MARINE FISHERIES INFORMATION SERVICE

No. 181

July, August, September, 2004

TECHNICAL AND EXTENSION SERIES

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

COCHIN, INDIA

(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
Lobsters have been identified as a valuable seafood delicacy and enjoy great market demand worldwide. World production of lobsters average about 2.1 lakh tonnes per annum. Annual lobster production of India averaging about 2000 tones has been steadily declining over the years, and as with most commercial fisheries, the gap between supply and demand seems to be widening. Commercial lobster fishery in India is supported by three species of spiny lobsters, Panulirus polyphagus, P ornatus and Phmonarus, the slipper lobster, Thenus orientalis and the deep sea lobster Puerculus sewelli. Slipper lobsters form only about 8% of the world’s lobster production. T.orientalis is a commercially exploited lobster in the Indo-west Pacific region (from the east coast of Africa through the Red Sea, India and up to Japan) on the northern coast of Australia.

Although spiny lobsters have dominated the lobster export from India, there has been an increase in the contribution of the slipper lobster, T. orientalis, which now fetches an export value of Rs.4.51 crores annually. This resource is most abundant off the northwest coast and also along the coast of Tamil Nadu but has been fast declining due to its increased vulnerability to trawling. The price at the landing centre ranges from Rs.200 to Rs. 400/kg depending on the individual weight. This species is found in depth ranges of 8-70 m, but more abundant in depth realm between 10 and 50 m. They thrive on soft substrates like sand or mud, or even on a mixture of the two and sometimes on shells or gravel. There are reports that it grows to a maximum length of about 25 cm with a carapace length of about 8 cm. They began to contribute to the fishery significantly from 1983 onwards. Unlike the spiny lobsters, T. orientalis has a restricted distribution with minimum movement from its territory. This increases its susceptibility to fishing at every stage of its life especially after it enters the juvenile phase, during which they live in nearshore habitat. The trends in fishing in Maharashtra echo this fact. In Mumbai, T. orientalis disappeared from the fishery in 1995. The all-India landing of this resource has also been on a declining phase. These lobsters have a meat yield of about 30-35%. The major markets are Japan, Taiwan and other south-east Asian countries.

Unlike shrimps, spiny lobsters generally have a complex and prolonged life cycle, which often involves long distance movement during the larval phase. The larvae after hatching transit through several planktonic larval stages and are carried away from the coast by currents. Less than one percent of hatched larvae will survive to adult stages, which requires, on an average, 2-3 years. They are harvested at various stages of their life cycle, many without having the opportunity of reaching adulthood, and the rest without attaining the reproductive size. Currently, no serious management measures, including regulation of fishery of berried lobsters are implemented and this in tandem with the long larval life have resulted in drastic decline in landings.

The practical solution to meet the ever increasing demand for lobsters properly is development of technologies for breeding, hatchery production, fattening and grow-out of juveniles. Successful propagation will depend on a variety of factors relating to maturation and mating in captivity, egg quality, larval nutrition, husbandry and disease. The issue of ensuring a supply of newly hatched larvae over a long period can be achieved by -

- facilitating maturation and breeding of lobsters in controlled environments
- ensuring a continuous and steady supply of newly hatched larvae by maintaining a continuous cycle of maturation/rematuration and mating of a wide size range of females
- subjecting the berried females to different environmental conditions like temperature and light intensity and feeding which favours proper egg development and ensure high hatching rates

Unlike the spiny lobsters, the slipper lobsters have a shorter larval phase. Research work carried out in different parts of the world indicate the amenability of several slipper lobsters to captive breeding and larval rearing. Captive breeding and complete larval rearing are major impediments in the development of a successful technology for commercial production of hatchery-raised seed. While there has been a lot of research and success in breeding of nepripid and palinurid lobsters in different parts of the world, only few slipper lobsters have been reported to have bred successfully in captivity, producing viable, healthy larvae which could also be reared to settlement in captivity.

**Broodstock development and breeding**

The slipper lobsters, *T. orientalis* and *Scyllarus rugosus* have been successfully bred in captivity at the Kovalam Field Laboratory of C.M.F.R.I, Chennai. The broodstock of *T. orientalis* was constituted by the sub-adult specimens collected from the gill net fishery along the south Chennai coast. The broodstock was held in rectangular FRP tanks through which water was recirculated continuously. The tanks were partially covered by blue cloth to reduce the light intensity. The animals were fed *ad libitum* with the fresh clam, *Meretrix casta*. They attained sexual maturity in the captive conditions and then mated in the holding tank. Experiments revealed that *T. orientalis* and *S. rugosus* mate during the intermoult stage and produce fertilized eggs. In both the species the spermatophoric mass was seen adhering to the post-ventral sternite and anterior abdominal region of the female in the form of a longitudinal white, jelly-like mass. Mating generally occurred in the night and egg extrusion started within 5-7 hours and oviposition was completed within 6-8 hours. The spermatophore was lost in about 12 hours after mating. In both species, the mated males were smaller than the females.

Berried *T. orientalis* were separated and maintained in FRP tanks with *in situ* filter under minimum light. 50% water exchange was given daily. Two adult-sized female *T. orientalis* (75 mm and 70.5 mm carapace length) which matured in captivity, were kept in a FRP tank with an external biofilter. Water was recirculated continuously through the system. Light exposure was controlled so as to provide alternating spells of light and dark for 12 hours each. Light coloured tanks were used for *S. rugosus* broodstock. Adult males (19 mm and 18.5 mm carapace length) and females (17 mm and 25.2 mm CL) were mated in captivity and egg extrusion started a few hours after mating. Oviposition was completed within 6-8 hours. The eggs produced after the first and second matings, in all the cases were viable. Fertilized eggs and larval rearing experiments were conducted with the larvae that hatched from these eggs.

Larval rearing of *T. orientalis* to settlement was done for the first time in India. The incubation period in laboratory bred female *T. orientalis* was observed to be about 35 days. The phyllosoma metamorphosed through four stages before finally metamorphosing to the post-larval ‘nisto’ stage. The larval phase was completed in 26 days after hatching. The average duration of each larval stage is shown in Table-1.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Mean Intermoult duration (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phyllosoma I (1st instar)</td>
<td>1</td>
</tr>
<tr>
<td>Phyllosoma I (2nd instar)</td>
<td>6</td>
</tr>
</tbody>
</table>
Phyllosoma II  5
Phyllosoma III  7
Phyllosoma IV  7

The larvae after hatching were reared in plastic containers of 1 litre capacity. The larvae were stocked @ 5 nos/litre of seawater. Mild aeration was maintained through external fanning. The rearing system used was ‘Clear water system’. with no algal medium. Larvae were exposed to low light intensity (<100 lux) and the light exposure was restricted to 12 hours during the daytime. The larvae were fed with chopped meat of the clam M. casta and live cnidophores collected from the sea. The larvae on transition to Phyllosoma state III were transferred to floating plastic basins (2 litre capacity) with bottom netting, in 1 tonne tanks fitted with biofilters (Closed Recirculatory System). The larvae were stocked @ 5 nos./basin. On the final day of the phyllosoma IV stage, the larvae underwent considerable change in appearance, with the abdomen turning cylindrical and the tail becoming opaque. At this stage the larvae stopped feeding and were swimming actively. When provided with clinging surfaces/substratum like net pieces, oyster shells and sand, the larvae immediately clung to these materials. Moultig to postlarvae (nisto) occurred during midnight. The larvae become rigid, holding the appendages stiff. The setae on the walking legs kept beating vigorously and the nisto broke out of the carapace through jerking movements. The nisto were initially transparent and later attained a brownish hue. The nisto showed a characteristic backward swimming movement when disturbed, as seen in adult lobsters. Moultig from nisto to juvenile took place on the fourth day after nisto formation, i.e. on the 30th day after hatching. The nisto stage was a non-feeding stage. On transition into the juvenile stage, the animals started feeding. The exoskeleton in the juveniles was hardened and the juvenile appeared in all respects like a miniature adult.

The number of phyllosoma I stocked at the start of the experiment was 100 and the survival rate from Phyllosoma I to nisto was 22%. Maximum mortality was noticed during the first three days, especially during and immediately following the first moult. The survival rate from nisto to juvenile was 100%. Water quality control, regulation of aeration, feed and strict feeding regime played a key role in the success of larval rearing.

The only success reported in complete larval rearing of T. orientalis earlier has been from Australia and the present success is the second instance on a global level and the first in India.

**Larval rearing of S.rugosus**

Laboratory bred female S. rugosus produced viable fertilized eggs and the incubation period ranged from 23 to 35 days.

The phyllosoma advanced through eight stages before metamorphosing into the post-larva (nisto) stage. The total number of days taken for the phyllosoma to settle as nisto was 32 days after hatching. The average duration of each larval stage is shown in Table-2.

The larvae were stocked in 500 ml beakers @ 10 nos./500 ml of seawater. Mild aeration was maintained through external fanning. The rearing system used was ‘Clear Water System’, with the microalgae *Nanochloropsis* sp. being added only at the time of feeding with *Artemia* nauplii during the first three phyllosoma instars. Larvae were exposed to light for 12 hours in the daytime. The larvae were fed with chopped meat of the clam M. casta from phyllosoma IV onwards. The initial number of larvae stocked was 100, out of which one metamorphosed into the postlarval nisto stage. The nisto remained alive for only about two hours after moultng. This species holds good potential as an ornamental lobster that can be kept in marine aquaria, due to its small size, easy maintenance and
peculiar appearance.

Table 2: Intermoult duration of phyllosoma larvae of Scyllarus rugosus

<table>
<thead>
<tr>
<th>Stage</th>
<th>Mean Intermoult duration (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phyllosoma I</td>
<td>2</td>
</tr>
<tr>
<td>Phyllosoma II</td>
<td>6</td>
</tr>
<tr>
<td>Phyllosoma III</td>
<td>4</td>
</tr>
<tr>
<td>Phyllosoma IV</td>
<td>5</td>
</tr>
<tr>
<td>Phyllosoma V</td>
<td>3</td>
</tr>
<tr>
<td>Phyllosoma VI</td>
<td>4</td>
</tr>
</tbody>
</table>

The short larval phase, high survival and fast growth under captive condition are positive characteristics which qualify the species for commercial farming. Large scale seed production and a grow out feed is required for successful pond farming of sand lobsters. The research programmes are directed towards achieving this goal.


1079 The mini trawl fishery of Kerala

Mini trawl operation started in Kerala during 1987, is another post motorisation innovation like the ring seine by the artisanal fishers. Mini trawl net is a seasonal gear mainly operated by the dugout boats as well as the plankbuilds. They are nylon nets with two otter boards attached to them. *Mini vala, Boardum vala, Valikkana vala* and *Pothen vala* are some of the vernacular names of the gear. Mini trawl is mainly intended to harvest the prawns available in shallow waters. Alleppey fishermen were the first to introduce this gear in the coastal sea. In order to capture the inshore demersals, fishermen cut their Thangu valloms into two halves and fitted out board engines having a capacity of 8 - 9.5 H.P. This type of new motorized crafts were called Muri valloms. At present these crafts use OB engine upto 20 H.P for propulsion. The nets used in this craft have a minimum code end mesh size of 20mm. Depth of operation is within the range of 8-20 metres. Man power employed in each unit is 2-4 and the duration of each haul is 1.5 hours. Fishermen make three or four hauls in each trip. Mini trawl operation is mainly concentrated along the Alleppey coast followed by Trichur, Malappuram, Calicut and Cannanore districts. Important resources captured by this gear are penaeid prawns, flatfishes, stomatopods, croakers, crabs, carangids and silverbellies. Major operation of this gear is during October to March period. During 2002, the total income realised from the mini trawl landings, was nearly Rs.30 crores.

Trend in total landings and effort

During 1987-2002, annual mini trawl landings ranged between 1,500 and 18,600 tonnes. The minimum landing was in 1987, when this gear was introduced for the first time in Kerala and the peak landings of 18,600 tonnes was during 1997. This accounted for nearly 7% of the total landings by the motorized units in the state. The unit operation varied from 1,800 between the years 1987 and 2002, with a peak of 256,000 units operations in 1997. As per the census of the artisanal marine fishing fleet of Kerala by SIFFS, Trivandrum, the active and non-selective mini trawls showed an increasing growth trend from 1648 in 1998 to 4531 in 2000. Catch per unit effort varied from 50kg in 1991 to 208kg in 1988. Even though vast fluctuation was noticed during the first 5 years, catch per unit effort was more or less steady during the remaining period. During 1998-2002, catch per hour varied between 10kg and 27kg.