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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

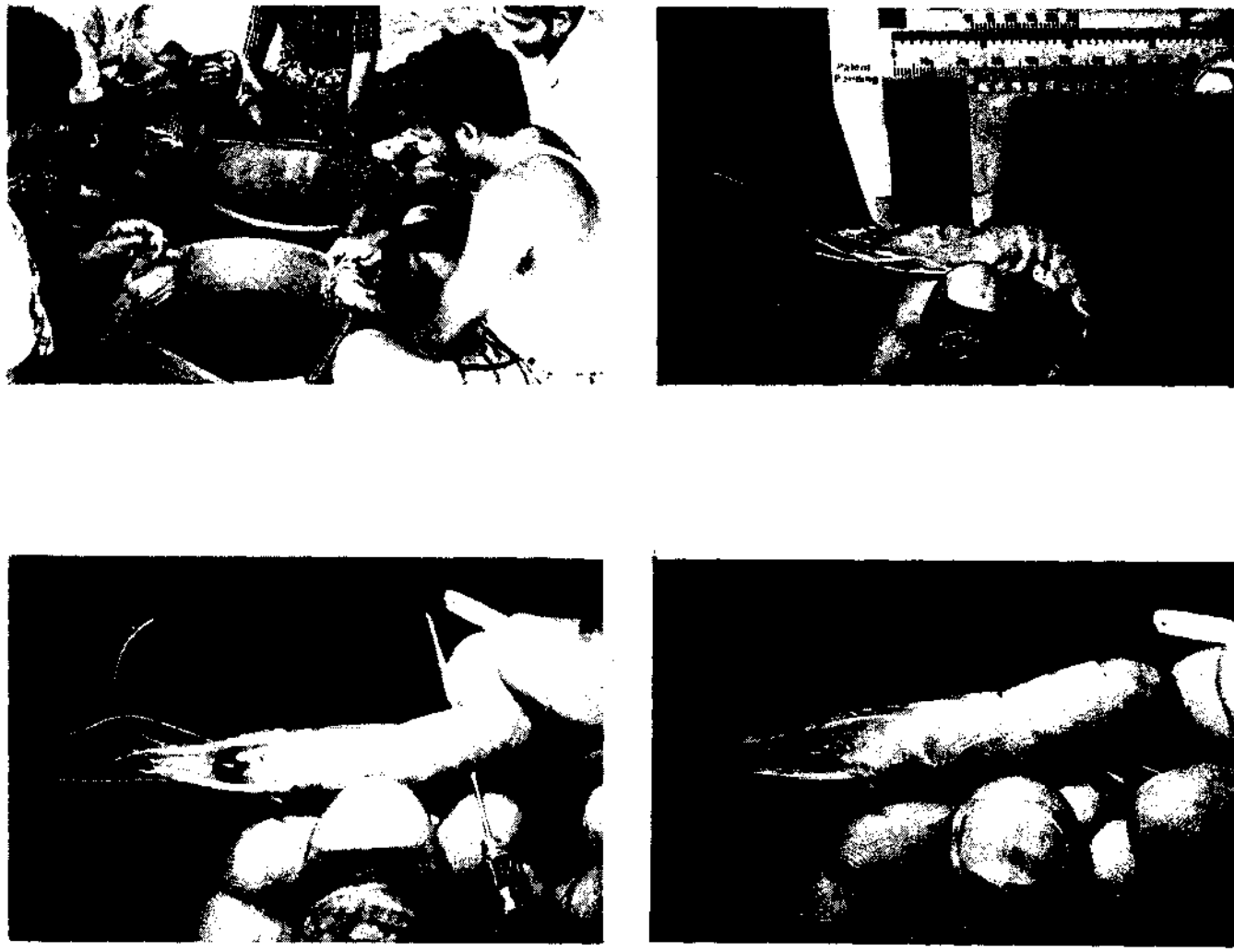
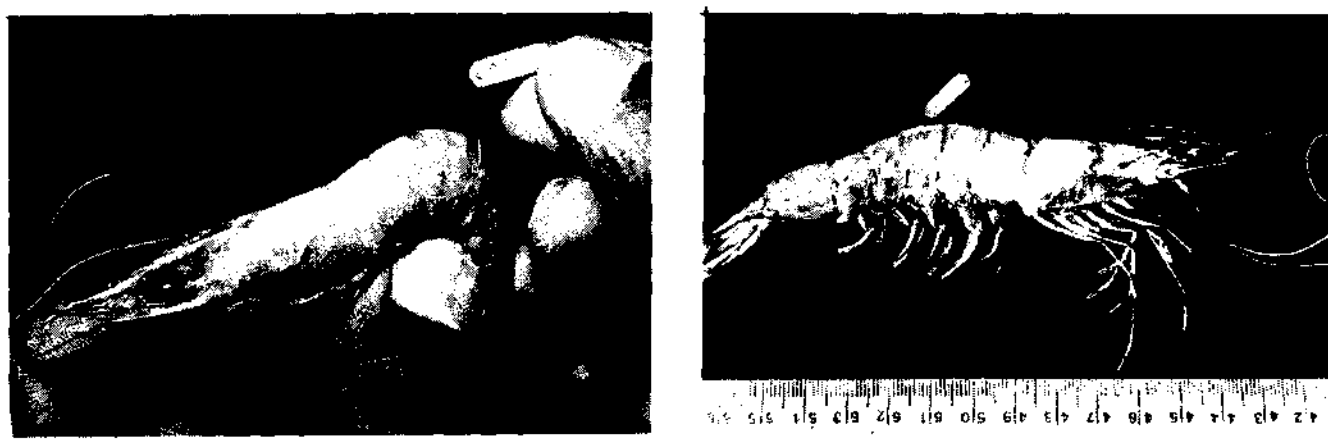


Fig. 1. Tagging procedure.



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.

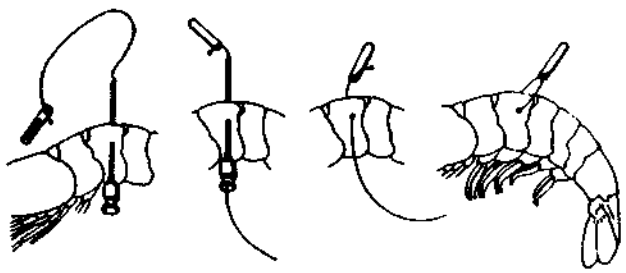


Fig. 2. Various stages of tagging.

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.

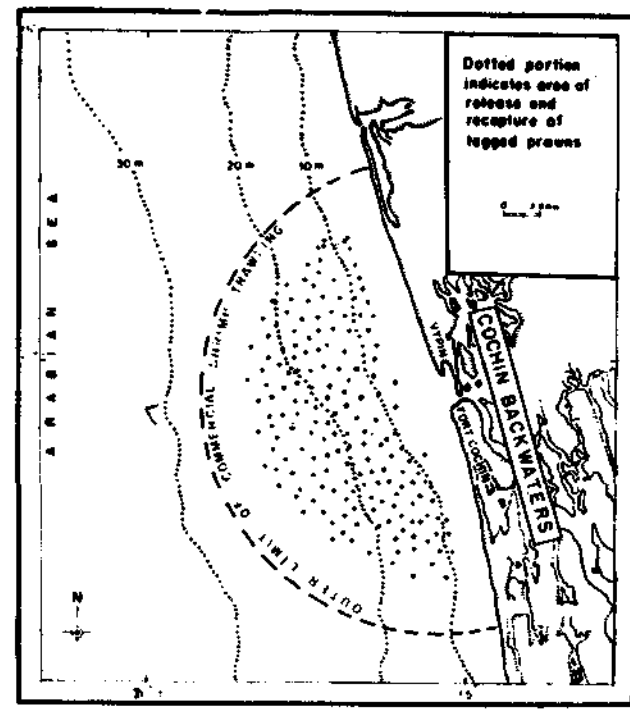


Fig. 3. Area of release and recapture of tagged prawns in the sea off Cochin.

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.

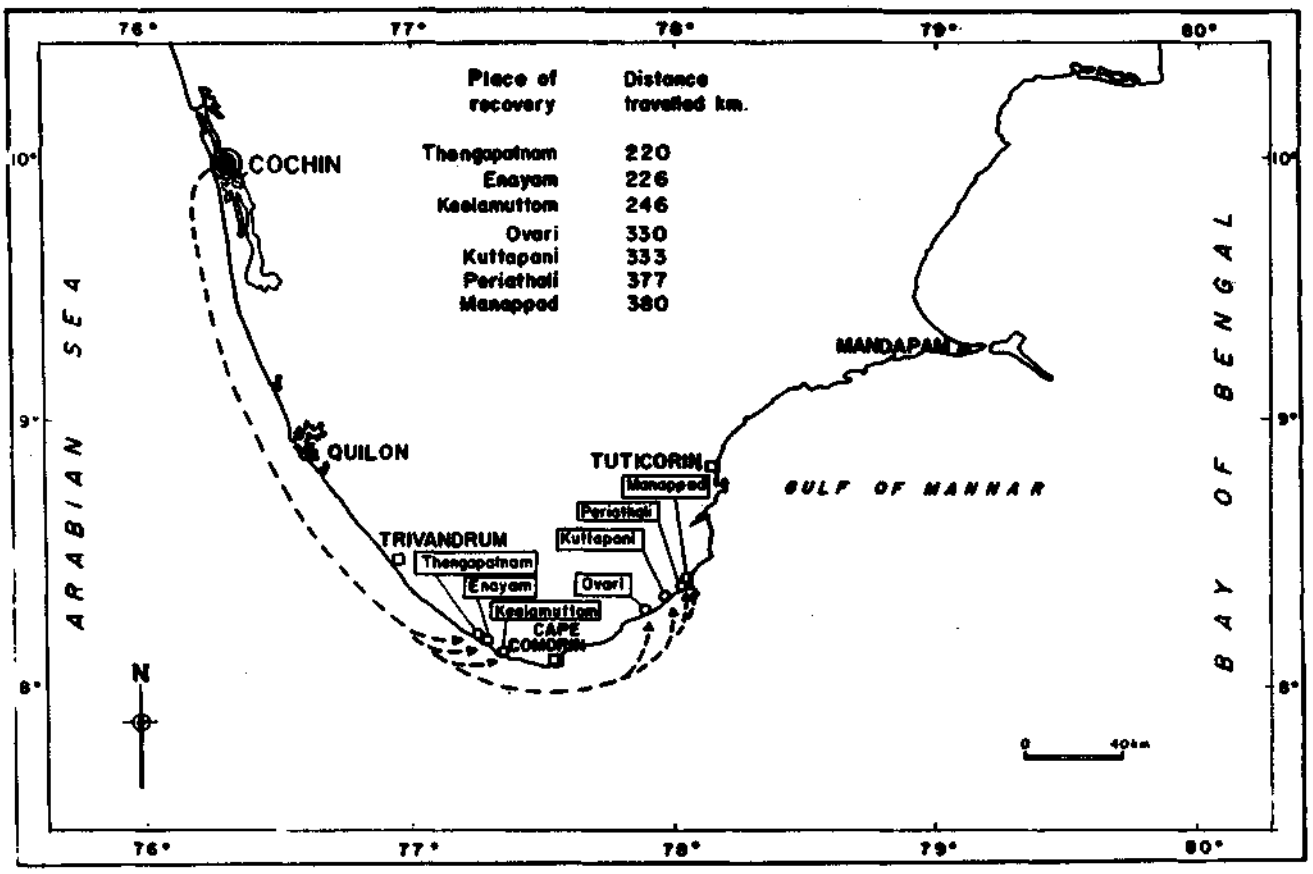


Fig. 4. Distant migration of tagged prawns

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

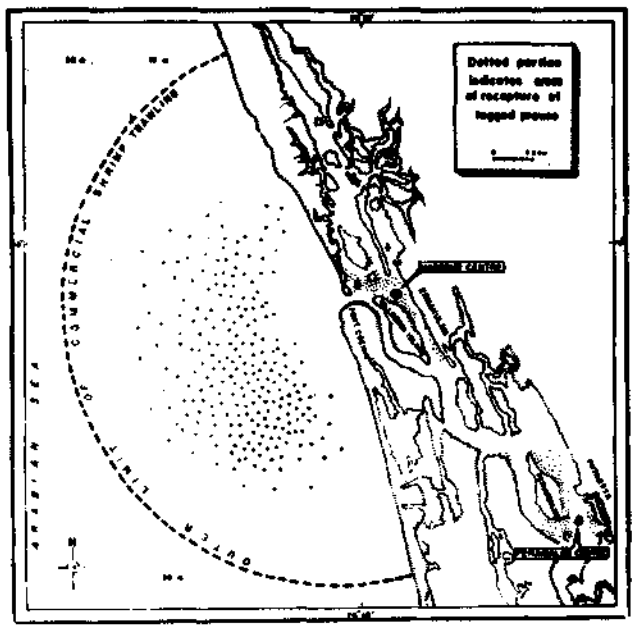


Fig. 5. The tagging centres in Cochin backwaters and areas of local recoveries.

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.

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.

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

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.

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