COMPARISON OF THREE DIFFERENT METHODS FOR THE NURSING OF OYSTER SPAT (*CRASSOSTREA BELCHERI*)

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ABSTRACT

Oyster spat were nursed in trays of motorcycle tyre and netlon from October 1995 to January 1996 in Khao Yoa Bay, Ranong Province. Three replicates of three experimental designs were studied in Completely Randomised Design (CRD). The stocking density was 1 spat inch^{-2} (average spat size 2 cm). Growth of oyster spat in tyre tray, netlon tray, and tyre tray within cage were not significantly different in shell length. There was no difference in shell width between tyre trays and netlon trays, but both methods were significantly different from tyre tray within cage. The shell area showed no difference between tyre tray and netlon tray, but differed from tyre tray within cage. Survival showed no difference between netlon tray and tyre tray in cage, but differed from tyre tray (54.07±9.83, 48.89±3.47 and 32.74±4.90 % survival respectively). The tyre tray within cage caused the highest cost, tyre tray the lowest, however, only netlon tray gave profit. The salinity was 20-31 ‰, temperature 27-29.5 °C, transparency 90-120 cm, and oxygen 5.2-6.8 ppm. The dominant plankton species were *Bacteriastrum* sp. and *Chaetoceros* sp.

INTRODUCTION

Shortage of oyster seed (*Crassostrea belcheri* (Sowerby, 1871)) has increased because of changes in the environment. Oyster farmers try to collect seed from nature, but without success. Kaonuna (1990) reported that farmers now use small size seed (3-5 cm) due to lack of larger size combined with high prices. Hatcheries producing spat therefore play an important role for oyster culture activities. Sahavacharin *et al.* (1989) succeeded to produce oyster seed in hatcheries, but large scale nursery technique still has to be developed regarding space and food requirements.

A suitable area for the nursing of oyster spat is within the culture area, but here are many oyster predators. This study aimed at developing a method for nursing oyster spat up to cultivable size. Mohamad (1993) and Quayle & Newkirk (1989) reported that oyster culture in tyre tray and netlon tray gave good growth rates, fat meat, and regular shell shape. In this study, three methods of culture will be compared, regarding growth rate, survival rate, cost and return.

MATERIALS AND METHODS

The study was conducted from October 1995 to January 1996 in Khao Yoa Bay, Ranong Province, Thailand. Oyster spat, 2 cm in length, was obtained from Surathani Coastal Aquaculture Centre. They were nursed in three different containers at the same stocking density (1 spat inch^{-2}). (1) Netlon trays of 15 x 15 inches. The frame was made of 1" PVC tubes and wrapped with netlon, 1 cm mesh size (Fig. 1). (2) Tyre trays made of motorcycle tyres. The bottom was covered with netlon, 1 cm mesh size (Fig. 2). (3) Tyre trays within cage. The tyre tray were as in (2), but hung in cages made of fish net with 1 cm mesh size to prevent predation (Fig. 3). Each treatment had 3 replications randomly laid out by CRD (Completely Randomised Design) (Fig. 4). Forty spat were sampled monthly and survival estimated. Spat and tray were cleaned twice monthly. Water quality was measured every second week: salinity (Reflecto photometer), temperature (thermometer), turbidity (Secchi-disc), pH (Fisher pH meter 950), and oxy-

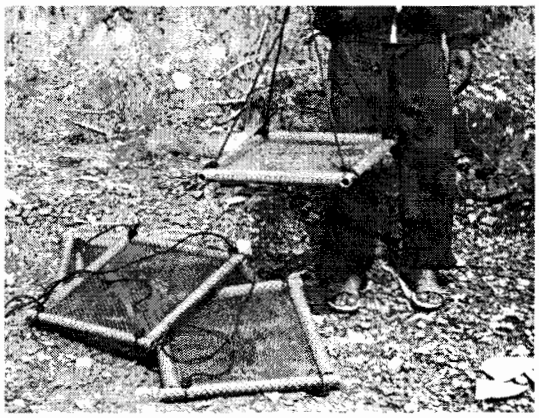

Figure 1. Netlon trays made of 1" PVC tubes and wrapped with netlon, 1 cm mesh.

Figure 2. Tyre trays made of motorcycle tyres. The bottom was covered with netlon, 1 cm mesh.

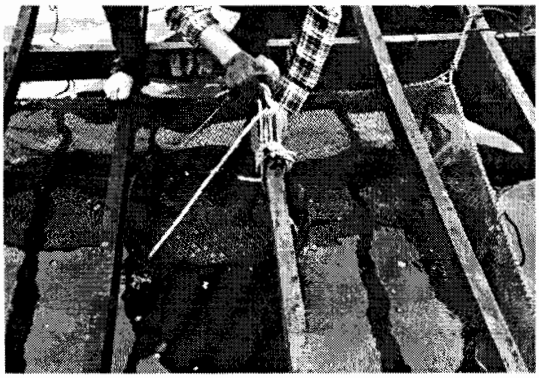

Figure 3. Cage made of fish net, mesh size 1 cm.

gen (Titration Swingle Method). Species composition and quantity of plankton were checked.

Data on growth were analysed by One-Way Analysis of Variance (Zar 1989) and survival rate was statistically compared by Duncan's New Multiple Range Test, 95 % confidence interval (Zar 1989).

RESULTS

After 3 months, the spat nursed in tyre tray, tyre tray within cage, and netlon tray had average shell lengths of 3.70±0.54, 3.47±0.58 and 3.59±0.61 cm and average shell width of 3.44±0.51, 3.14±0.54 and 3.56±0.62 cm respectively. The monthly growth is shown in Fig. 5 and Tab. 1. Spat nursed by the three methods differed only slightly in shell length, shell width or shell area.

Oyster spat were graded into 6 groups with

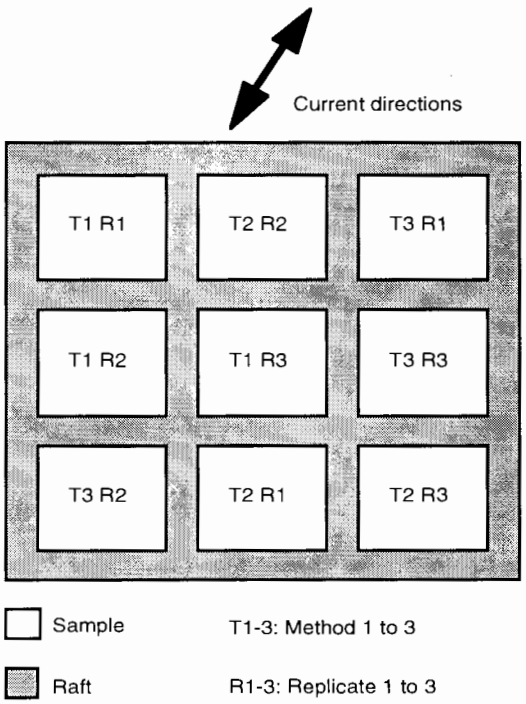

Figure 4. Experimental design of 3 nursing methods with 3 replications (completely randomised). T1: Tyre tray, T2: Tyre tray within cage, T3: Netlon tray.

Table 1. Shell length, shell width, and survival rates of oyster spat nursed for 3 months.

Nursing period months	Tyre tray			Tyre tray in cage			Netlon tray		
	Length (cm)	Width (cm)	Survival (%)	Length (cm)	Width (cm)	Survival (%)	Length (cm)	Width (cm)	Survival (%)
0	2.14±0.19	2.09±0.24	100.0	2.11±0.18	2.07±0.19	100.0	2.14±0.18	2.10±0.21	100.0
1	2.78±0.37	2.82±0.44	81.93±7.96	2.86±0.41	2.94±0.51	96.44±3.87	2.82±.039	3.03±0.56	89.63±3.78
2	2.91±0.36	2.89±0.38	56.74±6.03	3.07±0.53	2.82±0.47	79.11±7.90	3.01±0.48	2.97±0.54	76.15±9.07
3	3.70±0.54	3.44±0.51	32.74±4.90	3.47±0.58	3.14±0.52	48.89±3.47	3.59±0.61	3.56±0.62	54.07±9.83

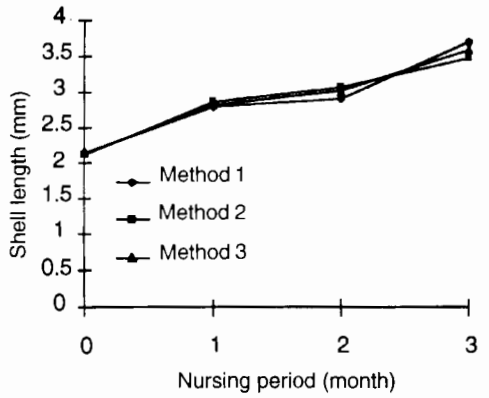

Figure 5. Growth rate of oyster spat. Method 1: Tyre tray, method 2: Tyre tray in cage, method 3: Netlon

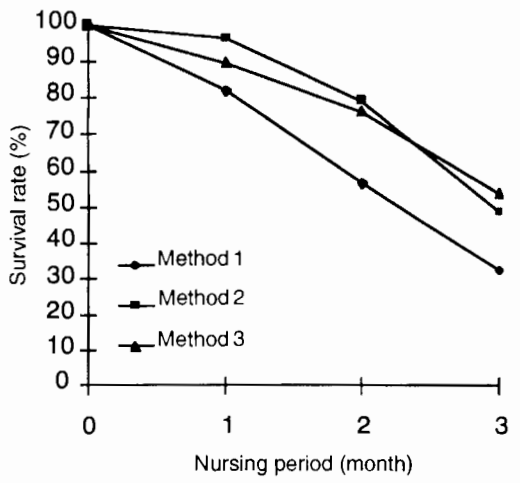

Figure 6. Survival rates of oysters nursed with the three different methods. Method 1: Tyre tray, method 2: Tyre tray in cage, method 3: Netlon

the size distribution of <3.0, 3.1-3.5, 3.6-4.0, 4.1-4.5, 4.6-5.0, and >5.0 cm. Oyster <3.0 cm dominated in tyre tray within cage (41.8 %), followed by tyre tray (29.8 %), while netlon tray had the lowest amount of small oyster (20.9 %). Netlon trays contained 6.7 % oysters having the larger size of > 4.6 cm. Tyre trays had 3.6 %, and tyre tray within cage had only 1.9 % (Tab. 2).

Survival rates of oysters nursed in tyre tray, tyre tray within cage, and netlon tray were 32.74±4.90, 48.89±3.74 and 54.07±9.83 % respectively. Survival rates of oysters in tyre tray within cage and netlon tray were not significantly different, but both were significantly different from the tyre tray (Fig. 6, Tab. 3).

Water during the experimental period had 20-31 ‰ salinity, temperature of 27.0 to 29.5 °C, transparency of 90-120 cm, and 5.2-6.8 ppm of dissolved oxygen (Tab. 4). The dominant plankton species in October-November

Table 2. Size distribution of oyster spat. T1: tyre tray, T2: tyre tray in cage, T3: Netlon tray.

Length of spat (cm)	Nursing period: 3 months (%)			4 months (%)		
	T1	T2	T3	T1	T2	T3
< 3.0	29.8	41.8	20.9	8.4	18.4	5.4
3.1 - 3.5	28.0	23.3	31.0	13.6	12.6	11.5
3.6 - 4.0	22.8	25.9	25.3	15.5	24.0	18.2
4.1 - 4.5	15.9	7.2	16.1	26.3	19.5	23.4
4.6 - 5.0	3.1	1.6	5.8	14.5	16.0	21.6
> 5.0	0.5	0.3	0.9	21.7	9.5	18.2

Table 3. Growth and survival rates of oyster spat with 3 models for 3 months. Shell area = π x 0.5 width x 0.5 length. Raised small letters, a-i, indicate significant differences ($p<0.05$).

Models	Initial size		After 3 months nursing			
	Length (cm)	Width (cm)	Length (cm)	Width (cm)	Shell Area (cm^2)	Survival (%)
Tyre tray	2.14±0.19	2.09±0.24	3.70±0.54^a	3.44±0.51^d	10.15±2.73^f	32.74±4.90^h
Tyre tray in cage	2.11±0.18	2.07±0.19	3.47±0.58^b	3.14±0.52^e	8.75±2.59^g	48.89±3.47^i
Netlon tray	2.14±0.18	2.10±0.21	3.59±0.61^c	3.56±0.62^d	10.28±3.26^f	54.07±9.83^i

Table 4. Water quality and quantities of 3 dominant plankton species.

Month	Sal. (‰)	Temp. (°C)	Turbidity (cm)	D.O (ppm)	Dominant plankton species	Number (cell cm^{-3})
October 1995	20-27	29	90-120	6.1-6.6	*Bacteriastrum* sp.	147
					Rhizosolenia sp.	81
					Biddulphia sp.	53
November 1995	23-25	29	110-120	5.2-6.8	*Bacteriastrum* sp.	145
					Chaetoceros sp.	71
					Thalassionema sp.	58
December 1995	30-30	27-28	110-120	5.3-6.0	*Chaetoceros* sp.	67
					Rhizosolenia sp.	55
					Ditylum sp.	55
January 1996	30-31	29-29.5	110	5.8-6.0	*Chaetoceros* sp.	134
					Bacteriastrum sp.	88
					Rhizosolenia sp.	79

was *Bacteriastrum* sp. (145-147 cells ml^{-1}), and in December-January *Chaetoceros* sp. (67-134 cells ml^{-1}).

There are 2 main costs of nursing oyster. First, the variable cost of transportation. Oyster seed 2 cm in size cost 0.25 Baht per individual (Taksinawisut 1989). The total variable cost was 178.75 Baht for each method. Second, the fixed cost of netlon, tyre tray within cage, which have a life span of 5 years and could be operated for 3 crops/year. The total fixed cost of tyre tray within cage, netlon tray, and tyre tray were 86, 12 and 6 Baht per crop, respectively. The total cost were 264.75, 190.75 and 184.75 Baht per crop respectively (Tab. 5). The netlon tray resulted in a profit, amounting to 83.00 Baht per crop. The tyre tray within cage and tyre tray gave a loss of 17.25 and 19.00 Baht per crop respectively.

DISCUSSION

Oyster nursed in tyre tray within cage had the lowest growth because of poor water circulation. Kritsana *et al.* (1989) nursed oyster spat from 1.83 to 2.56 cm in 3 months. They grew on average 0.24 cm $month^{-1}$ which was less than the results in this study. Size distribution of spat also differed. Larger size oysters were produced when nursed in

Figure 5. Cost excluding labour of 3 oyster nursing methods.

1. Oyster spat average 2 cm in size cost 0.25 Baht per spat (Somkit 1989) and 675 spat were used for each treatment.

2. Life span of the material is 5 years and 3 oyster crops can be nursed per year.

* Selling price of oyster spat, 30-35 mm, was 0.75 baht per spat (Somkit 1989).

Item	Netlon tray (T3)		Tyre tray in cage (T2)		Tyre tray (T1)	
Variable cost	per crop	Total	per crop	Total	per crop	Total
Oyster spat[1]		168.75		168.75		168.75
Transportation		10.00		10.00		10.00
Fixed cost[2]						
Netlon	180.00	12.00				
Tyre tray			90.00	6.00	90.00	6.00
Cage			12,000.00	80.00		
Total cost (Baht)		190.75		264.75		184.75
Total production (spat)		365		330		221
Total income *		273.75		247.50		165.75
Profit		83.0		-17.25		-19.0

netlon trays, and smaller size oysters were produced when nursed in tyre trays within cages.

The nursing method with predator protection (netlon tray and tyre tray within cage) gave better survival than those without. Crabs were the major predators of oyster spat. A crab, 3.5 cm in size, could daily eat 5 oyster spat of 4-5 cm size.

Although the tyre tray demanded the lowest investment, the oysters also had the lowest survival. Therefore, no profit was gained. This problem can possibly be solved by covering the top with netlon to protect against predators.

The netlon tray gave the highest profit. Therefore, at the moment, the netlon tray could be considered as the best method. It is suitable for nursing oyster spat of 2 cm in size in coastal water in Ranong when stocked with 1 spat inch^{-2} for 3 months.

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