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PROSPECTS ON SPINY LOBSTER *PANULIRUS* SPP. CULTURE IN THE EAST COAST OF INDIA

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ABSTRACT

A method for collecting large number of pueruli and post-pueruli of the spiny lobster *Panulirus* sp. using different types of collectors suspended from a floating raft is described. Mangalore tile was found to be the best collector. For optimum collection of larvae the collectors should be suspended near the bottom.

The best season for collecting the larvae was from February to May. The abundance of the larvae has been correlated with the current pattern of the locality, the shoreward current wafting in large number of just metamorphosed larvae towards the coast for settlement on the bottom.

The larvae have been reared successfully to the adult in 18 months feeding on green mussels and backwater clams. The lobsters attained sexual maturity in closed culture system and spawned releasing millions of phyllosoma larvae.

Since the rearing of phyllosoma larvae to pueruli is beset with number of problems like the availability of proper type of feed at various stages of their complex life history, the culture of the spiny lobster for the present has to depend mainly on collecting and growing the naturally occurring pueruli and post-pueruli.

INTRODUCTION

LOBSTERS are highly priced sea-food for export from our country next only to prawns. During 1978, India exported about 690 tons of frozen lobster tails fetching foreign exchange to a value of 46 million rupees.

The total annual production of lobsters in our country during 1978 was about 1307 tons, Maharashtra contributing nearly 50% of the catch. Tamil Nadu contributed about 250 tons of lobsters to the total annual production. The lobster landings have shown a marked decline from 1975 onwards. The production could be increased by culturing them in confined waters.

Spiny lobsters enjoy a wide distribution and occur in rocky areas from Gujarat to Andhra Pradesh. Along the coast of Tamil Nadu *Panulirus ornatus* and *Panulirus homarus* contribute a major portion to the catch. *Panulirus versicolor*, *Panulirus polyphagus* and *Panulirus longipes* are also known to occur along the Tamil Nadu Coast. Kanyakumari area is the most important area for lobster fishing.

Not much work has been done in culturing the spiny lobsters in any country because of its complex life history. Deshmuk (1968) has studied the metamorphosis of *P. polyphagus* from puerulus to post-puerulus stage. Thomas (1972) has studied the growth of *Panulirus homarus* in captivity. Attempts at culturing them have been made in America, Japan, South Africa, Soviet Union and Australia. Scientists in Scripps Institute of Oceanography

have kept the puerulus of *P. interruptus* in finger bowls for four moults. *P. elephas* has been successfully kept in aquaria and nursery ponds by Soviet Scientists. Japanese workers have reared *P. japonicus* for 5-10 months. Chittleborough (1974) has given an excellent review of prospects for rearing rock lobsters in Australian waters.

The present paper presents the results of work done at Madras in rearing spiny lobsters from pueruli to adult on a large scale and discusses the prospects for spiny lobster culture in India.

The fortuitous discovery by the authors of spiny lobster pueruli and post-pueruli occurring in large numbers on the mussel spat collectors suspended from the rafts in Covelong opened up a new avenue for investigation on lobster culture.

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Material and Methods

The Covelong Bay, where this work was carried out, is about 35 km south of Madras on the east coast road to Mahabalipuram. The bay is semicirculr and is guarded at its entrance by a series of rocky outcrops extending in north-south direction. A detailed description of the hydrological conditions, currents, topography, etc. has been given by one of us (Rangarajan, 1979) elsewhere.

A raft was floated at a depth of 8 metres and various types of collectors like Mangalore tile, plain as well as wound with thin coir rope, cut pieces of motor car tyres, bunches of frayed coir and nylon ropes, stringed coconut shells, etc., were suspended from the raft. The collectors were arranged at 6 metres, 3 m and 1 m depths. The collectors were lifted from the water daily and the occurrence of pueruli in the different collectors noted.

Results

The maximum number of pueruli and post-pueruli were collected from Mangalore tiles suspended at 6 m depth. Collectors at 3 m depth yielded only a few pueruli and those near the surface almost nil. This clearly showed that the depth at which the collectors were suspended is very important to get the maximum number of larvae.

It was noticed that more number of pueruli occurred on Mangalore tiles closely wound with thin coir rope than on plain tiles. It is quite likely that the rope wound tiles provided ideal hiding places for the pueruli since they were found in the gap between the tile and the rope. Although a few pueruli were collected from other collectors like motor car tyres and coconut shells, most of the pueruli were collected from Mangalore tiles.

More pueruli were found on Mangalore tiles which have been immersed in sea water for some time and over which a settlement of barnacles, mussel spats, amphipods, etc. have taken place rather than on new tiles. It is quite likely that the pueruli and post-pueruli were attracted by tiles with settlement of these organism.

Season of occurrence of pueruli and post-puerul

The pueruli and post-pueruli of *Panulirus* spp. came and settled down in large numbers on the collectors from November to June, the maximum number being obtained during March/April. The occurrence of pueruli and post-pueruli of three common species of spiny lobsters during 1977 is given in Table 1. After April they became scarce with stray numbers occurring during May and June. The best time to collect the pueruli of spiny lobsters is from February to May.

There was a similar pattern of occurrence of pueruli in the following year also.

TABLE 1. *Occurrence of pueruli of different species of* Panulirus *during* 1977

Months	*Panulirus homarus*		*Panulirus ornatus*		*Panulirus polyphagus*	
	Pueruli	Post-pueruli	Pueruli	Post-pueruli	Pueruli	Post-pueruli
January ..	—	—	—	—	—	—
February ..	2	7	2	2	1	—
March ..	14	20	9	23	17	1
April ..	4	6	4	11	12	2
May ..	—	1	—	2	8	—
June ..	—	—	—	—	5	—
July ..	—	—	—	—	—	—
August ..	—	—	—	—	—	—
September ..	—	—	—	—	—	—
October ..	—	—	—	—	—	—
November ..	—	—	—	—	13	—
December ..	—	—	—	—	12	—

GENERAL CONSIDERATIONS

The panulirid lobsters have a very complex life history, breeding in inshore waters and completing the protracted and complex larval development in the off shore areas. They are at the mercy of the currents in the sea and seem to get widely dispersed. It is not clear how the larvae pass through a number of moults to complete the metamorphoses and finally reach the rocky shores to settle down in their natural habitat.

Factors influencing the occurrence of larvae

The phyllosoma larvae are planktonic and with their long hairy appendages are well adapted for transport by sea currents. Their occurrence seem to be closely related to the currents in the sea.

The direction of current in the Covelong Bay is influenced by the prevailing surface winds. During May-June when the southwest monsoon sets in on the west coast, strong winds blow towards the sea. The direction of the current in the sea now is from south to north. It continues to flow towards north till September. During October the north east monsoon generally sets in along the east coast and the direction of wind is from northeast to southwest. The current in the sea reverses its direction and flows from North to South.

The occurrence of pueruli and post-pueruli of spiny lobsters near the coast coincides with the southerly current in the sea. The phyllosoma after completing the metamorphosis in the open sea are transported towards the coast by the southward flowing current and start occurring on the tiles from November onwards. The process continues till April during which period the maximum number of larvae were collected. With the change of current direction in May the occurrence of larvae becomes insignificant and scarce. During June to September when the northward current is quite strong the larvae are absent in the coastal waters. It is interesting to note that the breeding season of the spiny lobster in the east coast coincides with the onset of the northward current. Breeders in the natural population are very common during May-August. The northerly current presumably carry the phyllosoma larvae to offshore areas where the complex life-cycle is completed and southerly current bring the back towards

the coast where rocks are abundant for the final settlement of pueruli. Successful development and metamorphosis of the larvare probably require clear and high salinity water.

Prasad and Tampi (1965) reported that the phylosoma larvae were scarce at the surface with a maximum concentration at about 50 m. The number generally decreased with increasing depth and most of the larvae obtained from the deeper waters *i.e.* below 1000 m were of palinurid lobsters. They pointed out that the concentration of larvae in upper 100 m seemed to be related to the distribution of pycnocline which acted as an effective barrier for the vertical movements of the larvae.

They were of the opinion that in spite of the prolonged planktonic life (6 or 7 months) the larval population were retained in restricted areas to accomplish restocking of the areas and have cited Johnson and Brinton (1963) in support of this opinion. Johnson and Brinton assume that the larvae which swim from one depth to another during vertical migration under the directive stimulus of light may conceivably spend a good deal of time alternatively in currents flowing in different directions or at different speeds. In this way a retardation or prevention of the wholesale outwash is effected. According to this assumption for a weak swimming planktonic larvae like phyllosoma to remain in a restricted area there should not be an unidirectional current for a long period. Such is not the case in the sea since the currents usually flow for a considerable time, sometimes for a couple of months, in the same direction. It is more likely that the larvae are drifted by the currents for a considerable distance away from the shore since they have been recorded at greater depths beyond the shelf. The larvae of the spiny lobsters of Western Australia are known to be carried by currents hundreds of miles into the open sea. The occurrence of larvae even at the depths of 500 m or 600 m clearly showed that they have been transported by the currents. At what level the larvae are carried to far away places is not clear. Their distribution and occurrence is intimately connected with the current pattern of the locality and unless the current pattern is studied in detail and extensive collection made it is difficult to get a clear picture.

Growth of pueruli to adult

The pueruli and post-pueruli were held in large polythene basins containing pure sea water. Aeration was also provided. The pueruli do not feed in the laboratory on the first day. Within a day or two they moult in the laboratory and become post-pueruli when patches of colour appear on the body. The post-pueruli and the juveniles were fed to satiation point with the fresh flesh of green mussel *Perna viridis* or backwater clam *Meretrix casta*. They readily take the fresh mussel flesh and show a preference to it over the clam flesh.

The growth of the spiny lobster *Panulirus polyphagus* from pueruli to adult for over two years has been studied by Radhakrishnan and Devarajan (1979). They have found that the annual growth rate was 34 mm in carapace length for male and 28 mm for female during the first year and 20 mm for male and 20.5 mm for female during the second year. It was found that in captivity the male grew faster than the females and the females attained maturity at an average carapace length of 48 mm. The estimated average annual increase in weight was 47.24 g in males and 33.74 g in females during the first year and 117.76 g in males and 111.26 g in females for the second year.

Prospects of Farming Lobster

Lobsters are quite hardy and able to withstand lot of environmental stress during culture. At Covelong it has been possible to rear the lobsters with little mortality or cannibalism for the past three years.

In a closed system of culture as practised at Covelong, a strict feeding schedule had to be maintained. Feed was given in the late evening and the unconsumed food removed in the morning lest it should contaminate the water by decay. It has been possible to culture the lobsters successfully in this closed system where water was changed only once in 2-3 weeks.

For the first time in India large number of pueruli have been collected at Covelong and reared to marketable sizes in about 18 months. They have also attained sexual maturity and spawned in the laboratory releasing millions of phyllosoma larvae.

Scientists at Covelong are engaged in breeding the spiny lobsters and rearing the phyllosoma larvae to pueruli in the laboratory in an effort to produce the seed required for large scale culture. They have met with partial success and been able to rear the larvae upto stage V in 60 days feeding with the naupli of the brine shrimp *Artemia salina*. Till this venture succeeds lobster culturists for some years to come have to depend upon the seeds found in nature and there is an urgent need to assess the concentration and distribution of pueruli of spiny lobsters both along the east and west coasts of our country.

Feed and feeding schedule

Experiments at Covelong have shown that feeding with green mussels gave a good conversion ratio of 6 : 1 which is quite efficient. An integrated culture system for green mussels and lobsters is indicated where the large quantities of mussels produced by raft culture could be fed to the lobsters. With proper water management and cheap source of food having high conversion ratio, it is definitely possible to bring down the time taken to attain marketable size to about 12-15 months.

Assured supply of cheap food throughout the year is very essential for the successful management of lobster culture. Sometime, especially during the monsoon time, when fresh mussels and clams are not available for feeding the lobsters, feeding with trash fish have been tried, but the lobsters do not feed well on them. Moreover the fish contaminate the water very quickly. A pelletized feed consisting of fish meal, tapioca powder, mussel flesh, etc. are being tried and the lobsters readily accept them. Development of a cheap pelletized food, fortified with vitamins and minerals to meet the nutritional requirement of lobsters will go a long way in making their culture profitable and economical.

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