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# 57. STUDIES ON THE SETTLEMENT OF BARNACLES AT DIFFERENT DEPTHS IN THE PEARL OYSTER FARM AT TUTICORIN

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## ABSTRACT

Fouling on the pearl oyster cages in the farm by barnacles and other organisms is considered a big nuisance and also at times retards the growth rate of oysters leading to mortality. Removal of the barnacles is a labour intensive work. To avoid this, experiments were conducted to find out at what depth the intensity of barnacle fouling is minimal so that the cages can be lowered to that depth. It has been found that there is considerable reduction in the number of barnacles settled at 5 m depth even during the peak barnacle settlement season. It is considered to be advantageous to position the cages lower down the water column. The paper gives an account of barnacle fouling intensity on pearl oyster cages in different months and different depths in the pearl oyster farm.

## INTRODUCTION

In the normal condition the oysters reared in the farm are subjected to fouling and boring by different organisms. Fouling is a menace to the oysters as reported by Alagarswami and Chellam (1976), Dharmaraj and Chellam (1983) and Velayudhan (1983) in the pearl oyster

farm. Kuriyan (1950) had observed a dense settlement of organisms in the pearl oysters at Krusadai Island in the Gulf of Mannar. Arakawa (1980) has given a comprehensive account of the prevention and removal of fouling on cultured oysters in Japanese waters. Mizumoto (1964) and Yamamura et al (1969) have listed the major fouling organisms in the pearl oyster farms of Japan. The present study has been conducted in the pearl culture farm in Tuticorin Harbour basin on the settlement of fouling organisms on the glass panels suspended at different depths. The major fouling is barnacle, and other fouling organisms form a small percentage on the panels. This work has been carried out to study the sequential settlement of barnacles at different depths and find out steps to avoid the attachment of these organisms on the pearl oysters and to reduce the manpower in cleaning to reduce the mortality.

## MATERIAL AND METHODS

In the present study four sets of each containing five ground glass panels of size 20x20x5 cm with 5 mm dia. hole at 4 corners and 4 mm synthetic rope was fixed at depths of every 1 m upto 5 m. Of the total of 20 panels suspended at each fortnight period, 10 numbers were suspended horizontally and the remaining 10 vertically at each depth. The pearl culture raft was moored in the Harbour basin at a depth range of 5-7 m. The sea bottom is muddy with coral pieces and silt materials. A total of 960 number of panels were suspended during the study from April, 1982 to March, 1983. For counting fouling organisms a metal frame of 20x20 cm in size divided into 4 cm x 5 cm rectangular sub areas was used. The countings were made by placing the metal farme over the panel. The total count of barnacles and foulers in each randomly selected sub area were noted by using the random tables. The weight of foulers was determined from the intensity of their occurrence on the panels. The total weight and volume of barnacles as well as the total weight and volume of other fouling organisms were noted The total weight of barnacles and other fouler settled per month in 3,200 $cm^2$ was also calculated.

## RESULTS

### FOULING AT DIFFERENT DEPTHS

In order to calculate the mortality of pearl oysters at different depths five frame nets of size 65x45 cm made of 5 mm dia iron rods each with 5 compartments were used. A total of 50 pearl oysters of size 45 mm in DVM were kept in each frame net and suspended vertically from the raft at 0.5, 2, 3, 4 and 5 mm depths. The mortality of oysters and the intensity of fouling organisms on these oysters were also studied from December, 1980 to November, 1981.

#### A. *1 Metre depth*

The highest settlement of foulers barnacles, hodrozoans, compound ascidians, *Avicula*, algae and amphipods was during the months of June, May, April, September and May respectively. These organisms cause serious damage to oysters, especially the barnacle the density of which was 661 per 100 $cm^2$ weighing 117.68 g per 3,200 $cm^2$. The average number of barnacles which settled was 149 per 100 $cm^2$. The average monthly weight of barnacles which settled was 26.70 g per 3200 $cm^2$ during the year. The monthly average weight of compound ascidians settled was 1.73 g, bryozoans 0.04 g, hydrozoans 6.16 g, silt 5.45 g, algae 1.09 g, *Avicula* 1.19 g and amphipods 1.97 g per 3,200 $cm^2$. The total fouling load during June was 133 50 g per 3.200 $cm^2$ (Table 1).

#### B. *2 Metres depth*

The maximum settlement of foulers, barnacles, *Avicula*, hydrozoans, compound ascidians, amphipods and tubiculous polychaetes were during the month of June, May, February, April, February and June respectively. Barnacles which are the major fouling organisms were observed during June and showed a density of 1,115 per 100 cm weighing 159.85 g per 3,200 $cm^2$. The average monthly density of barnacles per 100 $cm^2$ was 302. The monthly average weight of compound ascidians was 2.18 g, bryozoans 0.23 g, hydrozoans 3.96 g, silt 5.48 g, algae 0.15 g, *Avicula* 1.15 g and amphipods 0.75 g per 3,200 $cm^2$ were observed during the period. The total weight of fouling organisms during June was 210 gper 3,200 cm.

TABLE 1. *Average weight and number of barnacles and weight of other fouling organisms and silt on the panels suspended at different depths in the pearl oyster farm at Tuticorin during the period from February, 1982 to March 1983.*

| Depth (m) | Wt of barnacle/ 3200 cm² | No. of barnacle/ 3200 cm² | Compound ascidian 3200 cm² (g) | Bryozoan 3200cm² (g) | Avicula 3200cm² (g) | Hydro-zoan 3200cm² (g) | Amphi-pods 3200cm² (g) | Algae 3200cm² (g) | Silt 3200cm² (g) | Barnacle/3200cm² Max. no. | Min. no. | Max. Wt. (g) | Min. Wt (g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 26.70 | 149 | 1.73 | 0.40 | 1.19 | 6.16 | 1.97 | 1.09 | 5.45 | 661 June | 7 Feb. | 117.68 | 0.59 |
| 2 | 36.24 | 302 | 2.18 | 0.23 | 1.15 | 3.96 | 0.75 | 0.15 | 5.48 | 1115 June | 23 Feb. | 159.85 | 0.81 |
| 3 | 34.03 | 346 | 0.10 | 0.10 | 5 56 | 9.50 | 1 86 | 0.01 | 10.31 | 12321 June | 57 Feb | 179.52 | 0.60 |
| 4 | 18.40 | 263 | 0.10 | 0.50 | 2.85 | 11.33 | 0.93 | — | 9.04 | 938 June | 6 Feb. | 63.85 | 0.01 |
| 5 | 16.37 | 116 | 0.50 | 0.37 | 2.74 | 10.41 | 0.48 | — | 14.77 | 276 June | 2 Feb. | 73.30 | — |

C. *3 Metres depth*

At this depth the pattern of settlement of fouling organisms was similar to that in 2 meters depth and the highest settlement of barnacles, hydrozoans, *Avicula*, amphipods and tubiculous polychaetes noted was during the months June, May, May June and June respectively. The other forms like simple ascidians, isopods and Anomia were negligible on the panels for quantitative study. The density of the major fouling organisms viz., barnacles was very high in June, 12,321 per 3,200 cm², weighing 179.52 g. The average monthly density of barnacles setting on the panels during the period of study was also high, 346 per 3,200 cm². The total number of barnacles observed on the panels during June was 1,540 per 100². The average weight of compound ascidians 0.06 g, *Avicula* 5.56 g, tubiculous polychaetes 0.49 g and amphipods 1.86 g per 3,200 cm² were observed during the period. The total weight of fouling organisms during June was 225.5 g per 3,200 cm².

D. *4 Meters depth*

The fouling oganisms settling on the panels at this depth are barnacles, *Avicula*, hydrozoans, tubiculous polychaetes and amphipods which settled in highest numbers during June, May, May, June and September respectively. The most prominent fouling organisms at this depth also were barnacles, 938 per 100 cm weighing 63.68 g per 3,200 cm². The minimum number of barnacles observed during February was 6 per 100 cm². The average weight of compound ascidians was 9.09 g, bryozoans 0.57 g, hydrozoans 11.33 g, silt 9.04 g, algae nil, *Avicula* 2.85 g and amphipods 0.93 g per 3,200 cm² were observed during the period.

E. *5 Meters depth*

The highest settlement of fouling organisms barnacles, hydrozoans, *Avicula*, amphipods and bryozoans was during the months of June, May, July, March and November. The maximum number of barnacles attached during October was 492 per 100 cm² weighing 49.64 g per 3,200 cm². The average monthly number of barnacles settled during the whole period was 116 per 100 cm². The total monthly weight of barnacles attached was 196 per 3,200 cm² and the average weight during the whole period was 16.37 cm² and average weight during the whole period was 16.37 g per 100 cm². The intensity of settlement of barnacles at different depths shown in the Table 2, clearly indicates that the fouling by barnacle as well as total fouling load is lowest at 5 m depths. The average weight of compound ascidians 0.4 g, bryozoans 0.37 g, hydrozoans 10.41 g, silt 14.77 g, algae nil, Avicula 2.74 g and amphipods 0.48 g per 3,200 cm² were observed during the period. The depth wise settlement of these fouling organisms is given in Table 2.

TABLE 2. *Depth and monthwise weight of barnacles settled on the panels suspended in the pearl culture farm during the period from April, 1982 to March, 1983.*

| Depth | April | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (m) | (g) | (g) | (g) | (g) | (g) | (g) | (g) | (g) | (g) | (g) | (g) | (g) |
| 1. | 7.00 | 0.89 | 117.69 | 37.16 | 30 75 | 20.76 | 28.25 | 38.28 | 22.30 | 16.24 | 0 59 | 0.64 |
| 2. | 35.70 | 5.89 | 159.85 | 20.99 | 23.32 | 48.08 | 55.90 | 47.23 | 25.64 | 10.68 | 0.81 | 0.82 |
| 3. | 48.36 | 1.50 | 179.52 | 18.13 | 38.39 | 42.62 | 50.83 | 47.53 | 15.27 | 2.84 | 0.60 | 0.70 |
| 4. | 15.92 | 0.11 | 63.86 | 11.38 | 15.24 | 28.73 | 40.75 | 34.17 | 10.15 | 0.32 | negli-gible | 0.19 |
| 5. | 3.52 | 0.10 | 73.30 | 5.39 | 15.43 | 3.19 | 49.64 | 32.08 | 13.50 | 0.26 | ,, | 0.01 |

TABLE 3: *Total fouling volume on ten numbers of oysters suspended at different depths in the pearl oyster farm from December, 1980 to November, 1981.*

| Depth (m) | Dec. Vol (ml) | Jan. Vol (ml) | Feb Vol (ml) | Mar. Vol (ml) | Apr. Vol (ml) | May. Vol (ml) | June Vol (ml) | July Vol (ml) | Aug. Vol. (ml) | Sep. Vol (ml) | Oct. Vol (ml) | Nov. Vol (ml) | Average Vol (ml) | Average Vol (ml) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5 | 65 | 86 | 180 | 100 | 140 | 60 | 260 | 80 | 65 | 180 | 94 | 138 | 121 | 2.67 |
| 2.0 | 45 | 54 | 108 | 92 | 100 | 55 | 250 | 55 | 70 | 170 | 90 | 132 | 102 | 4.1 |
| 3.0 | 40 | 65 | 93 | 57 | 65 | 50 | 180 | 50 | 60 | 92 | 92 | 149 | 86 | 2.8 |
| 4.0 | 30 | 45 | 26 | 19 | 55 | 45 | 175 | 75 | 45 | 96 | 96 | 148 | 73 | 4.5 |
| 5.0 | 25 | 12 | 5 | 5 | 50 | 15 | 10 | 5 | 5 | 46 | 46 | 120 | 28 | 2.5 |
| Total | 205 | 262 | 412 | 273 | 410 | 225 | 875 | 265 | 245 | 632 | 418 | 684 | | |
| Mortality % | 2.8 | 0.4 | 2 8 | 2.0 | 1.6 | — | 2.4 | 2.8 | 4.8 | 4.4 | 6 4 | 9.6 | | |

## FOULING ON THE LIVE OYSTERS

The average monthly settlement of fouling organisms were 121,108.86,73 and 25 ml respectively at 0.5, 2.0, 3.0, 4.0 and 5.0 m depths. During this period of observation, studies on the percentage of mortality of oysters at these different depths indicated that at 5 m depth it was as low as 2.5 whereas it was 2.67 (at 0.5 m), 4.1 (2.0 m), 2.8 (3.0 m) and 4.5 (4.0 m). Perhaps the mortality of oysters could be related to the fouling intensity, particularly the settlement of barnacles. It is of interest to find that during the month of May where there was very little of barnacle settlement, there was no mortality of oysters at all.

Intensity of fouling on live pearl oysters, ten numbers each, kept suspended in the same area at depths 0.5, 2.0, 3.0, 4.0 and 5.0 m depth showed identical result in the year 1980-1981.

During experiments conducted in the year 1982-1983 in the New Major Harbour area to study the intensity of fouling in different months at defferent depths (1.0-5.0 m) on glass panels suspended vertically and horizontally, it was noticed that settlement of foulers was more on the panels upto 4 m depth whereas those that were lower down showed less fouler settlement (Table 1). It is of interest to notice that glass panels kept horizontally attracted greater fouler settlement than thoae suspended vertically.

## DISCUSSION

The volume of fouling organisms on the live oysters was least at 5 m depth than at

other depths. Survival percentage appears to be more at this depth. The weight of fouling organisms on the panels lowered to different depths varied but the lowest level of fouling was always maintained at the 5 m depth. In the pearl culture farm at Tuticorin Harbour the maximum monthly average settlement was observed as 346 numbers per 100 $cm^2$ at 5 m depth. On the live oysters the maximum fouling volume was noticed at 1 m depth (120 ml) and lowest at 5 m depth (28 ml) per 10 numbers of live oysters. The total fouling volume was found decreasing with depth. According to Daniel (1956) that if only blue or green colours which do not contrast against the background were used in the antifouling paints it will have greater effect in successfully preventing settlement of larvae of foulers for a long period. It was found that on the ground glass panels used, the maximum barnacle settlement was observed at 1-3 m depth while the number decreased at 5 m depth in the pearl culture farm. It was observed that the silt deposition increase in Tuticorin Harbour with depth. This might have reduced the light penetration. This silt load not only might have also clogged the gills of barnacles larvae settling at 5 m depth but also affects the slime film formation also at this depth. In the Harbour farm the vertical clarity of water was found to range from 1 to 3.5 m.

According to Dharmaraj and Chellam (1983) great settlement of branacles was observed at Veppalodai in their experimental farming done during the period from June-November. In the present study also intense settlement of fouling organisms and higher rate of mortality of oysters was also noticed during June to November (Table 3). The monthly average percentage of mortality of oysters during this 6 months period was 2.4, 2.8, 4.8, 4.4 and 9.6 respectively guided by the results of this experience in the pearl culture farm at Tuticorin Harbour, fouling by barnacle in the pearl culture farm at Tuticorin Harbour, fouling by barnacles was substantially avoided by suspending culture frames at 5 m depth. Manpower employment for keeping off the intensity of fouling to a minimum by periodical cleaning of cages was brought to a minimum level by resorting to this avoidence technique.

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