underwent moulting between 6 and 11 days after ablation, resulting in the loss of the spermatophores in the thelycal plates.

However, one of the females (Sl. No. 3) was found with freshly deposited spermatophore after moulting, which could have been the result of the mating by one of the males present in the broodstock tank. During the first



Fig. 2. Group of nauplius VIth Stage.

15 days after ablation, no development of ovary was observed. Afterwards, the development of ovary was a slow process. Though the three females appeared with a thin streak of ovary, it was assumed that some more time might be needed for further development. Nevertheless, one female (Sl. No. 2) spawned on 31-8-1986, 25 days after ablation. The spawning occurred in the broodstock tank itself. All the eggs released were unfertilised, as anticipated. The other two females were removed from the broodstock tank and placed individually in 200 l spawning tanks.

The female (Sl. No. 1) specimen did not spawn, but the absorption of ovary was witnessed. The third specimen (Sl. No. 3) spawned partially at 0230 hrs on 3-9-1986 and released 24,800 viable eggs. The diameter

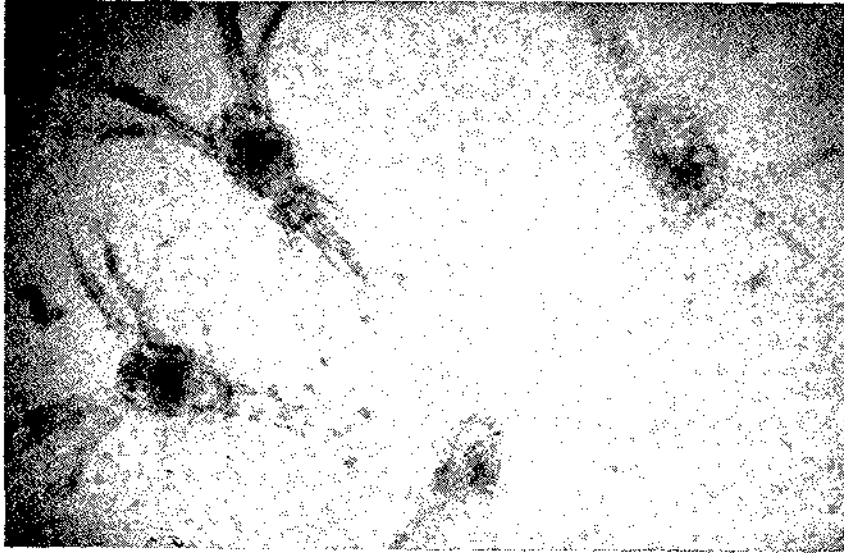


Fig. 3. Protozoa 1st Stage.

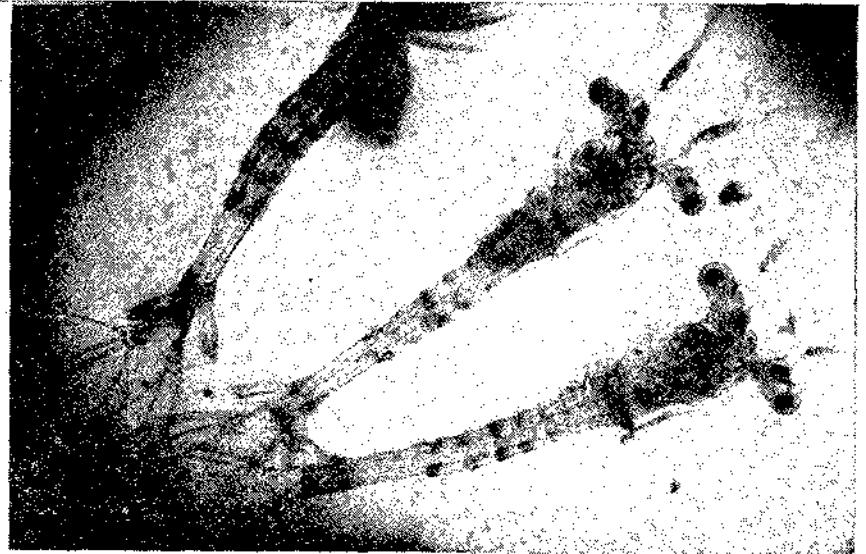


Fig. 4. Protozoa 2nd Stage.

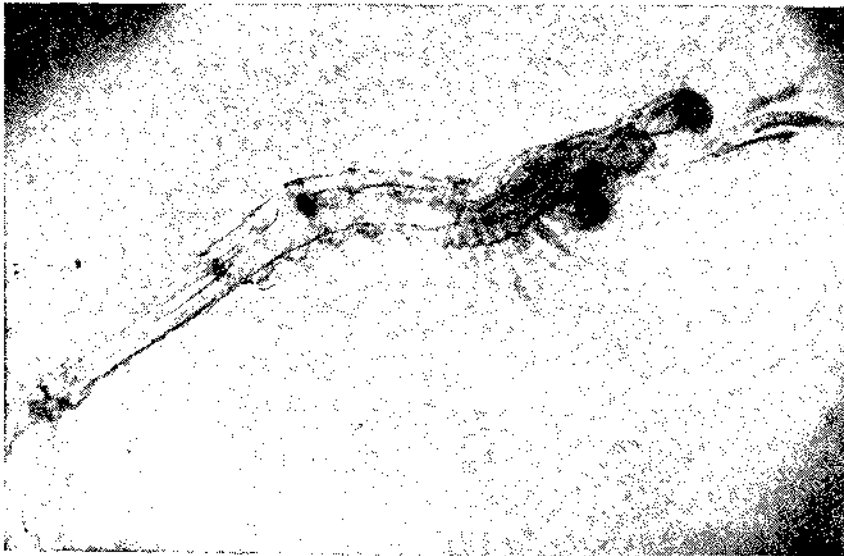


Fig. 5. Mysis 2nd Stage.

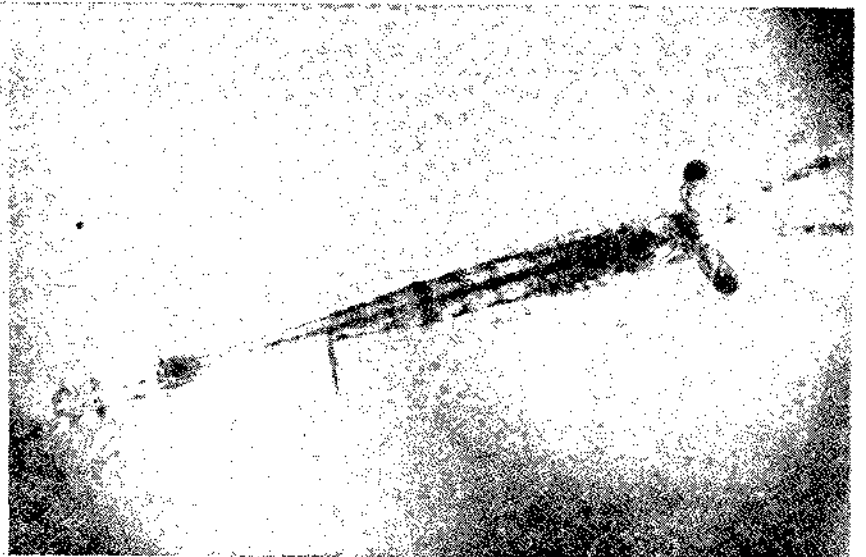


Fig. 6. Postlarva 1st Stage.



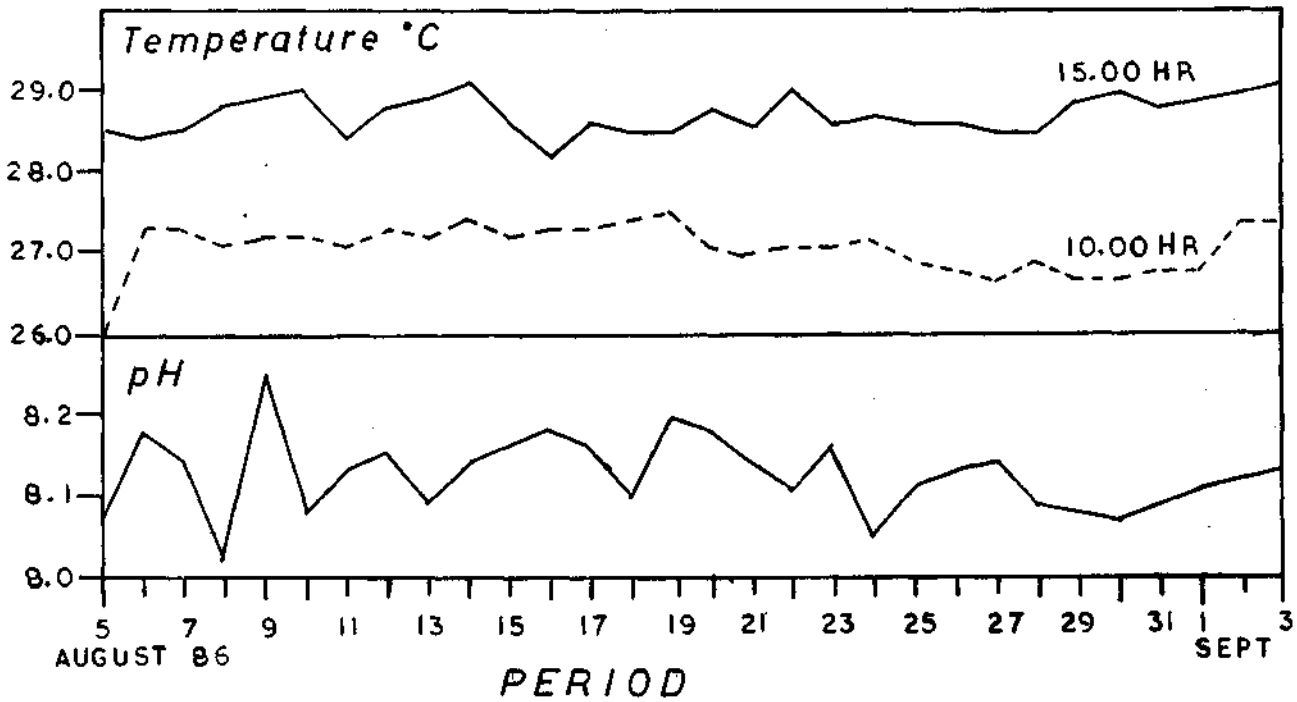


Fig. 7. Water temperature (1000 hrs and 1500 hrs) and pH values recorded in the broodstock tank during the period 5-8-'86 to 3-9-'86.

of eggs varied from 0.263 to 0.280 mm with an average value of 0.270 mm (Fig. 1). The time taken between ablation and spawning was 28 days. Due to the partial spawning and smaller size of the spawner, the number of eggs released was very less. Totally 20,000 nauplii emerged, the hatching rate being 80.6%.

#### Larval rearing

The hatched out nauplii (Fig. 2) were stocked in a one-tonne rectangular tank. When the larvae metamorphosed to N-6 stage (nauplius), 50 l of separately maintained unicellular diatom culture (*Chaetoceros* spp.) was provided as the feed for the protozoa I larvae (Fig.3). From protozoa I to postlarva I stage (Figs. 4-6), 90 l of diatom culture was given daily as feed for the larvae.

The temperature in the larval rearing tank was 26.7°C at 0600 hrs but rose to a maximum of 29.8°C at 1400 hrs and afterwards declined to 29.0°C at 1800 hrs, 28.0°C at 2200 hrs and 27.8°C at 0400 hrs. It took 12½ hrs for the development of eggs before hatching. The duration of the substages of nauplius larvae varied from 3 to 5 hrs and that of protozoa 27 to 30 hrs. In mysis stage, it ranged from 26 to 29 hrs. In all, it took 9 days and 1½ hrs to attain postlarva I from the time of spawning.

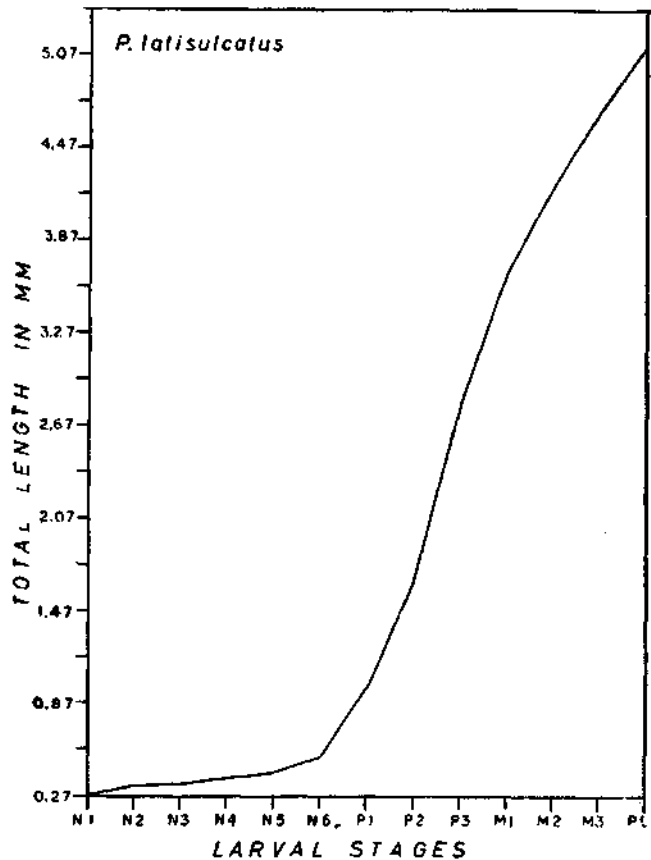


Fig. 8. Growth recorded at different larval stages of *Penaeus latissulcatus*.

### Larval growth and survival

At every substage of the nauplius, protozoa and mysis and also at postlarva I, the total length was measured to study the growth during larval development and the average size for each stage is plotted in Fig. 8. In the naupliar stage, 50% increase in length was seen from I to VI stage, while it was 65.6% from protozoa I to protozoa III. However, the growth was less from mysis I to III (22.8%).

The number of larvae that survived in each stage is given below:

Nauplius I	:	20,000
Protozoa I	:	15,950
Mysis I	:	9,780
Postlarva I	:	7,485

### Remarks

This is the first time in India that an experiment conducted on the maturation and larval production of *Penaeus latissulcatus* under controlled conditions has yielded fruitful results. The longer duration between ablation and spawning and also lesser number of eggs released may be because of the small size of the prawns. The larvae of King prawn are sturdy brightly coloured right from the naupliar stage. The time taken for the attainment of postlarva I from spawning (9 days at 26.7-29.0°C temperature range) agrees with the results obtained in Japan (Shokita, 1970) and Australia (Pownall, 1974). As this species has attained the marketable size of 30 g in 5-6 months of field culture trials conducted in Australia (Pownall, 1974), it is evident that this species could play a promising role in the context of developing marine prawn culture in the coastal waters of our country.



## SEA EROSION THREAT TO COASTAL FISHING VILLAGES OF VALSAD DISTRICT, GUJARAT\*

Severe sea erosion had occurred in some of the coastal fishing villages like Moti Danti, Nani Danti and Udwada, situated in Valsad District of Gujarat during the monsoon period of 1986 (Fig. 1).

Although sea erosion has been a recurring phenomenon in many of the fishing villages of Valsad District, the erosion was more severe in 1986 compared to those occurred in 1968 and 1976.

The Moti Danti and Nani Danti villages are located as narrow strips of land which jet out into the sea, and fall in the drainage vicinity and mouth of the River Ambika.

In Moti Danti, one portion of the land was completely eroded by the rough sea and also by the heavy rain which made the Ambika River to be in spate and change the course, leading to erosion from the inland portion of the village; ultimately leaving a chunk of

land as island. Many of the huts belonging to the fishermen were destroyed. The fish drying yards were also washed away. A few of the damaged huts and the steps taken to foil further erosion by piling stones and sand bags are seen in Fig. 2. It was reported by the village chief that nearly 2.5 sq km area of the village was lost due to sea erosion. The stones piled up for preventing erosion along the coast were also washed away due to high tides during the monsoon season.

The Nani Danti village is located in a sensitive position along the sea coast; and its elevation is slightly higher than the adjacent villages which are said to be below the sea level. Usually during monsoon, paddy is cultivated in Nani Danti and adjacent villages. During 22nd and 23rd June, 1986, due to the high tides, sea water entered through Nani Danti village to the adjacent villages inundating almost 300 acres of paddy fields, inspite of the steps already taken to avert the erosion by piling up stones and sand bags (Fig. 2).

The dwellings of fishermen, fish drying yards and standing paddy crop were damaged. It may be also

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\*Reported by A. P. Lipton, S. G. Raje and M. Chellappa, Veraval Research Centre of CMFRI, Veraval.

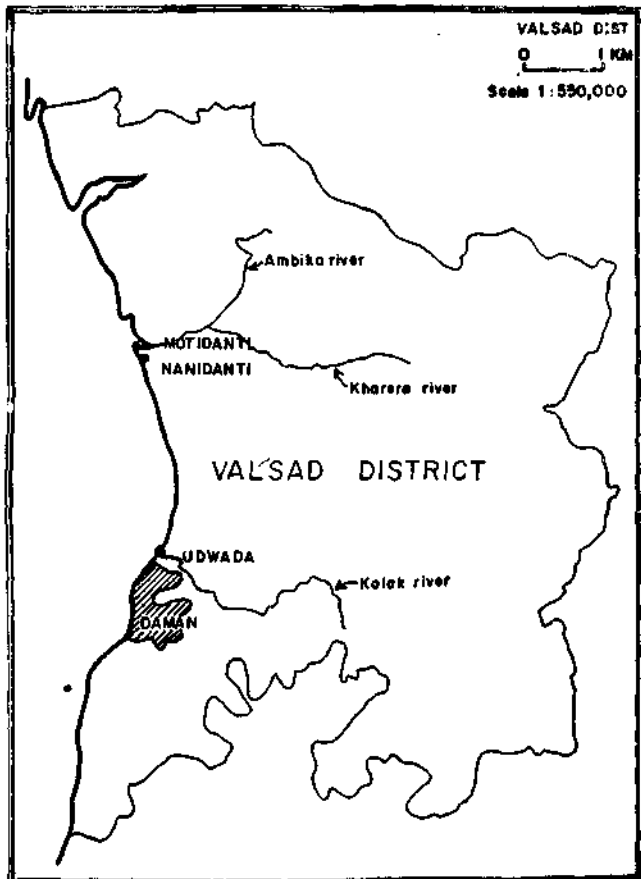


Fig. 1. The coastal villages in Valsad District where sea erosion took place.

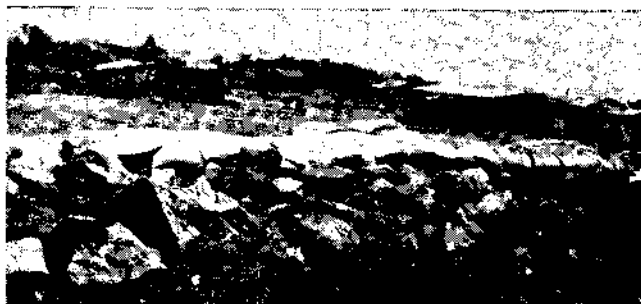


Fig. 2. A view of Nani Danti village where severe sea erosion took place.

noted that the effect of salt water would adversely affect the paddy crop in the ensuing seasons also.

In Udwada village, severe land erosion occurred in June, 1986. In the past several years, there has been continuous and progressive incursion of sea towards this village. It could be seen from Fig. 3 that many of the buildings near the sea coast are on the verge of collapse due to erosion. The elders in this village reported that about 25 years back, the sea was more than 100 metres interior to the present coast line. Due to the

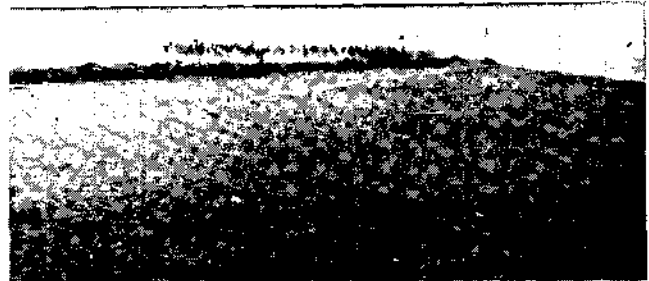


Fig. 3. The sea has entered far interior into village.

continuous erosion, several families of Udwada have migrated to other safer places during the past few years. The adjacent villages such as Kolak and Maroli are also under the grip of sea erosion.



Fig. 4. Another location of severe sea erosion.

It is felt by the villagers that if timely effective steps are not taken to stop erosion, the sea may enter into many of the villages near Nani Danti such as Kakawadi Danti, Methia, Bonsri, Dholai, Malwan, Karwa, Kar-diwa, Mutali, Durasana and Dungis which are situated below sea level and may adversely affect the crops and other cultivations in the years to come.

