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**24<sup>th</sup>  
Volume  
Initial  
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1.24 No. 1

*April* **2004**

**Rs.130**

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# Lessons to India from Chinese Multimillion \$ Sea Cucumber Industry

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The Food and Agriculture Organisation (FAO) organised a five day workshop from 14 to 18 October 2003, on Advances in Sea Cucumber Aquaculture and Management at Dalian, Lisoning Province, China. The author was invited to present a paper on status of Sea cucumber (Holothurian) Industry in India and also to participate in the workshop. The author availed of the occasion to visit Dalian Yude Halobios Science & Technology Co. Ltd. (Fig.1) and Dalian Bangchuideo Marine Products Co.Ltd. These companies

own hatcheries and farms of sea cucumber. At the farm owned by the former company, 30 million sea cucumber seed is produced annually. This they want to scale up to 60 million nos this year. They also plan to produce three million sea cucumbers at this farm valued at 24 million U.S.\$\$. At the farm owned by the later company, 15 million nos of sea cucumbers are expected to be produced. The observations made and the information collected are presented in this paper. Some remarks on the present status of the Indian sea cucumber industry

are given, with some suggestions for improvement of the industry in the light of the Chinese experience are given at the end of the paper.



Fig 1 : Entrance to Dalian Yude Halobios Sea Cucumber Hatchery,

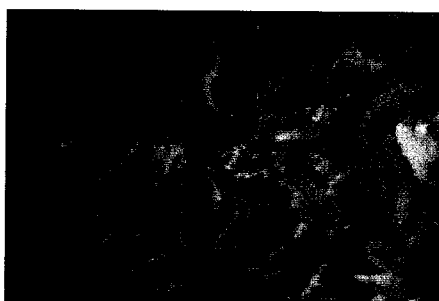


Fig 2 : Sea Cucumber : *Apostichopus japonicus*

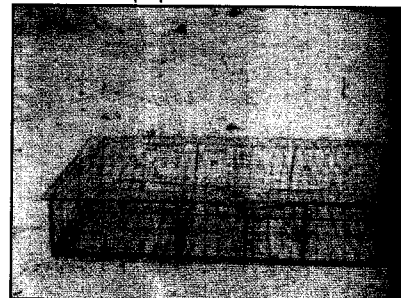


Fig 7 : Rectangular cage



Fig 8 : Velon Screen pen



Fig 3 : Interior of Chinese Sea Cucumber Hatchery

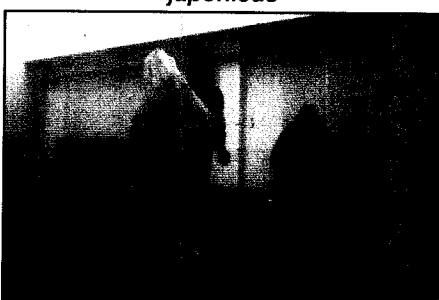


Fig 4 : Polyethylene sheet being turned over

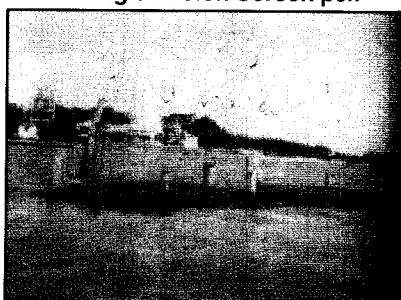


Fig 9 : Netlon pen



Fig 5 : Bay at Dalian where the Sea Cucumber juveniles are farmed

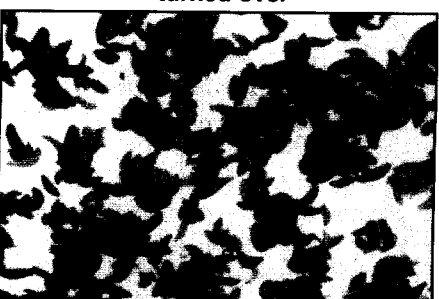


Fig 6 : Seed of *Holothuria scabra* produced in the hatchery at Tuticorin



Fig 10 : Shrimp farm at Tuticorin where the hatchery produced Sea Cucumber juveniles were farmed

In China food is not only medicine but also reflects Chinese culture. Sea cucumbers are a delicacy for the Chinese. They are consumed in various forms, fresh, chilled, frozen, dried or processed. It has become a part of life and tradition of the Chinese to eat sea cucumbers on festive occasions like the Chinese New Year day. They are cooked in many delicious ways. The prices for processed sea cucumbers shoot up in the international market during this time. These are rich in protein and low in fat content. They also find an important place in the traditional Chinese medicine.

In the Chinese seas 134 species of sea cucumbers are known to occur. Of these, 20 edible species have commercial value for consumption. The Chinese seas extend from 10° to 40° N lat. and have both the temperate and tropical species. In the temperate waters only *Apostichopus japonicus* (Fig.2) occurs and this is the only holothurian species that is farmed today in China. One kg of this species costs US \$ 400.00. The quality of this species cannot be compared with the quality of the tropical species. The high price is due to the superior meat quality of this species. This species occurs in the northern province of China, in Japan and also along the eastern shores of Russia. In China this species is mainly distributed in the Bohai and the yellow seas.

### Seed Production

The hatchery (Fig.3) has large rectangular tanks arranged in two rows. The roof is covered by translucent sheets to allow light into the hatchery. The seed of *Apostichopus japonicus* was produced for the first time in Japan more than 60 years back in Inaba (1937). After this many persons from China and Japan wrote on the hatchery work and culture of this species. Recently Chenb (2002) presented an overview of the sea cucumber hatchery, farming and sea ranching practices in China. The broodstock is collected from May to early July when the gonad index is over 10. The broodstock is maintained in cement tanks with 30 individuals in one cubic metre of seawater. Feeding rate is 5-10% of the body weight. Two year old individuals weigh about 250 g and at this stage they become mature.

Fecundity is high and females produce 1-2 million eggs. Sometimes the fecundity goes upto 10 million if the specimen happens to be large. Normally fecundity is related to weight. In mature specimens, there are 2,20,000 to 2,90,000 eggs per gram of ovary. When the seawater temperature near the bed reaches 15-17° C the brooders are collected. The diameter of the egg is 120-130  $\mu$ . In the spawning tank maximum density should be 200-300 eggs per ml. In the spawning tanks one million eggs can be stocked in one cubic metre of water. The auricularia larvae and the 7-10 days juveniles are sensitive to environmental changes. The highest mortality occurs during these two stages. The main problem is disease of the digestive tract especially gastritis. On reaching the pre-auricularia stage the larvae begin to feed on phytoplankton. In commercial sea cucumber hatchery *Dunaliella salina*, *phaeodactylum tricornutum* and *Chaetoceros simplex* and marine yeast are given as feed. From pre-auricularia to post-auricularia stage the algal cells in the rearing tanks are gradually increased from 10,000 cells to 25,000 cells per ml. The larvae are fed 2-4 times in a day. As the larvae develop to doliolaria and pentactula stages, their bodies start to constrict and shrink to half the original size. One or two days later they metamorphose to early juveniles. At this stage the length is about 400  $\mu$ . During this stage their behaviour changes from swimming to attaching. Hence there should be substrates for attachment in the rearing tanks at this stage. Normally the density should be kept at 20-50 individuals in 100 sq.cm. The juveniles spend several months in the hatchery. To increase the area for settlement polyethylene sheets are dumped into the tanks. They are daily turned over by long poles (Fig.4) so that the bottom ones can come to the top and the top ones can go to the bottom. Formulated feed is given till they reach a length of 20-30 mm. They are then transferred to farms and also used in sea ranching experiments.

### Sea Farming

The site selected for farming should be at a lower level so that the seawater can be filled by gravity. The salinity should be more than 27 ppt. Bottom should be sandy-muddy. Size of the

pond should be 1-4 ha. The depth of water should be two metres. There should be no pollution near the pond and should be protected from typhoons and strong waves. Usually calm bays (Fig.5) near the hatcheries are selected. Before filling the ponds with seawater, stone blocks are laid in rows or cones. Stone blocks serve to give shelter to the juveniles and also serve as substrate for the benthic algae and other organisms which serve as feed for the sea cucumbers. Rows of stone blocks are 3 m wide and 1.5 m high. The space between each row is 3-4 m. Stones of cone blocks have a diameter of 4-5 m at the base and the height is 1.5 m. The volume of stone used as substratum is 2250 cubic metres per ha. The optimum temperature for the growth of sea cucumber is 10-17° C but the juveniles grow at a faster rate when the temperature is 24 or 25° C. In northern part of China the stocking season is from March to May. The stocking density depends on the size of the seed and the habitat conditions, including the natural feed availability, seawater exchange rate etc. If the individual weight of the seed is 10 g during March-May at the time of stocking the average weight will increase to 150 g in October - November of the same year. If the seed weight is less than 1 g it will take 15-18 months to reach the commercial size. The oxygen consumption of the sea cucumber is much lower than that of the shrimp. This makes the farming of the sea cucumber easier than shrimp culture due to low water exchange rate and also no aeration is required. The cost of routine management is also much lower than that of shrimp culture operations. In experimental farming, juveniles of 30-40 mm length are stocked in early spring with a density of 1,50,000 individuals per hectare. The yield reached is four to seven tonnes in the following year. Growth rates are very variable depending on the availability of food and the environmental conditions. Weight of six months old juveniles ranges from 1.7 to 13 g and in two and half years time the weight increases to 65 to 225 g. The growth rate is a factor influencing the profit margins. Notwithstanding the slow growth rate due to cold climate, farming of sea cucumbers is a lucrative industry in China. This is attracting more and more investors from shrimp culture to sea cucumber farming.

### Sea Ranching

Sea ranching of the sea cucumber was initiated by the Yellow Sea Fisheries Research Institute in 1989. The results revealed that it is important to add substrates like stone blocks in the open bay. The functions of artificial substrate are to protect the broodstock and the larvae from predators, to increase the availability of natural feed like benthic algae and accumulating organic debris to improve the habitat for aestivation and hibernation. The criteria for site selection include water temperature (less than 25° c) salinity 27-35 ppt and relative absence of predators like starfishes and crabs. The results indicate that the key to success is site selection and routine management. In one site located in Shandong Province the output was increased 16 times by using enhancement practices.

### Indian Sea Cucumber Industry

In the seas around India about 200 species of sea cucumbers are known, most of them from deep waters. Of these 15 species are used for processing. The Chinese introduced the processing of sea cucumber to India more than 1000 years back. The Chinese brought porcelain, silks and sweetmeats and in exchange they took processed sea cucumber and pearls. The Chinese were stationed at Ramanathapuram in T.N. and they personally supervised the processing of the sea cucumbers along the Gulf of Mannar and Palk Bay. Seed (Fig.6) of the most valuable species *Holothuris scabra* was produced for the first time at Tuticorin Research Centre of CMFRI in 1988 (James *et al.* 1988) by thermal stimulation. James *et al.* (1994) brought out a hand book on the hatchery techniques and culture of *Holothuria scabra*. The seed was produced on a number of occasions and were grown at different places in the Gulf of Mannar and Palk Bay in rectangular cages (Fig.7), velon screen pen (Fig.8) and netlon pen (Fig.9). The results of these experiments were summarised by James *et al.* (1996). Using the same technology other countries like Australia, Indonesia, the Maldives, the Solomon Islands and Vietnam have produced the seed of this species and are farming them. The juveniles stocked in a shrimp farm (Fig.10) were seen to grow three times faster. (James *et al.* 2002).

### Conservation and Management

Since sea cucumbers offer no resistance at the time of capture, they are easily overexploited. Cucumbers of all sizes are indiscriminately collected without giving a chance for the animal to breed at least once during its life. To prevent the collection of smaller forms, Government of India imposed a ban in 1982 on the export of material which is less than 75 mm in length. Since there is no internal market for this product this ban should have proved effective, but in practice it was not so since undersized materials were illegally sent out of the country as hand baggage. The Ministry of Environment and Forests, Government of India brought all the sea cucumbers under Schedule I list of the Wild Life Protection Act 1972 and strictly banned their collection in 2001. Sea cucumbers have been recommended for inclusion under Appendix II list of the Convention of International Trade in Endangered Species of Wild fauna and flora (CITES) to conserve their declining populations. The livelihood of a few thousands of fishers is now jeopardized because there is no alternate profession for them. Instead of introducing a blanket ban, the Government should have taken steps to rehabilitate the fishermen by enabling them to undertake sea cucumber farming. They should be trained for mass scale breeding and sea ranching programme to keep up the natural stock in the sea. Rational exploitation can be allowed subject to size regulations and catch quota systems for sea cucumber fishing trade as done in other countries. Divers should not be allowed to collect sea cucumbers during their breeding season and certain areas should be declared as closed for the divers where the broodstock can be protected. Only effective management through strict regulation, periodic monitoring and sea ranching alone can save the Indian sea cucumber Industry.

### Lessons from China

China also faced the problem of disease in the shrimp farms. They successfully converted many of the shrimp farms into sea cucumber farms and also dug new farms in the same site to avoid disease. *Apostichopus japonicus* takes 15-18 months to reach marketable size due to cold climate.

*Holothuria scabra* will reach marketable size before the end of one year in India it is fed on prawn feed in the farm. Perhaps we can also follow the Chinese method by converting at least some the shrimp farms, closed because of the disease problem, into sea cucumber farms. Seed has to be produced on large scale and sea ranching programme should be there to enrich the natural populations.

### References

- CHEN, J. Overview of sea cucumber farming and ranching practices in China. *Beche de mer Information Bulletin. No. 18:* 18-23
- INABA, D. 1937. Artificial rearing of sea cucumbers. *Suisan Kenkyushi* 35(2):241-246
- JAMES, D.B., M.E. RAJAPANDIAN, B.K. BASKAR and C.P. GOPINATHAN. 1988. Successful induced spawning and rearing of the holothurian *Holothuria (Metriatyla) scabra* Jaeger at Tuticorin. *Mar. Fish. Infor. Serv. T&E Ser.* 87:30-33
- JAMES, D.B., A.D. GANDHI, N. PALANISWAMY and J.X. RODRIGO. 1994A. Hatchery techniques and culture of sea cucumbers *Holothuria scabra*. CMFRI Spl. Publ. 57:1-40
- JAMES, P.S.B.R. and JAMES, D.B. 1994b. Management of the *Beche-de-mer* industry in India. In: *Natl. Workshop on Beche-de-mer*. (Eds. K. Rangarajan and D.B. James) *Bull. Cent. Mar. Fish. Res. Inst.*, 46:17-22
- JAMES, P.S.B.R. and D.B. JAMES. 1994b. Conservation and management of sea cucumber resources of India. In: *Proc. Natl. Workshop on Beche-de-mer*. (Eds. K. Rangarajan and D.B. James). *Bull. Cent. Mar. Fish. Res. Inst.*, 46: 23-26
- JAMES, D.B., A.J. LORDSON, W.G. IVY and A.D. GANDHI. 1996. Experimental rearing of the juveniles of *Holothuria scabra* Jaeger produced in the hatchery. In: *Proc. Symp. Aquaculture for 2000 A.D.* (Ed.). Samuel Paulraj. pp.207 - 214.
- JAMES, D.B., P.S. ASHA, M.K. RAM MOHAN and P. JAIGANESH. 2002. Culture of Sea cucumbers in prawn farms - take off in technology. *Proc. Natl. Dev. Trans. Fish. Tech.* Fisheries College and Research Institute, Thoothukudi. pp.5-7.