THE SMALL-SCALE BACKYARD PENAEID SHRIMP HATCHERY: RESULTS OF JEPARA STUDY

by

M.L. Nurdjana, B. Martosudarmo, S. Adisukresno and B. Tiengsongrusmee
Brackishwater Aquaculture Development Centre
Jepara, Central Java
Indonesia

Abstract

The culture of penaeid shrimp in brackishwater ponds continue to expand especially in Southeast Asia. The increasing high market demand for the crop favours a further development in this field. The supply of shrimp seeds for stocking the ponds, either from natural sources or from hatcheries has not been adequate and presents major constraint to development. Governments in the region and a few enterprising private parties have put hatcheries to help solve the acute shrimp seed problem. This is true in Indonesia and a further step has recently been studied through the development of small-scale backyard hatcheries by fish farmers in partnership with an existing government centre. Results of this activity by the Brackishwater Aquaculture Development Centre in Jepara, Indonesia are described in this paper.

CONTENTS

1. INTRODUCTION

Since early 1978 the Brackishwater Aquaculture Development Centre (BADC) in Jepara, Indonesia has been successful in inducing the farm-raised shrimp Penaeus merguiensis and P. monodon to spawn in the broodstock tank by eyestalk ablation. The breakthrough gives a new dimension in stimulating the expansion of shrimp culture programme in Indonesia. At present, even though the BADC could produce over 3 million shrimp larvae a year, this production is still very inadequate when compared with 2 000 million shrimp larvae required by the Indonesian farmers. It has been estimated that to meet the present demand at least 100 shrimp hatcheries of the same capacity as Jepara will be required. Unless private investors undertake this sector of the industry, based on its present economy, it is beyond the capacity of the government to have adequate number of hatcheries to implement the shrimp culture industry.

To help the country solve the problem, the BADC is now moving in a direction so that the farmers themselves might be able to produce their own post-larval stock, if the rearing techniques of shrimp larvae can be simplified down to the level that the farmers could do themselves.

The present paper is an attempt to present the result of a pilot activity in producing the shrimp larvae operated in a small-scale basis with a view that the technology could be transferred to the progressive shrimp farmers so that the farmers will be able to produce their own fry with minimal assistance from the BADC.

2. DEVELOPMENT OF METHOD

The programme was started on 25 July and lasted till 5 October 1979. Further follow-up is being programmed. The spawners used for the studies were obtained from culture ponds. They were ablated and kept in the maturation tank of the BADC until the gonad developed to Stage III. The gravid female were transferred into a wooden box which served as spawning tank and larval tank in subsequent period. On many occasions, the spawners were spawned in the spawning tank of the hatchery at night, and only eggs were transferred into the larval rearing box the following morning.

The larval rearing tank (Figure 1)

The tank is made of wood lines with plastic sheet to retain the water. The thickness of the plastic is about 0.30 mm. The tank is about 4.00 x 4.00 x 0.60 m and filed with clean salt water (from pond or tidal seawater) of about 0.50 m. The tank can be set on any clean level ground without cement base or soil compaction.

Rearing medium

The saltwater used in the experiment may be obtained directly from the nearby shrimp pond within the vicinity of the Jepara Centre. The salinity in the test was about 38 ppt, but it was reduced down to 30 ppt by adding freshwater. Before use, the water was filtered through a 100 micron nylon mesh filter. If the water is still turbid, it can be left to stand for another two days to allow the sediment particle size smaller than 100 micron to settle down on the bottom.

Aeration (Figure 1)

Throughout the course of the study, simple portable aerators were used. For tank size of about 16 m^2 eight aerators were used. Each aerator was provided with two airstones.

Feeds and feeding

In this study, feeds and feeding were divided into three groups:

(a) First trial, fed with *Skeletonema*, *Tetraselmis*, *Artemia* and soybean curd,

(b) Second trial, fed with *Skeletonema*, *Tetraselmis* and soybean curd,

(c) Third trial, fed with pellets and soybean curd only.

Live food used in this experiment were cultured separately in wooden tanks with size of 1.00 x 1.00 x 0.60 m. *Skeletonema* and *Tetraselmis* were given during zoea to mysis stages. The algae were transferred directly to the larval tanks after the density of the algae culture reached 3-5 million cells per ml. The density of algae in the larval tank during zoea stage is about 10 000 to 20 000 cells per ml while in the mysis stage about 20 000 to 30 000 cells per ml. *Artemia* was given after the larvae reached post-larvae. In the third trial, the pellet used, of about 100 micron in size, contained protein of about 60 percent. Soybean curd (tahu) was given in varied sizes according to the stage of the larvae as shown in Table 1. Soybean curd and pellet were given five times a day at 0700, 1200, 1600, 1900 and 2200 hours.

Water quality management

During the whole experiment, no change of water was made. To keep the water in good condition for the larvae, siphoning the bottom of the tank to remove left-over food and other dirt were made starting from Mysis III. Besides that, the tank surface was covered with bamboo matting in order to reduce light intensity (Fig. 2). Experience showed that if the illumination is too bright diatom blooms will occur. Diatom blooms were always followed by bacterial blooms, and bacterial blooms usually result in high mortality.

3. RESULTS

From three trials, about 181 000 postlarval shrimp ages PL-9 were produced. The result is given in Table 2. The survival rate was 32.6, 10.6 and 11.4 percent in Trials I, II and III, respectively. It can be seen that even if the rearing medium utilizes raw pond water, this could be used for spawning the penaeid shrimp and rearing through its larval stages. The survival rate is about 33 percent if the *Artemia* nauplii was given after the shrimp larvae reached the postlarval stage. The results in Trials II and III suggested that the shrimp larvae could be produced through the stage that is suitable for pond culture without giving *Artemia* nauplii. About 10 percent survival rate of PL-9 was obtained. The survival rate could be improved to some extent if the density of the shrimp larvae in the rearing tank is thinned down so that it does not exceed 20 000 pieces per m^3 of rearing water.

As described in earlier section, the method of larval culture used in this experiment is simple. It could be easily absorbed by the progressive farmers. For supply of spawners, this could be filled directly by the government agency, like the BADC in Jepara or other similar centres. It could be supplied either as gravid female or as eggs that are newly spawned and ready to hatch out.

To give out the gravid female to the farmers might present difficulty in transporting and in spawning the shrimp especially those who live far from the Centre. The spawners may not spawn as it may suffer from stress and handling effect during transportation. It may be more practical if the shrimp were spawned at the Centre first and later only the newly spawned eggs are given out to the farmer. Besides, the farmers need not have spawning tanks, and it is assured that they will get the shrimp eggs that are already fertilized. Moreover, the Centre also can retain the spawners for reuse in subsequent period.

Experiments on egg transportation have been made. About 400 000 eggs were placed in two small plastic pails. Each plastic pail was filled with 20 liters of seawater and aerated with small aquarium compressor. The trip took about 3 hours from the Jepara Centre to one of the local hatcheries (Sluke Hatchery) where the eggs were reared up to post-larvae. Further retention of the eggs for 3 hours was made as experiment. The plastic pails with shrimp eggs inside were held with minimal aeration during transportation. Result of this experiment showed that all of the eggs remain in good condition. The hatching rate was not affected by 6 hours of retention.

From the economic point of view, it could be seen from Table 3 that even with only one batch the production could compensate the inputs. Disregarding the price of the spawner that the farmer might have to buy from the Centre in subsequent period, the farmer could have profits of about Rp[1]/ 790 000 per three months representing over 200 percent profit from the investment.

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[1] Rp or rupiah 625 = US$1

4. CONCLUDING COMMENTS

Under a partnership between the government and private fish farmers, useful and profitable small-scale penaeid shrimp hatcheries to serve the aquaculture industry can be developed. The successful pilot trials conducted by the BADC in Jepara, Indonesia clearly demonstrates this possibility. Large hatcheries with elaborate design and expensive physical plant cause considerable drain in capital expenditure for government budgets. With technologies still undergoing rapid changes, capital-backed private sector is still timid to invest in this venture. It is, therefore, worthwhile to promote these small-scale seed production or backyard hatcheries under a government/private fish farmer partnership.

Table 1. Size of tahu particles given according to the stage of shrimp larvae

Larval stage	Size (micron)	Amount of tahu given per 5-ton water	
		(with plankton) (g)	(without plankton) (g)
Z I	35-48	10	15
II	48-75	15	20
III	48-75	20	25
M I	75-105	25	35
II	75-105	30	40
III	75-105	30	40
PL 1	105	30	45
2	105	30	45
3	105	30	45
4	105	30	45
5	105	45	60
6	105	45	60
7	105	45	60
8	105	45	60
9	105	45	60

Table 2. The production of shrimp larvae from three trials

Stages	Number of larvae		
	I	II	III
Nauplius	352 000	454 000	158 000
Zoea	320 000	278 000	109 000
Zoea	306 000	273 000	84 000
Zoea	269 000	216 000	75 000
Mysis	242 000	172 000	54 000
Mysis	226 000	115 000	51 000
Mysis	183 000	103 000	47 000
Post-larva	115 000	48 000	18 000
Survival rate (%)	32.6	10.6	11.4

Trial I : Fed with *Skeletonema*, *Tetraselmis*, *Artemia* and tahu

Trial II : Fed with *Skeletonema*, *Tetraselmis* and tahu

Trial III: Fed with tahu and pellets

Table 3. Inputs and outputs of the operation for the small-scale backyard penaeid shrimp hatchery from July to October

Inputs			
1.	Wooden planks, 4 m x 0.20 x 3 cm, 12 pcs at Rp 1 900	Rp	22 800
2.	Labour for construction		7 200
3.	Plastic lining, 5.5 x 5.5 m x 0.3 mm thickness		23 000
4.	Miscellaneous - sundries		5 000
5.	Portable aerator' 8 units at Rp 8 500		68 000
6.	Airstone and plastic tubes		5 000
7.	Screen and plankton net		10 000
8.	Labour for maintenance, 6 months at Rp 20 000/month		120 000
9.	Brine shrimp		30 000
	Total inputs	Rp	291 000
Outputs			
1.	First harvest, 115 000 pcs at Rp 6		690 000
2.	Second harvest, 48 000 pcs at Rp 6		288 000
3.	Third harvest, 18 000 pcs at Rp 6		108 000
	Total outputs	Rp	1 086 000
	Profit per three months	Rp	795 000
	Percent profit over inputs (excludes spawner expenses)		273

Figure 1. Set-up of spawning/hatching/nursery tank

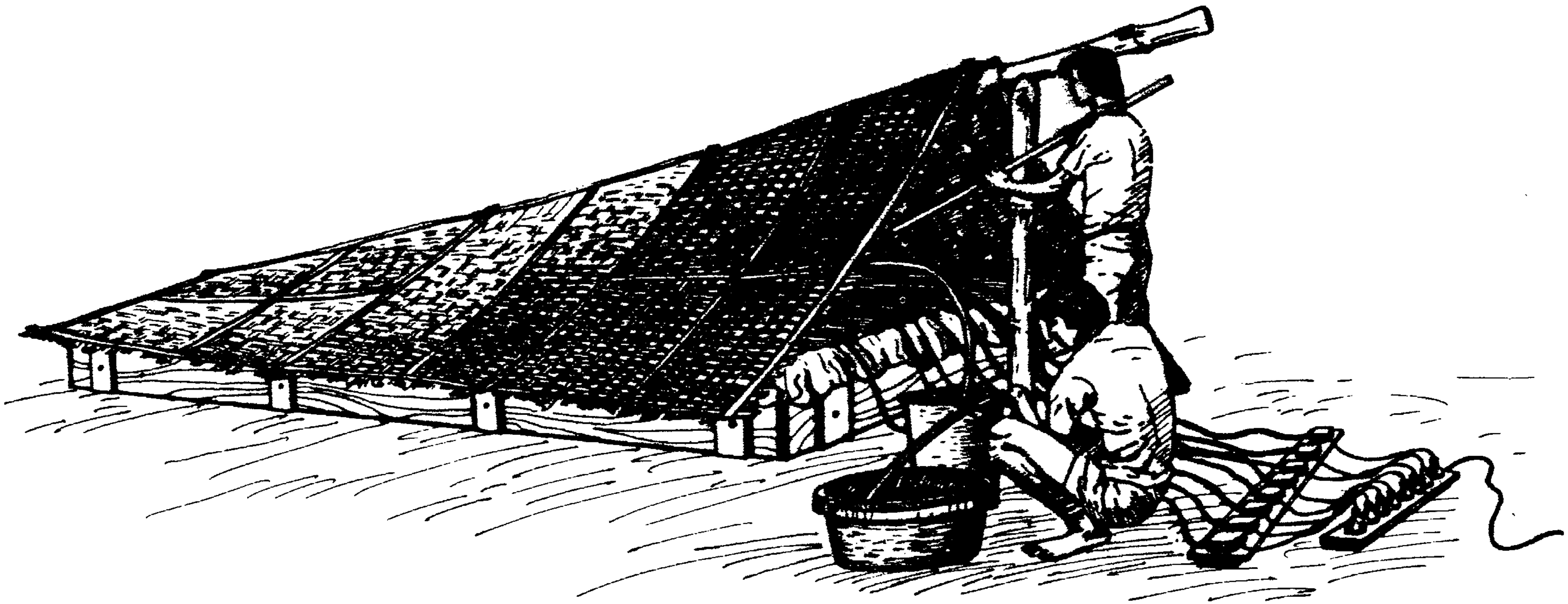

Figure 2. View showing backyard shrimp hatchery unit in actual operation