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EXPERIMENTS ON REARING OF THE JUVENILES OF *HOLOTHURIA SCABRA* JAEGER PRODUCED IN THE HATCHERY

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ABSTRACT

So far there is no information on the farming of sea cucumbers in India. The seed of *Holothuria scabra*, a commercially most important species today was produced for the first time in the sea cucumber hatchery at Tuticorin in 1988. Although this species forms a good fishery at several places in the Indo-West Pacific region, there is no report on the production of seed and farming of this species.

The seed produced was grown at Karapad and Valinokkam Bays, in rectangular cages, one tonne tanks, velon screen cages and netlon cages. Due to limited space and poor exchange of water, the growth in the rectangular cage is poor. The rate of growth of the juveniles was maximum in netlon cages (125 mg/day) because of good circulation of water from all sides. In the velon screen cage the growth rate was 89 mg/day. In one tonne tank and rectangular cage the rate of growth was 42 mg/day and 38 mg/day respectively.

INTRODUCTION

Although the seed of sea cucumber *Apostichopus japonicus* is produced in China and Japan, no serious attempts are made to farm them and the seed so produced in sea ranched to enrich the natural populations (Inaba ; (1937) ; Ishida ; (1979) ; Shuxu and Gongchao (1981), Zhang *et al* (1982), Kobayashi and Ushima (1983). Li (1983) and Liao ; (1986). Seed of *H. scabra* was produced at CMFRI hatchery, Tuticorin for the first time in 1988 (James *et al.* 1989). Since then the seed of *H. scabra* was produced in the hatchery on a number of occasions. This seed was grown in Karapad and Valinokkam Bays in rectangular cages, velon screen cages and also in netlon cages. The juveniles were also grown in one tonne tanks both in the hatchery and also at Karapad Bay. James and James (1993) wrote a paper on the prospects for sea farming of sea cucumbers. James (1994a, b) wrote papers on a review of the hatchery and culture practices of sea cucumbers in Japan and China and also on the seed production in sea cucumbers. James *et al* (1994a, 1994b) brought out a hand book on the hatchery techniques and culture of sea cucumbers and also on the breeding and rearing of the larvae and juveniles of sea cucumber *Holothuria scabra*. These are the only publications on the hatchery and culture of sea cucumbers from India.

MATERIALS AND METHODS

The seed produced in the hatchery are first grown for a period of two months in the hatchery itself. After they settle down to the bottom of the tank they are daily fed on the extract of the alga *Sargassum* sp. First the alga is cut into small bits and made into a fine paste in a mixie. This paste is diluted in sea water and is filtered through 50 micron sieve. The suspended matter settles down to the bottom of the tank as a fine film. The juveniles are found to feed well on the fine algal paste which settles at the bottom. Daily the water in the one tonne tank is completely changed and fresh algal extract is given to the juveniles. In two months time some of the juveniles grow to 20 mm length. It is observed that all the juveniles of the same brood do not grow at the same rate. Some of them grow much faster than the others and they are known as shooters. It is desirable to remove the shooters to a separate tank and grow them. Then some of the juveniles in the original tank grow faster than the others. In this way all the fast growing juveniles are separated and used in the rearing experiments.

The rectangular cages are made of iron rods of 7 mm diameter. They are three feet long and two feet wide and is in the form of a box with a lid (Fig. 1A). On the outer side of the cage nylon rope of 2 mm thickness is knotted to the frame. The distance between two knots is 30 mm. The cage is lined with fine velon screen inside to prevent the sand or mud going out. The cage was fixed to the bottom of the sea at a depth of two metres with the help of four casurina poles (Fig. 1B).

The velon screen cage was 2 sq.m. in area. It was made of velon screen of 4 mm mesh to allow the free flow of water. The length and breadth of the cage were 2 m and 1 m respectively. The height of the cage was 2 metres. The cage was fixed at a depth of 2 m on an algal bed. The bottom of the cage also has velon screen for easy and total retrival of the juveniles. The cage is fixed to the ground by four poles one at each corner of the pen. The cage is further strengthened by four more poles at the middle of four sides to keep the cage in position during high gales. To keep the bottom of the velon screen stable four big stones were kept at four corners. After the juveniles are stocked the top is covered by a velon screen and stitched so that fish and crabs may not enter the cage.

Netlon cage (Fig. 1C) is cylindrical in shape with an area of 1.65 sq.m. Diameter of the cage is 1.5 m and height of the same is 1.3 m. The mesh size is 5 mm. The netlon cage is erected in the sea at a depth of one metre (Pl. I,B). The cage is fixed to the bottom with the help of four stout casurina poles. The top of the cage is closed by velon screen by stitching to prevent the entry of other organisms. Every week during low tide two buckets of mud is put into the cage and this serves as food for the juveniles. The juveniles (Pl.I,D) are removed every month to find out the mortality and increase in average weight of juvenile.

RESULTS

A series of experiments were conducted to study the growth of the juveniles with artificial feed and also on the mud brought from various places. In the first experiment 50 juveniles were fed on the mud brought from the Karapad Bay and another 50 on the sand brought from the Hare Island. The mud from the Karapad Bay was black with fly ash and the sand from the Hare Island was brown in colour. 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 13 mm and 0.24 g respectively for the specimens reared on the sand brought from the Hare Island. At the end of two months the average length and weight increased to 40 mm and 3.24 respectively. Weight increase per day works out to 50 mg. The mortality works out to 8%. For the juveniles reared on the mud from the Karapad Bay the initial length and weight were 15 mm and 0.19 g respectively. This increased to 37 mm and 2.45 g after 60 days. The weight increase per day works out to 37 mg. There was no mortality in this case. This experiment clearly shows that the sand from the Hare Island is suitable for the growth of the juveniles. The details of the experiment are presented in Table I.

Table 1 Growth rate of juveniles of *H. scabra* reared on two types of sediments

Type of sediment	No. juveniles	No.days	Mortality %	Length (mm) Initial	Final	Weight(g) Initial	Final	Wt. increase day/mg
Hare Is.sandy substratum	50	60	8	13	40	0.24	3.24	50
Karapad Bay, muddy substratum	50	60	Nil	5	37	0.19	2.45	37

Eighteen large juveniles (shooters) were separately reared on sand from Hare Island. The experiment lasted for 60 days. The initial length and weight of the juveniles were 26 mm and 0.7 g respectively and this increased to 64 mm and 8.39 g. The increase in weight per day works out to 128 mg.

An artificial feed was prepared with soya bean powder (3.5 g), rice bran (12.0 g) and prawn head waste (10.6 g). An experiment was conducted by taking three 100 litres tanks and keeping 25 juveniles in each tank. For the experiments sand from Hare Island is used. In the first tank sand and formulated feed is used, in the second tank sand, formulated feed and algal extract and in the third tank only sand and algal extract is used. The experiment lasted 44 days. The initial average length and weight in the first tank were 25 mm and 0.68 g respectively. This has increased to 102 mm and 7.3 g. The weight increase per day works out to 150 mg. In the second tank the initial average length and weight were 27 mm and 0.63 g respectively. This has increased to 112 mm and 7.48 g. The weight increase works out to 156 mg/day. In the last tank the average initial length and weight were 26 mm and 0.83 g respectively. This has increased to 91 mm and 5.54 g. The weight increase per day works out to only 107 mg. From the above experiment it is clearly established that formulated feed and algal extract is the best combination for good growth of the juvenile sea cucumbers. The details of this experiments are given in

Table 2 Growth rate of hatchery produced seed of *H. scabra* fed with different feed.

S.No.	Feed	Length (mm)		Weight(g)		Weight increase
		Initial	Final	Initial	Final	day/mg
1.	Sand from Hare Island and formulated feed	25	102	0.68	7.3	150
2.	Sand from Hare Island, formulated feed and algal extract	27	112	0.63	7.48	156
3.	Sand from Hare Island and algal extract	26	91	0.83	5.54	107

Table 3 Weight increase per day in juveniles of *Holothuria scabra* produced in the hatchery during experiments.

S. No	Experiment site	Farming method	No.of days	No.of juveniles	% Mortality	Length(mm) Initial	Length(mm) Final	Weight (g) Initial	Weight (g) Final	Wt. increase day /mg
1	Valinokkam Bay	Rectangular Cage	233	53	47	40	57	2.8	11.6	38
2	Valinokkam Bay	Velon Screen Cage	214	100	80	22	63	0.4	13.5	61
3	Karapad Bay	Rectangular Cage	159	154	60	36	58	0.54	11.96	72
4	Karapad Bay	One Tonne tank	97	147	40	35	49	0.54	5.9	55
5	Karapad Bay	Velon screen Cage	29	10	Nil	-	-	1.5	3.0	52
6	Karapad Bay	Netlon cage	24	10	Nil	47	59	3.28	6.16	125
7	Hatchery	One Tonne tank	37	104	Nil	24	35	1.04	3.06	54

In addition to the above three experiments in rearing juveniles on different types of feed, the juveniles were also grown in rectangular cages, velon screen cages, netlon cages and also in one tank both at Karapad Bay and also at Valinokkam Bay. The juveniles were grown in one tonne tanks in Karapad Bay and also in the hatchery. At Valinokkam Bay the experiment in rectangular cage was conducted for 233 days with 63 juveniles. The mortality rate was 47%. The average initial length and weight were 40 mm and 2.8 g. This increased to 57 mm and 11.6 g. The weight increase per day worked out to 38 mg. The experiment with velon screen cage lasted for 214 days with 100 juveniles. The average initial length and weight were 22 mm and 0.4 g. At the end of the experiment this increased to 63 mm and 13.6 g. The weight increase per day was 61 mg.

The mortality rate was high at 80%. This was due to the bottom of the velon screen in the cage raising up. This drained out all the mud inside the cage except for the sides. Majority of the juveniles died due to starvation.

In the Karapad Bay experiments were conducted by keeping juveniles in rectangular cage, one tonne tank and netlon cage. The experiment lasted for 159 days in the rectangular cage. The experiment was started with 154 juveniles. At the end of the experiment mortality was 60%. This is due to the limited space available in the rectangular cage. The average initial length was 36 mm and this reached 58 mm at the end of the experiment. The average initial weight was 0.54 g and this reached 11.96 g at the end of the experiment. The weight increase per day works out to 72 mg.

An old one tonne tank is taken and the bottom is covered by mud from the Karapad Bay. The tank was fixed in 1.5 m depth of water with the help of four poles one at each corner. The top of the tank is covered by velon screen of 5 mm mesh to allow good circulation of 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 the tank was cleaned with a brush to remove the settlement of other marine organisms. The initial average length was 35 mm and this reached to 49 mm. at the end of the experiment. The average initial weight was 0.54 g and this increased to 5.9 g at the end of this experiment. The weight increase per day works out to 55 mg.

For the first time netlon cage was used in the Karapad Bay. Each mesh was 25 sq.mm. in area allowing free flow of water. As a test case 10 juveniles were grown for 24 days. There was no mortality at the end of the experiment. The average initial length was 47 mm and this increased to 59 mm. The average initial weight of the juveniles was 3.28 g and this increased to 6.16 g. The weight increase per day works out to 125 mg.

Juveniles were also maintained in one tonne 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 1.04 g and this increased to 3.06 g. The weight increase per day works out to 54 mg. Details of the above experiments are given in Table 3.

DISCUSSION

As a result of the experiments conducted on the feeding of the juveniles and also on rearing them under different conditions it is now clearly established that the mud in the Karapad Bay is not suitable for the growth of the juveniles since lot of fly ash from

the nearby thermal plant is mixed into the mud. The sand brought from the Hare Island appears to be good for the growth of the juveniles. A feed was prepared with soya bean powder, rice bran and prawn head waste. When this feed was given along with algal extract and sand from the Hare Island the growth was found to be maximum.

The area in the rectangular cage is less, therefore only limited number of juveniles can be stocked and also the circulation of water is not good since the cage is lined with fine velon screen to prevent the escape of sand. There is a possibility of the bottom portion of the velon screen rising up inside the water. As a result of this all sand in the cage goes out. This leads to starvation and death of the juveniles. In the one tonne tanks kept in the sea the circulation is poor and this results in the formation of hydrogen sulphide. Therefore the whole sand has to be changed every week for the better growth of the juveniles.

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