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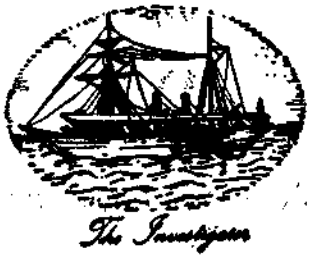

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EXPERIMENTS ON EDIBLE OYSTER SPAT COLLECTION AT TUTICORIN

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ABSTRACT

Standardizing the technique of spat collection is an important aspect in oyster farming. Although several established methods are in vogue in different countries, appropriate method of spat collection has to be developed to suit the local conditions taking into consideration the availability and cost of the materials employed.

This paper gives details and results of experiments conducted at Tuticorin with different types of spat collectors. Lime-coated tiles proved to be the most effective for spat collection while the use of corrugated asbestos sheets, oyster and mussel shells also gave satisfactory results.

INTRODUCTION

EXPERIMENTS were conducted for procurement of oyster spat at Tuticorin Bay, wherein a natural bed is also found nearby. Various type of spat collectors such as lime-coated tiles, cement-coated tiles, edible oyster shells, mussel shells, corrugated asbestos sheets, coconut shells, bamboo mats and palmyra lattices were used during 1977 to 1979. Among hese, lime-coated tiles, oyster and mussel shell, and corrugated asbestos sheets gave very satisfactory results thereby favouring employment of the same for large scale collection of oyster spat. On the basis of the above experiments, seasonal variation of spatfall and its intensity, appropriate period for laying the tiles to achieve maximum results were determined, apart from standardizing an effective system for the large scale collection of spat.

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EXPERIMENTS

The results of the experiments in terms of intensity of spat settlement in various months in different types of collectors, season of maximum spat attachment and the comparative efficiency of spat collectors are detailed below.

Experiments with lime-coated tiles

In order to find out the most efficient method of spat collection, several methods were tried. Although the method of collection of oyster spat by using lime-coated tiles had been successfully followed in some of the oyster farming European countries, it was felt that other methods also might yield equally good results. Therefore during these three years attempts were made to test the usefulness of spat collection by employing oyster shells, mussel shells, corrugated asbestos sheets, cement-coated tiles, coconut shells wooden lattices and bamboo mats in addition to lime-coated tiles (Table 1). Whereas the lime-coated tiles were set up during all the three years ; the other spat collectors were tried in different periods.

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During 1977 and upto the end of September 1978, all the experiments were confined to the area of natural bed inside the Karapad tidal inlet. The experiments had to be shifted to the open sea coast after September 1978 due to blockage of the tidal creek done by the interested salt manufacturers which hampered the free flow of tidal water in and out of the tidal creek.

TABLE 1. *Total number of spat collectors used*

Name of collector	1977	1978	1979
Lime-coated tiles ..	6,000	61,000	67,000
Oyster shell ..	1,300	3,000	5,400
Asbestos sheet ..	—	—	165
Mussel shell ..	—	70	4,200
Coconut shell ..	450	—	—
Cement-coated tiles	2,000	—	—
Palmyra lattices ..	—	4	—
Bamboo mat ..	6	..	—

Preparation of lime-coated tiles for spat collection

Earthenware semi-cylindrical country roofing tiles were used as spat collectors in experiments conducted from August '77 to October '79. These tiles were procured locally from demolished tiled houses. The size of each tile was 20 cm long and 12 cm wide, weighing 450 gms, curved in a 'U' shape. Lime-coating is an important aspect which is to be done before laying them. The tiles were dipped in lime mortar a few weeks before use. For initiating lime-coating work a lime hod or vat, stirrer, tongs, rubber gloves, sand sieve, balance, bamboo mats, lime and fine sand are necessary. The hod was filled with 50 litres of sea water and mixed with 30 kg of lime gradually. Immediately after adding the lime, stirring the lime was done regularly by means of a specially made oar-shaped wooden stirrer. Preparatory coating of lime was initiated only after 10-15 minutes. Before this a thorough washing of tiles was done so as to remove dirt on the tiles to facilitate efficient attachment of lime to the tiles. A team of 5 persons is necessary for liming the tiles. A small bench was used near the hod to keep the tiles being limed. While one person stirred the hod, two others performed the dipping of tiles by using tongs (Pl. I A). Two more persons arranged the tiles to dry on bamboo mats which were used to avoid contact with the dust and sand from the ground. During the entire operations rubber gloves were used to protect the hands as otherwise contact with lime would cause blisters on the fingers. Five persons can finish 10,000 tiles within 8 hours duration. Drying of tiles was done in a shaded place avoiding direct sunlight. To avoid the same, lime-coating work was invariably done during evening hours and dried during night till the next day morning and stacked and kept in a shady place. The preparatory or undercoat of lime was only an initial process after which a further coating of mortar is necessary. A second coating of lime and fine sand mixture is to be given to the tiles before they are employed for spat collection.

For this second coating a suitable mixture was prepared by mixing 30 kg slacked lime with 40 kg fine sand in 50 litres of sea water. The hod was stirred well to give the consistency of thin oil and while doing so, scum if any formed was collected and scooped out. Tiles with preparatory coating are treated with the above mixture to achieve a thickness of 2 to 3 mm coating. The above cited quantity of mixture would suffice for 500 tiles only, since the thickness of coating is triple the first coating. Sufficient quantity of water was added to the mixture, when coating becomes too thick and stirred well so as not to allow the sand settle to the bottom of the hod. The process of drying was done as in the case of first coating.

This type of lime-coating aids easy removal without causing injury to the spat when they reach 20 to 35 mm in size. The base had therefore to be sufficiently strong to stand for a long period and yet considerably be friable

enough to allow the removal of the spat without any damage while scraping.

Selection of site for laying spat collectors

Karapad Creek was selected for laying tiles since mother oysters were also there, which will ensure success in spat procurement. The nature of bottom of the selected site was sandy mud, with a depth varying from 1.0 to 2.2 metres. An additional site in the Tuticorin Bay was also selected to augment the collection. This area was of peaty mud free of predators, enemies and competing organisms. At the proper spawning time breeding stock of oysters in sufficient quantities were transferred from the creek to the bay. The area was protected from wind and wave action by natural formation of sandy shore arm projecting into the sea on the north-eastern side.

Laying of tiles

Special type of rectangular iron frames of size 100×75×15 cm was made using 5 mm M.S. rod. Each frame was coated twice with lacoloid black and dried for a day to avoid corrosion in the sea water. The frame was knitted with 2 mm synthetic twine to get a mesh size of 2.0 to 2.5 cm. Tiles were arranged side by side in each cage with the concave side facing down. A second layer of tiles was arranged perpendicular to the first one, in such a way that a minimum of 45 to 50 tiles could be kept in a single cage in two layers. Racks of size 14×2 m were constructed by driving 12 poles of 2.5 m length. Cross pole of 2 m long were tied to the poles just 30 cm below the water level. To these longitudinal poles were tied to serve as platform for the tiles. The cage with the arranged tiles (Pl. I B) were transported to the spat collecting ground by means of a dinghi and placed on the rack in such a way that the tiles were always submerged. Each month 1,000 tiles were laid for observing the spat intensity from August 1977 to July 1978 and thereafter till 1979 maximum number of tiles used during the season of maximum spatfall.

Results

Tiles were laid in July 1977 and spatfall was noticed during the month of August with an average of 15 spat per tile. The intensity was high in September, reaching 34 spat per tile (Pl. I C, Table 2). It was possible to observe spat numbering 17 per tile to a maximum of even 84 per tile. In October the average settlement came down to 7 per tile. From November '77 to February '78 no settlement was noticed.

During '78, spatfall was noticed during March and April with an average of 8 and 26 spat per tile which progressively diminished till August and in September the spat was 2 per tile. Practically there was no settlement from June to August. Surprisingly the spatfall was poor in September, 1978. Compared to the spat settlement of the previous year, this failure of spat settlement was disappointing, but could be explained because of some man-made changes brought about in the creek where a stone barricade was put up preventing the free flow of sea water in and out of the creek. The stagnant water in the creek with the abnormal physico-chemical conditions of the water perhaps acted adversely on the spawning of oysters thereby preventing normal spawning activities. However, experiments were continued outside the creek in the open shallow areas of the bar where during the month of April '79 spat settlement of 38 numbers per tile was observed. On several tiles intense settlement was noticed numbering 105 per tile. The settlement was irregular till August '79 and in September and October '79 again spat settlement was noticed with an average of 7 and 4 per tile respectively.

From the above experiments it was possible to deduce two seasons of fairly intense spat

PLATE I A. Application of lime coating to tiles, B. Lime coated tiles kept in trays, C. Lime coated tiles with oyster spat attached and D. Oyster shells strung on galvanized wires for collection of oyster spat.

PLATE II A. Oyster shells kept in a tray for collection of oyster spat, B. Oyster spat which have set on oyster shell cultch, C. Oyster spat which have set on mussel shell cultch and D. Corrugated asbestos sheet cultch with oyster spat attached.

TABLE 2. *Monthly average rate of spat attachment per unit*

Name of spat Collector	1977					1978									1979						
	August	September	October	November	December	January	February	March	April	May	June	July	August	September	April	May	June	July	August	September	October
Lime-coated tile ..	15	34	7	1	—	—	—	8	26	4	—	—	—	2	38	—	—	—	—	7	4
Oyster shell ..	1	9	2	—	—	—	—	3	5	1	—	—	—	—	9	—	—	—	—	2	2
Mussel shell ..	—	—	—	—	—	—	—	—	4	—	—	—	—	—	6	4	—	—	—	1	2
Corrugated asbestos sheet ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	393	—	—	10	—	36	38

settlement namely March/April (maximum spatfall) and September/October (subsidiary peak). It may be mentioned in this context that Hornell (1921) observed similar feature in respect of the oysters spawning in Pulicat Lake area. Table 1 shows the monthly average rate of spatfall per unit while Table 2 shows the total number spat collectors used during '77 to '79. Since spat attachment on tiles was successful, as many as 61,000 tiles were employed during '78 and produced 3 lakhs oyster spat. During the year 1979, the spat collectors were increased to 67,000 which enabled procurement of 5.82 lakhs of spat.

Features of edible oyster spat

As soon as the spat settles down it looks like a red triangular spat. On the fifth day longitudinal lines make their appearance from the umbo region to the posterior side of the shell. The settled spat can be categorised into three kinds red, black and pale white or ash coloured with red tinge. The red coloured ones are common. At this stage the umbo region is slightly elevated and lamellar process not clear. As the spat grows, the colour appears to fade away. Uniform growth of the spat seems to be influenced by (a) the nature of the surface of the tile, (b) overcrowding of spat and (c) settlement of fouling organism especially barnacles. When the spat is not influenced by any of the above factors and settles on an even surface of the tile, growth is uniform on all directions except the umbo, and the shell assumes a circular shape *i.e.*, growth occurs both lengthwise and breadthwise. The above observation seems to be normal growth pattern of a spat.

Scraping of spat

The spat grown to 20-35 mm size were preferred for scraping. Spat was detached from tiles by using a specially designed chisel or spatula. In the process of scraping great attention was paid for the complete casting of mortar from the tiles. Gentle hits with chisel in different angles of the tiles were sufficient for the detachment of fragments or flakes along with spat.

Oyster shell as cultch

(*i*) *Stringed shells :* Experiments were carried out with oyster shells both by hanging and broad-casting methods. Clean, weathered and aged shells were used for preparation of

strings. The shells were pierced by means of a special hammer and strung to a galvanized wire of 16 size or synthetic rope of 4 mm thickness with one metre length (Pl. I D), each string containing 30 to 35 shells. The strings thus prepared were suspended from casuarina pole in the seed collection areas in such a way as to be completely immersed in water. This method of spat collection was carried out in 1977 but was not giving good results. However, strings used in April '79 in the open sea gave satisfactory resuls by getting on an average of 9 spat per shell.

(*il*) *Broad-casting method:* A different method of experiment was carried out by spreading the old oyster shells in rectangular iron cages during the above period (Pl. II A). Iron cages of size $90\times60\times15$ cm were used and shells were compactly arranged at an average of 100 shells per cage. The cages with the shells were laid on submerged racks. The incidence of spatfall was noted regularly for a period of one year and thereafter during the period of peak season alone. Spatfall was noticed during September '77 and April '78 with an average of 9 and 5 spat respectively and the number of spat being 2-26 and 1-16 respectively (Plate II B).

Mussel shell

Mussel shells were used as spat collectors during April '78, suspending them in a box-type cage from the rack to a depth of 30 cm below the low tide level. Spatfall was noticed on these shells (Plate II C) with an average of 4 spat per shell and the range was 2 to 11 spat per shell. Strings made out of mussel shells were tried from April to October '79. Spatfall was noticed during the month of April and May at the rate of 6 and 4 respectively. No spatfall noticed during the period between June and August '79 and in September again an average of 2 spat per shell was seen. The spat collection was poor as in the case of oyster shells.

Cement-coated tiles

Experiments were conducted by using the common country tiles coated with cement also. 45 kg of cement in 30 litres of sea water would suffice for coating 500 tiles. The coating and drying of tiles were done as in the case of lime-coating work. The tiles were staked in cages and laid on the rack in the creek. On the basis of the results obtained for the month of August and September '77, cement-coated tiles proved to be a good collector with an average rate of spat attachment of 19 and 34 respectively. While comparing with the lime-coated tiles, the attachment of spat was 33% higher in the case of cement-coated tiles. The attachment of barnacles on these tiles was considerably high. Although attachment was heavy, scraping of spat faced a great problem resulting in damage of spat at the time of removal. Hence this method was considered not convenient.

Strings of coconut shells

One metre long strings of 10 coconut shells with a gap of 8 to 10 cm between the shells were used during August to October '77. Lime-coating was also carried out and suspended from the pole alongwith oyster string shells. The experiment with coconut shells proved to be of no use, since the average attachment was one spat per shell even during the peak period of spatfall in September.

Wooden lattices

Palmyra sticks nailed together in the form of lattices, which after coating with tar were used during the spawning period of April '78, but this method also showed very poor attachment of spat.

Bamboo mats

Six numbers of bamboo mats 2 m long and 1.5 m broad, were used during September '77. The mats were examined next month and the

spat attachment was very poor. Heavy accumulation of silt and formation of a thin algal growth in it probably does not permit settlement.

Corrugated asbestos sheet

Corrugated asbestos sheet bits of 30×30 cm size were used as spat collectors in April '79. Five sheets were tied into a 'bouquet' with synthetic or coir rope and placed on the rack. Three such stacks containing 15 sheets were laid on the rack to remain submerged in water to a depth of 15 cm below the water level. The sheets were examined periodically. After 20 days it was observed the heavy settlement of spat with a minimum of 254 and maximum of 517 spat/sheet which gave an average of 393 spat per sheet. Good spat settlement was noticed (Pl. II D) on all sheets except the uppermost one of a bouquet in which the lowerside had got heavy spat settlement but the upper side was deposited with heavy silt.

Detaching the spat was found difficult from the sheets. Hence lime-coated asbestos sheets were used from July to October '79 and the average rate of spat attachment was 10, nil 36 and 38 respectively. The removal of spat was easy as in the case of lime-coated tiles.

Discussion

The Romans cultured oysters as early as the first century B.C. though they did not have scientific knowledge. The practices of the Romans have helped in the revival of oyster culture in France in the nineteenth century.

The available information of the methods of oyster spat collection is scanty in India. However, Hornell (1916, 1921) has reported on the use of roofing tiles at Pulicat Lake. Devanesan and Chacko (1955) tried casuarina twigs, oyster and cockle shells, but did not get encouraging results. Nair (1975) has reported the suitability of using cement-coated oyster shells at Athankarai Estuary. According to Sundaram and Ramadoss (1978) lime-coated flat tiles gave good results at Tuticorin and on an average of 10 to 15 spat settled on either side.

Considering the easy availability and the cheapness of the materials to be used for spat collection from nature and also suitability to collect very huge quantities of spat it is clear that at present the spat collection and supply problem do not pose any difficulties. By the present method, large scale seed demand from the growers market can be effectively met. But this by itself does not assure satisfying the future demands and while planning for future the sure way to cope up with the requirements would be to develop a secure method of hatchery production of oyster spat as has been done in major oyster growing countries like Japan and U.S.A. To this end our experiments are already progressing. But it should be conceded that the maximum use of natural resources must be made for which the lime-coated tiles seems to be the best answer for spat procurement.

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