Methods of Spat Collection in the Culture of Shellfishes

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INTRODUCTION

Mariculture, the practice of farming marine invertebrates, vertebrates and algae for increasing the production of seafood, is of comparatively recent interest in India. In the culture practice, collection of 'seed' is one of the essential prerequistes. In the case of molluscs, the seed popularly called 'spat' is available in millions in natural conditions since the fecundity in bivalves, especially in oysters and mussels, is known to be very high (Ahmed, 1975), each individual liberating between 5 and 25 million eggs at spawning. When billions of these settle down on suitable substratum cover, crowding becomes inevitable due to the limited space available. Besides, several millions perish either because they are unable to find suitable substratum or encounter unfavourable environmental conditions. The settled stock undergoes further vissicitudes because of predation or destruction by sea bottom animal communities. Only a fraction of the total output survives, to reach the adult size. Therefore, natural bed as a source of seed collection is undependable. In this context the employment of different techniques of spat or seed collection assumes very great importance. This aspect is of particular importance in the careful planning of culture attempts of edible molluscs in as much as the industry has to be assured of steady uninterrupted supply of the seed required. When the spat develop into seed they can be transplanted to the farm site for commercial culture. Therefore with the object of collecting adequate quantities of seed during the spawning season it is necessary to perfect and standardise suitable methods of spat collection. The materials used for the purpose are known as 'spat collectors' and 'cultch materials'. Well known spat collectors may be classified into 1) stone, 2) glass sheets, 3) plastics, (non-toxic) 4) shells, 5) netron, 6) tiles, 7) wooden collectors, 8) ropes and 9) cages. These are used in different countries in different

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ways with local modifications to suit their requirements. Useful information on the various methods of spat collection followed in different countries for various species is given below.

Oysters

Oysters may be divided broadly into 1) edible oysters and 2) pearl producing oysters. Edible oysters may be further divided into 1) flat oysters comprising the species of the genus *Ostrea* and 2) cup shaped oysters representing the genus *Crossostrea*. Presently, Japan, France and North America, Philippines and Australia are the foremost oyster farming countries.

SPAT COLLECTORS FOR EDIBLE OYSTERS

1) **Japan**

Bamboo branches, tree branches and stones are traditionally used as spat collectors in Japan. Pieces of 1.2 to 1.5 meters long bamboo sticks *(Phyllosachys* spp.*)* with some branches are arranged in clusters, rows or in clumps by driving into the bottom and the seed oysters are removed by scrapping (Cahn, 1950). In this method, spat settlement is found to be good in chestnut, oak and pine tree branches but their britlleness renders constant renewal and can be used only in sheltered bays and inlets. Pieces of any stone thrown overboard over hard substratum, also helps in spat collection.

Recently, shells of scallops *(Pecten laquentus* and *P. yeasoensis)*, mussels *(Mytiluser assitesta)*, Oysters *(Ostrea gigas)* and abalones *(Haliotis kamacharkana)* are being used as cultch materials in one form or the other. In olden days these shells were either thrown overboard or spread on the collection ground by hand during low tide and/or fastened to a bamboo pole which is driven into the soft bottom in such a way that the cultch materials are positioned clear off the bottom.

In Hiroshima region of Western Japan, shells are used in the form of 'ren'. Pierced shells strung to a galvanized wire with bamboo or plastic spacers are hung across a bamboo frame-work driven into the bottom, thereby forming a double collector system (Fig. 1). In Honshu region the rens

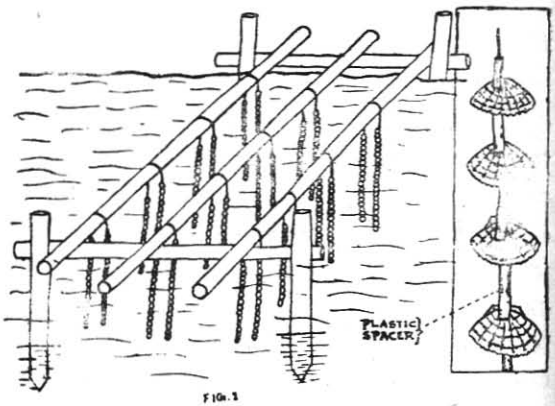


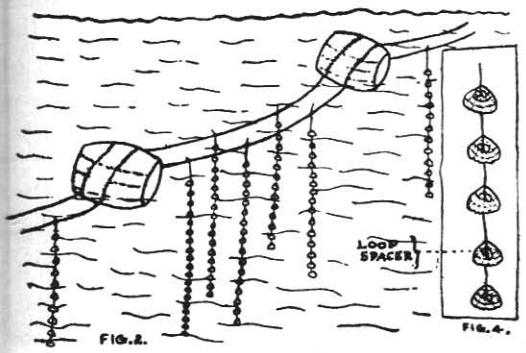
FIG. 1

Bamboo framework with suspending 'rens' (Diagrammatic).

Portion of a typical 'ren'

in vogue are devoid of spacers. Here, the spat necessary for use in raft culture in Japan itself and those to meet the export needs to be used in bottom culture are collected using scallop shells and oyster shells respectively. The deep and irregular shape of oyster renders them suitable for bottom culture, whereas the spat on the underside of the scallop shell may suffocate and die. In both cases the rens are suspended either from rafts or long lines

(Fig. 2). Employing 'netron' is also popular in collecting spat. This is a hexagonal plastic netting with a mesh size of 5 cm. diameter. Strips of these plastic nettings with greater length and shorter breadth (10 m. long and 15 cm. wide) are suspended horizontally from a collecting rack at suitable depths. When compared to ren, netron is very light and easy to handle.



Long line with suspending 'rens' (Diagrammatic)

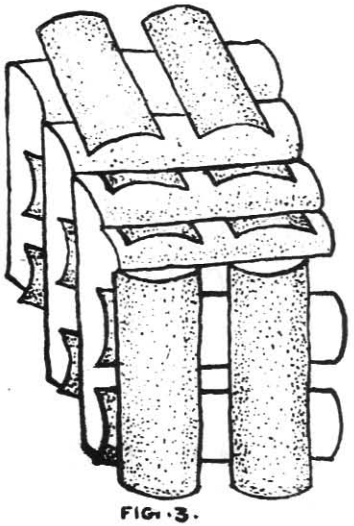
Ren with loop spacer (Diagrammatic)

North America

In North America, the American oyster *Crossostrea virginica*, the Pacific oyster, *C. gigas*, the Olympia oyster *Ostrea lurida* and the European flat oyster *O. edulis* are chiefly farmed. In Pendrell Sound, British Columbia and Dabof Bay along Pacific coast and Ocean Pond along Atlantic Coast which are the principal centres of spat collection, the method followed is similar to that of western Japan. But the same method is found unsuitable for the cold waters of northeast United States and Eastern Canada. Therefore, cement coated egg cartons, chicken wire bags containing shells and 3 mm. thick sheets of non-toxic plastics are satisfactorily employed and are found to be efficient than strings. The spat settled on these can be removed easily.

France

Flat oyster *(Ostrea edulis)* and Portuguese oyster *(Crossostrea angulata)* are the chief oysters farmed in France. The seed of flat oyster are collected by placing collectors, consisting of stack of paired semicylindrical ceramic tiles of about 0.3m. length and 10 to 12.5 cm diameter coated with a thin layer of lime (that renders scrapping very easy at a later stage), on wooden platforms in the river so as to raise them 15 to 30 cm. off the bottom. A single stack consists of 5 to 6 pairs of tiles arranged in such a way that each pair is perpendicular to those above and below. The tiles are wired together to form a single unit (Fig. 3). The seed oysters are scrapped off the tiles and transplanted to 'beds' or 'parcs' for further growth. Currently a cement coated rubber like plastic material



Stack of country tiles (Diagrammatic)

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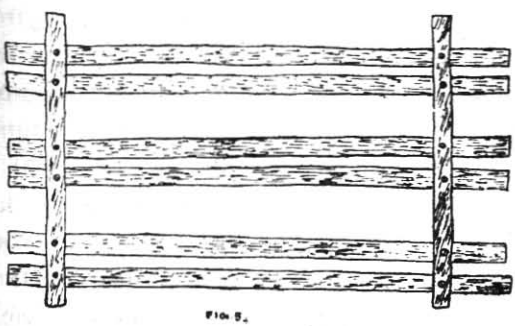
of the same size and shape as the ceramic tile is also used which is lighter to handle but not considered as efficient as tiles.

Philippines

Unlike Japan and many European countries where edible oysters are considered as luxurious food item, in Philippines they form a staple item of diet. Slipper oyster *(Crossostrea eradelie)* is extensively cultured in Manila Bay. Traditionally spat is collected by driving the sun dried bamboo poles of 5 to 10 cm. diameter either with or without oyster shells wired on to them. Strings of shells suspended with loop spacers in between the shells (Fig. 4) are also being used lately.

Australia

Spat collectors employed in Australia are entirely different from those used in other countries. Instead of strings of shells or bamboo poles, wooden ladder like structures constructed by railing four 2 m long and 22-25 mm. square hardwood sticks between 1 m. rails, the cross bars of which may be pairs of sticks in some cases, are used (Pig. 5). About fifty such ladders are tarred, stacked and wired on together to form a 'crate' of 3 m. high which is then wired to very sturdy racks.



A single ladder (Diagrammatic)

Other places

In the Carribbean, bitumen painted wooden planks and branches of red mangrove are used for spat collection. In California, Virginia and Canada plastic mesh collectors similar to the 'netron' collectors used in Japan are in vogue.

Spat Collectors for Pearl Oysters

Pearl oysters of the genus *Pinctada* are farmed in Japan and Australia chiefly for the production of cultured pearls. Traditional method in collecting the spat involves submerging bamboo pieces or stones on which oyster spat settle down which are later collected and transported to the farm site. Mikimoto devised a more effective method in 1924 in which he used a cage 84 x 54 x 20 cm. made of galvanized wire frame with wire mesh of 2 cm. diameter with seven horizontal shelves made of wire mesh. The cage was first dipped in hot coal tar to prevent corrosion and then in a thin mixture of sand and cement to provide a suitable base for the spat to settle on. Since pearl oysters are negatively phototrophic, black-painted boards were fastened to the sides and bottom of the cage to effect darkness and suspended from large rafts at considerable depths. A series of straw ropes to which abalone, oyster or turbo shells are strung and old fishing nets of woven palm rope, both suspended from bamboo rafts, are some of the other successful methods practiced in Japan even today.

Spat Collectors for Mussels

Spain, France and Philippines are the notable countries engaged in the production of mussels in which spain is far ahead of others due to the success achieved in raft culture technique. In Southern France, loosely woven rope spat collectors are suspended near the natural bed in the intertidal region on which mussel spat attach in large number in the crevices in between the strands of the ropes. Similarly, in Spain the ropes so suspended are tarred with wooden pegs inserted in between the strands at every 30 to 45 cm. to prevent the clumps of mussels attached from falling down. In Phillippines the 'seed' already available from the natural bed are scrapped and re-attached by placing them in big trays with oyster shells or bamboo sticks and suspended on poles so as to be 0.3 m. off the bottom. In case of bamboo sticks the upper half alone is exposed to mussel settlement so that the lower free half can be driven into the bottom later.

Spat collectors for other cultivable molluscs

Clams (*Anadara* spp., *Mercenaria* spp. and *Mya* spp.) abalones (*Haliotis* spp.) and scallops (*Pecten* spp.) are the other molluscs raised in the sea. In the case of abalone and scallops the farmer's requirements mainly depend upon hatcheries for obaining the seed. But in the case of clams the young ones are scooped from out of their natural habitat during low tide and are gathered in a container for planting them in suitable grounds later.

Investigations on the spat collection methods in India

The information available on the methods of spat collection in India is scanty. The earliest report is that of Devanesan and Chacko (1955). Crate system of spat collection of edible oyster tried intially in Pulicat Lake near Madras was not quite successful since the numbers of spat collected were inadequate for transplantation. Bundles of mangrove and casuarina twigs anchored in the deeper water area of the lake, bamboo mats, glass pans coated with cement mixture, oyster shells hung on a string and old oyster and cockle shells, bricks and tiles spread over the firmest and cleanest bottom of the lake did not yield encouraging results (Devanesan and Chacko, *loc. cit.*)

Oyster shells given a coating of cement and tied to bamboo strips or nylon ropes were tried recently and found suitable for the collection of spat of *Crossostrea madrasensis* in Athankarai Estuary near Mandapam (Nair, 1975). Nylon ropes with free filamentous suspensions and basket type collectors were found to be conducive for the settlement of the spat of pearl oysters at Vizhinjam Bay (Nair, *loc. cit.*) At Tuticorin lime coated flat tiles crated and laid on the natural settling grounds during the oyster spawning season, gave very good results. On an average 10 to 15 spat were found settled on either side of the tiles. Of a variety of 'cultch' materials used in the sheltered basin of the New Tuticorin Port good settlement of the spat of pearl oysters (*Pinctada* spp.) were observed on the nylon twine meshes of circular and square framed

iron cages (Nagappan Nayar *et. al.* Ms,). The incidence of spat settlement ranged from 13 to 132.

Remarks

From the foregoing account it may be seen that the spat collectors employed are of different types in various countries, For successful collection of spat it is necessary to select the suitable type of spat collector. The timing of spat collection and proper placement of collectors are crucial factors involved in the success of molluscan culture. The time of production of seed in the natural condition varies extremely with species due to diverse factors such as fluctuations in temperature, salinity etc. Care should be taken to place the collectors at suitable depths where maximum number of spat could be collected with minimum fouling effect since the concentration of the larvae of both the categories occur invariably at different depths. The depth at which the spat of the species in question occur may be decided by the systematic examination of the plankton all the year round and particularly during the spawning season. Therefore, thorough knowledge of the presence of larvae of oysters, mussles and other cultivable bivalves for deciding the suitable time and depth at which the collectors can be placed and devising an efficient type of spat collector for each species in different areas are the main criteria for the successful collection of spat from the natural bed.

When compared to the inexhaustible edible fin fish resources of the sea, the edible molluscan resources are restricted because the area available for the latter to settle and thrive is limited. Foremost consideration in our endeavour to increase the output of our protein rich marine resources has been bestowed on improving the existing status of the edible molluscan supply. Assessing the quantity of available natural molluscan resources of our country for exploitation to the optimum level, also appears necessary in addition to developing the culture technology. In recent years great accent has been laid on the culture of edible molluscs in India. Demand from the export market also will add new dimensions in the immediate future as has happened in the case of prawns. In order to provide a satisfactory solution an all-out effort to perfect the technology of the culture of edible molluscs under Indian conditions has been launched. It is a race against time as in all kinds of marine farming and our country needs to keep abreast of the time. This underlines the paramount necessity in evolving standardised techniques of spat collection as much needed for the culture operation. The preference of the fish eating population may have also to be ascertained and efforts taken to popularise the shellfish flesh eating habit of our people. While the above aspects are complimentary, increased production of molluscan seafood can be gradually achieved by adopting suitable culture methods. Experiments are already on the way by Central Marine Fisheries Research Institute and a spectacular break-through in the culture of mussels and edible oysters is in the offing. ●