UNDERWATER OBSERVATIONS ON THE SETTLEMENT OF SPAT OF PEARL OYSTER ON THE PAARS OFF TUTICORIN

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ABSTRACT

A periodic underwater survey on the pearl bank during the three years from 1970 to 1972 has shown that it is inadvisable to depend totally on the wild oyster beds for collection of seed for raising pearl-oyster farms on commercial basis. The spat fall on the paars is irregular and subject to great quantitative fluctuation. Increasing *Modiolus* settlement causes severe damage to the oyster bed from year to year. But, there exists a vast scope for collecting the spat by means of artificial spat collectors.

INTRODUCTION

The irregularly cyclic character of the pearl fishery of the Gulf of Mannar, which was long apparent, has once again been witnessed from 1961 from which time there had been no fishing for oysters. It was pointed out that in order to establish a permanent pearling industry in India cultivation of oysters in farms as done in countries like Japan and Australia should be resorted to, so that cultured-pearl production can be attempted. Alagarswami and Qasim (1973) succeeded in their attempts to produce, on an experimental scale, cultured pearls in India. For commercial-scale production of pearls, an unfailing supply of oysters for farming operations and nuclei implantation has to be established. There are two courses open to ensure this. One is collecting the already-settled oysters from the natural beds as and when they are noticed and the other, setting up, during the oyster spawning season, of artificial spat collectors near the surface of the sea. The present paper deals with the results of attempts made through SCUBA diving to collect pearl-oyster spat from the natural beds off Tuticorin during 1970-1972.

MATERIALS AND METHODS

SCUBA diving for observations on pearl oysters was carried out periodically by the authors during 1970-72. Devi Paar and Nagarai Paar (Zone 1), and Tholayiram Paar, Pulipoondu Paar, Pasi Paar and Kuthadiar Paar (Zone 2) were chosen for surveying oysters so as to get a comparative picture of oyster life in the shoreward (Zone 1, up to 14m depth) and offshore regions (Zone 2, 14-30m depth). Sixty trips were undertaken during the period, observations

being restricted to the period from November to March of each year. Diving in 1970 commenced by November end. Oyster samples were collected from $1m^2$ area of the paar, with the aid of an iron frame of $1m^2$. Care was taken to sample the northern, middle and southern sections of each paar. Competing settlers were also studied.

Oyster Settlement

Table 1 gives the relative abundance of oysters and *Modiolus* observed in various areas.

The density of oyster-spat settlement had been uniform in 1970 although it could not be considered profuse. The size of the oysters collected ranged from 15 to 30 mm. This suggested the probability of spat settlement in early October of 1970 as oysters are known to spawn during the period October-December (Herdman 1906, Hornell 1916). Re-inspection of the grounds in November 1971 revealed that the stock of 1970 had grown to 55mm size. But there had been a marked decrease in the density of oysters. The mortality ranged from 70 to 88%, except in Kuthadiar Paar where it was total. Absence of oysterlings indicated that during the intervening period there had been no spat fall.

In 1972 also, spat fall did not take place except in Kuthadiar Paar. The stock of 1970 had further diminished. This time the mortality ranged from 50 to 85%. The year-to-year mortality of oysters had thus reduced the population of oysters to an almost negligible number. The surviving oysters in these localities exhibited a peculiar mode of attachment to the paar. Normally the oysters attach to the substratum with the dorsoventral valve-axis almost parallel to the base of attachment. In the present case both the valves were upright with their dorsoventral axis perpendicular to the base.

Modiolus Settlement

When compared with the density and pattern of pearl-oyster settlement, *Modiolus* settlement showed disparity. For example, in 1970, only 75 oyster spat were noticed in $1m^2$, while the number of *Modiolus* was as high as 4000 over the same area. The individuals ranged in size from 5 to 8 mm, suggesting very recent settlement. Re-inspection of the same beds in 1971 revealed that no fresh settlement of *Modiolus* had taken place (except in Tholayiram Paar and Kuthadiar Paar). Most of the previous year's stock had perished after attaining 15-18mm length. The mortality was 98 per cent in Pasi Paar, and 26 per cent in Pulipoondu Paar. Samples collected from Tholayiram Paar and Kuthadiar Paar $3,000/m^3$ consisted spat entirely of 5-8 mm which indicated fresh settlement in these two areas alone, the entire previous year's stock having probably died earlier and washed away by currents. In 1972, fresh *Modiolus* settlement, of 5-8mm size individuals, was noticed once again in all Paars except Tholayiram Paar. But this was less dense than in 1970.

TABLE 1. *Relative abundance of oysters and* Modiolus *on different paars.*
(size range in mm)

	Name of Paar	1970			1971			1972		
		Pearl Oyster		*Modiolus*	Pearl Oyster		*Modiolus*	Pearl Oyster		*Modiolus*
		Nos/m^2	Size range	Nos/m^2	Nos/m^2	Size range	Nos/m^2	Nos/m^2	Size range	Nos/m^2
Inshore	Devi Paar	75	15-20	4000	17	35-55	500	5	50-65	1200
	Nagarai Paar (Zone 1)	75	15-25	6500	15	35-55	300	10	40-55	1200
	Pulipoondu Paar (Zone 2)	90	15-20	900	35	35-50	650	7	55-60	2700
	Pasi Paar (Zone 2)	60	15-30	3000	7	45-50	50	1	55-65	1500
Offshore	Tholayiram Paar (Zone 2)	45	15-25	750	7	45-55	3000	1	55-65	250
	Kuthadiar Paar	65	15-25	3500	—	—	3000	100	15-20	3000

PEARL OYSTER IN RELATION TO *MODIOLUS* SETTLEMENT

Throughout the period of observation, 1970-1972, wherever *Modiolus* settlement was noticed, curious nests of threads had been seen woven by the individuals, in which were entangled fine sand, bound intact to form thick mats. Imprisoned in this matrix were pearl oysters. Oysters which had settled down on the shell valves of *Pinna* sp., growing commonly on the intervening sandy patches of the Paar areas, were not much affected by this mat formations. Many regions in Tholayiram Paar, particularly, exhibited this feature. The oysters gain height by their attachment to the broad sides of the raised valves of *Pinna* shells. Probably the periodic opening and closing of *Pinna* shell valves prevent the spreading of *Modiolus* mat formation over it thus indirectly benefiting the oysters settled on it.

REMARKS

Herdman (1906) found May-July and November-January as spawning seasons of the pearl oysters in Gulf of Mannar. According to Hornell (1916) April-May and September-October constituted the intense spawning period. Malpas (1933) observed that the pearl oysters in Ceylon has two spawning seasons each year, reaching the maxima in July-August and in December-January respectively, the former being coincident with the height of the southwest monsoon and the latter with northeast monsoon. Craig, quoted by Tranter (1958), found midsummer (June-July) spawning only for the same species in 34° N Latitude, thereby indicating that in higher latitudes the breeding season is restricted.

Experiments already conducted for oyster-spat collection off Tuticorin (Nagappan Nayar *et al*, Ms) have revealed the probability of intense spawning in warmer months of April-May based on the availability and collection of good number of 15-20mm size spat in May. The present observations in which pearl oyster settlement (15-25mm size) has also been noticed in December confirm the view of the biannual spawning of *Pinctada fucata*.

Kelaart (1859) estimated that each mature pearl oyster in the natural beds would release at least 12 million eggs. Herdman (1906) and Hornell (1922) also studied the reproduction in *P. fucata* but did not estimate the number of eggs produced. Spat fall occurs 5 days after fertilization (Hornell 1916). Devanesan and Chidambaram (1956) stated that this depends on environmental factors. The probable effects of currents carrying the veligers far away from the site of the pearl banks and natural mortality of larval population act as limiting factors in spat settlement on the paar. The available substratum for the spat settlement and growth had been calculated to be about 10% of the area of the sea bed (Mahadeven and Nagappan Nayar 1967) within 22m depth limit in the zone bounded by 8°35'N-8°55'N lat and 78° 15'E-78°30'E longitude which happens to be the most productive region for

pearl oysters in the Gulf of Mannar. This would narrow down the possibility of the spat fall reaching the ideal substratum; a good many might settle down on muddy or sandy habitat and perish totally. Those which settle down on the paar also face serious competition in the early months from *Modiolus* population. Mahadevan and Nagappan Nayar (1972) had enumerated other divergent adverse factors contributing to the fluctuations in the population density of pearl oysters in the natural beds.

There appears to be no particular pattern in the settlement of either pearl-oyster spat or *Modiolus* in pearl-oyster beds. Going through the pearl-bank inspection reports since 1835, it is seen that the settlement of pearl-oyster spat had been taking place every year in some area or other within the stretch from Mandapam (8°25'N Lat) to Rameswaram (9°25'N Lat). Year after year, the settled stock had been disappearing except, by chance, in those years preceeding and during the pearl fishery. The *Modiolus*-sand-mat formation covering the valves of the oysters in the spat stage appears to be one of the main causes for the destruction of oysters, preventing the normal flow of water current into the body of the animal eventually leading to the death of oysters buried underneath. Should, however, the oyster-spat fall be free of *Modiolus* proliferation during the first year when oyster growth is fast, the oyster may become strong enough to survive the subsequent years' *Modiolus* settlement unless the fall is very profuse forming more than 5cm-thick mat which is not uncommon in many places.

The above uncertainties associated with the natural beds make it necessary to resort to oyster-spat collection by setting up suitable spat collectors near the sea surface during the intense spawning months. This appears to be a more reliable method than collection from natural beds which, however, can be carried out as and when conditions are favourable.

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