Production and growth of cultchless oyster spat of *Crassostrea madrasensis* (Preston) for single oyster culture

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In India, edible oyster (*Crassostrea madrasensis*) farming is being practised by several farmers in central Kerala employing the rack and ren method in the estuaries and backwaters. However, farmed oysters do not find ready marketability due to the high labour costs involved in handling and shucking. The Central Marine Fisheries Research Institute, Cochin, Kerala, has developed the hatchery technology for edible oyster spat production, both cultched and cultchless. Nevertheless, these have not been commercialised due to the fact that spat collection from wild is still the most feasible option in oyster farming. The aim of the present study was to produce cultchless spat in the farm site itself and rear it to commercial size for harvesting uniform sized regular, rounded single oysters.

Cultchless oysters have several advantages over attached oysters for both commercial and research applications. Advantages include superior shape, uniformity, ease of transportation and shucking and elimination of costs of handling cultch materials (Dupuy and Rivkin, 1972). In hatcheries/ laboratories, cultchless oysters can be easily handled and measurements are not hampered by the attached cultch. Uniformly shaped and rounded single oysters have great aesthetic appeal and are in great demand in European and south-east Asian cuisines.

The edible oyster (*C. madrasensis*) spat production and farming were carried out in the Moorad Estuary. The Moorad Estuary is located between 11° 32' N 11° 35' and 75° 35' to 75° 40' S along north Kerala. It is a small estuary with a water spread area of about 1.4 km^2 supporting a vibrant fishery of finfish and bivalves.

In a preliminary experiment, clam shells (*Meretrix casta*) were stocked in netlon cages (1 mm mesh) and suspended in the rack in the Moorad Estuary during January 2004. Spat fall began in February and profuse spat fall occurred in March. The clamshells served as very good cultch for the edible oyster spat and profuse spat settlement occurred on these shells. After nearly three weeks of growth, the clam shell invariably gets dislodged, the spat therefore become cultchless (Fig. 1).

The growth of these spat was rapid and regular rounded oysters could be grown to marketable size.

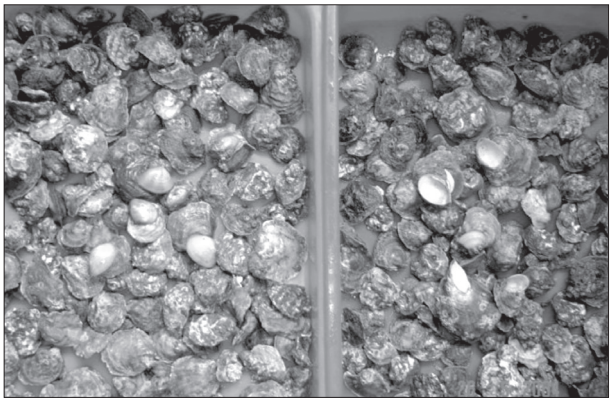

Fig. 1. Cultchless oyster spat produced on clamshells in the CMFRI Integrated bivalve research cum demonstration farm

The average total length of the spat in April was 26.76 cm. They attained average total length and weight of 70.04 mm and 70.94 g respectively in January. The instantaneous growth was 43.13 mm in 8 months with a growth rate of 5.41 m per month; the instantaneous growth in terms of weight was 62.5 mm in 7 months with weight gain of 8.93 g per month. The growth of the oysters was rapid during May - June attaining 11.7 mm and 15.1 g in June. However, during July-August, the growth declined due to drop in salinity. Growth recovered after monsoon and in November, the growth increments were 12.2 mm and l9.3 g in January, while the growth in terms of length stabilised, the weight gain was tremendous with total weight increment of 14.9 g. The oysters had attained perfectly round and regular edges and significant weight for the marketable size as those preferred in European countries (Fig. 2).

Fig. 2. Single oysters grown in the integrated bivalve research cum demonstration farm of CMFRI

The experiment was repeated using different spat collectors in 2006. Four substrates were stocked at 200 numbers per 0.5 m^2 netlon cages *viz*.,

1) Clam shells (*M. casta*) of medium size having average length of 25 mm
2) Clam shells (*M. casta*) of small size having average length of 15 mm
3) Lime coated clam shells of 25 mm size and
4) Broken shell pieces of green mussels

These were suspended in the integrated bivalve farm set up in Moorad Estuary in January 2006 and examined every month for spat settlement.

It was observed that medium sized clam shells of *M. casta* of average size 25 mm gave best results in terms of percentage of settlement compared to small clam shells, lime coated shells and mussel shell bits (Table 1). Also, in all cases, except in lime coated shells, percentage of settlement of spat was higher on the inner side of the shell. In lime coated shells also, it was only marginally higher on the outer surface of the clam shells, probably due to the lime coating.

A total of 485 oyster spats were thus collected during the experiment. The spats were further transferred to specially designed wooden cages for single oyster culture. A three tier cage was fabricated using netlon (>10 mm) as the base and also with wooden panel support. Three such trays were stocked with the cultchless spat and tied together to form one unit and suspended in the farm for further rearing. Four such units were stocked with cultchless spat for further rearing. The growth was monitored. The details of the growth of single oysters are given in Table 1.

Table 1. Experiments for spat collection for single oyster culture: Moorad Estuary 2006

A. Small clam shells (15 mm)

	No. of shells	No. of spat on inner side	No. of spat on outer side	Total no. of spat	% settlement	% settlement on inner side	% settlement on outerside
1	200	10	6	16	8.0	62.5	37.5
2	200	9	12	21	10.5	42.9	57.1
3	80	16	5	21	26.3	76.2	23.8
4	178	19	8	27	15.2	70.4	29.6
5	177	18	3	21	11.9	85.7	14.3
Total / Mean	835	72	34	106	14.4	67.5	32.5

B. Medium sized clam shells (25 mm)

	No. of shells	No. of spat on inner side	No. of spat on outer side	Total no. of spat	% settlement	% settlement on inner side	% settlement on outerside
1	88	1	13	14	15.9	7.1	92.9
2	57	30	8	38	66.7	78.9	21.1
3	57	47	8	55	96.5	85.5	14.5
4	26	8	7	15	57.7	53.3	46.7
5	200	28	27	55	27.5	50.9	49.1
6	155	7	7	14	9.0	50.0	50.0
Total / Mean	583	121	70	191	45.5	54.3	45.7

C. Lime coated clam shells (25 mm)

	No. of shells	No. of spat on inner side	No. of spat on outer side	Total no. of spat	% settlement	% settlement on inner side	% settlement on outerside
1	200	2	3	5	2.5	40.0	60.0
2	200	24	16	40	20.0	60.0	40.0
3	200	10	18	28	14.0	35.7	64.3
4	200	16	12	28	14.0	57.1	42.9
5	192	5	7	12	6.3	41.7	58.3
6	194	7	7	14	7.2	50.0	50.0
7	180	10	8	18	10.0	55.6	44.4
Total/ Mean	1366	74	71	145	10.6	48.6	51.4

D. Mussel shell bits

	No. of shells	No. of spat on inner side	No. of spat on outer side	Total No. of spat	% settlement	% settlement on inner side	% settlement on outerside
1	100	31	12	43	43.0	72.1	27.9

E. Growth of single oysters in wooden cage

Cages	Avg TL mm	Avg T Wt g	Meat %	Max TL mm	Min TL mm	Total nos.	% Mortality
1	64.1	52.5	8	84	36	61	35.7
2	64.4	48.7	-	85	48	45	49.0
3	59.1	37.2	-	76	44	55	44.6
4	58.5	39.0	-	79	32	21	76.0

A total of 373 single oysters were reared in the farm. However, 182 single oysters of regular rounded shape were harvested at the end of the experiment. The experiment had to be terminated in June due to the onset of monsoons. There was heavy mortality with the drop in salinity in June. The single oysters attained an average total length of 62 mm and average total weight of 44 g.The maximum length recorded was 85 mm and minimum length 32 mm. The meat content was 8%. The mortality recorded was 51%.

The salinity at the farm site during the culture period ranged from 32 ppt in February to 38 ppt in March – April. The pH ranged from 7.14 in May to 8.26 in January, gross productivity ranged from 2.56 g C m^{-3} day^{-1} in February to 6.52 g C m^{-3} day^{-1} in March and the net productivity ranged from 0.25 g C m^{-3} day^{-1} in May to 1.88 g C m^{-3} day^{-1} in January.

Further experiments to standardise and upgrade this system for large-scale production of single oysters are necessary. This will significantly enhance production and provide uniform sized, regular shaped single oysters for the “half shell” raw oyster market. Further, value addition of these can be done to supply “flash frozen, half shell” products for the International Pacific Rim markets. Farmers are certainly looking forward to a simplified farming technology wherein handling of oysters during shucking, transportation and processing is less arduous and more economical besides providing an appealing product.