EXPERIMENTAL CULTURE OF THE INDIAN OYSTER, *CRASSOSTREA MADRASENSIS* (PRESTON) AT ASHTAMUDI LAKE, KERALA

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INTRODUCTION

The edible oyster, *Crassostrea madrasensis* (Preston) occurs attached to hard substrates in the intertidal and subtidal regions of the coastal areas. Oyster meat is a highly esteemed seafood and aquaculture of oysters is widely prevalent and well established in many temperate countries. Recently many South-East Asian countries have embarked upon programmes to develop scientific oyster culture to meet the growing demand for oyster meat. The world production of oysters in 1992 amounted to 0.95 million metric tonnes (FAO).

Oyster culture has not been commercialised in India, eventhough complete package of oyster farming technology, including hatchery production of seed has been developed by the Central Marine Fisheries Research Institute (CMFRI) at Tuticorin. Of the different methods of oyster culture experimented, the rack and tray method gives a production of 130t shell-on wt/ha/yr and the ren method 80 t shell-on wt/ha/yr.

Kerala State is endowed with rich oyster resources. A survey conducted by CMFRI has revealed the occurrence of natural populations of *C. madrasensis* and *Saccostrea cucullata* (Born) in 16 water bodies of Kerala, the notable being the Ashtamudi Lake, Chandragiri, Korapuzha and Chaliyam estuaries. A study was undertaken at the Ashtamudi Lake in Kerala to test the feasibility of developing oyster culture and the results are given below.

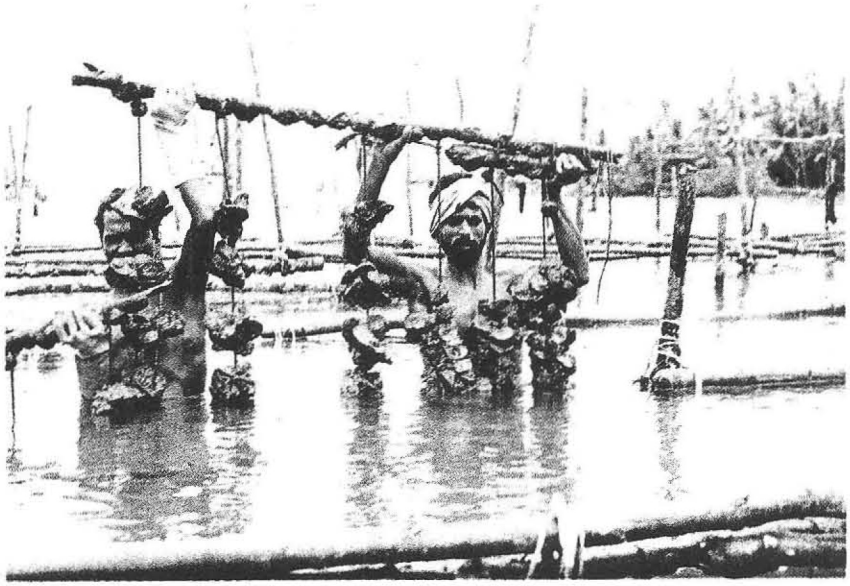

Plate 1. A view of the farm-grown oysters

LOCATION

Ashtamudi lake (Fig. 1), situated between lat 8°45'=9°28'N and long 76°28'-77°17'E has 32 km^2 water spread. The presence of dense oyster beds in the lake suggests that the interaction of the species with the environment is favourable.

OYSTER FISHERY IN THE ASHTAMUDI

C. madrasensis, locally known as *'Kadal muringa'* is exploited by a few fishermen families. The oysters occurring in the intertidal region are gathered during low tide and a chisel is used to dislodge them from hard substrates. In the subtidal area oysters occur as clusters in depth upto 2.5 m and they are hand-picked after diving; a non-powered canoe is used for transport. The catch per canoe ranges from 45 to 60 kg and the fishing lasts from 4 to 5 hours. The shucked oyster meat is sold @ Rs. 25-30/100 pieces in the local market. The average weight of 100 pieces is 800 g and a kilo of oyster meat costs Rs. 31 to 38/-. The annual production from the lake is estimated at 81 t.

OYSTER CULTURE EXPERIMENTS

Two sets of experiments were conducted; in the first, oyster spat brought from Tuticorin hatch-

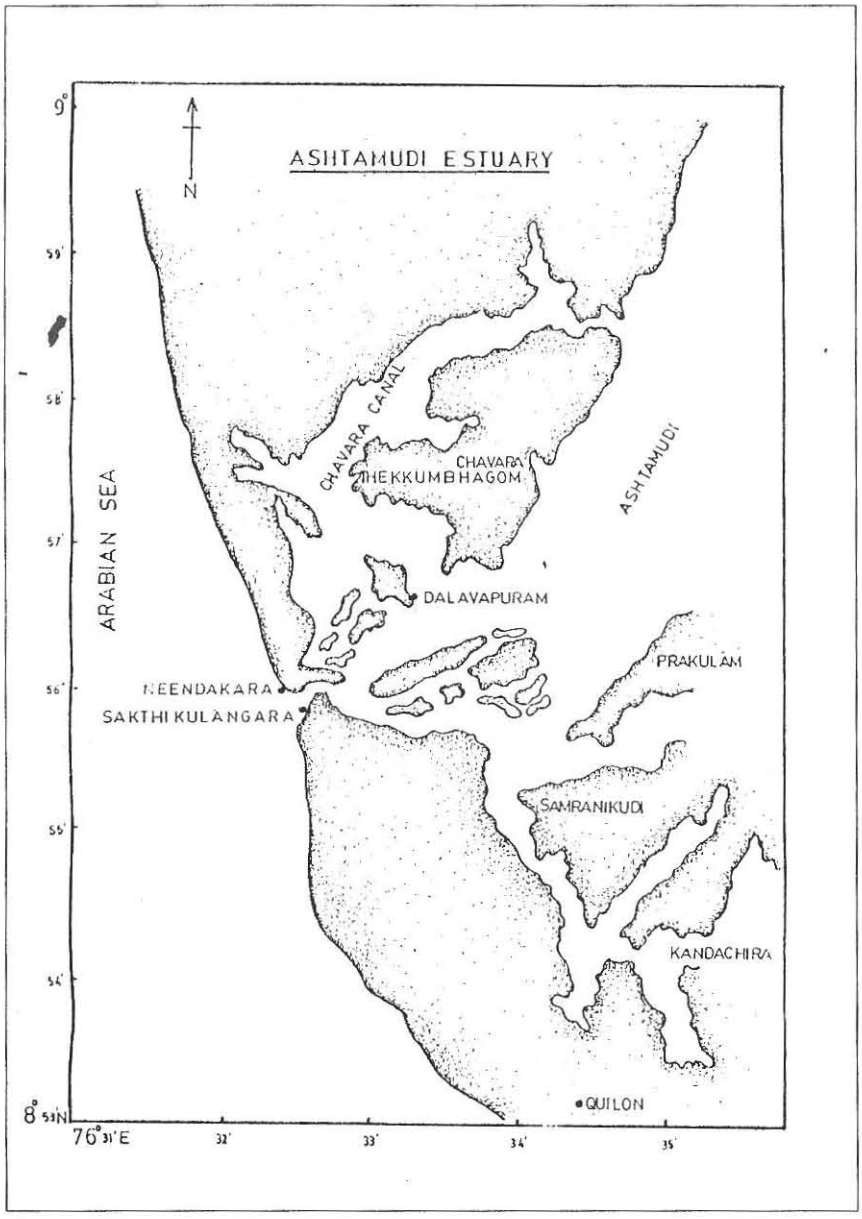

Fig. 1. Map of Ashtamudi Lake where the experiment was conducted

ery were cultured and in the second, carried on simultaneously, the spat set on collectors laid in the Ashtamudi lake were reared.

a. Culture of Oyster spat transplanted from Tuticorin hatchery

Twelve oyster rens, each holding six oyster shells with spat attached were transported from Tuticorin hatchery and were suspended at a depth of 2 m from the horizontal platform of a Chinese dip net. The total number and the length of oysters in one string were measured at monthly intervals in the field itself. The growth in weight and other biological details were noted in the laboratory by analysing the oysters attached on one shell in the string. The length data of the oysters were grouped into four class intervals namely <25 mm; 25-50 mm; 50-75 mm and >75 mm.

In October 1993, at the time of initiation of the experiment, 471 oyster spat of average length 28.2 mm were present in the 12 rens. Majority (84%) of the oysters were in the 25-50 mm length group and the rest were below 25 mm (Fig.2). In the following month it was noted that only 66% of the oysters were in the 25-50 mm group. This reduction in the percentage of oysters in the above group and increase in the <25 mm group is due the mortality of Tuticorin oyster spat and the fresh settlement of oyster spat from the natural ground in the study area. Subsequent observations on the length of the oysters showed that there is fresh settlement of oyster spat in the following 10 months except in June and August. After a period of two months, 3 to 4% of the oysters were in the 50-75 mm length group. In May, fifty percent of oysters were in this group while 29% were above 75 mm (Fig.2).

The overall growth in length and weight of the oyster spat is depicted in Fig. 3. The oysters grew from an initial average length of 28.2 mm to 63.9 mm average length in 11 months. During the same period the increase in average total and flesh weights was 35.5 g and 4.11 g respectively. The total weight of the oysters showed an increasing trend throughout while the flesh weight increased from October to June, reaching a peak of 4.9 g in June. Thereafter it decreased in July and August and again increased slightly in September.

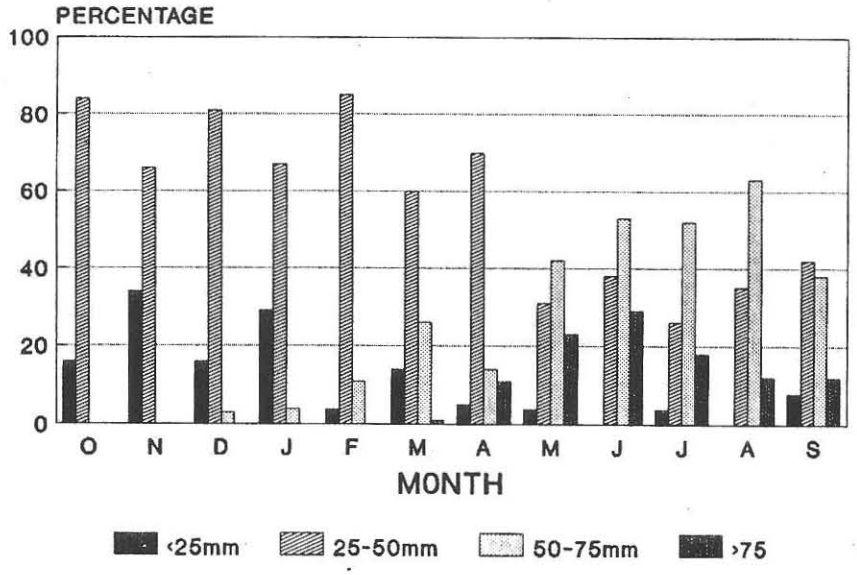

Fig. 2. Monthly percentage composition of the different length groups of oyster spat transplanted from Tuticorin and grown in the Ashtamudi Lake

During this 11 month study, the maximum length, total wt and meat wt of the oyster recorded in the entire stock were 90.1 mm, 75.2 g and 8.5 g respectively in August 94.

PRODUCTION

During the study period, mortality of the oysters was low. The initial density of oysters was 69 nos/meter of ren in October 1993. In November this number was reduced to 21 oysters/m, indicating 69.5% mortality. From November to February (Table 1) there was continues settlement of oyster spat recruited from the natural population, with the average number of spat per meter of string reaching a maximum of 65 in February. During March 24.6% mortality was noted and the density was reduced to 49 oysters/string. Till May the density remained at 48 oysters/ meter. From May till September, there was 3.1% mortality per month and by the end of September the number was reduced to 42 per m length of rope.

The production (shell-on wt) is estimated at 1.4 kg/m length of rope in 7 months with the meat weight amounting to 230 g (Table 1). The total flesh weight per oyster ren was highest in May (Fig. 6). In June the flesh weight was comparable to that of May. This clearly indicates that May-June is the best period for harvest and culturing the oysters beyond June will not be profitable.

b. Culture of oyster spat collected from the Ashtamudi

Concurrent with the culture of oyster spat brought from the Tuticorin hatchery, this experiment was planned to collect the natural oyster spat from the extensive oyster beds in the Ashtamudi Lake and grow them. Locally available empty oyster shells were cleaned of all fouling organisms, a hole drilled in the centre and by using 5 mm synthetic rope the shell rens were prepared. A total of 125 oyster shell rens, each holding 5 shells were suspended in November 1993 from the horizontal platform of Chinese dip nets in the Lake in the same area where the first experiment was conducted. In December 1993, a total of 15,374 oyster spat of average length 24.0 mm had settled on the rens, and the average number of spat per ren was 123 and per single cultch 24.6. In the following month also settlement of

Table 1. Production per meter of oyster ren farmed at Ashtamudi lake (Tuticorin stock farm hatchery used)

Experiment 'A'

Month	Total Number of oysters	Shell-on weight (g)	Flesh weight (g)
October 93	69	-	-
November	21	119	25
December	33	227	42
January 94	45	324	81
February	65	559	147
March	49	646	156
April	48	974	182
May	48	1430	230
June	45	1431	220
July	44	1377	198
August	43	1470	176
September	42	1608	189

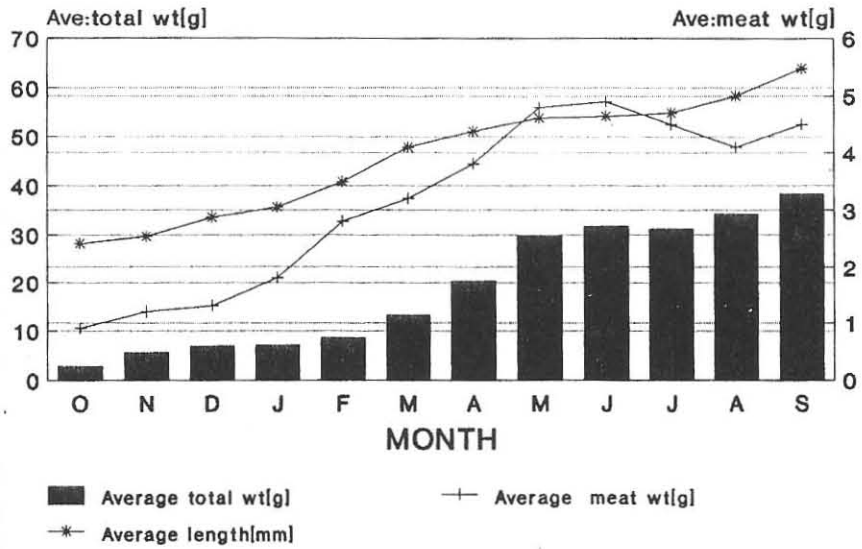

Fig. 3. Average monthly growth in length (mm) total weight (g), and flesh weight (g) of the oysters transplanted from Tuticorin

oyster spat was noted. In December and January 88% and 55% of oysters were below 25 mm length. This indicates that the peak spat settlement period in the Ashtamudi Lake is during December-January. After a period of 4 months in April 42% of oyster spat were in the 50-75 mm length group and 3 % were above 75 mm. In the remaining months 3 to 21% of the oysters were in above 75 mm size group (Fig. 4).

The average length of the oyster increased from 24.0 mm in December to 57 mm in July (Fig.5). However, in August and September, the average length came down to 55 and 56 mm respectively due to the occurrence of fresh spat and mortality of large oysters. From October onwards the growth picked up. Average total weight of the oyster increased from 2.37 g in December 1993 to 41.3 g in November 1994 indicating an increment of 38.9 g in 11 months. The flesh wt of the oyster increased from 0.36 g in December to 5.1 g in June. After June, there was a slight decline till October. During the study period, in November '94 the maximum length of 78.5 mm, total weight of 76.1 g and flesh wt of 8.10 g were recorded.

PRODUCTION

The oyster meat production per metre length of rope in the second experiment was 392 g in 6 months. The meat yield per meter of oyster ren decreased during June to October reaching a minimum, 348 g in October. However there was a progressive increase in the shell-on weight per meter of the ren throughout the period. The initial shell-on weight per meter was 296.2 g in December, while the final weight was 2870 g on November, registering a 9-fold increase. The number of oysters per meter of rope was 125 and 137 in December and January. The density of oysters per meter came down to 77, indicating 38.4% mortality during the 6-month period. From June to November there was only 9% mortality.

Comparison of production between experiments

The total meat yield per string is comparatively high at 392 g in 6 months in the second experiment, than in the first at 220 g in 7 months (Tables 1 and 2). The number of oysters per string was also more at 77 in the second experiment, than in the first experiment. The probable reason for

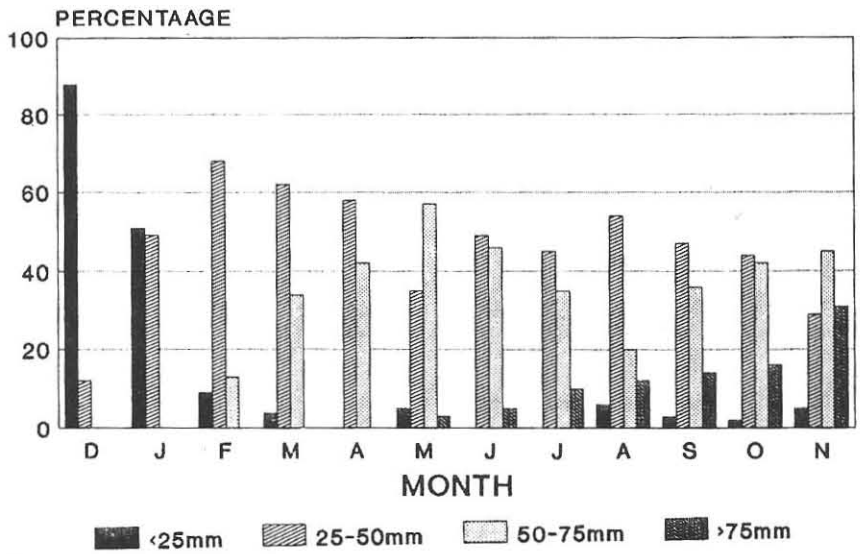

Fig. 4. Monthly percentage composition of the different length groups of oyster spat collected from and grown in the Ashtamudi Lake

this difference in production can be attributed to the fact that the oyster shell cultch suspended in December in the second experiment was well prepared by removing all the epifauna and was in position at the appropriate time for higher spat settlement. Also the fouling organisms as well as fresh spat settled in subsequent months were removed regularly to an appreciable extent in the second experiment. This management practice reduced competition and provided healthy environment for the growth of individual oysters.

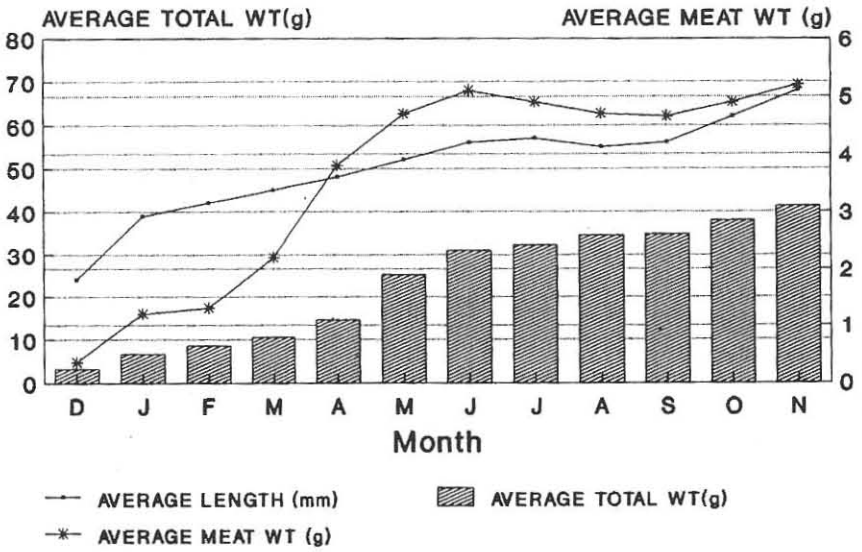

Fig. 5. Average monthly growth in length (mm), total weight (g) and flesh weight (g) of the oysters collected from and grown in the Ashtamudi Lake.

BIOFOULING

Very heavy settlement of barnacle, *Balanus amphitrite* and tubiculous polychaete, *Hydroides norvegicous* was noted on the oyster shells. Apart from these, *Modiolus* sp, the green mussel *Perna viridis* and algae also occured on the oysters. These were removed manually from time to time. Boring by the tubiculous polychaete, *Polydora ciliata* was observed in a few oysters.

REMARKS

The encouraging results obtained in the experimental culture of the oyster, *Crassostrea madrasensis* clearly shows that a seasonal culture of the oyster for a period of 6 to 7 months is possible in the Ashtamudi lake. In some south-east Asian countries, like the Philippines and Taiwan, oysters are farmed for short periods of 6 to 9 months as a seasonal crop during the fair weather season. Similar practice can be adopted in the Ashtamudi by raising an oyster crop during November/December to May/June.

The oysters harvested from the natural bed are marketed without any 'fattening' or 'greening'. In France, the farmed oysters are stocked in small ponds called "Claire" before they are marketed. 'Claires' are small tidal ponds which are prepared by fertilizing the water. The pond will develop rich algal growth and the oysters stocked in these ponds feed intensively and put on significant weight and the meat also gets a special flavour within a short period. This type of 'fattening' can be tried in India also for obtaining higher meat yield and value addition.

Table 2. Production per meter of oyster ren farmed at Ashtamudi lake (natural spat used)

Experiment 'B'

Month	Total number of oysters	Total wt. (g)	Total meat wt. (g)
December 93	125	296	45
January 94	137	917	160
February	106	911	190
March	90	945	198
April	80	1168	304
May	79	1998	371
June	77	2387	392
July	76	2454	372
August	75	2595	352
September	75	2610	348
October	75	2850	367
November	70	2870	364

The study has brought to light the following points.

1. The heavy spat settlement (average 23 nos/oyster shell cultch) indicates that this lake can be used as a major spat collection center. The best period to lay spat collectors is from November to February. The spat can be used for oyster farming in other areas also.
2. A seasonal oyster crop of 6-7 months duration during November/December to May/June can be raised by rack and ren method. Retaining the strings till September/October will not result in commensurate increase in meat yield.
3. Removal of fouling organisms and fresh settlement of spat every month is essential for obtaining good growth of oyster.
4. The lake has a water spread of 32 sq.km and considerable part of this water body can be developed for oyster culture. The high gross productivity ranging from 930 mg c/m3/day to 8900 mg c/m3/day observed by us indicates that the lake has the potential to support high biomass.
5. There is traditional fishing in the lake, practised by small-scale fishermen for a variety of finfish, prawns, crabs, clams and oysters. It is necessary to demarcate the area for oyster culture and to avoid conflicts, the small-scale fishermen traditionally using this water body may be encouraged to take up oyster culture. The Ashtamudi lake presents a congenial scenario for blending capture fisheries with oyster culture, leading to additional income and employment generation among the small-scale fishermen.
6. The bivalves are known to accumulate pathogens and deputation of the oysters is necessary before they are marketed. The facilities already developed around the Ashtamudi lake area for clams can be conveniently used for oyster deputation. The proximity of several processing plants should help to develop value added products for both domestic consumption and export.

Realising the potential of the Ashtamudi lake the Central Marine Fisheries Research Institute is implementing a technology transfer programme to develop this lake as a model for the propagation of oyster culture in other parts of the country.

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