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Tagging experiments on searanched *Penaeus indicus* in the Palk Bay, southeast coast of India

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ABSTRACT

An attempt has been made to study the suitability of hatchery raised and farm grown *Penaeus indicus* for searanching, and to study the growth and movement of ranched population in the Palk Bay and the Gulf of Mannar. The eggs released by a spawner without eyestalk ablation were raised upto juveniles through rearing in the hatchery, nursery cement tanks and in earthern ponds. The hatching rate and subsequent survival rate from nauplius-1 to PL-1 was 92.3 and 53.0 % respectively. Survival from PL-1 to PL-21 was 49.5 %. The seeds thus raised were stocked in two coastal earthern ponds at a rate of 50,000/ha and fed with pellet diet daily at the rate of 5-10 % of biomass. After 111 days, retrieval was 41.45 % in pond I and 75 % in pond II. The growth was from 22.95 mm TL to 111.7 mm TL/10.1 g wt. in pond I and 103.06 mm TL/ 8.1 g wt. in pond II. These juvenile prawns were tagged with loop tags and released in the Palk Bay off Mandapam at 3 m depth. Recovery started from the subsequent day onwards in the trawl catches of Palk Bay and Gulf of Mannar and continued upto 28 days. Of the 3,430 prawns released, only 19 were recovered accounting for <1 % recapture. Distribution and movement of tagged prawns and the prospects of searanching of *P. indicus* have been discussed.

Introduction

Exploitation of penaeid shrimps in Indian coastal waters has reached the optimum level and further increase in fishing effort, would lead to depletion of stocks (Sudhakara Rao *et al.*, 1995; Suseelan and Pillai, 1995). An alternate means to increase the production is searanching. Among the different penaeid shrimps of commercial importance in the Mandapam region in the southeast coast of India, *Penaeus semisulcatus* and *P. indicus* are found to be suitable for searanching. Accordingly, the Central Marine Fisheries Research Institute (CMFRI) having developed the technology for rearanching undertook a programme in 1986 on the rearanching of *Penaeus semisulcatus* and the results obtained were reported by Rao *et al.* (1991) and Pillai *et al.* (1991).

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On the same line, searanching of *P. indicus* was attempted during 1993-'94 by releasing the hatchery raised and farm grown juveniles into Palk Bay. The important components of searanching are identification of artificially recruited (searanched) population from the wild, monitoring of survival, movement in the fishing ground, growth and recruitment pattern of the released stock. Mark-recovery experiments were carried out to test the feasibility of tagging of prawns and collect preliminary information

Material and methods

The *Penaeus indicus* raised in the hatchery of the Regional Centre of the CMFRI and further reared upto juveniles in the two earthern ponds at the marine fish farm at Mandapam were used for searanching during October 1993 to March 1994. Nauplii from the fourth spawning (third spawn of single moult cycle) were reared upto PL-I following the method described by Silas *et al.* (1985). Nursery rearing was carried out in two linear out-door cement tanks (each 7 t capacity) for 21 days. PL-21 were further reared upto taggable size (<100 mm TL) in two earthern ponds (300 sqm and 400 sqm) for 111 days.

111-113 days after stocking, the surviving juveniles were collected alive with dragnet for tagging. The prawns were held in a hapa errected in the sea at 0.5 m depth for acclimatisation for two hours before tagging. Red coloured and numbered plastic loop tags (Atkins tag), which were successfully tested with *P. semisulcatus* (Pillai *et al.*, 1991) eariler, were used for tagging *P. indicus*. Tagged prawns were conditioned in hapa for two hours before release. Healthy and active tagged prawns were selected for searanching and carried in fibreglass containers on indigenous boat fitted with inbuilt engine and relased at 3 m depth in the Palk Bay off Marine Fish Farm of the Regional Centre of CMFRI (Fig. 1).

A week prior to tagging, wide publicity was given at all trawl landing centres and fishing villages along Palk Bay and Gulf of Mannar through posters and by contacting the fishermen appraising them of the importance of tagging. An incentive reward of Rs. 15/ prawn was announced to encourage reporting of the recovery. The data and location of recovery of either the recovered prawn or tag alone and information on the depth at the capture site were recorded. The total length, weight and sex of the recovered prawn were also recorded whenever possible.

Results

Seed production : Out of 2,60,000 eggs spawned 2,40,000 (92.3 %) were hatched into nauplii (N-I). Of these, 1,50,000 were further reared and 80,000 PL-I were produced. The survival rate from N-I to PL-I was 53.3 %. The methodology of larval rearing including food and feeding of larvae, water management and monitoring of the larval stocks were as per the standardised method developed and perfected at CMFRI (Silas *et al.*, 1985). During the larval rearing period the salinity of the medium was 35 ‰ and the temperature range was 27.5-30.6°C.

The postlarvae (PL -1 = 5 mm) were further reared in the nursery tanks for 21 days and 39,600 PL -21 (22.95 mm) were produced with 49.5 % survival rate and a growth increment of 17.95 mm. The water temperature in the nursery tanks varied from 28.5 to 33.0°C and the salinity 32.6-34.3 ‰.

Pond culture : On 16-11-1993, pond I and II were stocked with PL-21 at a rate of 1,500 and 4,000 respectively. After 111 days of culture, all the survived prawns were collected and used for tagging during 7-9/3/1994. The salinity of the pond water was at 30 ‰ at the stocking time and it gradually decreased to 13 ‰ by day 46 due to the northeast monsoon rains and gradually increased to 32 ‰ in pond-I and 24.6 ‰ in pond-II by day 97. Dissoloved oxygen varied between 4.0 and 6.0 ml/l. Temperature gradually increased from 26.5°C in November to 33.4°C in February due to change in season. Water depth ranged from 0.8 to 1.2 m.

Out of 1,500 seed stocked in pond- I, 621 prawns were recovered when final fishing was carried out on 8-3-1994 after 112 days of stocking. The low survival rate was 41.4 %. The growth rate per day was 2.03 mm / 0.11 g on day 28; 0.38 mm/0.060 g during 29-66 days; 0.41 mm/0.08 g during 67-97 days; and 0.30

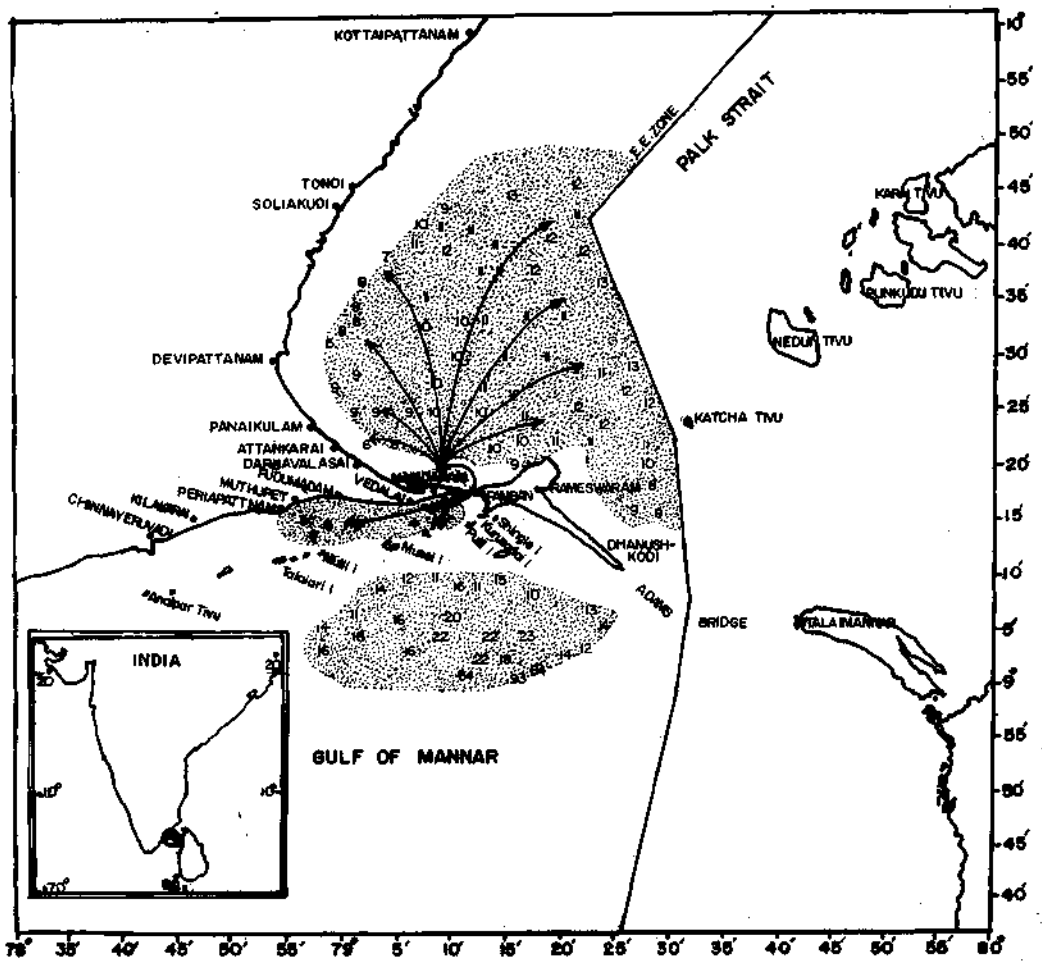

Fig. 1. Distribution of tagged *P. indicus* in trawl fishing grounds in the Palk Bay and Gulf of Mannar.

TABLE 1. *Growth of* P. indicus *reared in coastal ponds at Mandapam during November 1993 - March 1994*

Pond No.	Parameter	At stocking	After stocking					
			28 days	46 days	66 days	81 days	97 days	111 days
I	Total length (mm)	22.95	79.8	86.51	94.41	101.41	107.41	111.71
	Weight (g)	0.12	3.2	4.8	5.5	7.0	8.0	10.1
II	Total length (mm)	22.95	76.5	82.33	89.00	94.5	99.8	103.06
	Weight (g)	0.12	3.0	4.2	5.0	5.5	6.8	8.1

mm/0.15 g during 98-111 days. The average size attained during a culture period of 112 days was 110.88 mm TL/ 10.0 g for male and 112.43 mm TL/10.2 g for female.

In pond-II 3,000 prawns were recovered out of 4,000 seed stocked. Growth rate per day was 1.91 mm/0.12 g on day 28; 0.32 mm/0.039 g between 29 and 66 days; 0.34 mm/0.058 g during 67-97 days and 0.23 mm/0.092 g during the last 14 days. The average total length/ weight attained for male and female was 101.86 mm/8.0 g and 104.17 mm/8.2 g respectively during a total of 113 days of culture in the pond.

Though the stocking rate and the feed offered were similar, the growth rate in pond-II was poor as compared to that in the pond-I. Relatively low survival in pond-I was due to escape of some of stocked population to neighbouring pond during heavy rains. *P. semisulcatus* was stocked in the neighbouring pond (400 m^2 area) at a rate of 40,000/ ha. On day 111, 630 numbers of *P. indicus*, measuring 123.08 mm TL/ 14.0 g wt (mean) for male and 126.53 mm TL/16.0 g wt for female, were recovered from the neighbouring pond along with 530 numbers of *P. semisulcatus* and tagged. But the growth of these was fairly good as compared to those of pond -I and II due to variation in feed. Biofeed (imported from Singapore) was given for stocked population in the neighbouring pond.

Tagging and recovery : Of the 3,430 prawns (73-145 mm size range) tagged and released, only 19 were recovered from the trawl catches (Table 2) accounting for less than 1 % (0.55 %) of recapture. Recovery started from the very next day of release, but continued upto 28 days. Fig. 1 shows the movement of tagged prawns and locations of the recapture in the Palk Bay and Gulf of Mannar. Of the 19 recovered, 11 were from Palk Bay and 8 from Gulf of Mannar. Six prawns were recaptured on the next day after release, 10 between 2-8 days and 3 between 22-28 days of release. Most of the prawns recovered were headless. One male recovered after 22 days from Palk Bay, had shown a growth increment of 4 mm in total length and 2.0 g in weight (worked out from average weight). The capture of tagged prawns in the Gulf of mannar off Pudumadam, a day after release, indicated the fast movement of *P. indicus* i.e. 15 nautical miles/day. Prawns migrated to 25 nautial miles in the Palk Bay off Soliakudi after 21/22 days (Fig. 1).

Discussion

The number of eggs (2,60,000) released by the spawner without resorting to eyestalk ablation and the hatching rate (92.3 %) of eggs recorded in the present study are comparable with the

TABLE 2. *Particulars of tagged and recovered* P. indicus *from the trawl catches in the Mandapam region*

Sl. No.	Date of release	Date of recovery	Sex	Total Length at Release (mm)	Total Length at Recovery (mm)	Weight at Recovery (g)	Elapsed period in days from release	Sea area where captured	Landing centre from where tagged prawns were recovered	Remarks
1.	7.3.'94	08.3.'94	Female	137	137	17.5	1	Off Pillaimadam	Mandapam	-
2.	7.3.'94	08.3.'94	Female	129	129	16.0	1	Off Pillaimadam	Mandapam	-
3.	7.3.'94	08.3.'94	Female	123	123	12.5	1	Off Dhargavalasai	Mandapam	-
4.	7.3.'94	08.3.'94	Male	123	123	12.5	1	Off Pillaimadam	Mandapam	-
5.	7.3.'94	08.3.'94	Female	139	139	19.0	1	Off Pudumadam	Mandapam	-
6.	8.3.'94	10.3.'94	Male	125	125	14.5	2	Off Athankarai	Mandapam	-
7.	9.3.'94	10.3.'94	Female	105	105	05.5	1	Off Pudumadam	Mandapam	-
8.	8.3.'94	10.3.'94	Male	105	105	06.0	2	Off Mandapam (Gulf of Mannar)	Mandapam	-
9.	8.3.'94	10.3.'94	Female	103	-	-	2	Off Mandapam (Gulf of Mannar)	Mandapam	Headless : B.Wt. 4.0g & B.L. 60mm
10.	7.3.'94	10.3.'94	Female	128	-	-	3	Off Mandapam (Gulf of Mannar)	Mandapam	Only tag recovered.
11.	8.3.'94	10.3.'94	Male	121	-	-	2	Off Athankarai	Mandapam	Headless: B.L.67mm & B.Wt 5g
12.	7.3.'94	13.3.'94	Female	138	-	-	6	Off Mandapam (Palk Bay)	Mandapam	Headless : B.L. 85m & B.wt. 11.0g
13.	8.3.'94	13.3.'94	Male	111	-	-	5	Off Mandapam (Gulf of Mannar)	Mandapam	Headless: B.L.66mm & B.wt. 5g
14.	8.3.'94	13.3.'94	Male	110	-	-	5	Off Devipattinam	Mandapam	Headless: B.L.72mm & B.Wt.6.5g
15.	7.3.'94	15.3.'94	Male	127	-	-	8	Off Mandapam (Palk Bay)	Mandapam	Headless: B.L. 65mm & B.wt.4.5g
16.	8.3.'94	15.5.'94	Male	122	-	-	7	Off Devipattinam	Soliakudi	Headless: B.L. 78mm & B.Wt. 9.0g
17.	7.3.'94	29.3.'94	Male	124	128	15.0	22	Off Soliakudi	Soliakudi	-
18.	87.3.'94	29.3.'94	Female	111	-	-	21	Off Soliakudi	Soliakudi	Headless: B.L.85mm & B.Wt. 10.5g
19.	9.3.'94	06.4.'94	Male	100	-	-	28	Off Mandapam (Palk Bay)	Mandapam	Tag only recovered.

results reported in *P. indicus* by Muthu and Lakxminarayana (1979) and Muthu *et al* . (1984, 1986). After 21 days of nursery rearing, the recorded survival(49.5 %) and growth increment (17.95 mm TL) also agree with the observations made by Silas *et al.*(1985).

The 0.799 mm growth rate/day and 41.4 % survival in pond- I and 0.721 mm growth rate / day and 75 % survival in pond-II are relatively better than those reported for *P.indicus* by George (1975) and Nandakumar (1982) and agree with the results of Lazarus *et al.* (1988). The better growth recorded in pond - I is due to thinning of stocked population because of the escape to neighbouring pond. Variation in growth of *P.indicus* at different stocking densities was reported by Uma Maheswari (1983) and Lazarus *et al.*(1986 and 1988).

The searanched prawns not only survived in the natural environment but also get distributed to different locations of fishing grounds in the Palk Bay and Gulf of Mannar within 28 days. Though the recovery rate was low the numerical study showed that the released population survived, grew and got recruited to the fishery. Large scale searanching of *P. indicus* might help to improve the stock in this region. It would also help to understand the recruitment pattern of this species into Palk Bay and Gulf of Mannar.

The tagged prawns travelled 25 nautical miles (off Soliakudi) within 22 days in northern direction. In southern direction it had travelled 15 nautical miles within one day and reached off Pudumadam in the Gulf of Mannar via Pamban pass. The mark-recovery study conducted in the east and west coasts had revealed that prawns had not moved far from the fishing grounds except for a single instance of one *Metapenaeus dobsoni* that travelled 32 nautical miles within 10 days (Anon., 1975). The study by Vijayaraghavan and his team (CMFRI, 1982) has revealed that *P. indicus* released in the Arabian sea off Kerala coast, travelled southward along the west coast, and was finally recaptured in the Bay of Bengal off Tamil Nadu coast after travelling 205 nautical miles within 68 days. Simultaneous observations on the movement of drift bottles revealed that southward current would have aided the prawns upto Tamil Nadu coast. During the northeast monsoon period (November-January) southward current develops in the Bay of Bengal and exists upto April (Sewell, 1929). Further study has to be conducted by releasing tagged prawns and drift bottles simultaneously to confirm the involvement of this southward current with the drift of *P. indicus* by 15 nautical miles/day.

In the present study, *P. indicus* recovery was reported upto 28 days in the fishing grounds of Palk Bay whereas tagged *P. semisulcatus* that were released simultaneously were recovered upto 79 days. It is well known that the inshore waters of Palk Bay with the seagrass ecosystem is the favourable habitat for *P. semisulcatus* and this might be the reason for longer duration stay of this species. *P. indicus,* in this region is generally exploited between the stretch of Islands and Srilanka in the Gulf of Mannar, where depth and habitat differ from those of Palk Bay (Fig. 1). The faster movement and distribution of *P. indicus* from the releasing site, compared to those of *P. semisulcatus,* indicate the possibility of this species migrating in search of its

habitat. Intensive studies are required to confirm this pattern of migration.

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