GROWTH OF OYSTER SPAT (*CRASSOSTREA BELCHERI*) CULTURED IN TYRE TRAY AS A FUNCTION OF STOCKING DENSITY

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ABSTRACT

Stocking density was 1 spat per 6, 13, and 19 cm^2 with 3 replicates. Average initial spat size was 3 cm. Growth and survival were checked once a month. Oyster spat were cleaned and water quality determined every two weeks. The growth of oyster spat in terms of length and width was not different ($P>0.05$) for all stocking densities. But, the survival rates were significantly different ($P<0.05$) between stocking densities of 1 spat per 6 cm^2 and 1 spat per 19 cm^2. A stocking density of 1 spat per 6 cm^2 had the highest initial cost but gave the highest return per crop.

INTRODUCTION

Growing demand for *Crassostrea belcheri* has caused a shortage of spat for culture in Thailand. The farmers are unable to collect enough spat from natural water. Pollution and high rates of sedimentation have been blamed for this situation, especially in the biggest natural spat collection and culture area in Ban Don Bay, Surathani Province. Because of insufficient supply of good sized spat, farmers tend to start oyster culture using smaller spat: 3-5 cm instead of 5-8 cm (Koawnuna 1992).

Sahavacharin *et al.* (1989) stated that it was feasible to produce hatchery spat, but the spat seemed to be under the size required by farmers. There are many factors limiting the production of big spat in the hatchery. Firstly, a huge area is needed for maintainance of large numbers of spat. Secondly, many cement ponds are needed for production of diatoms to feed the spat. This means high production cost due to high investment, including electricity and labour.

Some coastal sites are good for natural nursing of spat because the water is rich in diatoms and other planktonic food organisms. It is possible to take advantage of this, even though there are other problems caused by many predators in these areas. Pripanapong (1997) reported that nursing of oyster spat in tyre tray hung in net cage could prevent predation and increase the survival rate. This study applied tyre trays, covered at the bottom and the top with netlon, for nursing spat. The study compares growth rate, survival rate and cost and return at 3 different stocking densities.

MATERIALS AND METHODS

A total of 1,236 individuals of *Crassostrea belcheri*, average size 3 cm, were used. They were produced in the hatchery of Surathani Coastal Aquaculture Development Center. Motorcycle tyres, diameter 43.7 cm (converted from square inches), were covered on the top and the bottom with netlon 1 cm mesh size (Fig. 1), and used for stocking of spat.

Oyster spat were stocked at densities of 225, 112, and 75 individuals per tray corresponding to 1 spat per 6, 13, and 19 cm^2. There are 3 replicates in one treatment. The trays were randomly hung under a raft (CRD: Completely Randomised Design) (Fig. 2). Forty spat were sampled per tray. Shell length and shell width were measured following the Quayle & Newkirk (1989) method for growth monitoring. Mortality of spat was checked monthly. The spat were cleaned every two weeks. Water quality and plankton were monitored every two weeks (Tab. 3). Salinity by Reflecto Photometer (Atago model S/Mill). Temperature by mercury thermometer. Acidity and Base by pH meter

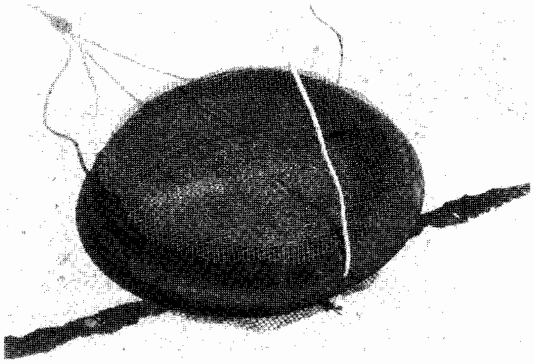

Figure 1. Oyster stocking container made from converted motorcycle tyre.

(model Fisher 590). Dissolved oxygen by titration following Tookwinas (1985). Plankton collected by plankton net and preserved in 5% formalin solution. Species and quantity were checked under microscope in a Sedgwick Rafter Cell Slide. Identification of species followed Shirota (1966).

Comparisons of growth and survival of spat were made among 3 stocking densities by Duncan's New Multiple Range Test (Zar 1984) with 95 % confidence.

RESULT

Growth

The initial shell lengths of spat at the 3 stocking densities (1 spat per 6, 13 and 19 cm^2) were 3.2 ± 0.17, 3.2 ± 0.18, and 3.2 ± 0.21 cm. The initial shell widths were 2.7 ± 0.32, 2.7 ± 0.28, and 2.8 ± 0.30 cm respectively. After 3 months, they measured 5.4 ± 0.46, 5.3 ± 0.41, and 5.3 ± 0.61 cm in length and 4.8 ±0.45, 4.9 ± 0.46, and 4.9 ± 0.67 cm in width respectively (Tab. 1 and Fig. 3). There were no differences ($P>0.05$) in growth rates among the densities.

Survival Rate

After nursing of oyster spat for 3 months, survival at the stocking density of 1 spat per 6, 13, and 19 cm^2 were 75, 82, and 83 %, respectively (Tab. 1 and Fig. 4). The survival rates were found to be different ($P<0.05$) between stocking densities of 1 spat per 6 cm^2 and 1 spat per 19 cm^2.

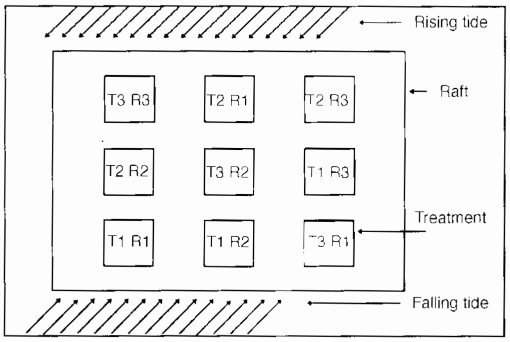

Figure 2. Lay-out of the experimental containers hanging randomly under the raft. T1 - stocking density 1 spat per 6 cm^2; T2 - stocking density 1 spat per 13 cm^2; T3 - stocking density 1 spat per 19 cm^2. R1, R2, and R3 were numbers of replicates.

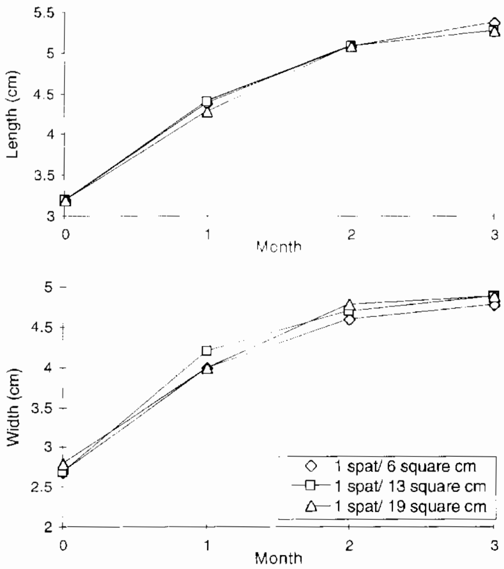

Figure 3. Growth of oyster at different stocking densities in terms of shell length and shell width.

Cost and Return

The variable costs included purchase of oyster spat and transportation costs. One 3 cm spat would cost 0.75 baht (1$ =25 baht). The total cost was 522 baht per crop at a stocking density of 1 spat per 6 cm^2, followed by 268 baht per crop at 1 spat per 13 cm^2 and 185 baht per crop at 1 spat per 19 cm^2.

Return of the operation at a stocking den-

Table 1. Growth and survival rate of oyster spat at three different stocking densities. [a], [b], [c], and [d] indicate statistical difference between groups ($P<0.05$).

Stocking densities (1 spat per)	Initial size		After 3 months		
	Shell length (cm ± SD)	Shell width (cm ± SD)	Shell length (cm ± SD)	Shell width (cm ± SD)	Survival (%)
6 cm^2	3.2 ± 0.17	2.7 ± 0.32	5.4 ± 0.46[a]	4.8 ± 0.45[b]	74.96[c]
13 cm^2	3.2 ± 0.18	2.7 ± 0.28	5.3 ± 0.41[a]	4.9 ± 0.41[b]	81.84[d]
19 cm^2	3.2 ± 0.21	2.8 ± 0.30	5.3 ± 0.61[a]	4.9 ± 0.67[b]	83.11[d]

Table 2. Cost and return of nursing the oyster spat at three different densities. Remarks: a) price of spat at 3 cm is 0.75 bath per spat (Taksinawisut 1989); b) tyre tray lasts for 5 years with 3 crops per year; c) given price of spat at 5 cm is 2.00 bath per spat.

Costs and production	Stocking density		
	1 spat/6 cm^2	1 spat/13 cm^2	1 spat/19 cm^2
Variable costs (baht):			
Spat[a]	506.25	252	168.75
Transportation	10.00	10.00	10.00
Tyre tray[b]	6.00	6.00	6.00
Total costs (baht)	522.25	268	184.75
Total production (spat)	506	275	187
Revenue[c] (baht)	1012	475	374
Profit (baht)	489.75	207	189.25

Table 3. Water qualities and phytoplankton at the experimental site, 1996.

Month	Salinity (ppt)	Temperature (°C)	pH	Turbidity (cm)	DO (mg/L.)	Phytoplankton (dominant species)	Quantity (cells/ml)
February	31-35	29-30	7.5-7.6	110-160	4.9-5.9	*Thalassiothrix* sp.	152
						Asterionella sp.	103
						Chaetoceros sp.	101
March	34-34	28-32	7.7-8.1	155-160	5.3-6-0	*Asterionella* sp.	30
						Chaetoceros sp.	26
						Biddulphia sp.	14
April	30-35	30-31	7.6-7.8	150-155	4.8-6.2	*Chaetoceros* sp.	162
						Thalassionema sp.	64
						Asterionella sp.	56
May	30-31	29-30	7.6-7.7	110-160	4.9-6.2	*Thalassionema* sp.	44
						Dithylium sp.	18
						Chaetoceros sp.	16

sity of 1 spat per 6, 13, and 19 cm^2 were 490, 207, and 189 baht per crop respectively (Tab. 2).

Water quality, plankton species and quantity was monitored as shown in Tab. 3.

DISCUSSION

Growth

Obviously, the density of spat per unit area had no effect on the growth of oyster from 3 cm to 5 cm, when spat was nursed in na-

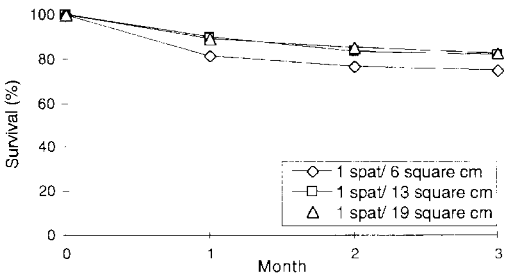

Figure 4. Survival rate of oyster spat at different stocking densities.

ture. The average growth rate was 2.15 cm per 3 months (0.7 cm per month). The growth rate was good compared to the study of Thitikulrat (1989). He nursed oysters on cement tubes in Ban Don Bay, Surathani Province and achieved a growth rate of 0.50 cm per month.

Survival Rate

The survival of oyster spat ranged from 74-83 %, considerably higher than the 32-54 % survival found in Khoa Yoa Bay (Pripanapong 1997). In Khoa Yoa Bay, mortality was caused by low salinity in the rainy season and fouling polychaetes. Pripanapong (*op. cit.*) found that a stocking density of 1 spat per square inch yielded better survival than a density of 1 spat per 3 square inch. The reason for the latter seemed to be a higher level of sedimentation related to a higher density of spat. Sediment attracted fouling polychaetes which then caused high mortality. Frequent cleaning of spat was recommended. Every two weeks as in the present study, was not sufficient in the Khoa Yoa Bay.

Cost and Return

It was calculated that a stocking density of 1 spat 6 cm^2 had the highest cost but also gained the highest return per crop (Tab. 2), so a stocking density of 1 spat per 6 cm^2 should be recommended for long-term operation.

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