Net Cage Culture of *Lates calcarifer* Bloch and other Marine Animals in Thailand

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Aquaculture plays an important role in the Southeast Asian countries economy by being a major source of protein and by providing employment. In 1976, the aquaculture production of the ASEAN countries was 555,957 MT or 11 percent of the total fishery production. Inland aquaculture produced 169,420 MT or 30 percent and mariculture or brackish water contributed 386,537 MT or 69 percent. Indonesia contributed the biggest production from inland aquaculture while Thailand had the largest production for marine and brackish water.

Net cages have been used for culture of sea bass *(Lates calcarifer* Bloch) since the last decade. Most of the culture activities were conducted in Songkhla Lake, the largest brackish and fresh water lake in Thailand. Several experiments on feed and feeding, high density culture, and cost of investment were continuously carried out and it was proved that sea bass could be successfully cultured in net cage.

EXPERIMENTS ON SEA BASS CAGE CULTURE

Feeding experiments on sea bass in nylon net cages have been conducted since 1971 in Songkhla to obtain information on growth rates, survival rates, food conversion rates, and some environmental conditions that affected the fish.

The net cage was made of nylon net (no. 18) 5 x 6 x 3 m^3 in diameter, and 3.5 cm in mesh size. The pieces of net already cut were sewed together to a rectangular shape without frame. Floated in water, the depth of water varied from 1 to 2 meters depending on the tide. For the experiment, five net cages were used and each of them contained 90 fish of almost the same size and length.

The first and second cages were stocked with 21.4 cm (in average length) sea bass, while the 3rd, 4th, and 5th cages contained 23.0, 24.1 and 26.2 cm fish, respectively.

Table 1. 1976 fresh water and brackish water aquaculture production of the ASEAN countries*

Countries	Inland (MT)	Brackishwater (MT)	Total (MT)
Malaysia	1,603	31,642	33,245
Philippines	47,042	112,761	159,803
Indonesia	85,871	78,776	164,647
Thailand	34,301	163,283	197,584
Singapore	603	75	678
Grand Total	169,420	386,537	555,957

*From Fish. S at. Bul. for South China Sea Area 1976.

Trash fish (1 bht/kg) were used as food. They were cut into pieces and given at 10.0 percent of total body weight. After the fish finished their daily feeding the remaining foods were weighed again to find out the exact consumption.

The fish were caught from each cage every two months to get the survival and growth data. The environmental factors such as chemical and physical properties of the water were checked daily. The experiment was conducted for one year.

RESULTS

Table 2 indicates very favourable growth and survival rates. The average weight increased to 1596.25 gm from an initial 236.95 gm; survival percentage was extremely high, 94 percent; Food Conversion Ratio (FCR) was only 7.22:11.

PROBLEMS

Water current. Fish would swim against a strong current and stop feeding.

Parasite *Aega sp.* was always observed when the salinity decreased, but only a few were found at high salinity.

Turbidity. Generally, sea bass will come up to the water surface to feed, but it becomes rather difficult for them to see the food in turbid water. The water becomes turbid during September and December by the run-off of fresh water from the upper part of the lake to the sea. The rainy season of the Southern part of Thailand where Songkhla Lake is situated is May to October.

Salinity. Sudden change in salinity causes the fish to stop feeding. Salinity changes occurred with the tides as the cages were placed near the mouth of the lake.

Table 2. Growth in length and weight, and survival of sea brass reared in nylon net cages

Cage No.	Initial No.	Initial Length ($\bar{x}$–cm)	Initial Weight ($\bar{x}$–cm)	Final No.	Survival (Percent)	Final Length ($\bar{x}$–cm)	Final Weight ($\bar{x}$–cm)	Total Wt. Gain (kg)	FCR
1	90	21.4	171.1	156	86.66	42.0	1219.6	80.285 x 2	6.39
2	90	21.4	171.1						
3	90	23.0	210.8	88	99.77	43.8	1465.8	109.09	8.25
4	90	24.1	244.6	90	100.00	45.5	1620.9	123.375	7.61
5	90	26.2	321.3	89	98.88	48.0	2002.2	149.780	6.63
$\bar{x}$	90	23.68	236.95		94.00	44.83	1596.25		7.22

COST OF INVESTMENT AND RETURNS

Table 3. Cost of investment of raising sea bass in 30 m^3 net cage (duration of one year)

Items	Expenditure (Bht)
Net cage (one year)	700
Feeds	1,890
Labour (one person)	14,400
Young sea bass and net cage for nursing	300
Net cage frame (rope) and others	2,000
Total	19,290
Receipts from fish sold at the market at 50 Bht/kg	13,500 Bht

It cannot be said that to raise sea bass in net cages is expensive if we consider the labour. It has been shown that one person can take care of at least 5 cages of 30 m^3 each. However, further study was done by carrying out the culture of sea bass in 10 net cages of 10 x 10 x 2 m^3 in dimension and the following data show promising results.

Table 4. Cost of investment of raising sea bass in five 10 x 10 x 2 m^3 net cages (duration of one year)

Items	Expenditure (Bht)
Five net cages (one year)	7,000
Feeds	18,900
Labour (2 persons)	28,800
Young sea bass and nursing cage	3,000
Net cage frame (rope) and others	20,000
Total	77,700
Receipts from fish sold at the market at 50 Bht/kg	135,000 Bht
Net Gain	57,300 Bht

NURSING SEA BASS IN NET CAGES

Net cage can also be used for nursing young and fry. This has been conducted since 1975.

Net cage used for this purpose is 1 x 2 x 0.9 m^3 in dimension. They were floated in a concrete ponds of 6 x 15 x 1 m^3 in size filled with water to a depth of 0.9 m. These net cages were very useful in rearing fry of about 1 - 1.5 cm in length. Generally, young sea bass is a strongly cannibalistic type, the larger fry eat the smaller ones. Therefore, they were separated by size and reared in separate net cages until they reached the fingerling stage at which they were transferred to larger cages.

The open water system was employed; the water supply run from the tap and flowed to the drainage tube set at another side of the pond. By this method the survival rate appeared very high.

POSSIBILITY OF NET CAGE FOR OTHER MARINE ANIMALS

In 1978, the mariculture and seed production staff of the Marine Fisheries Division succeeded in mass production of several economic invertebrate species such as large cuttle fish *(Sepia pharaonis)*, mud crab *(Scylla serrata)*, blue swimmer *(Portunus pelagicus)*, striped crab *(Charybdis sp.)*, giant oyster *(Crassostrea gigas)*, and two other species of oyster.

Among these marine invertebrates only the cuttle fish *(Sepia sp.)* showed the best potential for culture in net cage. The oyster appeared to be also suited for floating cage culture.

SPECIAL CONSIDERATIONS

The change in the ocean regime seriously affects Thai marine fisheries. The country faces decline in the production of fish and other marine species. This decline can be conceivably offset by immediately conducting large-scale mariculture in which the net cage culture will become the most important system after the mangrove area is completely utilized.

PROBLEMS

Among the problems that retard the development of net cage culture at present are:

1) Insufficient supply of necessary facilities and equipment;

2) Inadequate modern techniques;

3) Lack of lead training center to train farmers who can carry out net cage culture by themselves; and

4) Inadequate supply of marine seeds.