

COASTAL ZONE MANAGEMENT

(In Tamil Nadu State, India)

**R. Natarajan,
S.N. Dwivedi &
S. Ramachandran**

SHRIMP RANCHING

*P.Vedavyasa Rao, N.N.Pillai, P.E.Sampson Manickam,
G.Maheswarudu and M.R.Arputharaj*

At several of the important prawn fishing centres along the coast, it is shown that prawn production has reached the optimum level and further increase in effort may not enhance the yield. In this context the strategies considered to sustain and to increase the production are judicious management of the exploited resource, extension of range of exploitation to underexploited resources and the development and promotion of culture fisheries. As an offshoot of mariculture activities of penaeid prawns to augment production, the release of hatchery and nursery raised postlarvae / juveniles into the natural environment has emerged as an important activity. This system of released hatchery stock which grow and subsequently get recruited in capture fishery, forms the basis of sea ranching. (Uno Yutaka, 1984).

Against the above background, a research programme on "sea ranching of prawns" has been initiated by the Central Marine Fisheries Research Institute for the first time in the country in 1985. Mandapam was selected as the main project site in consideration of the topographical features of the area, active prawn fishing effort and facilities available for larval production and for monitoring the resource. *Penaeus semisulcatus* which is the main-stay of prawn fisheries in this area was selected as the candidate species for ranching.

The sea ranching techniques involve (hatchery) production of postlarvae, (nursery) rearing, release of seed and monitoring of the released and exploited resources. Gravid female of *P. semisulcatus* (for spawning in the laboratory) were obtained from the local commercial trawl catches. Following the technology developed and perfected by the Institute for hatchery production of penaeid prawn seed (Silas *et al.* 1985), the spawning and larval rearing were undertaken in the experimental hatchery upto the I postlarval stage. Thereafter, the postlarvae were reared in 6-t capacity rectangular cement tanks by feeding with egg-prawn meat compounded feed for 10-15 days. At this stage, they reached 10-15 mm size and exhibited "clinging" behaviour to sea grasses. Besides, *P. semisulcatus* seed were also produced

in 60 t capacity square cement tanks following community culture system, where the seeds were raised to 25 - 30 mm sizes (Maheswarudu *et al.*, in press).

Selection of site for the release of seed is important to ensure better survival and growth of released stock. Preferably, the site should be a nursery ground providing congenial physico-chemical requirements and better refuge from predators and adequate food for growth.

Observations made on the distribution pattern of *P.semisulcatus* during different phases of its life off Mandapam indicated that the young ones occurred abundantly in shallow inshore grounds where sea grasses were plenty. In this habitat they spend a part of their life before being recruited into the fishery in the deeper grounds of this area. In due consideration of this fact, the sites of release of seeds were the seagrass beds, nearer to the hatchery in the Gulf of Mannar. Another site selected was the salt water lagoon (at Mandapam) which extends to about 6 km spread over 360 ha. during high water. At the time of north-east monsoon the lagoon gets filled up by land drainage and tidal water. With cessation of rains, the water supply is maintained upto May / June when the bar mouth gets closed. Thereafter, the water in the lagoon basin, sustained at low level, is characterized by gradually increasing salinity till the onset of north-east monsoon. The lagoon supports a minor prawn fishery during December- April/May, although *P. indicus* and *Metapenaeus burkenroadii* form the dominant species in the fishery.

During 1985, 5.84 lakhs postlarval *P.semisulcatus* were produced in the temporary hatchery at Mandapam. Of these, 3.09 lakhs postlarvae were released into the waters of Palk Bay as a trial. Following the establishment of an experimental hatchery, over 25.6 lakhs postlarvae were produced during April '87 - August '89 and were grown in nursery tanks. Of these, 7.5 lakhs seeds were released into the Gulf of Mannar and 7.1 lakhs into the salt water lagoon at Mandapam (Table.1). The remaining seeds were used for culture in seawater fed earthen ponds adjacent to the lagoon and for other studies concerning the growth and survival of the species in different salinities.

To understand growth and recruitment pattern of the released stock, regular monitoring of the catches from the lagoon was carried out. In August 1988, 97,789 *P. semisulcatus* juveniles, ranging in size from 11 to 30 mm, were released into the lagoon. A month after the release, when experimental fishing by drag net was carried out at different locations in the lagoon, *P.semisulcatus* was not encountered. Another batch of

batch of seeds (16 - 35 mm) numbering 70,366 were released into the lagoon on 3.10.88. After 24 hrs of release, a fixed bag net made of mosquito netting was operated at the bar mouth at regular intervals, from 12.30 hrs on 4.10.88 to 00.20 hrs on 5.10.88, coinciding with the low and high tides. The net was operated against the current. Although about 5 kg of fish were caught in the first two hauls operated between 12.30 and 18.00 hrs, no prawns were encountered in these hauls. In the subsequent four hauls taken during the night hours (19.00 - 02.00 hrs), a total catch of 0.373 kg of *P. semisulcatus* (520 numbers), 10 kg of *M. burkenroadii* and 6.25 kg of fishes were obtained. In the nets operated during high tides no prawns were caught.

Table 1. Number of *Penaeus semisulcatus* seed produced in the hatchery and released into the Gulf of Mannar/ Pillaimadam salt water lagoon at Mandapam during April, 1987 - August, 1989.

Month	1987		1988		1989	
	Postlarvae produced	Seed released	Postlarvae produced	Seed released	Postlarvae produced	Seed released
January	—	—	38,490	25,950	25,200	10,185*
February	—	—	106,830	73,390*	30,000	1,000*
March	—	—	142,060	128,060*	79,600	172,870*
April	335,333	34,000	65,000	71,000*	79,600	—
May	108,100	11,050	32,500	—	—	—
June	63,244	98,354	307,179	234,965	—	—
July	162,046	—	197,740	57,820	241,640	24,900*
August	191,736	78,050	25,512	43,137	—	38,400*
September	109,460	18,100	67,728	25,512	—	—
October	30,000	22,950	—	70,366*	—	—
November	16,000	—	94,000	5,676*	—	—
December	—	12,000	12,440	94,000	—	—
				15,400*		
Total	1,015,919	274,504	1,089,479	943,065	456,040	247,355

* released at Pillaimadam salt water lagoon.

The percentage size composition of *P. semisulcatus* released on 1.8.88 and 3.10.88 and those obtained in the experimental fishing is depicted in Fig.1. The size of *P. semisulcatus* caught in the experimental fishing ranged from 21 to 103 mm. As these were caught during the low tide, it was inferred that they were the emigrating population from the lagoon to the sea. As 46.5% of this population composed of juveniles measuring between 21 and 35 mm and since the bulk of the population released on 3.10.88 belonged to this size group, probably they belong to the population released into the lagoon on 3.10.88.

It was observed that the emigrating population also composed of large size of prawns also. In consideration of the fact that there was no report of any catch of *P. semisulcatus* in the commercial fishery of the lagoon in September '88 and since no juvenile prawns were encountered in the nets operated during high tide and the large prawns in each of the size group were represented by only a few numbers, obviously they did not represent a population that had earlier immigrated from the sea, but might represent a segment of the population released in August '88 but stayed in lagoon. Among them, the prawns belonging to the size group of 91-95 mm, forming a minor mode (10.6%), probably represent the major group of juveniles (16-20 mm) released into the lagoon on 1.8.88. The other size groups in the catch might represent the population that were growing at different rates. As the biological productivity of the lagoon is known to be relatively low, it is possible to get such wide variations in the growth rates of prawns. The inference that the prawns belonging to the size group of 91-95 mm represented the juveniles of 16-29 mm size group released in August is further supported by the observation by Sampson Manickam *et al* (unpublished) who recorded a growth rate of 1 mm per day during the first 60 days of culture of *P. semisulcatus* in seawater earthen pond located adjacent to the lagoon. These observations thus indicate that while one part of the released population in the lagoon migrates to the sea, another part remains in the lagoon itself and grows upto 75 mm (average) size in a period of two months.

To study the effects of ranching on prawn populations and also on productivity in this area, regular monitoring of the exploited resources were carried out (from the landing centres) at Mandapam and Pamban. *P. semisulcatus* was caught mainly by bottom trawl nets operated by small mechanised boats (9.14 - 9.75 mm size). Besides, 'Disco' nets (three walled entangling nets) were also employed to catch prawns.

Generally the active fishing season was observed from April to October in the Palk Bay and from November to March in the Gulf of Mannar. The fishing range extends from close to the shore upto about 50 m depth nearshore.

The important population parameters of *P. semisulcatus* observed during 1987 and 1988 are given in Table 2. The size of exploited population in this region ranged from 90 to 220 mm total length, the principal modal size contributing to the fishery being 121-130 mm for males and 146-150 mm for females. Although the breeding activity of *P. semisulcatus* population was seen throughout the year, the peak breeding season during 1987 and 1988 was observed during January-February and July-August. The peak recruitment of juveniles into the fishery was recorded in April-June in 1987 and during April, May and October - December in 1988. The quantum of seed released in the present experiment was small to identify and separate the naturally recruited and released population, but data collected would serve as a base for further studies on the effectiveness of sea ranching of shrimps to augment production.

Table 2. Important population characters of *Penaeus semisulcatus* exploited from Gulf of Mannar at Mandapam region during 1987 and 1988

	1987	1988
1. Estimated catch (t)	219.9*	206.3
2. Catch per unit effort (kg/hr)	1.631	1.157
3. Size range (in mm)		
Male	90 - 160	90 - 160
Female	100 - 210	85 - 220
4. Principal modal size (mm) of the population		
Male	121 - 125	126 - 130
Female	146 - 150	146 - 150
5. Peak breeding season	Jan. Feb and July-August	Jan. Feb. and July August
6. Peak recruitment period	April, May and June	April-May and October November and December

* Excludes the catch from July - October.

REFERENCES

- Maheswarudu, G., N.N. Pillai, P.Vedavyasa Rao, P.E. Sampson Manickam and M.R.Arputharaj. Seed production of the green tiger prawn, *Penaeus semisulcatus* in a non-circulatory and non-aerated out door tank. (in press) J. mar. biol. Ass. India.
- Sampson Manickam, P.E., et al (Unpublished) . On the growth of *Penaeus semisulcatus* de haan in seawater earthen pond, cement tank and at different salinities (MS).
- Silas, E.G., K.H.Mohamed, M.S.Muthu, N.N.Pillai, A.Laxminarayana, S.K.Pandiyan, A.R.Thirunavukkarasu and Syed Ahamed Ali, 1985. Hatchery production of penaeid prawns. Publication, No. 41. C.M.F.R.I. Cochin.
- Uno Yutaka, 1984. An ecological approach to mariculture of shrimp: Shrimp ranching fisheries. Proc. I Intl. Conf. on Culture of Penaeid Prawns / Shrimps. Iloilo city, Philippines, SEAFDEC Aquaculture Department: 37- 45.