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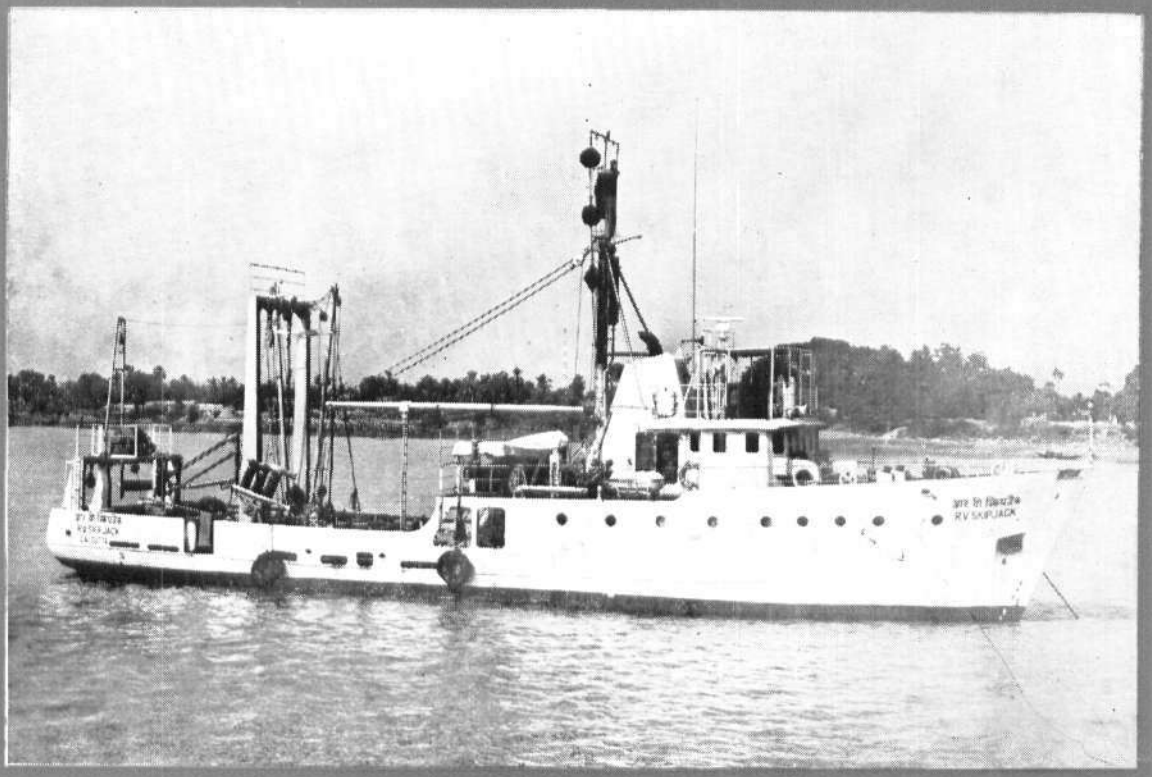

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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the Fishery Data Centre and the Research Divisions 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.

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Cover photo: R.V. Skipjack

NEW LIGHT ON THE MIGRATION OF THE INDIAN WHITE PRAWN, *PENAEUS INDICUS**

Introduction

The migratory habits of the commercial prawns of India were first investigated by means of mark recapture experiments by the All India Co-ordinated Research Project on "Studies on Marine Prawn Biology and Resources" between 1972 and 1974. Subsequently, an intensified series of mark recapture experiments on prawns were initiated at Cochin in 1976 under the National Tagging Programme (NTP) of the CMFRI and it is still in progress. All the past inquiries had indicated that these prawns are not extensive migrants and that their movements are rather restricted to the regions from where they were normally fished. Over the years this concept appeared to have gained a degree of general acceptance except for a few inferences from indirect evidences. Against this background an unexpected report which was received of the capture of a specimen of the Indian white prawn *Penaeus indicus*, which was tagged and released 42 days earlier in the Cochin harbour, at Ovari (Tinnevelli coast) situated 330 km away on July 5, claims special attention. A few more reports of distant recoveries soon followed. In this article the implications of this new finding shall be examined along with other related information obtained so far from the mark recapture experiments conducted on prawns by the NTP at Cochin, though detailed analysis of the data on many other aspects of the shrimp populations is not intended as they would be published elsewhere in due course.

The mark recovery experiments conducted by the All India Co-ordinated Research Project at Goa (M.M.Kunju and others), Cochin (P.V.Rao and others) and Madras (M.S.Muthu) yielded an overall recovery of 2.1% from a total of 3,053 prawns marked with Petersen disc tag and released in the marine and estuarine environments. The prawns were not found to move far from the fishing grounds except for the single instance of one *Metapenaeus dobsoni* released at Goa having travelled in the sea for 60 km in 10 days (Anon, 1975).

Mark recapture investigations of the NTP

Past researches on the fishery and biology of commercial prawns off Cochin have indicated that most of the penaeid prawns of this area migrate in varying degrees into the backwaters of Cochin from the sea during their larval and postlarval stages and that on approaching adulthood after having used the backwaters as nursery and feeding grounds they emigrate to the sea, where they support a fishery, (George 1962, George & Vedavyasa Rao 1967, Mohamed and Vedavyasa Rao 1977, Vedavyasa Rao 1972 and many others). If the shrimp fishery off Cochin is sustained by emigration from the Cochin backwaters, as is generally assumed, mark recapture studies could provide a better picture of this phenomenon. Therefore the main thrust of the mark recapture experiments conducted by the NTP from 1976 to 1980 and in 1982 had been to observe the emigration of the commercial species from the backwaters of Cochin to the sea, though incidentally the experiments would also yield information on growth rate and other useful population parameters.

The tag and tagging method

Loop tag made up of a coloured plastic strip 18 mm long, 3 mm wide and 0.5 mm thick with rounded corners and a pinhole at one end through which is passed a nylon monofilament with its end fused to form a bulb that will not slip through the hole was used through out the experiment. Serially numbered tags of colours red, blue or green, were employed depending on the availability of the raw material for making the tags.

Prawns conditioned for a while in retaining cages or vessels were transfered to shallow basins containing sea water and individually measured over a fish measuring scale. The size and other details were recorded against the serial number of the tag to be used. A hypodermic needle was passed laterally through the first or second abdominal segment of the prawn without injuring its vital organs. The free end of the tag filament was passed through the bore of the needle from its pointed end till it became visible at the other end and the needle was then pulled out. The end of the filament that had passed through the body of the prawn was threaded through the pinhole on the plastic strip and fused to form a bulb using a glowing stick (Fig. 1 & 2). The dry male inflorescence of Anjili tree which could be collected easily during the season and stocked were ideal for the purpose. The tagged prawns were retained for some time and released after removing the dead and weak ones.

*Prepared by National Tagging Project Team

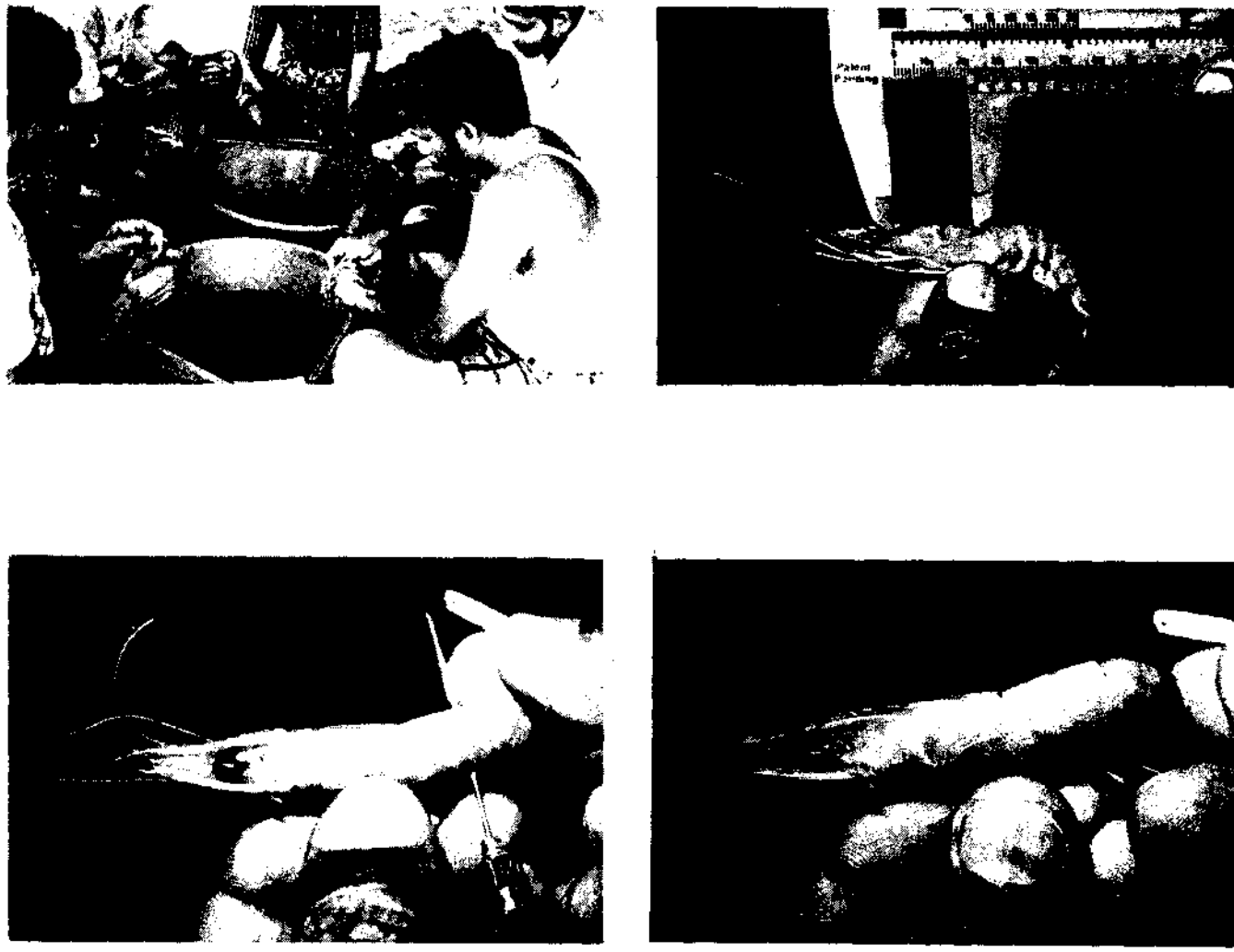
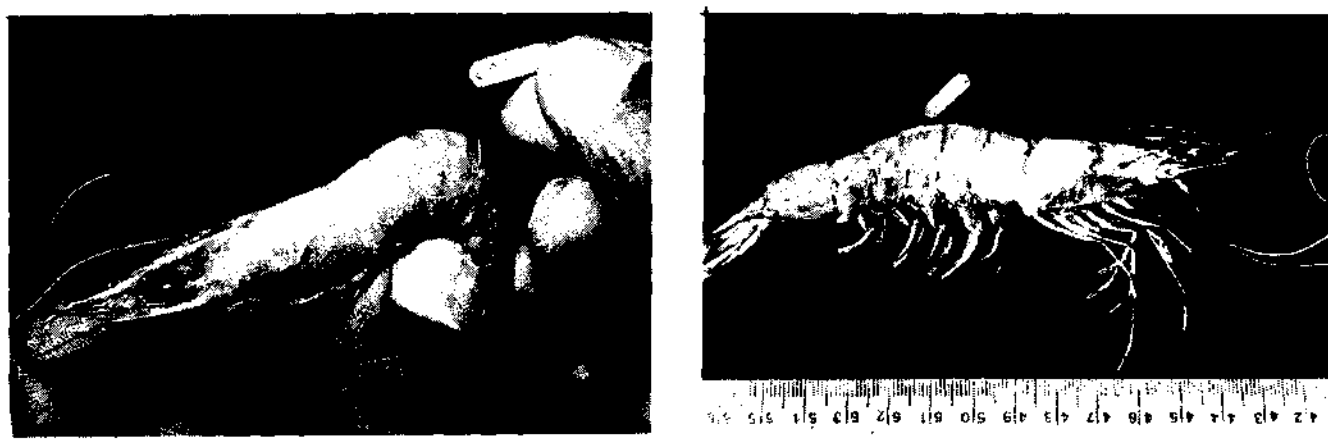


Fig. 1. Tagging procedure.



The mark recapture experiments were conducted at sea as well as in the backwater. In the sea they were performed in the traditional shrimp trawling grounds off Cochin between the 15 m and 25 m depth zones. Live prawns for the purpose were taken from this area using a shrimp trawl operated by the departmental vessel CADALMIN I and from commercial trawlers. For the experiments in the backwaters the prawns were collected using a "try net" (a small trawl net of special design operable in the backwaters) from M.L. MANTHA, a small research boat of this institute.

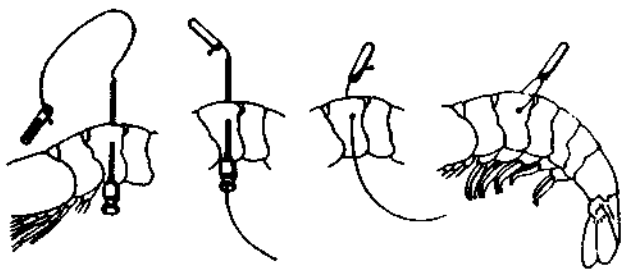


Fig. 2. Various stages of tagging.

Publicity

Propaganda for the return of recaptured tagged prawns were mainly through distribution of hand bills and display of wall posters throughout the fishing centres, fish markets and other strategic places besides periodic personal contacts with those engaged, at the various levels, in the fishing industry. An incentive reward of Rs.3/- for each prawn with tag and Rs.1/- for tag alone with details of place, date and size of the prawn was announced. Lately, this amount has been raised to Rs.5/- and Rs.2/- respectively.

Tagging experiments

The investigation was executed in four sequential phases. In the first three phases the tagging operations were carried out concurrently in the sea (Fig.3) and at selected centres in the backwaters (Fig.5). In phase I (1976-'77) there was only one centre in the backwaters, located in Perumbalam 25 km up the Vembanad lake from the harbour mouth at Cochin. In phase II (1978-'79) a second centre located in the Cochin harbour was added where the releases were made in the shipping channel (the Ernakulam channel) opposite

Table 1. *Summary of data on mark recapture experiments on prawns at Cochin from phases I to III (TL - Total length)*

	Phase	Release location	Number released	Size range TL (mm)	Percentage recovered	Place of recovery/ distance travelled	Days of freedom	Species
I	1976	Sea	5571	35-145	1.74	Within prawn grounds off Cochin	1-36	*P.indicus, M.dobsoni, M.affinis, M.monoceros P.stylifera*
		Backwater (Perumbalam)	636	32-75	2.52	0.5 to 1.0 km in backwaters	3-7	*M.dobsoni, M.monoceros, P.monodon*
I	1977	Sea	4128	52-151	0.97	Within fishing grounds off Cochin	3-40	*P.indicus, M.dobsoni, M.affinis, P.stylifera*
		Backwater (Perumbalam)	5101	35-68	1.85	0-2 km in backwater	6-17	*P.indicus, P.semisulcatus, P.monodon, M.dobsoni, M.monoceros, P.stylifera*
II	1978	Sea	4125	59-117	1.50	Within prawn grounds off Cochin	5-27	*P.indicus, P.semisulcatus, M.dobsoni, M.monoceros, M.affinis, P.stylifera*
		Backwater (Perumbalam)	1413	38-75	0.50	0-2km in backwater	7-10	*P.indicus, P.monodon, M.dobsoni*
		Backwater (Cochin harbour)	2523	35-122	0.99	Within prawn grounds off Cochin and 0.5-3 km in backwater	5-14	*P.indicus, P.semisulcatus, M.dobsoni*
II	1979	Sea	97	40-120	0	0	0	*P.indicus, M.dobsoni, M.monoceros*
		Backwater (Perumbalam)	420	34-73	9.5	0.5-1.0 km in backwater	5-15	*P.indicus, M.dobsoni, M.monoceros*
		Backwater (Cochin harbour)	13492	30-80	38.0	Within prawn grounds off Cochin and 0-5 km in backwater	1-25	*P.indicus, P.semisulcatus, M.dobsoni, M.affinis, M.monoceros*
III	1980	Sea	2341	50-164	7.0	Prawn grounds off Cochin	1-10	*P.indicus, M.dobsoni, P.stylifera*
		Backwater (Cochin harbour)	12859	36-120	0.22	0.5-8.0 km in backwater	1-21	*P.indicus, P.semisulcatus, P.monodon*

the oil tanker berth 4 km from the sea. In phase III the perumbalam centre was discontinued. Besides tagging and releasing of prawns in the natural environments experiments were also conducted on the growth rate, tagging mortality and tag suitability by maintaining tagged prawns in a tidal pond at Perumbalam. In phase IV (1982) the tagging operations were restricted to the harbour centre where the marking experiment was intensified during April to July when the seaward migration of the prawns was expected to be more. The data on release and recapture of prawns are presented in Tables 1,2 and 3.

Results in brief

Experiments in the sea: The experiments in phase I to III in which 16,262 prawns constituting *P.indicus M.dobsoni M.monoceros, M.affinis* and *Parapenaeopsis stylifera* were released showed that there was no migration beyond the area from which they were fished, tagged and released. The overall recovery was 0.86%.

Experiments in the backwaters

The experiments at Perumbalam in which 5,737 prwns were tagged in phase I and 1,833 prawns in phase II indicated that there was hardly any seaward migration of prawns from this area which was 25 km away from the sea. Perhaps this was to be expected since only small size groups occurred here. The potential emigrants are presumably to be found closer to the sea. The percentage recovery at this centre has been 3.59.

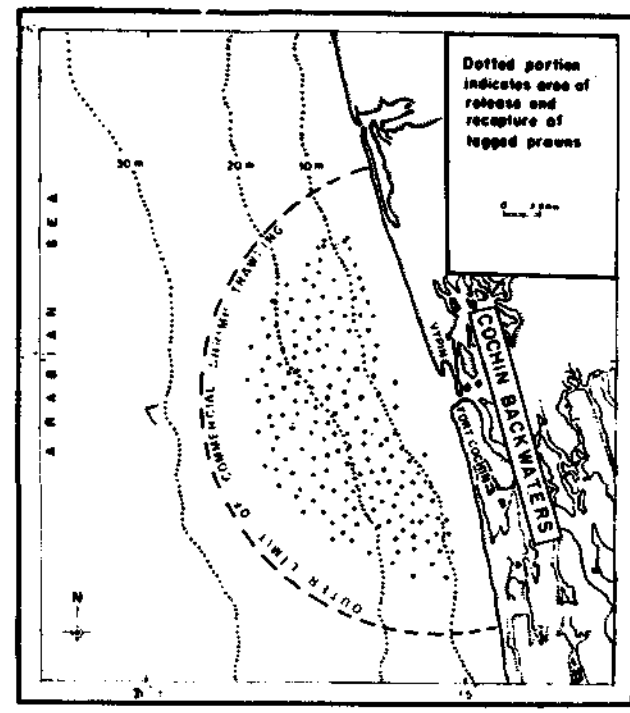


Fig. 3. Area of release and recapture of tagged prawns in the sea off Cochin.

Table. 2. *Summary of data on releases from harbour centre and recoveries from the backwaters and inshore sea of Cochin during Phase IV*

	Details of releases			Recoveries from backwaters				Recoveries from inshore sea off Cochin			
Species	Month of release	Number released	Size range at release TL mm	Number recovered	Distance travelled Km	Days of freedom	Growth rates mm/day	No.* re-covered	Distance travelled Km	Days of freedom	Growth rates mm/day
P.indicus	April	1338	60.0-146.5	44	0-5	1-38	1.20	13	within fishing grounds	4-76	0.87
	May	990	62.5-136.0	67	0-5	1-27	0.90	10	"	12-39	0.64
	June	1542	52.5-122.5	59	0-6	1-36	0.70	31	"	1-50	0.61
M.affinis	April	678	48.4-108.0	3	0-5	1-16	0.80	4	"	4-43	1.10
	May	919	55.5-119.0	42	0-5	1-22	0.60	5	"	8-28	0.70
	June	204	52.7- 80.4	15	0-5	6-31	0.80	5	"	17-34	0.58
	July	120	55.5- 78.0	19	0-5	10-25	0.60	—	—	—	—
M.monoceros	April	907	59.0-103.5	11	0-5	1-11	0.60	2	"	4-33	0.75
	May	637	52.7-110.3	17	0-5	1-28	0.70	13	"	16-30	0.65
	June	879	53.1-112.5	36	0-5	1-40	0.50	7	"	3-23	0.63
	July	63	47.3-212.9	41	0-5	1-38	1.00	—	—	—	—
M.dobsoni	April	45									
	May	55									
	June	82	50.0- 82.0	2	1	20	0.80	2	—	2-19	1.10
	July	221		10	4	46	0.50	—	—	—	—
P.semisulcatus	April	41									
	May	7	75.5-104.0	—	—	—	—	—	—	—	—
	June	12									

* Date of 17 recoveries are not presented, the information being undependable.

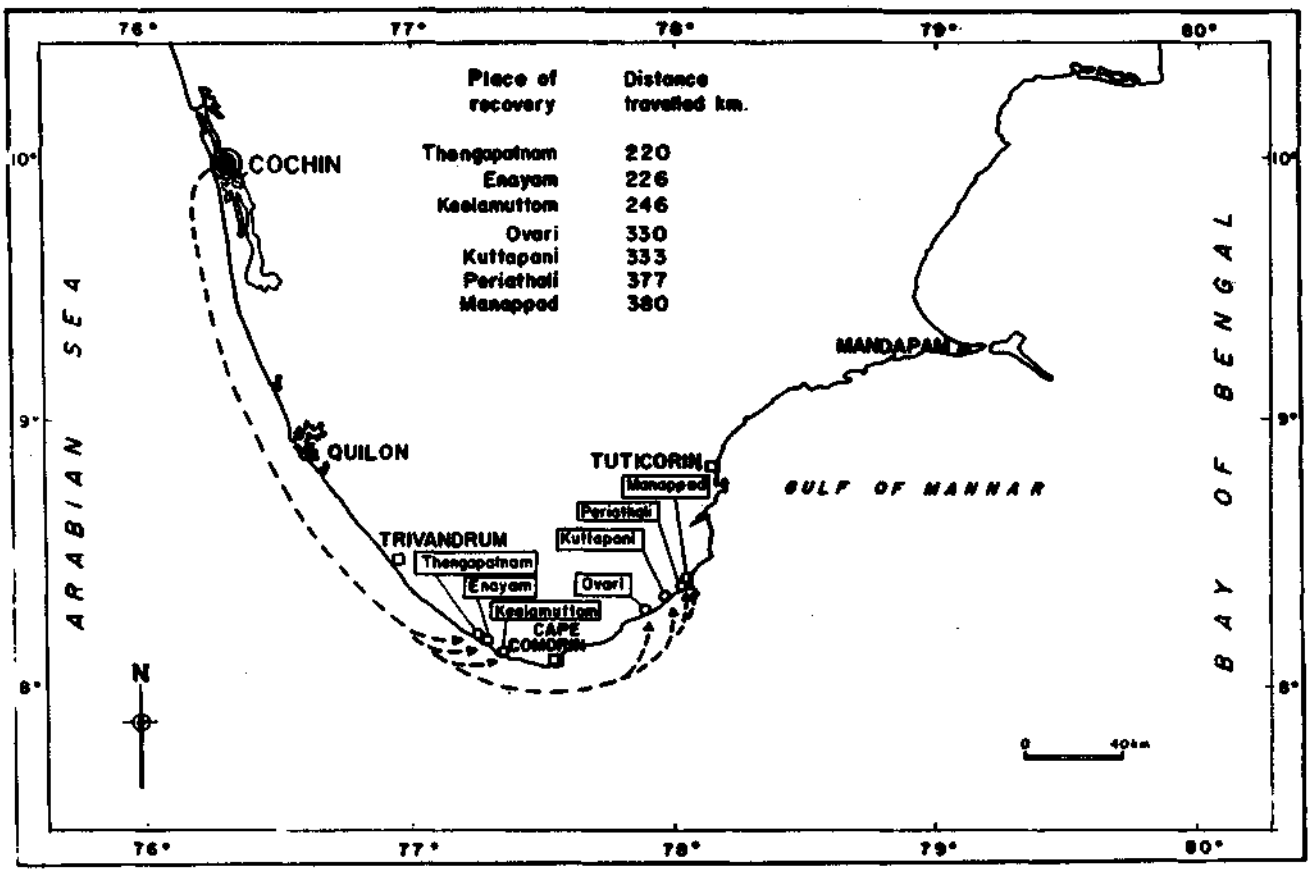


Fig. 4. Distant migration of tagged prawns

Table. 3. *Details of distant recoveries of P.indicus released from harbour centre at Cochin: Phase IV (15 April to 6 July 1982)*

Tag number	Released on	Recovered on	Days of freedom	Sex	TL at release mm	TL at recovery mm	Growth in freedom mm	Growth rate mm/day	Place of recovery	Distance from release km	Average speed km/day
A 2793	29-4-82	5-7-82	61	♂	106.0	148.0	42.0	0.69	Ovari	330	5.41
A 2401	29-4-82	13-7-82	75	♂	99.0	140.0	41.0	0.53	Tengapatnam	220	2.93
A 3188	1-5-82	11-8-82	103	♂	80.0	152.0	72.0	0.70	Kuttapani	333	3.23
A 4780	22-5-82	21-7-82	68	♂	110.0	149.0	39.0	0.57	Manappad	380	5.58
A 5349	29-5-82	2-8-82	94	♂	86.5	153.0	66.5	0.70	Ovari	330	3.51
A 5507	29-5-82	13-7-82	45	♂	106.0	127.0	21.0	0.47	Keelamuttom	246	5.47
A 6390	3-6-82	9-9-82	99	♀	82.0	179.0	97.0	0.98	Periathali	377	3.81
?	?	10-7-82*	—	?	—	(140 ?)	—	—	Enayam	226	—

* The prawn was lost by the fishermen who could remember the date and approximate size.

It was a surprise that, even from the harbour centre which was as close as 4 km to the sea, the recoveries were mostly from within the harbour and nearby backwater areas. Of the 28,874 prawns tagged and

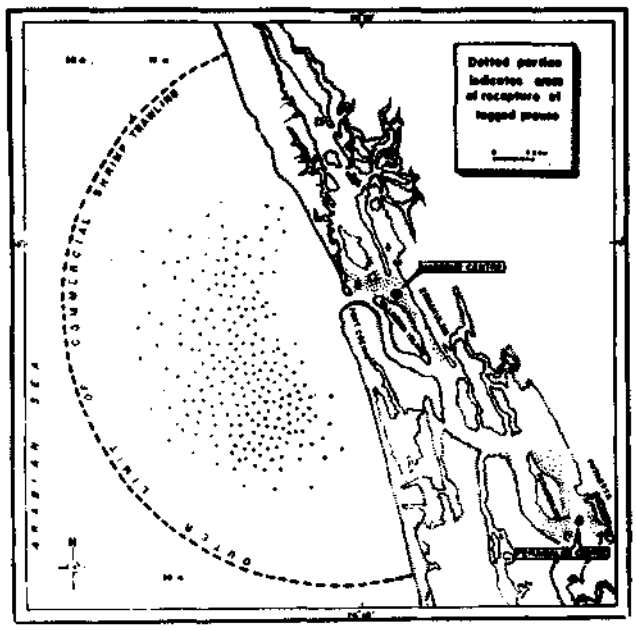


Fig. 5. The tagging centres in Cochin backwaters and areas of local recoveries.

released from this centre in phases II and III only 11 prawns, all of them *P.indicus*, had been recaptured from the sea (Table 4). Of the 11 prawns recovered from the sea 5 were recovered during February, April and May 1978 and 6 during January, February, March and August 1979, indicating that whatever emigration to the sea that occurs is spread over these months.

Examining the data on the eleven prawns, a relationship is discernible between the size of the prawns at release and the number of days lapsed before their recovery from sea, the larger their size at release in the backwater, the quicker has been their recovery from sea (Table 5). Obviously those which are smaller than 44 mm linger in the backwaters till they are 50 mm to begin their seaward migration. Therefore, in phase IV the lower size limit for tagging was raised from 35 mm to 50 mm so that a greater number could be expected to be recovered from the sea. The size at which the prawns begin to migrate from the backwaters of Cochin to the sea has been considered to be 110 - 120 mm by George (1962) and 80 mm by Mohamed & Rao (1971). However, the lower size limit for tagging during this phase was raised to only 50 mm instead of the minimum size reported by the above authors in order to study the intensity of migration among the size groups below 80 mm.

Table 4. *Data on P.indicus released from harbour centre and recovered from shrimp trawling grounds off Cochin*

Year & month of recovery	No. recovered	TL at release, mm	TL at recovery, mm	Days of free-dom
1978				
February	1	44.0	72.0	20
April	2	78.0	87.1	7
May	2	88.0	93.2	4
		77.0	85.4	6
1979				
January	1	38.0	62.0	20
February	1	56.0	67.7	9
March	2	78.0	86.4	6
		59.0	70.7	9
August	2	41.0	61.8	16
		80.0	86.0	5

In phase IV, 8,740 prawns *(P.indicus, P.semisulcatus, P.monodon, M.dobsoni, M.monoceros* and *M.affinis)* were tagged and released from the harbour centre between 15th April and 6th July 1982. It was from this that 7 prawns of *P.indicus*, were recovered in the Tinnevelli and Kanyakumari coasts (Fig.4). The local and the distant recoveries from this experiment are dealt with separately.

The local recoveries

The recoveries up to the time of the compilation of this article has been 109 (1.22%) from the sea and 366 (4.19%) from the backwater. The percentage of recovery from the sea may be a very close reflection of the intensity of migration of prawns from the Cochin backwaters during the period since all the shrimp trawlers operating off Cochin have to bring their catch to the Cochin Fisheries Harbour where the CMFRI has a unit and the situation was ideal for closely monitoring the trawler landings of tagged prawns. Whereas, the percentage of recovery from the bakwaters is likely to be an under estimate since the fishery within the backwaters, being subsistance and artisanal in character, is varied, widely scattered with unregulated disposal of

Table 5. *Relationship of size of P.indicus at release in the backwater and time taken for recovery from the sea.*

1978		1979	
size mm	Number of days	Size	No.of days
44	20	38	20
77	6	41	16
78	7	56	9
80	7	59	9
88	4	80	5

catches and hence prone to a high degree of non reporting of recoveries. Yet the number recovered from the backwaters has been more than three times of that recovered from the sea.

While the necessary data for making reliable estimates of the prawn population of the trawling grounds off Cochin are available, the absence of it for assessing the density of the juvenile stock in Cochin backwaters percludes any attempt to evaluate the contribution made by emigrant prawns from these nursery areas to the stock that sustains the prawn fishery off Cochin. Yet it may broadly be assumed from the above mentioned result obtained by the tagging experiment that hardly one third of the prawn population in the backwaters reaches the trawling grounds.

The distant recoveries

As the data from phase IV was being sorted out the first reports of the recovery of naran chemmeen *P.indicus* from Ovari and Manappad in the Tinnevelli coast 330 and 380 km respectively from Cochin was received in July 1982. The recovery from such great distance, of prawns which were tagged and released in the Cochin harbour was beyond the anticipations of the present investigation. Based on the past results, all of which indicated only localised migration, the propaganda aimed at recoveries was not geared to cover such far flung places. A hurriedly organised publicity campaign yeilded a few more recoveries (Table 3). The recoveries were from Manappad, Periathali,Ovari and Kuttapani in the southeast coast and from Thengapatnam, Keelamuttom and Enayam in the southwest coast. The longest distance covered by the prawns has been 380 km and the shortest 220 km, at speeds that varied from 2.93 km to 5.58 km per day. Prawns belonging to the same batch of release have travelled at different speeds. Two of which were released on 29th April 1982 and were recaptured at Ovari and Thengapatnam have moved at the rate of 5.41 km and 2.93 km per day respectively. In another case the speed of the prawns which were released on 29th May 1982 and recovered from Ovari and Keelamuttom had been 3.51 and 5.47 km per day respectively. Studying the prawn fishery of Kanyakumari district an interesting phenomenon noticed by Suseelan (1973) was the movement of shoals of *P.indicus* from Colachel to Manakudy during the monsoon months and in the reverse direction during Novermber. He observed that the shoals take about 3-4 days to cover the distance of about 32 km between the two centres. Of the seven prawns which were recovered, only one was a female. The rarity of females in the recoveries is in conformity with the observations of earlier workers on the fishery of this area.

It may be mentioned in this context that certain species of penaeid prawns have been known to perform long migrations in the American, Australian and Japanese coasts. The distance of 380 km covered by the *P.indicus* released at Cochin is great compared to the migration of 193 km by the American pink shrimp *P.d.duorarum* along the North coast, the 314 km of the brown shrimp *P.a.aztecus* of Texas, the 170 km of the kuruma shrimp *P.japonicus* in the western Seto sea and the 120 km of the Australian school prawn *M.macleayi*, although the record migrations are the 580 km of the American white shrimp *P.setiferus* along Cape Kannedy and the 930 km of the Australian king prawn *P.plebejus* along the southwest coast of Australia.

Migratory pattern of Naran Chemmeen

From our knowledge of the biology of *P.indicus* they are supposed to move from the inshore trawling grounds off Cochin to deeper waters for breeding since, only few spawners come in the trawl catches. Examining the possibility of coastwise movements George *et al* (1967) felt that the knowledge till date did not indicate this in the Cochin region and that only mark recapture investigations could clarify this.

That the prawn fishery in the Kanyakumari district and at Manappad, which are mainly composed of large size *P.indicus*, are probably supported by recruitment from the Kerala coast was inferred by George and Mohamed (1967) and Mary Manisseri & Manimaran (1981) after examining the respective fisheries. The present investigation provides the first direct evidence that *P.indicus* nurtured in the Cochin backwaters would in deed move into the sea and migrate southward along the west coast, skirt round Cape Comorin and proceed further along the southeast coast up to Manappad. The available information on the nature and composition of the prawn fishery along the coasts traversed by the migrating *P.indicus* reveal that Manappad is the northern limit up to which this species dominates the landings and that north of Manappad the tiger prawn *P.semisulcatus* forms the main stay of the catches. Significantly, there has been no recovery from north of Manappad which seems to be the end point of the migration of naran chemmeen from Cochin.

It is apparent that this migration was aided by the prevailing current since, from February to October a southerly component of the equatorial current of 0.5 kt. magnitude follows the coast line of India in the west while a northerly component follows the coast line in the east (Varadachari & Sharma, 1967). However, the prawns that were released in the same batch appear to have moved at different speeds. The data in hand is inadequate to infer whether this suggests a size oriented schooling and whether they exercise any control over their speed and magnitude of their migration.

The one female prawn which was recovered from the Tinnevelli coast was in the spent condition and the other males had grown to the breeding size. It is probable that the movement of these prawns was a breeding migration though more evidence is needed to confirm this.

Growth of prawns

While migrating, the prawns had grown at an average rate of 0.6 mm/day among the males and 0.98 mm/day in the case of the single female which was recovered. Recoveries from the inshore areas of Cochin (Table 4) indicated a growth of 0.61 to 0.87 mm/day in *P.indicus*, 0.58 - 1.10 mm/day in *M.affinis*, 0.63 - 0.75 mm/day in *M.monoceros* and 1.10 mm/day in *M.dobsoni*. From the table it will be seen that the growth rates were some what faster in the case of prawns recovered from the backwater ie. 0.70– 1.20 mm/day in *P.indicus*, 0.60 - 0.80 mm/day in *M.affinis* and 0.50 - 1.00 mm/day in *M.monoceros*. The growth rates observed in the case of *P.indicus* are much higher than what has been recorded from the earlier length frequency studies, 20.0 mm/4 months ie. 0.17 mm/day in males and 15.0 mm/4 months (ie. 0.13 mm/day) in females by George *et al* (1963) for the species in the off shore waters of Cochin and 15.0 mm/4 months (ie. 0.13 mm/day) in males and 5.0 mm/month (ie. 0.17 mm/day) in females by George & Mohamed (1967) from the inshore fishing grounds of Kanyakumari district. At the same time the results of experiments of intensive culture of the species conducted in culture ponds and farms have indicated much faster growth rates upto nearly 2.5 mm/day (Mohamed *et al* 1980 and Mohamed, personal communication). Comparably higher growth rates have been obtained in the present results from tagged specimens of *P.indicus* in the experimental pond at Perumbalam (Fig.6). Despite the possible effects of tagging, a growth rate of 63.3 mm/month ie. 2.11 mm / day, which is higher than the maximum so far recorded for this species from the brackishwater environments of India, (Jhingran & Natarajan, 1969; Suseelan, 1975) was recorded.

General Remarks

The most interesting and significant point which emerges from the long distance tag recoveries is that at least part of the fishery of *P.indicus* along the south east coast, if not the whole, is supported by the juvenile population from the Cochin area. Although some indirect evidences had pointed to this possibility as suggested by George & Mohamed (1967) and Mary Manisseri & Manimaran (1981) the present results categorically establish the fact that to a certain extent the *P.indicus* population of Tinnevelli coast is replenished by prawns migrating from the backwaters of Cochin. However, these mark recapture results of the NTP in general and the long distance recoveries in particular raise more questions than answers, the answers to which may greatly change our appreciation of the characteristics of the shrimp population in these waters.

For instance, it is not known what part of the population of *P.indicus* occurring in Cochin area undertakes the southerly migration and contributes to the fishery on the south east coast. Studies on the East Australian king prawn, a related species, have shown that part of the population migrates long distances while those which are left behind spawn in the nearby estuaries (Ruello, 1975). In case only part of the shrimp population of the southern region is contributed by recruitment from Cochin area, the possibility of these prawns completing their life cycle in the sea itself on the southeast coast and contributing to the rest of the fishery there cannot be ruled out, as there are no large scale brackish water areas nearby to serve as nursery grounds.

It is equally intriguing that not a single tagged prawn involved in this southerly migration was captured in the trawl fishery operating off Quilon which is located enroute, in spite of the large scale publicity work and propaganda for recoveries at Quilon.

Fig. 6. Tidal pond at Perumbalam where tagging experiments were conducted on prawns to study the growth rate, tagging mortality and tag suitability.

Similarly, as the recoveries of tagged prawns from the shrimping grounds tend to indicate, only a fraction of prawn population from the Cochin backwaters contributes to the stock that supports a year long shrimp fishery off Cochin, obviously the marine shrimp stock is sustained by inputs from other sources also, either by ingress from elsewhere or by self replenishment or both. Here it is pertinent to recall the observation made by Mohamed and Rao (1971) while discussing

the estuarine phase in the life history of prawns in the west coast of India. Trying to explain the fair representation of smaller sizes of the species in the inshore population, the authors suggest that it indicates the probability of the prawn completing the life cycle in the sea itself.

If a species like *P.indicus* which is an important constituent of the prawn population that supports the fishery off Cochin migrates away from the population, as the present results suggest, the phenomenon will have to be properly evaluated for its incorporation in the assessment of the local stock. It has also to be investigated whether recruitment into the Cochin prawn grounds takes place from the northern regions along the Kerala and Karnataka coasts which yield substantial shrimp landings.

Undoubtedly, these results serve only as pointers and suitable mark recapture experiments to study more comprehensively the migration and other aspects of the species would be the immediate concern of the NTP. The results will naturally have far reaching implications with regard to our approach to the assessment of the shrimp stocks, their exploitation and management.

Participants in the NTP

The following individuals were involved, as stated, with this investigation during its various phases and the preparation of this article: P. Vijayaraghavan - Project leader (planning, organizing, leading tagging teams, analysis and interpretation of data, propaganda, preparation of the article); M.M. Thomas - Associate Project Leader (support and advice in planning and organising, leading tagging teams, tagging and propaganda); A. Noble - Associate Project Leader (leading tagging teams, tagging and propaganda); K.N. Gopalakrishnan - Tagging, registering data, help in analysis of data; K. Chellappan - Tagging, registering data; C. Suseelan - Tagging, valuable discussions; M. Rajamani - tagging, sending the first and subsequent reports of recovery of marked prawns from Tinnevelly coast, propaganda; S.G. Vincent - reporting recovery from south west coast, propaganda; Habib - propaganda north of Tuticorin; P.M. Aboobacker, M. Ayyappan Pillai, P.L. Ammini, V.P. Annam, V.K. Balachandran, K. Balachandran, G. Balakrishnan, V.K. Balakrishnan, K. Balan, K.K. Balasubramaniam, G. Bharathan, S.R. Chakraborthy, V. Chandrika, Daniel Selvaraj, D.V. Dattatraya, I. David Raj, D.C.V. Easterson, K.C. George, K.V. George, Gita Antony, G. Gopakumar, C.P. Gopinathan, Grace Mathew, S. Haja Nazeemudeen, Jacob D. Eapen A.A. Jayaprakash, V.S. Kakati, L.P. Khambadkar, A. Kanakam, K.N.R. Kartha, M. Kathirvel, M.N. Kesavan Elayath, P. Kumaraswamy, L. Krishnan, G. Krishnankutty Nair, Krishna Srinath, C.H. Kunjiraman, V. Kunjukrishna Pillai, G.P. Kumaraswamy Achari, N. Surendranatha Kurup, S. Lalitha Devi, A. Laxminarayana, S. Lakshmi, Madanmohan, P.K. Mahadevan Pillai, K.J. Mathew, M.M Meiyappan, H. Mohamed Kasim, C. Mukundan, M.S. Muthu, C.Nalini, K. Nandakumar, K. Narayana Kurup, V.A. Narayanankutty, J.Narayanaswamy, M. Abdul Nizar, K. Nandakumaran, M.V. Pai, K.K.P. Panikkar, P.P. Pillai, G. Ponniah, B. Prassanna Kumari, G. Radhakrishnan, E.V. Radhakrishnan, K.V. Raghavan, R. Reghu, A. Regunathan, M.S. Rajagopalan, V. Rajendran, N. Ramachandran, P.V. Ramachandran Nair, C.P. Ramamritham, D.S. Rao, G.S. Rao, D.B.F Sahare, R. Sathiadas, U.K. Sathiavan, C.R. Sanmughavelu, R. Sivaraman, K.V. Somasekharan Nair, P.V. Srinivasan, M. Srinath, G. Subbaraju, Syed Ahmed Ali, G. Syda Rao, C. C. Thankappan Pillai, V. Thangaraj Subramanian, A.R. Thirunavukarasu, K.K. Valsala, Varghese Jacob, Varghese Philippose, R. Vasanthakumar, M. Vijayakumaran, K. Vijayalakshmi, D. Vincent, K.P. Viswanathan and K.C. Yohannan - tagging.

REFERENCES

Ann. 1975, Report of the All India Co-ordinated Research Project Studies on marine prawn biology and resources': 1 - 123.

George, M.J. 1962, *Indian J. Fish.*, 9 (1) A : 110 - 116

George, M.J. 1962, *ibid.* 9 (2) A : 468 - 475

George, M.J., S.K. Banerji and K.H. Mohamed, 1967. *FAO Fish. Rep., 57* (2) : 265 - 284

George M.J. & K.H. Mohamed 1967 *Proc. IPFC. Coun., 12* (II) : 210 - 219

George, M.J. & P.V. Rao 1967. *Proc. Symp. Crustacea, Mar. Biol. Asso. India* Part II : 698 - 700,

George, M.J., K. Raman & Karunakaran Nair 1963. *Indian J. Fish. 10* 2 (A) : 460 - 499

Jhingran, V.G. & A.V. Natarajan 1969. *J. Inland Fish. Soc. India, 1* : 49 - 126.

Mary K. Manisseri & C. Manimaran 1981. *Indian J. Fish 28* : 208 - 216.

Mohamed, K.H. & P.V. Rao 1971. *J. mar. biol. Ass. India 13* (2) : 149 - 161.

Mohamed, K.H., M.S. Muthu & R. Marichamy 1980 *Mar. Fish. Infor. Serv. T & E. ser., 26 : 3 - 5*

Rao P.V. 1972 *Indian J. Fish., 19* (1 & 2) : 86 -96.

Ruello, N.V. 1975. *Aust. J. mar. Freshwat. Res., 26* : 343 -54.

Suseelan, C. 1973. Proc. Second Workshop on the All India Co-ordinated Research Project on 'Studies on Marine Prawn Biology and Resources': 5.

Suseelan, C. 1975 *Indian J. Fish., 21* (2) : 96 - 106

Varadachari, V.V.R. and G.S. Sharma 1967. *J. India Geophy. Union, 6* (2) : 61 -73.

भारत का राजपत्र
The Gazette of India

असाधारण
EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (ii)
PART II—Section 3—Sub-section (ii)

प्राधिकार से प्रकाशित
PUBLISHED BY AUTHORITY

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इस भाग में भिन्न पृष्ठ संख्या दी जाती है जिससे कि यह अलग संकलन के रूप में रखा जा सके
Separate Paging is given to this Part in order that it may be filed as a separate compilation

MINISTRY OF AGRICULTURE

(Department of Agriculture and Cooperation)

NOTIFICATION

New Delhi, the 26th August, 1982

G.S.R. 619(E).—In exericse of the powers conferred by section 25 of the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981 (42 of 1981), the Central Government hereby make the following rules, namely :

1. Short title and commencement.—(1) These rules may be called the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Rules, 1982.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. Definitions.—In these rules, unless the context otherwise requires :—

(a) "Act" means the Maritime Zones of India (Regulation of Fishing by Foreign Vessels Act, 1981 (42 of 1981);

(b) "crew" includes the team of technical, semi technical and non-technical member associated with the operation of the fishing vessels ;

(c) "flag state" in relation to a foreign vessel means the State in which the vessel is registered or, where the vessel is not registered, the State whose flag the vessel is entitled to fly ;

(d) "Form" means a Form annexed to these rules ;

(e) "licence" means a licence granted under section 4 ;

(f) "permit" means a permit granted under section 5 or under section 8, as the case may be ;

(g) "Schedule" means Schedule to these rules ;

(h) words and expressions used but not defined in these rules but defined in the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981 (42 of 1981) shall have the meanings respectively assigned to them in that Act.

3. Licences.—(1) Every owner of a foreign vessel or any other person described in section 4, who intends to use such vessel for fishing within any maritime zone of India, shall make an application in Form A to the Central Government. This form shall include the following information :—

(a) the name and description of the vessel, its equipment and complement ;

(b) the flag state and home port of the vessel :

(c) the name and address of the owner and master o the vessel and, where applicable, its character ;

(d) the side number of the vessel, the radio frequencies and call sign ;

(e) a description of the proposed purpose and the period for which the licence is required ;

(f) the name and address of a person resident in India having a permanent office or establishment in India who is authorised by the owner of the vessel to represent him for the purpose of providing liaison with the Government of India ; and

(g) any information required by the Central Government or by an officer designated by it to grant a licence in any case where, in its opinion the information furnished by the applicant requires clarification or amplification.

(2) Every application referred to in sub-rule (1) shall be made not less than thirty days prior to the first day on which the licence is required ;

(3) Every such application shall be accompanied by a fee of rupees five hundred which shall not be refundable.

(4) The Central Government or an officer designated by it may, on receipt of an application, after making such enquiry as may be relevant, grant a licence in Form B for all or any of the following purposes, namely :—

(i) to engage in commercial fishing ;

(ii) to tranship or to take on board any fish, outfit or supplies while at sea ;

(iii) to process fish at sea ;

(iv) to transport fish from fishing grounds ;

(v) to land fish or fish products at an Indian port ;

(vi) to purchase or obtain bait, outfits, provisions or supplies (including fuel) at an Indian port ;

(vii) to effect repairs at an Indian Port ;

4. Validity of Licence : (1) Every licence shall,—

(a) be issued in original duplicates ; and authenticated copies shall be distributed to enforcement and other concerned authorities ;

(b) apply only to the foreign vessel described in the licence and, where applicable, to the crew of that vessel ; and

(c) be valid for the period specified in the licence.

(2) The disposition of the duplicates referred to in clause (a) of sub-rule (1) shall be as follows :—

(a) one licence shall be for the use of the licensee ; and

(b) one licence shall be retained by the Central Government.

5. Terms and conditions of licence.—(1) Every licence, shall be subject to the following terms and conditions, namely :—

(a) the licensee shall pay to the Central Government an amount set out in the Schedule I for the purposes mentioned therein at the time of taking delivery of the licence ;

(b) the master of the foreign vessel for which a licence is granted or a person acting on behalf of the master shall give twenty four hours prior notice to the authorised officer of—

(i) the estimated time of entry of the vessel into the maritime zone of India ;

(ii) of the location of such entry ; and

(iii) of the approximate schedule of activities to be conducted.

(c) the vessel and its crew shall engage only in the activities that are authorised by the licence ;

(d) the activities authorised by the licence shall be carried out only at the time and in the areas of the maritime zone of India or ports set out in the licence ;

(e) the licensee shall ensure that foreign members of the crew are employed only after obtaining necessary clearance from the Central Government. The Licensee shall further ensure that every subsequent change in the foreign members of the crew is made only after the clearance from the Central Government ;

(f) the master of each foreign fishing vessel during fishing operations shall notify the authorised officer the following,—

(i) time and position of commencement of fishing ;

(ii) the time and position of the temporary departure from the fishing grounds for the purpose of embarking or disembarking an observer or for a call at an Indian port or any other temporary departure from the grounds which will involve departure from any authorised fishing are but which does not include departure from seaward limit of the fishing area beyond the Exclusive Economic Zone of India ;

(iii) the time and position of return to the fishing grounds following temporary departure described in sub-clause (ii) above ;

(iv) the time and position of any shift in its fishing area ;

(v) the time and position at which it will cease fishing and the leave the fishing area ;

(g) the master of the vessel shall communicate the information, to be notified under clause (f), to the officer of the Coast Guard in Porbander, Bombay Cochin, Tuticorin, Madras, Vishakhapatnam, Paradeep, Haldia or Port Blair, at least twenty four hours before the commencement or cessation of fishing. He shall record in communication log, the Indian Standard Time and the contents of each communication made under this clause. All the communication shall be in English ;

(h) where the fishing is authorised by the licence,—

(i) the crew of the vessel shall fish only for the stocks or groups of stocks described in the licence ;

(ii) the crew of the vessel shall not catch any fish by a species, size or age set out in the licence as prohibited catches, that are covered under the Wild Life (Protection) Act. 1972 (53 of 1972) and where such fish are caught they shall be retained and preserved on board the vessel, accounted for in Form C and shall be surrendered at such places as may be directed by the authorised officer ;

(iii) the quantities of fish of any stock or group of stocks caught in any area of the maritime zone of India during the terms of licence, or during any specified portion thereof, shall not exceed the quantities set out in the licence ;

(iv) the crew of the vessel shall not discard any substantial quantities of fish of a stock or group of stocks caught in excess of the quantities set in the licence. Such quantities of stock or group of stocks shall be retained and preserved on board the vessel accounted for in Form D and shall be surrendered at such place as may be directed by the authorised officer ,

(v) the crew of the vessel shall fish only by means of fishing equipment and gear of a kind set out in the licence ; and

(vi) the master of the vessel shall cause written records to be maintained on a daily basis of the fishing effort and catch of the vessel and of any transhipment and other dispositions of the catch by quantities, species size and weight in Form E.

(i) where the transporting of fish from fishing grounds is authorised by the licence—

(i) Only the species and quantities of fish set out in the licence shall be taken on board the vessel for that purpose;

(ii) the fish may be taken on board only from vessel of a class set out in the licence; and

(iii) the master of the vessel shall cause written records to be maintained on a daily basis of the fish taken on board the vessel for transportation in Form F;

(j) where the processing of fish is authorised by the licence, the master of the vessel shall cause written records to be maintained on a daily basis of the processing operations carried out and of the species, quantity and the State of processing of the fish taken on board the vessel for that purpose in Form G;

(k) the vessel shall have on board at all time during the period it is in maritime zone of India, equipment and fishing gear, including communications equipment, described in the licence as "required equipment";

(l) the master of the vessel or a person acting on behalf of the master shall, when authorised by the licence to visit an Indian Port, notify the authority specified in the licence of the estimated time of entry of the vessel into that port not less than twenty four hours prior to that estimated time;

(m) where the vessel is in an area of the maritime zone of India and is not authorised by its licence to engage in fishing at that time in that area, all fishing gear on board the vessel shall be stowed in the manner specified in rule 14;

(n) the master of the vessel shall cause reports to be made of the position of the vessel in space and time, operational conditions, and the nature of fishing including, where applicable, its catch statistics, and any transhipments or other dispositions of its catch, at such times, to such persons and by such means as are set out in the licence.

(o) where the Central Government requires the vessel to carry out, from time to time, a programme of sampling, observation or research in connection with fisheries in the maritime zone of India, the master shall comply with instructions issued to him by the Government in respect of that programme;

(p) the master of the vessel shall, where required by the Central Government or an officer authorised in this behalf, permit a technical observer or observers designated in writing by that Government to go on board and remain on board, at a time and for a period specified in that behalf, for the purpose of recording scientific data and observations or taking samples and records or any other purpose specified in the order;

(q) the master of the vessel shall take all reasonable precautions to ensure the safety of any authorised officer or technical observer boarding or leaving the vessel at sea including the observance of practice of good seamanship and, where necessary, the placing of a boarding ladder of good quality and design and safety line over the side of the vessel;

(r) where an authorised officer or technical observer is on board the vessel for a period of more than four hours the master of the vessel shall provide the authorised officer or technical observer with suitable food and accommodation;

(s) the master of the vessel shall—

(i) at the request of an authorised officer or technical observer, arrange for that officer or observer to send or receive messages by means of communication facilities on board the vessel;

(ii) provide all reasonable assistance in his power to enable an authorised officer or technical observer to carry out his duties and functions, and to the use of vessel's navigation equipment and personnel as necessary to determine the vessels's position.

(t) the master of the vessel shall, at any time, while within the maritime zone of India, at the request of an authorised officer, proceed forthwith for inspection to a place at sea and to a port as may be specified by that officer;

(u) the master of the vessel, upon being approached by an authorised officer in a vessel or ship or in an aircraft, shall immediately comply with any directions given to him by such authorised officer. For this purpose, the International Code of Signals shall be used;

(v) The vessel shall, at all time while within the maritime zone of India,—

(i) fly the flag of the flag state;

(ii) display in a place that is clearly visible both from the air and from sea level the letters and numbers identifying the vessel as set out in its licence, in white markings of at least one metre in height in the case of a vessel whose overall length exceeds twenty metres or one-half metre in height in any other case, on a black background, and where the markings are painted, the paint work shall be maintained in good condition so that the markings are clearly legible at all times;

(w) where the vessel is in the maritime zone of India, the master of the vessel or a person acting on behalf of the master shall notify the Central Government of the estimated time of departure from those waters not less than seventy two hours prior to that estimated time;

(x) the licensee shall, when required to do so, make arrangements for training of Indian crew and personnel on board the vessels;

(2) the licensee shall be bound all or any of the terms and conditions mentioned in sub rule (1) and such additional conditions or restrictions as may be specified in the licence.

6. Permits: (1) Every Indian citizen and person described in section 5 who intends to use any foreign vessel for fishing

within any maritime zone of India shall make an application to the Central Government for a permit.

(2) Every application referred to in sub-rule (1) shall be in Form H and shall be made not less than thirty days prior to the first day on which the permit is required.

(3) Every such application shall be accompained by a fee of rupees five hundred which shall not be refundable.

(4) The Central Government or an officer designated by it may on receipt of an applications after making such enquiry as may be relevant, grant a permit in Form I for all or any of the purposes mentioned in sub-rule (4) of rule 3 of these rules.

7. Validity of permit — (1) Every permit shall,

(a) be issued in original duplicates and authenticated copies are to be distributed to enforcement and other connected authorities.

(b) be valid for a period as may be specified in the permit and in no case exceed more than five years.

(2) The disposition of the duplicates referred to in clause (b) of sub-rule (1) shall be as follows:

(a) one permit shall be for the use of the permit holder; and

(b) one permit shall be retained by the Central Government,

8.Terms and conditions of permit: (1) Every permit shall be subject to the following terms and conditions, namely:—

(a) the permit holder (herein after referred to as the charterer in this rule) shall pay to the Central Government an amount of Rupees ten thousand per vessel per year at the time of taking delivery of the permit;

(b) the charterer shall have the requisite managerial personnel who possess the necessary experience of fishing;

(c) the charterer shall give an undertaking in the form of bank guarantee, before the commencement of the charter, of an amount to be decided by the Central Government in each case to the Central Government that he shall purchase required number of vessels and put them in fishing operation in the Exclusive Economic Zone of India before the end of the stipulated period specified in the Schedule II.

(d) the charterer shall ensure that at least twenty percent of the crew are Indian citizens and are posted as under studies to the foreign skipper, the engineer and to the other operational crew and that they shall be kept in readiness to embark on the chartered vessel at the time of inspection of the vessel by the authorised officer and shall remain on board the vessel throughtout the charter period.

(e) the charterer shall ensure that the charter party provides for the settlement of disputes between the parties by arbitration in India.

(f) the Central Government may post scientist / observer on board each of the chartered vessel; the charterer shall ensure that the Indian scientists and observers, when so directed by the Central Government are permitted on board the chartered vessel for collection and examination of such data and material as may be required by that Government and shall see that such scientists and observers are provided proper food and accommodation on board the vessel by the master of the vessel;

(g) the charterer shall furnish to the Central Government valuation and sea worthiness certificates for the chartered vessel from an appropriate authority of its flag state and also furnish a copy thereof to the Director General of Shipping, Bombay;

(h) the charterer shall cause to be furnished to the Central Government the necessary certificates to the effect that the chartered vessel meets with the requirements in respect of safety of vessels and crew as per the provisions of the Merchant Shipping Act, 1958 (44 of 1958);

(i) The charterer shall ensure that,—

(i) no fishing is done for the protected species which are covered under the Wild Life (Protection) Act, 1972 (53 of 1972);

(ii) such protected species, if caught are immediately returned to water alive, if possible, and if not they shall be retained and preserved on board the vessel and accounted for in Form C and shall be surrendered at such place as may be directed by the authorised officer;

(j) the charterer shall not undertake shrimping operations for exploitation of coastal shrimps;

(k) where the charterer is a company, the paid up share capital of the company shall not be less thanrupees five lakhs during the charter period;

(l) the charterer shall not pay any marketing commission without the prior approval of the Central Government;

(m) the charterer shall ensure that the chartered vessel reports to the authorised officer before and after every fishing voyage and delivers the copy of the permit in its possession to the charterer before every departure to the foreign port;

(n) the charterer shall ensure that the foreign members of the crew on the chartered vessel are employed only after obtaining necessary clearance from the Central Government;

(o) the charterer shall further ensure that every subsequent change in the foreign members of the crew is made only after the clearance from the Central Government;

(p) the charterer shall furnish to the Central Government voyage-wise statement of fish catch and exports form the chartered vessels with all the necessary details as set out in Form J;

(2) The charterer shall be bound by,—

(i) all or any of the terms and conditions mentioned in sub-rule (1);

(ii) all or any of the terms and conditions applicable,to the licence except conditions prescribed in clause (a) of sub - rule (1) of rule 5, and

(iii) such additional conditions or restrictions as may be specified in the permit.

9. Display of licence or permit on board the vessel.— (1) Subject to sub-rule (2), a copy of the licence or permit, duly attested by the issuing authority,shall be kept on board the foreign vessel described in the licence or permit while that vessel is in the maritime zone of India and shall be produced for examination by an authorised officer at his request.

(2) Every foreign vessel described in the licence or permit may enter in the maritime zone of India and proceed directly to an Indian port for the purpose of obtaining a copy of the licence or permit if,—

(a) all fishing gear on board the vessel is stowed in the manner specified in rule 14;

(b) the master of the vessel complies with any directions given to him by an authorised officer.

10. Damage to Indian Vessels prohibited.— No foreign vessel fishing in the maritime zone of India under the licence or a permit granted under these rules shall cause any damage either wilfully or through gross negligence to any fishing vessel, fishing stakes, fishing gear, fishing net or other fishing appliances owned or in possession of an Indian citizen;

11. Commencement of fishing operations.— No foreign vessel fishing in the maritime zone of India Under the licence or the permit granted under these rules shall commence fishing operations without the clearance from the Coast Guards.

12 Fishing in territorial waters prohibited.—No foreign vessel shall undertake fishing operations with in the territorial waters of India, unless otherwise specifically permitted for any specialised type of fishing and shall be subject to any other restrictions that may be specified in the licence or permit.

13. Prohibition to carry any explosives, poisonous or noxious substances,— (1) No foreign vessel or any person shall carry or have in its possession or control any explosives, poisonous or other noxious substances or apparatus fitted for or capable of utilising an electric current with the intention of using such explosives, poisonous or other noxious substances or apparatus for killing, stunning, disabling or catching fish. Any explosives, poisonous or other noxious substance found on board any vessel or in possession of any person, shall be presumed, unless the contrary is proved, to be intended for the use specified above.

(2) No foreign vessel or any person shall attempt to destroy or abandon any fishing gear, fishing net or other fishing appliances, explosives, poisonous or other noxious substances or any other object or thing with the intention to avoid their detection or seizure.

14. Entry into maritime zone of India without licence / permit,— (1) subject to sub-rule (2) a foreign vessel may, without the authority of a licence or a permit enter the maritime zone of India for the purpose of passing through such waters in the course of a voyage to a destination outside the maritime zone of india.

(2) A foreign vessel that has entered in the maritime zone of India without the authority of a licence or a permit shall comply with the following conditions while in the maritime zone of india,—

(a) all fishing gear on board the vessel shall be stowed below deck or otherwise removed from the place where it is normally used for fishing and placed where it is not readily available for fishing;

(b) all fishing nets, fishing lines, hooks, jigs, trawl boards, weights and floats shall be disconnected from their towing, connecting or hauling wires, ropes or rigid frames;

(c) the master of the vessel shall comply with any directions given to him by an authorised officer; and

(d) where an authorised officer requests information respecting the name, flag state, location, route or destination of the vessel, or the circumstances under which it entered maritime zone of India, the master of the vessel shall promptly convey the information to the officer.

15. Fishing for scientific research,investigation, etc.— Where a foreign vessel is to be used for fishing within any maritime zone of India for the purpose of carrying out any scientific research or investigation or for any experimental fishing, the Central Government may grant a permit to such foreign vessel under section 8 of the Act. Where such a permission is granted, the Central Government may apply all or any of the terms and conditions prescribed for licence under the rule 5 or for permit under rule 8, as well as such additional conditions as may be specified.

16. Contravention of conditions of licence, permits of rules,— Contravention of any of the provisions of these rules shall be punishable with fine, which may extend to Rs.50,000 without prejudice to the penalties which may be awarded under the Act.

[No. 29012/2/81-Fy. (T.I)]
S.P.JAKHANWAL, Jt. Secy.

SCHEDULE I

[See rule 5 (1) (a)]

Amount payable under rule 5 (1) (a)

Purpose of licence	Amount Payable
1.Fishing by squid jigging.	Rs.1,000/-per tonne of fish the vessel is permitted by the terms and conditions of the licence.
2.Fishing by trawling.	Rs.2,000/-per tonne of fish the vessel is permitted by the terms and conditions of the licence.
3.Fishing by long lining/ gill-netting	Rs.1,500/-per tonne of the fish the vessel is permitted by the terms and conditions of the licence.
4.Fishing for tuna by long lining/purse-seining/pole and line fishing.	Rs.1,000/-per tonne of fish the vessel is permitted by the terms and conditions of the licence.
5.Transporting of fish	Rs.500/-per tonne of fish carrying capacity of the vessel for each voyage.
6.For any other purpose mentioned in rule 3 (4).	Rs.200/-per gross registered tonne of the craft for each voyage.

SCHEDULE II

[See rule 8 (1) (c)]

Schedule of purchase of vessels

No of vessels / or pair of Vessels	No. of months from the beginning of the charter operation when obligatory purchase and fishing operation becomes due				
or first vessel	First Vessel or second pair of vessel	Second Vessel or third pair of vessel	Third Vessel or fourth pair of vessel	Fourth Vessel or fifth pair of vessel	Fifth Vessel pair of vessel
1	18	..	..	..	..
2	18	30	..	..	..
3	18	24	33	..	..
4	18	24	33	42	..
5	18	24	33	42	51

FORM A

[See rule 3 (1)]

Form of Application of Licence

To

The Secretary to the Government of India,
Department of Agriculture and Cooperation,
Ministry of Agriculture,
Krishi Bhavan,
New Delhi-110 001,
India.

Sir,

I hereby apply for a licence under section 4 of the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981, in respect of which the following particulars are furnished:

1. Name of the applicant and postal address.
2. Status of the applicant and his financial position (If the applicant is a company, full details thereof)
3. Present activities of the applicant including the specific activities relating to fishing.
4. Details of fishing vessels/fish processing units/export /import of fish as in the past three years.
5. Details of the proposed fishing project indicating particulars on fishing vessels, number of vessels to be operated, anticipated fish catch, project economics, processing and marketing arrangements, area and base of operation etc.
6. Description of the vessel, equipment and complements:—
   (a) Name of the Vessel.
   (b) Flag state and home port of Vessel.
   (c) Country and port of registration.
   (d) Registration number.
   (e) Radio call sign/signal letter/ radio frequencies.
   (f) Name of owner and master of the vessel.
   (g) Nationality and address of owner and master.
   (h) Purpose of vessel (kind of vessel)
   (i) Kind of vessel's hull.
   (j) Vessel's year (date of construction) and date of launching.
   (k) Number of deck.
   (l) Number of mast.
   (m) Registered length.
   (n) Registered breadth.
   (o) Registered depth (draft).
   (p) Gross tonnage and net tonnage.
   (q) Fish Hold capacity and Refrigeration Capacity.
   (r) Kind of main engine, name and place of main engine manufactured.
   (s) Rated H.P. of main engine.
   (t) Kind of propeller.
   (u) Class of equipments (list).
   (v) Certified crew capacity.
   (w) Service limitations of the vessel.
   (x) Name and address of the ship builder
   (y) Value of the vessel.
   (z) Any other remarks.
7. The electrical specifications of the craft and its equpment.
8. Description of the proposed fishing operation:—
   (a) the species to be fished;
   (b) the method of fishing and type and dimensions of gear to be used and mesh sizes of different parts of fishing net.
   (c) area/areas to be fished;
   (d) the amount of fish to be caught;
   (e) the period of time for which licence is sought;
   (f) the place in which the fish is to be landed and / or processed.
   (g) a description of support operations and the name and licence number (if any) of fishing vessels in support of which related activities are to be carried out
9. Name and address of the person resident in India appointed by the owner to represent him in all dealings with the Government and evidence of the extent to which he is authorised to undertake legal and financial obligations on behalf of the owner.
10. Plans for the use of Indian facilities in the support, provisioning and maintenance of vessels.
11. Such other information as may be required by the Government of India.

Dated ..... Day ..... of .....of the year ...

Signature of the applicant

FORM B

[See rule 3 (4)]

Government of India
MINISTRY OF AGRICULTURE
Department of Agriculture and Cooperation New Delhi

No .....

Dated .....

Licence to Fish in the Exclusive Economic Zone of India

This Licence is granted in pursuant to section 4 of the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981 (42 of 1981)

2.The foreign Fishing vessel described hereunder is hereby licensed for the purposes specified in paragraph 3 of this licence and in accordance with the conditions set out in paragraphs 6 and 8 of this licence and shall be subject to all the Indian laws that apply to the vessels in the Maritime Zones of India.

Description of the vessel

Name of the vessel .....

Name of the owner.....

Type of vessel .....

Country of registrtion / Flag State.....

Registration Number .....

Overall length .....

Gross tonnage.....

International radio call sign and radio frequency.....

Name and address of the master .....

3.The purposes for which the vessel may be used:

4.Area:

5.Period:

6.The licence shall be bound by the terms and conditions specified in rule 5 and the additional condition / restriction specified in paragraph 8.

7.Exemptions in the terms and conditions, if any.

8.Additional conditions.

9.Names of the foreign crew:

10.List of required equipments .....
.....
.....

11.Subject to the provisions of the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Rules, 1982. the licence is valid from the .....day of .... 198 .... to the..... day of 198

12.This licence is not transferable.

Secretary to the Govt. of India.

FORM C

[See rule 5 (1) (h) (ii)]

Data on catch of prohibited fish species

1. Name and address of fishing company:
2. Particulars of fishing vessels:

   Name
   Size
   Horse Power of Main Engine:
   Base of operation:
3. Licence Number and period of validity.
4. Description of fishing operations authorised in the licence.
5. Details of fishing gear used:— (a) Length of headline
   (b) Greatest depth.
   (c) Mesh size.
6. Description of the catch.

Sl. No.	Location of the vessel		Date and Time	Gear in operation	Fishing zone	Depth (Metre)	Species (prohibited)	Average Length (CM)	Average Weight (Kg)	Number
	Latitude	Longtitude								
1	2	3	4	5	6	7	8	9	10	11
1.										
2.										
3.										

7. Place of surrendering the catch.
8. Conditions of the catch at the time of surrendering
9. Comments of the Master / Skipper.

Signature of owner / owners representatives

FORM D

[See rule 5 (I) (h) (iv)]

Data on quantity of fish caught in excess of permitted quantum

1. Name and address of fishing company:
2. Particulars of fishing vessels.

   Name:
   Size:
   Horse Power of Main Engine:
   Base of operation:
3. LicenceNumber and period of validity.
4. Description of fishing operations authorised in the licence.
5. Species-wise quantity of fish permitted in the licence (quota)
6. Details of catch particulars.

No.	Location of fishing vessel	Date & Time	Fishing Zone	Length, Depth and mesh size of fishing gear	Species Caught	Raw Weight (Kg.)	Processed products prepared on board the vessel if any	Weight (Kg.)	Total catch (Kg.)
1	2	3	4	5	6	7	8	9	10

7. Details of excess catch

Sl. No.	Location of fishing vessel	Date & Time	Fishing Zone	Depth (Metres)	Species caught in in excess	Average Weight (Kg.)	Average length (cm)	Condition of fish	Reasons for excess catch
1	2	3	4	5	6	7	8	9	10

8. Particulars of excess catch surrendered.

Species	Weight(Kg)	Place of surrendering	Authority to whom surrendered

9. Remarks of Master / Skipper.

Signature of owner / owners representatives

FORM E

[See Rule 5 (I) (h) (vi)]

Daily Cumulative catch Log

1. Name and address of the fishing company.
2. Particulars of fishing vessels;

   Name:
   Size:
   Horse Power of Main Engine.
   Base of operation:

3. Licence Number and period of validity.
4. Description of fishing operations authorised.
5. Species-wise catch of fish and quantity permitted in the licence.
6. Fishing Area.
7. Date of entry to Indian Exclusive Economic Zone.

S.No.

S.No.	Vessel number	Position	Date & Time	Time of Shooting gear	Time of hauling gear	Hours of fishing	Depth (Metre)	Type of gear
1	2	3	4	5	6	7	8	9

Mesh Size	Species caught	Quantity	Disposition	Cumulative total	Cumulative disposition	Details of transhipment
10	11	12	13	14	15	16

8. Details of Disposition of catch

Item	Quantity (Kg)
(a) Consumption:	
(b) Fish gutted:	
(c) Head on (or off):	
(d) Filletted.	
(e) Frozen.	
(f) Canned.	
(g) Fish meal	
(h) Oil.	

Signature of owner/owner's representative

FORM F

[See rule 5 (1) (i) (iii)]

Particulars of transhipment

1. Name and address of fishing company.
2. Particulars of fishing vessels.
   Name:
   Size:
   Horse Power of main engine.
   Base of operation.
3. Licence Number and period of validity.
4. Catch and Effort Data:

Area	Species	Number of days fished	Catch (in kg)	Product from vessel

5 Licence Number and side number of vessel receiving transhipment.

6. Position at the time of transhipment:

   Latitude
   Longitude

7. Date of message from vessel:

8. Species and quantities transferred:

Species	Gross weight (kg.)	Value

Signature of own licencee / his representatives

FORM G

[See Rule 5 (1) (j)]

Particulars of processing operations on board the vessel under licence

1. Name and address of fishing company.
2. Particulars of fishing vessels.

   Name
   Size
   Horse Power of main engine.
   Base of operation.

3. Licence Number and period of validity.
4. Description of fishing operations authorised in licence.
5. Name of the port to be used as base.
6. Processing Machinery and Equipment:

Type	Number of Units	Specifications and daily capacity	Percentage utilisation of capacity

8. Storage and holding

Nature of storage	Number of species	Dimensions / volume fish hold

9. Processing details.

Species	Area of Operation	Date of operation	Duration of operation From To	Catch particulars	Products prepared on vessel & quality (Kg.)

(Enter in this column, types of products processed on board the vessel by species, viz: fish gutted, head on (or off) filletted, salted, frozen, caned, meal & oil etc.

10. Position and time of reporting:

    Latitude
    Longitude
    Time
    Date

Signature of owner / owner's representative.

FORM H

[See rule 6 (2)]

Form of Application for 'permit'

Outline Details Required for Proposed Operations

1. Name of the applicant and postal address.

2. Whether the applicant is a registered company under the Companies Act. If so, furnish the following particulars:—

(a) Date and number of Registration and Place.

(b) Authorised, subscribed and paid up share capital.

(c) Attach latest Balance-sheet.

(d) If the company comes under the provision of Monopolies and Restrictive Trade Practices Act, 1969 (54 of 1969), please state whether necessary clearance is available.

3. The foreign collaborator's name, address, Telephone number, Telex number and name of Bankers and their activities in India and in other countries.

4. Present activities of the applicant, if any:

(a) Specified activities undertaken.

(b) Details of fishing vessels / fish processing units and fish export made during the past three years.

(c) Name of all Directors / Chief Executive / Operations Manager / other employees of the Indian Company, their experience in marine fisheries indicating specified fields.

5. Details of the Project proposed to be taken up (enclose project report covering particulars on fishing vessels, anticipated fish production, processing and marketing origanisation management, including financial sources, economics of operation, area and base of opertion, identity of fishery resources to be exploited, catching methods, gear to be employed, etc.)

(a) Type of vessels, type of gear and number of vessels proposed to be chartered (Enclose detailed spacifications and general arrangement drawings and also a full list of machinery and equipment, navigational lights, life saving appliances, fire fighting equipment, inventory items etc.)

(b) Description of the vessel, equipment and crew complement (Enclose certificate given by competent authorities regarding valuation and sea worthiness of the vessels):

(i) Name of the vessel.
(ii) Flag state and home port of vessel.
(iii) Country and port of registration.
(iv) Registration number.
(v) Radio call sign / signal letter / radio frequencies.
(vi) Name of owner and master of the vessel.
(vii) Nationality and address of owner and master.
(viii) Purpose of vessel (kind of vessel).
(ix) Kind of Vessel's hull.
(x) Vessel's year (date of construction and date of launching)
(xi) Number of deck.
(xii) Number of mast.
(xiii) Registered length.
(xiv) Registered breadth.
(xv) Registered depth (draft).
(xvi) Gross tonnage and net tonnage.
(xvii) Fish Hold capacity and refrigeration capacity.
(xviii) Kind of main engine, name and place of main engine manufactured.
(xix) Rated Horse Power of main engine.
(xx) Kind of propeller.
(xxi) Class of eqipments (list).
(xxii) Certified crew capacity.
(xxiii) Service limitations of the vessel.
(xxiv) Name and address of the ship builder.
(xxv) Value of vessel.
(xxvi) Any other remarks.

(c) Number, qualification and experience of foreign crew

(d) Number and names of foreign personnel to be employed ashore.

(e) Enclose authenticated copy of the offer received from foreign collaborator.

6. Duration of charter.

7. Annual rate of charterage or charterage for entire duration.

8. Whether the charterer retains option to purchase vessels after the charter period and terms thereof.

9. Whether the foreign collaborator is willing to assist in export of catches, if so, the terms and conditions.

10. Arrangements for training of Indian-counterparts.

11. Statement of foreign exchange inflow anticipated (excluding payments in foreign exchange out of total earnings by way of exports) for the duration of charter.

12. Total income, total expenditure and net profit anticipated for the duration of charter.

13. Form of charter party proposed to be entered into.

14. Financial arrangements (Describe in detail).

15. Proposals of shore establishment (if any).

(i) Intended location and description of any shore based plant.
(ii) Proposal for registration and date of completion of any shore based plant as a Registered Export Establishment.
(iii) Arrangements for processing catch.
(iv) Estimated annual output of the plant.
(v) Percentage of total catch to be processed and / or exported.
(vi) Export market and marketing arrangements for total catch.

DECLARATION

I / we ..... by this declaration subscribed by me / us pursuant to and in compliance with section 5 of the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981, (42 of 1981), fully understand all the provisions of the said Act and Rules and orders issued thereunder and agree to abide by them. I / we ..... further declare that the particulars furnished in the above

application are true to the best of my/our knowledge.

Signature of the applicant (s)

FORM I

[See rule 6 (4)]

Government of India

Ministry of Agriculture

Department of Agriculture & Cooperation, New Delhi.

No .....

Dated .....

Permit to Fish in the Exclusive Economic Zone of India

This permit is granted in pursuant to section 5 of the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act 1981 (42 of 1981).

2. .....is hereby permitted to use the foreign fishing vessels under charter described hereunder for the purposes specified in paragraph 5 of this permit and in accordance with the conditions set out in paragraphs 8 and 10 of this permit and shall be subject to all the Indian laws that apply to the vessels in the Maritime Zone of India.

3. Description of the vessel

(i) Name of the vessel:
(ii) Type of vessel:
(iii) Country of registration:
(iv) Registration number:
(v) Overall length:
(vi) Gross tonnage;
(vii) International radio call sign and radio frequency:
(viii) Name and address of the master:
(ix) Name and address of the foreign collaborators.

4. Details of charters fee made of payment and any other stipulation.

5. The purposes for which the vessel may be used.

6. Base and area of operation.

7. Period of operation of the vessel.

8. The permit holder shall bound by the terms and conditions specified in rule 8 and the additional conditions/restrictions specified in paragraph 10.

9. Exemptions in the terms and conditon if any

10. Addtional conditons.

11. Name of foreign crew

12. Subject to the provisions of the Maritime Zones of India (Regulation by Foreign Vessel) Rules, 1982, this permit is valid from the .....day of ..... 198 ..... to the .....day of 198

13. This permit is not transferable.

Dated .....

Secretary of the Govt. of India

FORM J

[See rule 8 (1) (p)]

Voyage-wise Statement to be Furnished by the Charterer.

1.Name and address of the Charterer.

2. Particulars of fishing vessels:
Name
Size Over length
Gross Registered Tonnage.
Horse Power of main engine.
Base of Opertion.

3. Number of crew:
Foreign
Indian.

4. Period of voyage:

(i) Date of departure from foreign port
(ii) Date of entry into the Maritime Zone of India
(iii) Date of reporting at the base of operation.
(iv) Period of fishing From To
(v) Date of departure from the base of operation.
(vi) Date of leaving the Maritime Zone of India.

5. Details of each fishing operation (for each haul)

(i) Haul Number.
(ii) Type and Size of Gear.
(iii) Position Shooting Hauling
Latitude
Longitude
(iv) Time
Shot
Hauled
(v) Depth (metres)
(vi) Total catch (in kilograms)

Maintain species caught	Weight (Kilograms)
1.	
2.	
3.	
4.	
5.	
6.	
etc.	

6. (i) Value declared at customs for the total catch and for each variety (in foreign currency).

(ii) Value realised on domestic marketing for each variety (in Indian rupees)

7. Quantity, value and country to which each item was exported.

8.Payment made to foreign collaborator:
In foreign exchange.
In Rupees

9.Payment received from foreign collaborator.
In foreign exchange.
In Rupees.

Signature of the Charterer

PROVEN TECHNOLOGY

2. TECHNOLOGY OF CULTURED PEARL PRODUCTION

Highlights: Cultured pearls of good quality are produced in the Indian pearl oyster *Pinctada fucata* by artificially inducing the oyster to secrete mother-of-pearl around an implanted spherical core material produced from shells. The pearl oysters are either produced through artificial breeding in hatchery (see Hatchery Technology of Pearl Oyster Production) or collected from the natural beds by SCUBA - diving. The oysters are grown in an open-sea farm under raft culture, being placed in baskets and suspended at appropriate depths from the floating rafts. Pearl oysters are a minimum one-year old when they are used in surgery and post-operative culture duration ranges from 3-24 months depending on the size of pearls. Multiple implantation technique enhances rate of production. Re-use of oysters for a second crop is possible under certain conditions.

Operational details: The pearl culture farm will have several rafts of 5 m × 5 m size or other dimensions, each constructed using teak poles lashed with ropes and mounted on cylindrical metal barrels to get appropriate buoyancy. The raft is moored by anchors at depths of 5-10 m or more. Pearl oysters are reared in baskets suspended from rafts and when they reach the right size (20-30 g weight) they are taken to the on-shore surgery. Healthy oysters are conditioned using the chemical menthol for operation. Shell-beads of diameter 3-8 mm produced from the shells of conch or other molluscs form the core material or nucleus for implantation. A special set of surgical tools is employed in surgery.

Fig. 1. An aspect of surgery for implantation of shell-bead nucleus in the pearl oyster.

Some oysters are used in preparing the graft tissues of 2-4 mm pieces from the mantles. At the operation, a graft tissue and a nucleus are implanted into the gonad of the oyster. In the case of multiple implantations 2-5 or more nuclei are used at various sites in the body of the oyster. An experienced technician can operate on about 20 oysters per hour. After surgery, the oysters are maintained in the laboratory under gentle flow of seawater for recovery and healing for 3 days. Later the oysters are returned to the farm. The graft tissue grows around the nucleus to form the pearl-sac which then secretes mother-of-pearl (nacre) depositing it on the nucleus. The process continues and when the cultured pearl attains sufficient maturity in terms of lustre, it is ready for harvest.

The rate of rejection of nucleus can be kept within 10% and overall mortality rate within 10% under good conditions. Pearl production rate is around 60% among surviving oysters. Harvest is done by hauling the seeded oysters ashore and opening them for collection of pearls. Sorting of pearls is done under 3 categories, namely grade-A of top quality, B containing medium quality pearls which can be used in jewellery and C containing more or less rejects. A ratio of 30:30:40 of these grades can be obtained under optimum situation.

Fig. 2. A cultured pearl produced in the pearl oyster. The tip of needle points towards the pearl.

Production: Pearl culture is an industrial scale operation. The estimated production in a five-year project employing a total of 2 million oysters would be around 1.2 million cultured pearls of Grades A and B. The production would come in stages commencing from about the 6th month after establishment depending on the schedules of surgery and the duration of post-operative culture which would range from 3-24 months. The bye-products of pearl culture are the pearl shells, seed pearls which are incidental and the

Fig. 3. A batch of cultured pearls of different sizes.

meat. Appropriate technologies for bye - product utilisation are yet to be developed.

Inventory and cost: The capital assets for a 5-year project would be boats, vehicles, SCUBA-diving Units, Compressors and buildings for on-shore work. Expenditure on these would be around Rs.1.5 million. Contingent expenditure on farm structures, shellbeads, instruments, maintenance of boats and vehicles and chemicals and glassware would amount to Rs. 1.7 million. Salary component would be Rs.1.8 million. The total estimated cost of the 5-year project would be Rs. 5 million.

Estimated cost of production: The estimated cost arrived at by certain projections is Rs.4.20 per cultured pearl. Actual cost of production remains to be worked out.

Prospects: India has a good scope for starting a pearl culture industry based on the knowhow available at the Central Marine Fisheries Research Institute (CMFRI). The hatchery production of pearl oysters should be linked up with pearl production which would help in reducing cost of production. The only constraint at present is dependence on imports of shell-bead nuclei. The technology for nucleus production is being developed at CMFRI. Potential areas for setting up pearl culture units for the present would be the Gulf of Mannar along Tamil Nadu coast, Gulf of Kutch along Gujarat coast, as also the Andaman & Nicobar Islands. The world pearl trade has been continuously on the ascent during the last decade and India is a steady importer of cultured pearls. This situation could be changed to the country's advantage when commercial projects are established. The CMFRI can extend the technical knowhow through training programmes at managerial and operative level.

3. TECHNOLOGY FOR HATCHERY PRODUCTION OF PEARL OYSTER

Major highlights: Given the uncertainty resulting from the wide fluctuations of populations of the pearl oyster *Pinctada fucata* in their natural beds in the sea (Gulf of Mannar and Gulf of Kutch), a pearl culture industry in India will have to depend largely on pearl oyster seed produced in hatcheries. Broodstocks are artificially spawned in the hatchery and the larvae are reared in tanks with supplies of appropriate live food. Around day 20, these larvae metamorphose and settle as spat on collectors. They are further reared in nursery tanks upto a size suitable for transplantation to open-sea farm. These young pearl oysters may be supplied to pearl production farms. Availability of good quality sea water and appropriate food would determine the success of spat production.

Operational details: The pearl oyster hatchery has six major functions towards production of spat, namely artificial breeding, larval rearing, spat collection, nursery rearing, microalgal food production and water management. Selected pearl oysters, males and females, are spawned in glass vessels and the eggs are fertilised. The fertilised eggs are transferred to larval rearing tanks and from the early straight-hinge veliger stage, which is reached 24 hours post-fertilisation, the

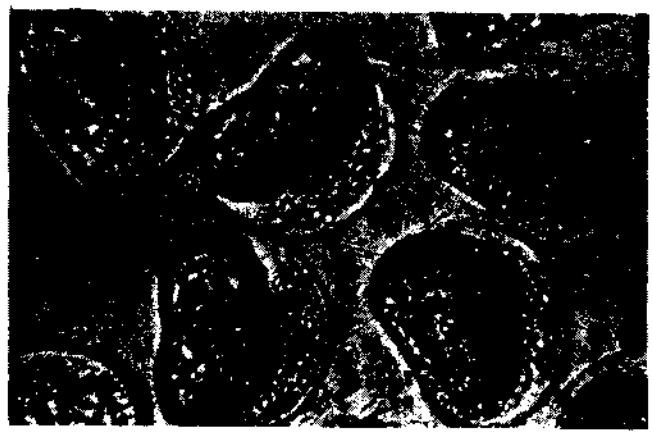

Fig. 1. The straight-hinge veliger larvae of pearl oyster.

larvae are fed with live microalgal forms, particularly *Isochrysis galbana*, which are produced on a large scale in the hatchery. The larval rearing tanks are of 100 litres capacity and larval density ranges 10-20/ml. Seawater filtered to remove particulate matter and treated with ultraviolet light and/or antibiotics to kill bacteria is used in the larval rearing system. Water change is effected on alternate days through careful screening of larvae. Aeration is used to keep the larvae in suspension and to maintain level of dissolved oxygen.

Under good conditions of water quality and feeding (80 - 120 cells/microlitre), the larvae grow progressively through umbo, eye-spot, pediveliger and plantigrade stages before they set as spat around day 20 post - fertilisation. Fibreglass plates of a matty finish are suspended in the setting tanks as spat collectors upon which the spat settle down to begin a sedentary life. The spat, which are as small as 330 micrometers in size, are later reared on a mixed phytoplankton diet in nursery tanks of 500 litre capacity till they reach about 3 mm. Subsequently they are removed from spat collectors, placed in special growing cages and reared in the sea till they reach the "thumbnail" size when they can be supplied to pearl culture farms. The whole hatchery operation would last about four months per batch of spat production.

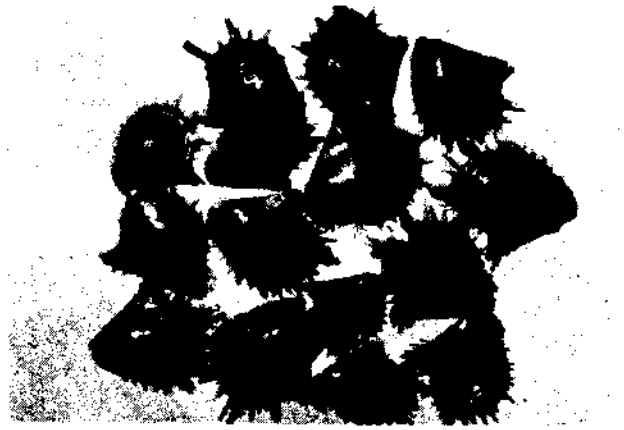

Fig. 2. Young pearl oysters produced by the hatchery technology.

Production: A hatchery with about 50 larval rearing tanks can yield a production of about 500,000 spat per spawning. In four spawnings a year, an annual production of about 2 million young oysters (thumbnail size) can be obtained from a pearl oyster hatchery.

Inventory and cost: The capital assets of a pearl oyster hatchery would be a semi-permanent hatchery building with laboratories of a total area of about 400 sq. m., larval rearing and nursery tanks, sea water sumps and overhead tanks, air compressors and pumps, and laboratory equipment. The total cost of all capital assets would be about Rs.650,000. Contingent expenditure on glassware, chemicals, U.V. equipment, filters, screens, rafts, cages and broodstock would amount to Rs. 175,000.

Fig. 3. A view of pearl oyster hatchery laboratory at the Tuticorin Research Centre of CMFRI.

Employment and cost: A pearl oyster hatchery for an annual production of about two million spat would provide employment to one scientist (in charge of the project), three technicians (one each for larval rearing, live food production and farm rearing), one mechanic, three supporting staff and two watch & ward staff. The annual cost on salaries would be about Rs.100,000.

Estimated cost of production: The estimated cost of production or the break-even price arrived at by certain estimates is approximately Re 0.22 per spat. Actual cost of production remains to be worked out.

Prospects: Establishment of pearl culture industry in India would to a very great extent depend on hatchery produced pearl oysters. The hatchery can work either as a composite unit of pearl culture or as an independent unit supplying spat, depending on the growth of the industry. The CMFRI can provide training in hatchery technology. The immediate scope would be for a hatchery in the Gulf of Mannar region and another in the Gulf of Kutch region, both areas having a potential for pearl culture.

R.V. SKIPJACK COMMISSIONED

The first fishery research vessel built in India *R.V. Skipjack* has been commissioned and handed over to Central Marine Fisheries Research Institute. The vessel has been designed by AUKRA BRUK A/S, Norway and built at Garden Reach Shipbuilders & Engineers Limited, Calcutta. The vessel was taken over by the Institute at Calcutta.

R.V. Skipjack is a multipurpose steel vessel eqipped for trawling, purse-seining, acoustic surveys, hydrography and marine biological work. The vessel is a Stern Trawler with LMC and of the Lloyds 100 A I class.

Dimensions and particulars

LOA	32.6 m
LPP	28.0 m
Beam	7.4 m
Draught (Loaded)	3.31 m
Depth (Mld)	3.7 m
Speed (Trial)	11 knots
Endurance	15 days

Main Engine

GRW/MAN R8V TLS Marine Diesel Engine 705 BHP at 1600 r.p.m. (DIN 6270 rating), Air starting. Controllable pitch propeller, 1850 mm diameter.

Diesel Generator

2 Nos. with Kirloskar Cummins Engines 192 HP and alternators Jyoti, 160 KVA, 230/415 Volts AC, 3 Phase.

Winches (Hydraulic)

Main winch: Trawl/Purse-seine 13 t hauling capacity-wire 1500 m (20 mm dia.) on each drum. Net winch: 6 t capacity with transport rollers. Topping winch: 1.5 t hoisting capacity Guy winch : 1.5 t hoisting capacity. Cargo winch: 3 t capacity. Hydrographic winch: Autospooling with 4000 m 4 mm wire.

Refrigeration

Fish Hold Temperature 34°F (1°C)

Capacities

Fish Hold	115 m^3
Fuel Tank	78 m^3
Lub. Oil	2 t
Fresh Water	12.5 m^3
Fresh Water Generater Capacity	1.5 t/day

Navigational aids

Electrohydraulic Steering
Autopilot-Robertson
Radio Direction finder ADF 5 MK II
Log SAGEM type LHS
Radar Furuno FRS-48

Communication System

SSB Radio telephone SIMRAD PF 3
Intercom-Talk Back and Loud Hailer System (Philips)
S.P. Telephone (ITI)

Acoustic Instrumentation (SIMRAD)

EQ Echosounder 38 kHz
EX Echosounder 50 kHz
Sonar SQ-D 24 kHz
Echo Magnifer MC-100
Trawl eye FH

Laboratory

One laboratory on Main Deck
Operation of Hydrographic/Biological equipments from upper deck Leadsman platform.
Running fresh and sea water facility
Arrangements for live fish tanks on Main Deck

Accommodation

Cabins	7
Baths	2
W-C	2
Ship's Officers & Crew	15 persons
Scientists	4 "

The vessel has reached her operational base at Cochin in December 1982. Research cruises are scheduled to start from early January 1983.

Compiled and prepared by M.J. George, G. Subbaraju and S.K. Dharmaraja.
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