

PERSPECTIVES IN MARICULTURE

Editors

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2001

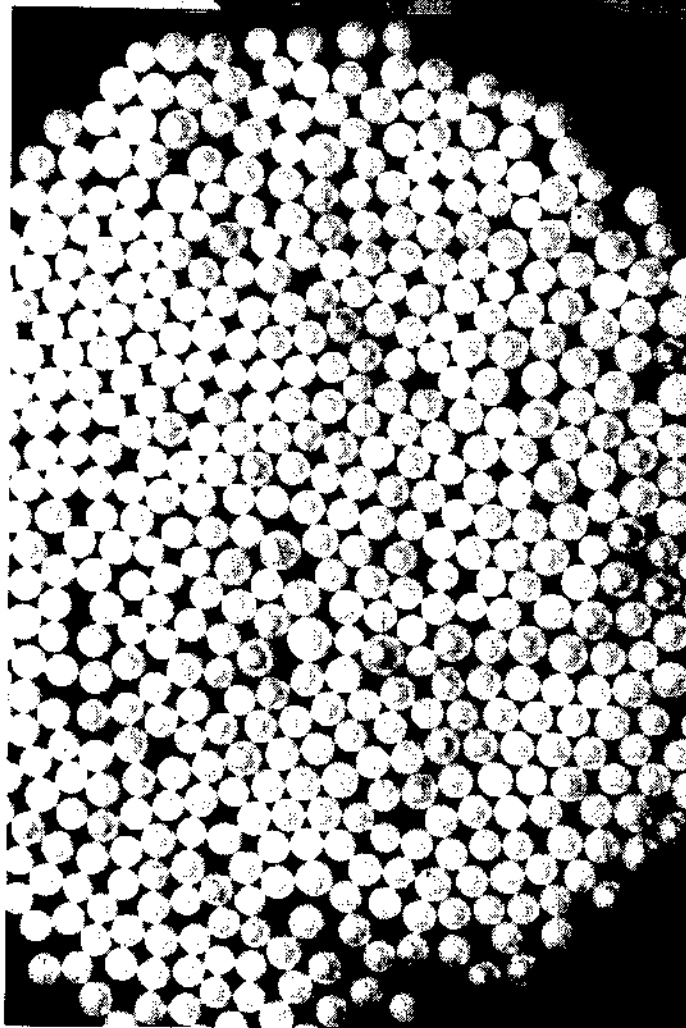
**Results of the mother
oyster culture and
pearl production in
Pinctada fucata
(Gould) in the
inshore waters of
the Gulf of Mannar
and Palk Bay**

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ABSTRACT

*It is established experimentally
that the inshore areas of the Gulf of
Mannar and Palk Bay bordering
Mandapam Camp can profitably be
used for mother oyster culture and
cultured pearl production.*

*The depth of the inshore waters
of the Gulf of Mannar is
comparatively deeper where the raft
culture can be adopted from
November to May, whereas, the*



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nearshore waters of Palk Bay is shallow where rack can be used to farm the oysters from June to October, thus a continued farming is possible in all months in a calendar year.

Though the hydrological and environmental conditions of both the seas are almost same, it is found that Gulf of Mannar is better suited

for mother oyster culture as indicated by the better growth rates of spat and oysters.

If farming is done properly, high survival rates of spat, mother oysters and implanted oysters can be achieved with an enhanced rate of production of better quality cultured pearls.

Introduction

Pearl oyster *Pinctada fucata* Gould occur in large numbers on paars lying between Kilakarai and Kanyakumari in the Gulf of Mannar. These oysters are known for their best quality pearl production. CMFRI has developed technologies for pearl production in 1973 and Hatchery production of seeds in 1982. However, inspite of the technologies readily available, entrepreneurs are to venture into this industry. In Tamilnadu, in 1983 a joint venture project between Tamil Nadu Fisheries Development Corporation and Southern Petrochemical industries was started and a pearl culture farm was established in Krusadai Island, Gulf of Mannar. Except for this no other entrepreneurs had come forward to establish pearl culture farms for reasons best known to them. Hence an attempt was made by Mandapam Regional Centre of CMFRI to carry out experimental culture of pearl oyster spat to operatable sized oysters and production of cultured pearls in *Pinctada fucata* in the inshore areas of Gulf to assess the suitability and redemonstrate the economical viability of pearl culture in the inshore areas of Gulf of Mannar and Palk bay sea during 1996-97. The results of these experiments on rearing spats to mother oyster size and pearl production was encouraging. The salient features of the experiments, problems encountered and the need for propagation of pearl culture in these area were discussed in this paper.

Results

Topography and environmental conditions of the culture sites

Gulf of Mannar : Gulf of Mannar sea is calm during the period

November to April. The seawater salinity ranged from 29.0 to 36.0 ppt, temperature from 25.0 to 32.0 C, pH from 8.0 to 8.4 and dissolved oxygen content from 3.6 to 5.5 ml/l in general throughout the year. The present culture site is sandy intermittent with rocks here and there.

Palk Bay : The Palk Bay sea is very shallow and calm during May-October. The culture site sea bottom is sandy and has abundant seagrass growth in places. It also has natural bed of pearl oyster *Pinctada suquillata* and rock oyster *Saccostrea cuculata*. *Pinctada fucata* population in this bed is very sparse. The sea water temperature ranges from 25.7 to 33.0°C salinity from 26.9 to 35.6 ppt, pH from 8.0 to 8.8 and dissolved oxygen from 2.8 to 6.0 ml/l.

Observations on spat rearing

In the present experiments, oyster spats were reared both in the Gulf of Mannar and Palk Bay inshore waters to assess the suitability of these areas for pearl culture. Spats produced from the Tuticorin Research Centre hatchery of CMFRI were transported to Mandapam Camp by adopting 'wet' method, and also spats produced out of the larvae (veliger stage 70 μ) transported from TRC of CMFRI and subsequently reared at MRC of CMFRI were used for the culture experiments. The growth rate were monitored separately upto the oyster reaching operatable size (45mm) or till the time the oysters had to be transferred to the other sea due to the inclement sea conditions. The oysters were also allowed to grow in both the seas by sifting them to access the cumulative growth rates of pearl oysters in both the inshore areas.

Gulf of Mannar : Experiment no.1. In this experiment laboratory produced pearl oyster spats transported from TRC of CMFRI was used (16,500). In July 96 the spats were stocked in conventional box cages of 40x40x10 cm size. Uniform stocking of 1500/cage was maintained and the cages were suspended from floating rafts made out of the palmyrah rafters and moored in the inshore area at an average depth of 2 1/2 m. The rafts hold an average of 80 cages each. Periodical observations were made on the condition of the cages, condition of oyster spats, fouling and mortality. The initial size of the oysters spat ranged from 3.2-12.3mm (Ave.7.2mm). The oysters were periodically thinned as they were growing. At the end of the sixth month the spats had grown to operatable size of 34.6-51.6mm(44.9mm). The monthly growth rate worked out was

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6.3mm. The survival percentage of the oysters under culture was 50 % (Table 1).

Experiment no. 2. In the second experiment a total of 50,000 spats of size ranging from 7.7 to 21.8mm (16.6mm) were used. The average stocking density per cage was 1500 nos initially. The culture was carried out for only 1 1/2 months as the sea has become rough. The thinning was carried out and the density of the oysters had grown to 15.2-34.5 mm (24.9mm) registering an average growth rate of 5.5. mm/month. The survival rate at the time of shifting it to the Palk Bay was 80% (Table 1).

Palk Bay : Experiment no. 1. In the experiment a total of 14,000 laboratory produced spats were used. As the Palk Bay sea is very shallow a rack was constructed using casurina poles. The size of the rack was 30sq m. The average depth of the sea in the area was 1 1/2-2 m. The density of the spats maintained in each cage was 1000 nos. The initial size of the spat were from 6.1 to 10.4 mm (8.0m). These spats were regularly monitored for their growth, fouling and periodical thinning was also carried out. At the end of the five month culture period each cage had 400 nos after the periodical thinning. The oysters had grown to the size ranging from 27.0-39.1mm(31.0mm) showing average growth of 4.6mm/month. The percentage survival was observed to be very high (92.0%). Subsequently the oysters had to be shifted to the Gulf of Mannar due to rough weather. The details of the experiments are presented in Table 1.

Table 1. Growth of pearl oyster (*Pinctada fucata*) spat in cages at the Gulf of Mannar and Palk Bay 1996-1997.

Experiment no/ location	Initial size/ (Ave) mm	Final size/ (Ave) mm	Growth/ month	Duration (Month)	% Survival	Remarks
Gulf of Mannar						
Experiment 1	3.2-12.3 (7.2)	34.6-51.8 (44.9)	6.3	6	50	Moderate fouling
Experiment 2	7.7-21.8 (16.6)	15.2-34.5 (24.9)	5.5	1½	80	""
Palk bay						
Experiment 1	6.1-10.4 (8.0)	27.0-39.0 (31.0)	4.6	5	92	Less fouling

Results of the mother oyster culture

Gulf of Mannar and Palk Bay : Experiment no 1. Under this experiment the oysters were allowed to continuously grow in both the seas by shifting the oysters as and when required. The oysters shifted to Palk Bay during June '97 had the size range of 15.2-34.9 (24.9mm) and were reared up to middle of October '97 and had reached a size of 29.3-40.0 mm (34.3mm) showing an average monthly growth rate of 2.1mm. Subsequently they were shifted to the Gulf of Mannar and reared, the oysters reached operatable size of 36.2-40.3mm during December 97 by registering a monthly average growth rate of 4.0mm. However, the cumulative average growth rate of oysters in these seas was found to below 2.6mm/month. The collective survival rate of the oysters in general was high. The details are given in Table 2.

Table 2. Observations on the growth rate of pearl oyster *Pinctada fucata* reared continuously in the Gulf of Mannar and Palk Bay.

Location/Date	Initial size (Ave) (mm)	Final size (Ave) mm	Growth/ month	Duration Month	% survival	Cumulative growth(mm)
Palk bay						
June 97 to	15.2-34.5	29.2-40.0	2.1	4.5	High	
October 97	(24.9)	(34.3)				2.6
Gulf of Mannar						
October 97 to	29.3-40.0	36.2-45.5	4.0	1.5	High	
December 97	(34.3)	(40.3)				

Results of the nucleus implantation and pearl production

Experiments were conducted in *Pinctada facata* for nucleus implantation and pearl production at the Gulf of Mannar during 1997. A total of 4350 oysters were nucleated during July-December 97 (Table 3). The nucleus used were 3-5mm depending upon the size of the oysters. The nucleated oysters were placed in netlon trays and suspended in an one ton FRP tank where a mild flow of sea water was ensured. The oysters were kept in the tank for a period of 3 days for observation in the post operative convalescence, rejection of nuclei and mortality. Later, the oysters were placed in box type cages and were suspended in the Gulf of Mannar at 2 m depth. The average depth of the culture area was about 2.5m. The stocking density of the oysters ranged from 60-85 nos/box/cage of 40x40x10 cm size. Initially to observe the rejection, a fine mesh

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velon netting was provided in the cage. Periodical monitoring of the oysters were carried out and the health of the oysters, mortality, predation and damage to the cages were noted. Nucleus rejection was observed upto a period of 2 months from the implantation. To enhance free flow of water the velon netting was removed after a period of 1 month and the culture was continued. After a post operative culture period ranging from 6-9 months, the oysters were brought to the laboratory and the pearls were retrieved by teasing out from the gonad of the oyster. The harvested oysters were placed in cages and once again transferred to new cages and taken to farm for the healing of the incision wound. Out of 4350 oysters monitored, about 2950 survived at the end of the harvest accounting for 67.8% of the initial stock. Of this 2034 oysters were found to retain the nucleus implanted (68.9%). The harvest yielded a total of 1809 pearls comprising different grades of pearls accounting for 61.3% pearl formation in the surviving oysters. Among the pearls, premium quality pearls of 'A' grade was 523 (17.7%); 'B' grade pearls was 550 (18.6%) and 736 nos (24.9%) were 'C' grades and the rest being the poorly coated pearls of no commercial value (217 nos; 7.4%).

Table 3. Results of pearl production experiments in the Gulf of Mannar 1996-1977

Particulars	July 97	Aug.	Sep.	Oct.	Nov.	Dec.	Total
No. of oysters operated	549	945	115	380	1202	1159	4350
Nos. surviving at harvest	327	682	85	322	897	637	2950
% survival	59.6	72.2	73.9	84.7	74.6	55.0	67.8
Nos. retained nucleus	231	494	64	235	590	420	2034
% retention in surviving oysters	70.6	72.4	75.3	72.9	65.8	65.9	68.9
No. of quality pearl/	172	448	61	214	547	367	1809
*percentage	52.6	65.6	71.7	66.5	60.9	57.6	61.3
Grade 'A'	43	125	21	101	167	66	523
%	13.1	18.3	24.7	31.4	18.6	10.4	17.4
Grade 'B'	36	149	20	64	163	118	550
%	11.0	21.8	23.5	19.9	18.2	18.5	18.6
Grade 'C'	93	174	20	49	217	183	736
%	28.4	25.5	23.5	15.2	24.2	28.7	24.9
Ungraded pearls	59	46	3	21	46	42	217
%	18.0	6.7	4.7	6.5	5.1	6.6	7.4

* % in terms of surviving oysters.

Discussion

From the forgoing account it can be seen that the inshore waters of the Gulf of Mannar and Palk Bay seas offer ideal conditions for farming pearl oyster in the open sea. Comparatively deep the Gulf of Mannar offers ample scope for mooring offshore rafts for pearl culture while Palk Bay being very shallow is ideal for rack construction. Culture can be taken up at the Gulf of Mannar during November to April and in Palk Bay from May to October.

Although the physico - chemical characteristics of both the Gulf and the Bay are almost same, the Gulf of Mannar is more suitable for pearl culture than Palk bay as indicated by better growth rate in the former area. (Jeyabaskaran *et al.*, 1983).

In both the farms, predation is found to be negligible. While fouling on the oysters was moderate in the Gulf of Mannar and it was less in Palk Bay. The major fouling organisms were sponges, barnacles and ascidians. Alagarsami and Chellam (1976) has described the fouling on the oysters cultured at Veppalodai. Barnacles, bryozoans, spats of other molluscs *Avicula* and *Crassostrea* sp are the dominant foulers and spionid polychaete *Polydora* sp and the Clionid sponge *Cliona cellata* were important borers.

Mortality in general were observed in the cages which were either over stocked or those which were not periodically monitored due to logistic problems. Mortality of oysters, in cages where small crabs and predatory molluscs have entered, were also observed.

The optimum size of floating rafts and rack could be 3x3 m and 30 sq m which can hold about 80 and 240 cages respectively. A unit of 3 such rafts and one rack can be established in the Gulf of Mannar and Palk Bay respectively on which year round pearl culture could be successfully carried out.

The model unit suggested has a production rate of about 5400 pearls/ 6-9 months if exclusively used for rearing nucleated oysters (Table 4).

Table 4. Production potential of a model pearl culture unit.

No. of unit/ size	Holding capacity	Stocking density/ cage	Total oyster under rearing	Survival %	Pearl formation %	Production (nos)	Gross + Revenue (Rs. Lakhs)
One unit of Three rafts of 3x3 each & a rack of 30 sq m.	240 cages	75	18,000	60	50	5,400	2.16

* Calculation based on the results given in this paper.

+ at average price of Rs.40/pearl.

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From the experimental result, a good survival rate ranging from 72.2 (Aug) to 84.7% (Oct) was observed. The moderate survival during December and July (55.0 and 59.6%) may be attributed to the health of the oysters implanted during that period. The overall nucleus retention in the implanted oysters were good ranging from 66 to 75% in different months.

The production of premium quality pearls (Grade A) ranged from 10.4 (Dec) to 31.4% (Oct) and the average was 17.7%; good quality (grade B) pearls ranged from 11.0 (July) to 23.5% (Sept) and the average being 18.6% of the surviving oysters.

Alagarsamy (1974) reported 55.8 to 62.8% pearl formation in the Veppalodai farm and the results obtained in this experiments (52.6 to 71.7%) are fairly comparable with his observations and an average of 50% of pearl formation out of the total implanted oysters is quite possible in the inshore areas of this region.

Acknowledgements

The authors wish to thank the Director, CMFRI, Kochi for inspiring the team and for facilities extended. They also thank the Head, Molluscan Fisheries Division, CMFRI, Kochi, for his constant guidance.

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