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Culture Possibilities of Sea Cucumbers in India

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Sea cucumbers are consumed by the Chinese, the Japanese, the Koreans and in recent times by the Europians and the Americans. They are consumed in the fresh, chilled, frozen, dried or in brine or in the processed form. In the world there are about 1400 species of sea cucumbers and of these about 30 species are consumed in various ways. In the seas around India about 200 species are distributed and of these about a dozen species are of commercial importance. The Chinese introduced the sea cucumber industry to India more than 1000 years back.

Sea cucumber are defenseless animals and get quickly over exploited from any place. The sea cucumber population in the Gulf of Mannar and Palk Bay dwindled alarmingly due to continuous exploitation over the years. The Government of India imposed a ban on the export of processed material less than 75 mm in length in 1982 as a measure of conservation. Since there is no local market for this product in the country, this ban should have proved effective. Despite the ban undersized material was illegally exported for many years. Therefore the Government of India banned the collection, processing and export of all species of sea cucumbers two years back with other groups.

The only way to make use of this valuable product and earn foreign exchange for the country is to produce the seed and farm them to marketable size. India produced the seed of the most valuable species *Holothuria scabra* in 1988 at Tuticorin by thermal stimulation. Following the same techniques other countries like Australia, Indonesia, New Caledonia, Maldives, Solomon Islands and Vietnam have produced the seed of this species and are farming them. In China the tequiniches for farming are perfected for the temperate species *Apostichopus japonicus*. The same methods can be applied with suitable modifications. The seed of *Holothuria scabra* is found to grow well in the prawn farms subsisting on the excess feed settling at the bottom of the farm without affecting the prawn farming operations. The results obtained so far are very encouraging and the seed is expected to reach marketable size at the end of one year.

Introduction

Although the seed of the temperate species *Apostichopus japonicus* was produced nearly seventy years back, the farming experiments for this species started only in mid eighties since the demand for the product was not great. When the prices of the processed product shot up in international markets like Hong Kong and Singapore people started looking for the resources in other places and began to fish them intensively. Many countries including India imposed restrictions on the

collection of the sea cucumbers as a measure of conservation. This triggered research on farming of the species and harvesting them. The temperate species cost US $ 400.00 per kg. And our best varities command as much as US $ 100.00 per kg in the market. It is cooked in many delicious ways. It is high in protene and low in fat making it a safe diet. In the seas around India *Holothuria scabra* (Fig.1) is the most important species commercially.

Review of Literature

It is interesting to note that as early as 1917 sea cucumber juveniles from the wild were collected for farming. Sir Fredrick Nicholson mentioned in his report to the Madras Administration that the experiment was a success (Anon.1917). James (1981) farmed juveniles of *H. scabra* collected from the wild at Port Blair (Andamans). James et al. brought out a hand-book on the hatchery and culture of *H. scabra*. Lal Mohan *et al.* (1989) reported on the possibilities of sea cucumber culture in the Lakshadweep. They suggested that *H. nobilis* (Fig.2) another valuable species can be tried. James (1994) documented on the culture practices in China and Japan and their possibilities for India. James *et al.* (1996) reported on the results of farming hatchery produced seed. James (1998) also reported on the growth of the juveniles in concrete ring inside Tuticorin Harbour area. The spectacular growth of the juveniles in a prawn farm is reported by James *et al.* (2002). Finally James (2003) summerised all the culture experiments from India at an International Workshop held in China during October, '03. Pitt and Duy (2003) have grown hatchery produced seed of *H. scabra* at Vietnam. They found that the weight increased from 30 g to 300 g in three months time. Mercier *et al.* (2003) have shown that *Isostichopus fuscus* grows to a length of 80 mm in three and half months at Galapagos Islands. The fast growth rates are encouraging for sea cucumber culture.

In Feb.'78 462 juveniles (Fig.3) of *H. scabra* in the length range of 65-160 mm (modal class 81-90 mm) were collected from the Sesostris Bay at Port Blair and broadcast (Fig.4) in an enclosed area (1.5 ha) near Aberdeen Jetty. The bottom was partly muddy and partly sandy. At the end of July '78 they hqad grown to 190-290 mm. (Anon. 1978) This experiment gave some indication of the possibilities of semi-culture of sea cucumbers by collecting the juveniles from the wild.

Juveniles produced in the hatchery were reared in one tonne tanks in the hatchery by feeding them on algal extract of *Sargassum* spp. An artificial feed was prepared with soya bean powder (3.5 g), rice bran (12.0 g) and prawn head waste (10.6 g). The juveniles were found to grow well on these feeds. After two months they were transferred to the sea and grown in old one tonne tanks, rectangular cages, velon

screen pens, netlon pens and concrete rings. The results of these experiments are presented below.

Old condemned tanks are used to grow the juveniles. The bottom of the tank is filled with mud collected from the upper layer at Karapad Bay. The tank was fixed at a depth of 1.5 m with the help of four casurina poles one at each corner. The top of the tank is covered by velon screen of 5 mm mesh to allow the circulation of sea water and also to prevent the entry of fish and crabs into the tank. At the end of the experiment the mortality was found to be 40%. Every week the velon screen covering of the tank was cleaned with the help of a brush to remove the settlement of other organisms. One hundred and forty seven juveniles were stocked in one tonne tank. The initial length was 35 mm and the length increased to 49 mm after 97 days. The initial average weight of 0.54 g increased to 5.9 g.

In the rectangular cage (Fig.5) at Karapad Bay 154 juveniles were stocked. The initial average length was 36 mm and this reached to 58 mm after 159 days. The initial average weight of 0.54 g increased to 11.9 g. The mortality was found to be 60%. In Vallinokkam Bay also the juveniles were reared in a rectangular cage. Fifty three juveniles were stocked with average length of 40 mm and average weight of 2.8 g. After 233 days the average length increased to 57 mm and the average weight increased to 11.6 g. The mortality was found to be 47%.

Velon screen cage in Vakinokkam Bay was stocoed with 100 juveniles. The initial average length was 22 mm and this increased to 63 mm after 214 days. The initial average weight 0.4 g increased to 11.6 g and the mortality was 80%. Ten juveniles were stocked in velon screen cage in Karapad Bay with average initial weight of 1.5 g and this increased to 3.0 g after 29 days. There was no mortality.

In Karapad Bay netlon cage was stocked with 10 juveniles. The initial average length was 47 mm and this increased to 59 mm after 24 days. The average weight initially was 3.2 g and this increased to 6.1 g. There was no mortality.
Juveniles were also maintained in one tank in the hatchery. The experiment lasted 37 days with 104 juveniles. There was no mortality. The initial average length was 24 mm and this increased to 35 mm. The initial average weight was 1.0 g and this increased to 3.0 g.

An experiment was conducted to see the efficiency of the sandy substratum from the Hare Island and the muddy substratum from Karapad Bay. The mud from Karapad Bay was black with fly ash from the thermal station and the sand from Hare Island was brown. When all the five thermal units work at Tuticorin 4500 tonnes of fly ash is let into the dykes daily. Eventually this finds its way into the Karapad Bay. The duration of the experiment was 60 days. The initial average weight and length

of the juveniles were 0.2 g and 13 mm respectively for the specimens reared on the sand brought from the Hare Island. At the end of two months the average weight and length increased to 3.2 g and 40 mm respectively. The mortality was 8%. For juveniles reared on the mud from Karapad Bay the initial weight and length were 0.1 g and 15 mm respectively. This increased to 2.4 g and 37 mm after 60 days. This experiment clearly shows that the substratum at Hare Island is suitable for the growth of the juveniles.

The circulation of water in one tonne tanks is poor since the height of the tank is 50 cm. Due to poor circulation hydrogen sulphide is formed at the bottom of the tank leading to the death of the juveniles. The area in the rectangular tanks is limited, therefore small number of juveniles only could be reared. Since the rods of the rectangular cages is made only up of irn they get rusted on coming in contact with sea water. Since the mesh size of the velon screen cage is small the holes get clogged due to algae and mud. Therefore the cages have to be periodically brushed to remove the blokage. The netlon material becomes brittle on remaining in the sea for more than three months. Because of all these drawbacks it was decided to grow the juveniles in concrete rings used in the construction of wells. These will last for a very long time in the sea. The concrete ring selected was 70 cm in diameter and 30 cm in height. Larger rings where more juveniles can be stocked cannot be used since they are very happy to handle. The concrete ring is set at a depth of one metre on even ground. It is set in an area which is out of bounds for the fishermen who may disturb the ring and remove the juveniles. The bottom of the ring is covered with velon screen to prevent the juveniles to burrow and escape. After setting the ring in proper position mud from the same area is put inside the ring to a height of 20 cm. The juveniles subsist on the organic matter present in the mud. The top of the ring is also covered with velon screen to prevent the entry of other organisms. The juveniles in the ring and also one kg of Mahima feed. This has a protene content of 35-40%. The juveniles were stocked in April, '96 with an average weight of 22 g. The average weight increase to 120 g in ten months time. The poor growth of the juveniles is due to the fly ash present in the mud collected from the harbout area.

Take off in Technology

It is well known that much of the feed given to the prawns in a farm goes as a waste and settles down at the bottom of the farm causing pollution. In recent years in India prawn farming was rocked by disease and legal problems. *Holothuria scabra*, most valuable species appears to be a good candidate for stock enhancement because of its bottom cleaning efficiency and high value. It grows rapidly at high densities

on simple low cost diets. The presence of sea cucumbers at the bottom of the farm will no way affect the prawn farming activities. In fact the prawns grow faster since the environment is kept clean. Due to these reasons it was decided to grow the juveniles in prawn farm. The prawn farm selected for the experiment to grow the hatchery produced juveniles was Eastern Aquafarm at Tharuvaikulam, Tuticorin. It is a modified extensive shrimp farm having four ponds of different areas. The ponds were stocked with tiger prawn *Penaeus monodon*. They were fed on pelleted diets with 40-42% protein. The experiment was first conducted in a pond of 0.63 ha area after two month cultured period having *Penaeus monodon* stocked at a density of 17 nos./m2. The prawns were fed daily with 15 kg ULTRA-TWL feed having a composition of 42% protein, 30% lipid and 13% ash.

The experiment was started in June, '98. Juveniles were stocked in a concrete ring used in the construction of well, having 70 cm diameter and 30 cm height. The concrete ring was placed at a depth of 0.7-0.8 m and placed at a corner of a rectangular pond about 3-4 m from the edge of the pond. Velon screen was kept at the bottom of the ring and tied tightly with a coir rope to prevent burrowing and escaping of the juveniles. After setting the ring, upper layer of surrounding mud was scooped put and filled in the ring upto three fourths of its height. After this juveniles were stocked and the top portion of the ring was covered with velon screen and tightly by a coir rope to prevent the entry of prawns and other organisms. The juveniles subsist on the organic matter present in the mud. The culture pond had four paddle wheel areaters which ensured the circulation of water and desired dissolved oxygen.

During the experiment period (June, '98 to January, '99), the salinity in the pond ranged from 28-40% and temperature from 24-29C. The water level in the pond varied from 90-150 cm and the transparency of the water from 30-110 cm. After the second month the juveniles were shifted to a new pond since the prawns were harvested in the old pond. The seed which was stocked with an average weight of 67 g in June '98 increased to 72 g in July, '98 showing an increase of 5 g during the month. In August '98 the weight increase was 19 g. The weight increase during September and October '98 was spectacular being 72 g and 62 respectively. During November and December '98 the weight increase dropped to 39 g and 20 g respectively due to the fall in salinity.

During October, '98 seven specimens with an average weights of 168 g from the brood stock were released into a separate concrete ring in the prawn farm. The average weight increased to 232 g in November '98, the increase being 64 g during the month. The average weight increased to 260 g in December, '98 and 330 g in

January, '99. The increase during the months of December, '98 and January, '99 was 28 g and 70 g respectively. The lower increase in weight during the period is due to lower salinity. The weight increase in prawn farm was 36.1 g whereas it was only 9.8 g when grown in harbour area under similar conditions. If juveniles are produced in large numbers it is advisable to stock them at the rate of 30,000 per hectare.

Lessons from China

The author had an opportunity to visit China in October, '03 at the invitation of the FAO to present a paper at a Workshop on Advances in Sea Cucumber Aquaculture and Management at Dalian, Liaoning Province. He had the previlage of visiting some of the sea cucumber farms around Dalian. In China they have perfected the technology for the production of seed and also farming of the temperate species Apostichopus japonicus in the bays to marketable size. China also faced disease problem in prawn farms. They have converted many of the prawn farms to sea cucumber farms. In one hectare 1,5000 seed is stocked. If the seed is less than 1 g it will take 15-18 months to reach marketable size. Chan (2003) has given an overview of the sea cucumber farming and sea ranching practices in China. Our experiments in prawn farms has shown that marketable size can be reached for *H. scabra* at the end of one year due to tropical conditions.

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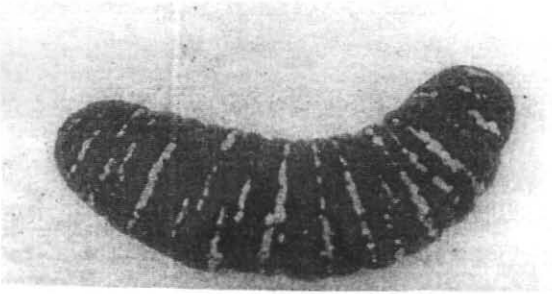

Figure 1: *Holothuria scabra*

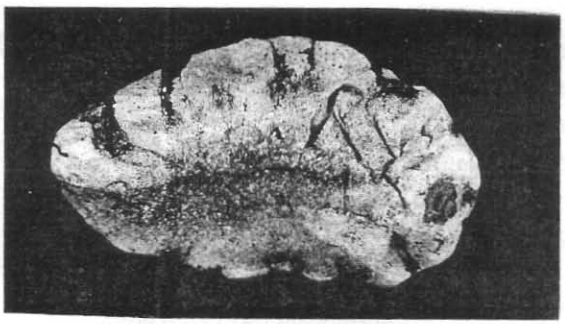

Figure 2: Holothuria nobilis

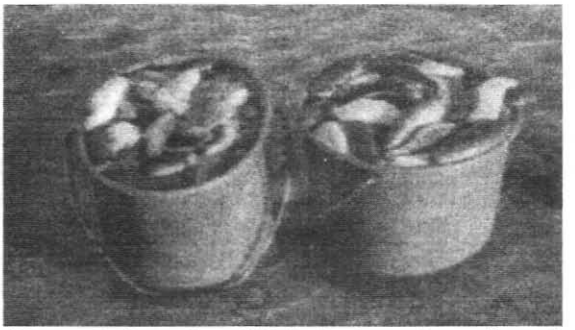

Figure 3: Juveniles of *Holothuria scabra* collected from the wild and ready for transport

Figure 4: Broadcasting the juveniles in the 'farm'

Figure 5: Rectangular cage being installed in Karapad Bay (Tuticorin)