

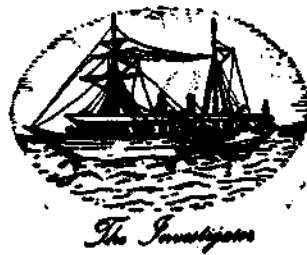
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FISH CULTURE IN PENS IN THE GULF OF MANNAR, INDIA

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ABSTRACT

Realising the immense potentialities which India holds for large-scale coastal aquaculture with its numerous bays along its coast line, experiments on the culture of fish in the pens in the sea were initiated in the beginning of 1977 at Mandapam Regional Centre of Central Marine Fisheries Research Institute on the southeast coast of India. Two pens, made out of bamboo screens, were erected at a site in the Gulf of Mannar near CMFRI Jetty, Mandapam camp.

Constructional details of pens and the measures taken to protect them from heavy seas during rough weather are given. The pens, which consisted of double layered screens made out of bamboo splits, were firmly fixed to the sea bed with the aid of casuarina poles. They were square in shape and each pen covered an area of 81 sq. m.

3,288 fingerlings of *Mugil* spp. and 77 fingerlings of *Chanos chanos* were introduced in the first pen, the mean size of the former being 32 mm and the latter 72 mm. Another batch of 80 milkfish fingerlings of the size range 46-108 mm was introduced in the second pen. Good growth rates in respect of mullets and milkfish were observed. An account of the hydrological conditions prevailing in the pen enclosure and the food given to the stocked fishes are also given.

Constraints faced in the maintenance and operation of the pens in the sea and suggestions to overcome them are presented and discussed.

INTRODUCTION

IN INDIA, an awareness has developed in recent years on the need to carry out aquaculture and especially coastal aquaculture on a scientific basis, as a means to augment fish production and to provide greater job opportunities to the rural folk. This has become all the more important in the context of wide fluctuations in the landings of some of the major capture fisheries in India (Silas *et al.*, 1976). Realising the immense potential of coastal aquaculture, which this country offers with its coastal lagoons, estuaries, backwaters and mangrove swamps, the scientists of the Central Marine Fisheries Research Institute initiated at the beginning of 1977 an intensive programme of pen and cage culture using cheap indigenous materials,

Taking advantage of the existence of intertidal mudflats, creeks and calm bays in the southeast coast of India and availability of fish, prawn and crab seeds in plenty in this region, experiments relating to culture of the same in pens and cages were carried out at Mandapam and Tuticorin. The details of pen culture, which is of pioneering nature, carried out at Mandapam on the Gulf of Mannar side in the southeast coast of India are presented in this account.

We are highly grateful to Dr. E. G. Silas, Director, Central Marine Fisheries Research Institute for the guidance, encouragement and suggestions given in carrying out the pen culture work. We are thankful to Mr. M. Najmuddin, for the analysis of the water samples from the pen and to Shri. V. Gandhi for the assistance rendered in the maintenance of the pen.

MATERIAL AND METHODS

Site

A site in the Gulf of Mannar, about 366 m from the western side of C.M.F.R.I. jetty was selected for the erection of two pens as the sea forms a small Bay at this place and is relatively calm even during rough weather. Further, a test survey in this area showed that the sea bottom was mostly sandy and suitable for driving casuarina poles into the bottom. In order to arrest the action of the waves over the pens, a crescent shaped barrier of casuarina poles was constructed for a length of 57.9 m driving five hundred poles of 4.9 m length and 0.2 m diameter into the sea bed for a depth of 1.8 m. In order to strengthen the barrier, the vertical poles were supported with horizontal poles and braced cross-wise by bolts and nuts. Stones were also laid on the outer and inner sides of the casuarina barrier upto the same length for a height of 2.4 m from the bed of the sea to give further protection to the pens from the action of waves and to prevent silting.

Pens

Bamboo pens specially designed to withstand the action of the waves and to last for a long period in the sea were made. The pen was a square enclosure of 9 m long and sides of 3 m height. It was made of double layered *thatti*, an outer layer of bamboo splits of 9 mm thickness and an inner layer of 5 mm thickness. These were firmly joined together by iron straps. Three *thatti* pieces (3 x 3 m) were joined together to form each 9 m long side. Altogether a single pen consisted of twelve 3 x 3 m *thatties*. Tar was applied upto a height of 0.5 m from the bottom of the *thatti* and over it kride was painted. These structures when fixed to the sea bed formed an enclosure covering 81 sq. m.

In order to strengthen the *thatties* country wood reapers of 3 m length, 0.2 m breadth and 13 mm thickness were fixed horizontally on either side of each *thatti* at 0.6 m interval.

In addition to this, two runners of 9 m length and 0.1 m breadth were fixed to the *thatties* at 0.6 m intervals and these ran on all the four sides of the pen. The pen was supported on each side by 15 casuarina poles and the reapers/runners, *thatties* and casuarina poles were firmly attached to one another by bolts and nuts. These *thatties* were joined together at the corners with a wooden pole 4 m in height so that no gaps were left at the corners. The depth of water in the pen ranged from 1.2 m in the low tide to 1.8 m in the high tide. The bottom was mostly sandy. There was good exchange of the sea water through the minute crevices in the *thatties*. Two pens were erected in the same area, one in 1977 and the other in 1978.

Fingerlings

Fingerlings of *Chanos* and *Mugil* spp. were collected from Chinnapalam creek and tidal pools at Pamban, Pillaimadam and Athankarai Estuary. Before introducing the fingerlings in the pen, all predators present inside the pen were fished by a net. Further the bottom of the pen was checked to ensure that there were no crevices below the water level which may allow escape of fingerlings. The weight, size and the number of fingerlings of each species were recorded before release in the pen.

The fishes were fed every morning with a known quantity of food equivalent to 1/10 of the weight of the fingerlings introduced and it comprised of equal proportions of minced fish meat and oil cake paste. The food was kept in an aluminium tray of the size of 0.5 x 0.5 x 0.2 m which was fixed at the centre of the pen in such a way that the tray was just above the low tide water level. They also fed on natural food like algae, phytoplankton and zooplankton available in the pen.

Periodic estimates of salinity, oxygen and pH in the pen site were made. In the first pen, the salinity ranged from 23.75 to 35.00‰ and the dissolved oxygen content varied from 1.40

to 5.75 ml/l. The oxygen values were very low during June (1.70 ml/l) and July (1.40 ml/l) when the *Trichodesmium* bloom occurred in the sea. In the second pen the salinity range was from 33.36 to 36.72‰ and the range in dissolved oxygen content was from 2.34 to 5.25 ml/l. The pH ranged from 7.2 to 8.0.

RESULTS

Altogether 3,288 fingerlings of *Mugil* spp. of the size range 20-60 mm and mean size 32 mm were introduced in the first pen in March, 1977. During a three month period of March to June their size increased to 87 mm thereby registering a growth of 18 mm per month. The average weight of fish increased from 0.8 g to 15 g. In the same month, 77 fingerlings of milkfish *Chanos chanos* of the size range 60-90 mm were introduced in the first pen, their mean size being 77 mm. In June, the mean size of fish increased to 227 mm thus showing a growth rate of 50 mm per month. The initial average weight of fish which stood at 3 g rose to 77 g at the end of three months.

Another batch of 80 milkfish fingerlings of the size range 46-108 mm was introduced in the second pen in February, 1978. At the time of introduction, the mean size was 84 mm and it increased to 226 mm in May, the growth rate during this period being 47 mm per month. The mean weight increased from 4 g to 110 g during this period. In the subsequent period of June to September the mean size increased from 226 to 380 mm registering a growth rate of 51 mm per month and the mean weight increased from 110 g to 448 g.

DISCUSSION

This is the first time that pens have been erected in the shallow bays in the Indian seas. This is an arduous task because the pens would

have to face the hazards of the sea like the impact of tides and waves and withstand the attack of fouling organisms. Bearing these factors in view, care was taken to erect the pens firmly in the sea and the materials used were treated with anti-fouling paints along their submersible portion.

The growth rates of milkfish and mullet fry and fingerlings introduced in the pens were found to be very satisfactory. The growth rates of milkfish and mullet were found to be 47 to 50 mm per month and 18 to 29 mm per month respectively which compares favourably with the results obtained elsewhere (Bensam, 1974).

Some constraints were observed in the maintenance and operation of the pen in the sea extending over a period of two years. The bamboo screens did not last for more than a year in the sea due to fouling organisms like marine borers and due to wear and tear caused by the action of waves. Experiments are under way to construct pens made out of palmyrah leaf stem and sliced palmyrah wood to study their durability and cost factor.

One of the major problems encountered in the operation of the pens was the large accumulation of sea grasses in and around the pen during southwest monsoon months of the year. The hydrogen sulphide released by the decomposed sea grasses polluted the sea water and brought down the dissolved oxygen content in the pen site thereby causing mortality of fish. Blooms of the green algae *Trichodesmium* were also observed during the above months which also caused mortality of fish inside the pen. To overcome these difficulties culture work can be carried out in the Gulf of Mannar side of the Mandapam Regional Centre over a period of seven to eight months starting from September and extending upto May when the sea is free from pollution caused by the accumulation of sea grasses and blooms of blue green algae. Further, during this period the sea is

calm and normally devoid of cyclone which causes uprooting of the pens. The elaborate props for supporting the pen may not be required thereby reducing the cost of erection of pens. The screens made out of bamboo or palmyrah leaf stems can be removed from the sea during the non-operation period. During this period the maintenance work of the same such as applying tar and fastening the splits with binding wire can be attended to.

Valuable experience has been gained on the design, maintenance and operation of the pens in Indian seas as a result of the work so far carried out and based on this, it is proposed to improve the techniques of pen culture in the coming years. The availability in abundance of the seeds of mullets *Mugil* spp. and milkfish *Chanos chanos* (Tampi, 1973) shows that there is a great scope to develop culture fisheries along the southeast coast of India.

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