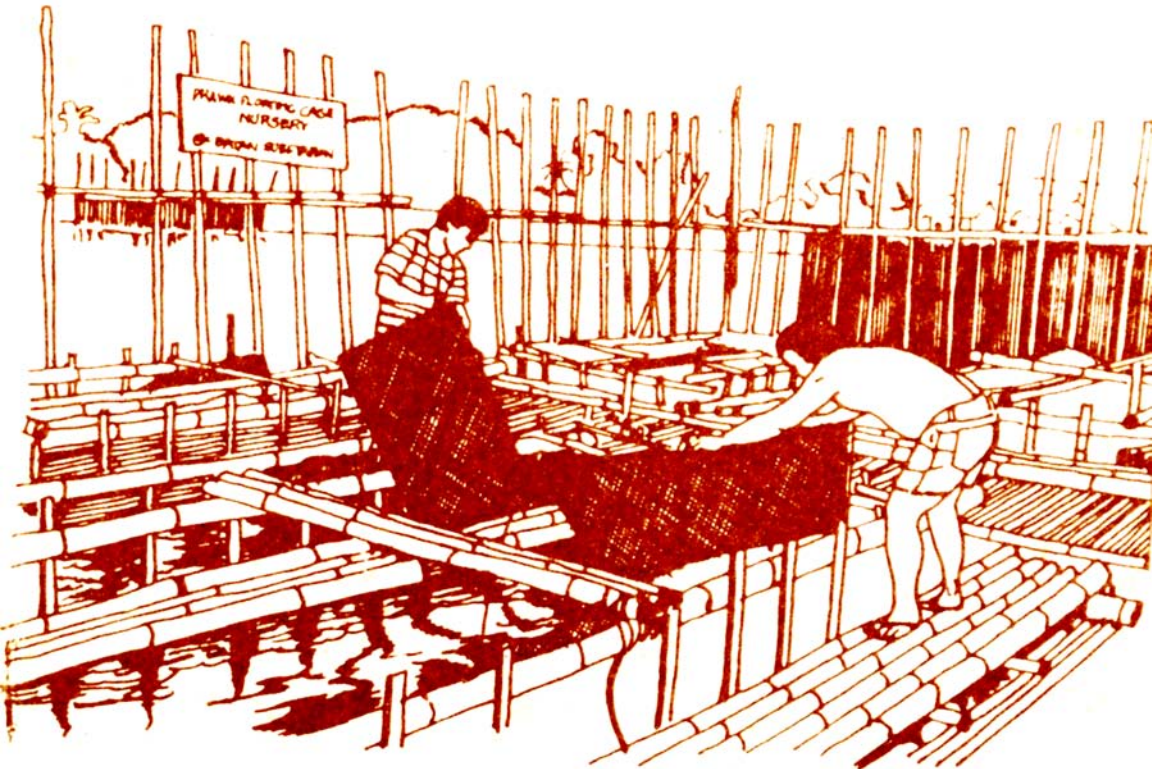


FLOATING CAGE NURSERY FOR TIGER PRAWN

D.T. de la Peña Jr., O.Q. Prospero and A.T.G. Young



AQUACULTURE DEPARTMENT
Southeast Asian Fisheries Development Center
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Oscar Q. Prospero
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ISSN 0116-0044
ISBN 971-8511-07-5

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Correct citation:

De la Peña, D.T., Jr.; O.Q. Prospero; A.T.G. Young. Floating cage nursery for prawn. Aquaculture technology module, no. 3. Tigbauan, Iloilo, Philippines: SEAFDEC Aquaculture Department, 1985. 35 p.

PREFACE

This Aquaculture Technology module is a result of pioneering research on postlarval rearing of *P. monodon* conducted at the Batan Substation of the SEAFDEC Aquaculture Department. The module has been pre-tested among prawn operators from Capiz, Aklan, Iloilo, Cebu, Davao del Sur, Davao City and Surigao del Sur.

The floating cage nursery for tiger prawn has been demonstrated to be superior to land-based nursery tanks. The floating cages are cheaper to construct using primarily available local materials such as bamboo and wood. It is also easier to manage and operational costs are significantly reduced by eliminating aeration and pumping, not to mention reduced feeding requirements. Higher stocking densities are obtainable with this system at 10,000 PL₈/ton. It has also been shown that survival rates are higher and juveniles are stronger than those raised in tanks. Harvesting efficiency is also increased as all one has to do is lift the nets and transport preparation is made easier since water is taken directly from the nursery area. However, it must be emphasized that in the choice of a culture site, the selection criteria mentioned in this module should be followed.

For the over-zealous beginner in fishfarming who tends to overfeed his postlarvae, the floating cage has a decided advantage of avoiding the resultant pollution caused by decaying feeds.

The floating cage nursery system for sugpo should contribute greatly to augmenting the supply of prawn postlarvae as more operators adopt the technology.

ANTONIO ORTIZ, LL.B.
President
Capiz Fishpond Owners Association
December 1985, Roxas City

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FLOATING CAGE NURSERY FOR TIGER PRAWN

INTRODUCTION

The availability of fry is an important factor to consider in most aquaculture ventures. In the prawn industry, the presence of sufficient seed can trigger intensified pond culture and increase production of marketable size prawns particularly the tiger prawn, *Penaeus monodon*, locally known as *sugpo*, (Tagalog), *lukon* (Hiligaynon) or *pansat* (Cebuano). This need partly led to the establishment of numerous prawn hatcheries in various parts of the Philippines where prawn culture is a growing industry.

Earlier attempts to stock young *sugpo* postlarvae (PL₅ or 5-day old postlarvae, approximately 14-15 days after hatching) from the hatchery directly in ponds were generally not successful. Inadequate pond preparation associated with ponds originally intended for milkfish culture yielded poor results. Considering the need for bigger and healthier postlarvae for pond stocking, a nursery has been integrated into the hatchery complex.

At present, nursery or postlarval rearing of *sugpo* is popularly done in hatchery tanks where fry are reared for about two weeks or until they become juveniles. The juvenile stage begins at 30 days old from the postlarval stage when the prawns are the size of a matchstick with the minimum weight of 0.1 gm.

A recent development is the use of floating cages installed in protected inshore waters like bays and coves. This can be operated independently or as an integral part of the hatchery. Promising results of studies conducted in 1983 and 1984 at SEAFDEC AQD Batan Substation can be potentially adopted in other similar areas.

Rationale

A floating cage nursery has the following advantages:

- it allows high stocking density;
- assures high survival of postlarvae;
- easy to manage;
- minimizes water fouling due to excess feeds;
- eliminates the need for pumping and aeration systems;
- and
- low capital and operating costs.

One consideration in using this nursery system is its site specificity. Some fishpond operators in Northern Panay, Philippines, however, have tried setting up and operating nursery floating cage net enclosures inside their ponds and have reported significant success.

Objectives

This AQUACULTURE TECHNOLOGY module will serve as a guide in applying the techniques of operating a nursery floating cage for tiger prawn or *sugpo*. After going through this module, you should be able to:

- Select a suitable site for floating cage nursery for sugpo
- Design, construct and install a floating cage nursery
- Operate and manage the nursery.

SITE SELECTION

A good site for a prawn hatchery may not necessarily be suitable for a floating nursery cage. Whether you construct your floating nursery cage to be integrated with the hatchery in the same site or set it up independently, consider the following:

1. Protection from Natural Hazards

Protected areas like bays and coves are ideal sites for floating nursery cages (Fig. 1). They should be sheltered from strong winds, waves and drift wood which can destroy the cages.

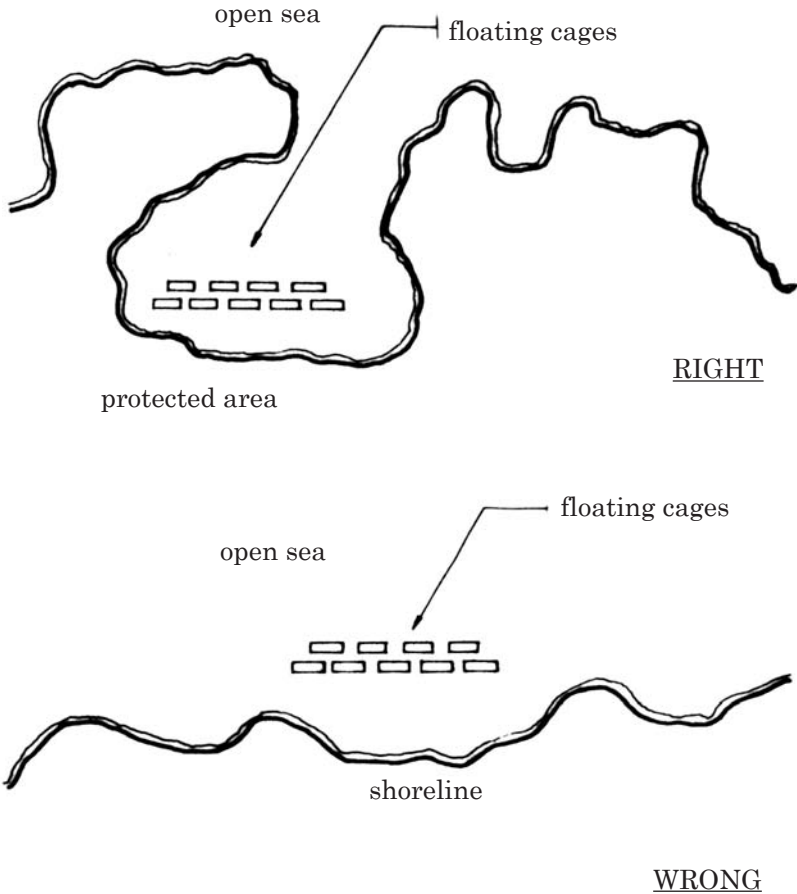


Fig. 1. Floating nursery cages should be properly located.

2. *Water Quality*

The site should be far from freshwater tributaries to avoid wide salinity fluctuations. It should also be free from domestic, agricultural and industrial wastes. Turbid water is one indication of a poor site.

3. *Water Current*

The site should have moderate water current to allow sufficient water exchange inside the cages.

4. *Supply of Postlarvae*

There should be a reliable source of postlarvae (PL₆-PL₁₀) if the cages are operated independently. The site should preferably be near prawn hatcheries to reduce transport costs and mortality of postlarvae in transit.

5. *Proximity to Market*

Harvested postlarvae (PL₂₀ or older) should have a ready and accessible market. Short transport duration from 1 to 3 hours is advisable to reduce mortality.

DESIGN AND CONSTRUCTION OF A FLOATING CAGE

The size of the cage varies depending on the number of postlarvae that can be obtained from the wild or from the hatchery. A 10 m³ capacity cage can hold from 50,000 to 100,000 postlarvae at a density of 5,000-10,000/m³. You may add more cages depending upon the total number of postlarvae you wish to stock. Smaller cages are easier to manage compared to bigger ones but they are more expensive per unit area when you consider the netting materials used.

The frame of floating nursery cages can be constructed using bamboo. Other materials like wood and coconut lumber, a galvanized iron (G.I.) pipes or polyvinyl chloride (PVC) pipes may also be used.

A floating nursery cage consists of three major parts (Fig. 2), namely:

1. cage frame,
2. floats, and
3. netting materials.

The cage also has two important accessories: feeding nets and stone sinkers.

To construct a floating nursery cage, you will need the following materials the quantity of which can be determined according to the size and number of cages needed.

Bill of materials needed to construct a 10 m³ floating nursery cage (2 x 5 x 1.5 m)

<i>Materials</i>	<i>Quantity</i>
Bamboo poles (10-12 m long)	40 pcs
Monofilament No. 180	3 kg
A-net (single width, 5 mm mesh size)	31 m
White nylon hapa net (single width, 1 mm mesh size)	31 m
Copper nail 1 in.	0.25 kg
2 in.	0.50 kg
Polyethylene rope 4 mm dia	140 m
8 mm dia	50 m
Cement coated styrofoam floats (0.45 x 0.9 x 0.45m)	4 pcs
Nylon twine 210/90	1 spool

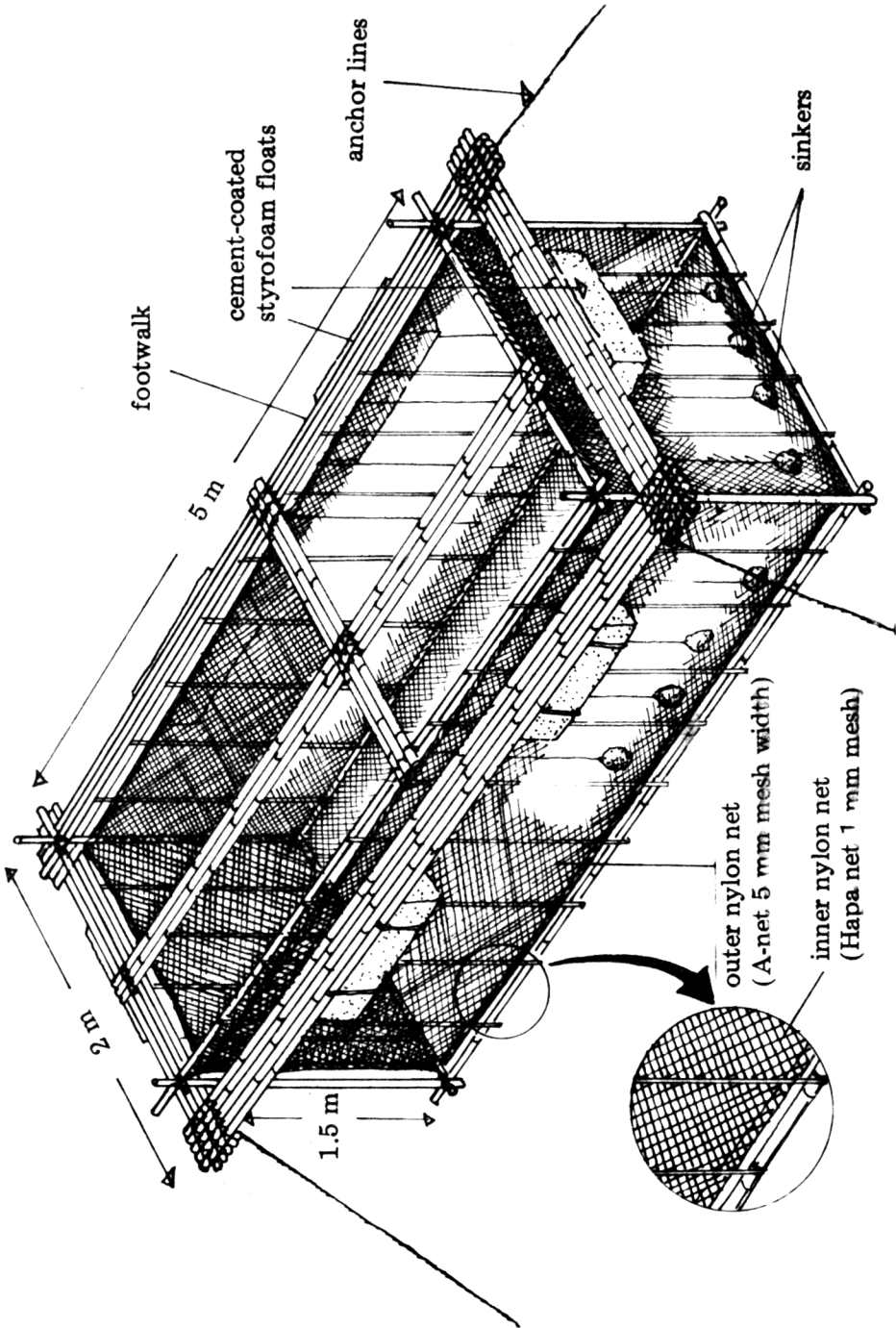


Fig 2. Full view of a floating nursery cage with bamboo cage frame, floats and netting materials.

To construct a 10-ton floating nursery cage and its accessories, you need to prepare the following:

1. *Cage Frame*

Construct a 2 x 5 x 1.5 meter cage frame using bamboo poles for the framework and bamboo slats for the 4 sides.

Each nursery cage will need 5 pieces of bamboo poles installed around the top portion of the frame to serve as foot-walk.

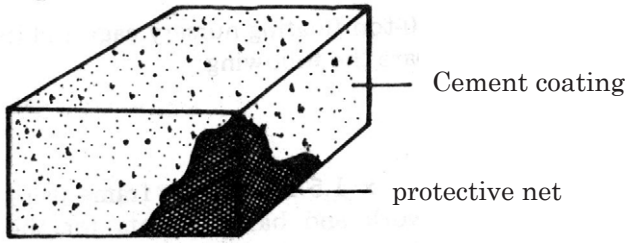
2. *Floats*

Various kinds of floating materials can be used to float the cage: cement-coated styrofoam sheets, marine plywood box, empty oil drum (200 liters), and empty plastic container (Fig. 3). Among these, the styrofoam float coated with cement has been tested to be the most effective.

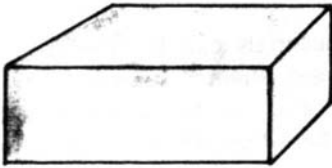
Here is how to prepare a cement-coated styrofoam float:

- a. Cut a styrofoam sheet measuring 0.9 x 1.8 x 0.1 m equally into four parts with each part measuring 0.45 x 0.9 x 0.1 m
- b. Glue the cut styrofoam sheets by placing a surgical gauze moistened with gasoline between each sheet to form a float now measuring 0.45 x 0.9 x 0.4 m.
- c. Wrap the float with a nylon netting material (10 mm mesh width). Sew the net on all sides using pamo twine No. 210/90.
- d. Coat the styrofoam block with cement mix (1 part cement: 2 parts sand) and allow to dry for 3 days.

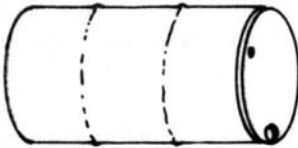
Four floats are needed for a 10-ton floating cage.



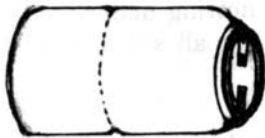
Cement-coated styrofoam float



Marine plywood box



Empty oil drum (200 l)



Empty plastic container

Fig. 3. Kinds of float for a floating nursery cage.

3. Netting Materials

Prepare nylon nets (inner and outer) each measuring 2 x 5 x 1.5 m. Sew all sides of each net together to form an inverted mosquito net (Fig. 4). The nets can be sewn either by machine or by hand.

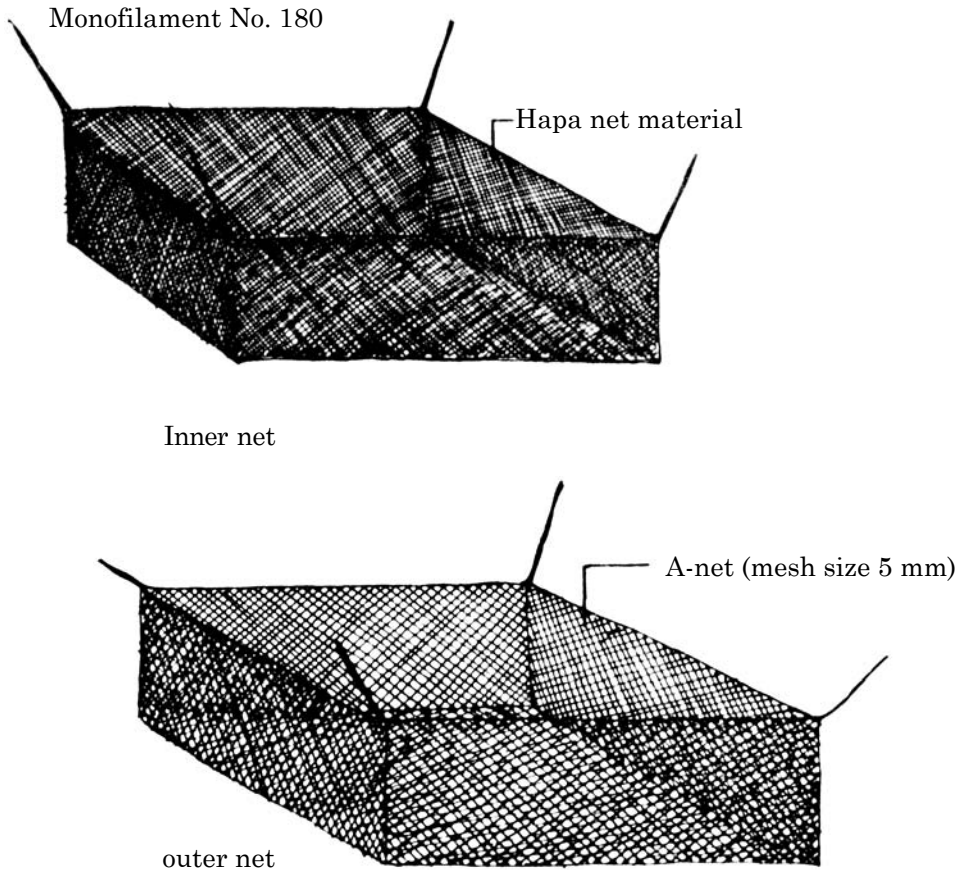


Fig. 4. Inner and outer nylon nets.

4. Feeding Nets

At least six feeding nets are needed for a 10-ton floating cage. To construct a feeding net, use G.I. wire No. 5 and form a rectangular frame 1.5 x 0.6 m. Sew a nylon netting material (1 mm mesh size) around the edges of the G.I. frame, constantly stretching out the net to keep it firm (Fig. 5).

Tie the 2 upper corners of the feeding frame suspended vertically using monofilament measuring 1.5 meters long to suspend them vertically from the upper bamboo frame of the cage during feeding.

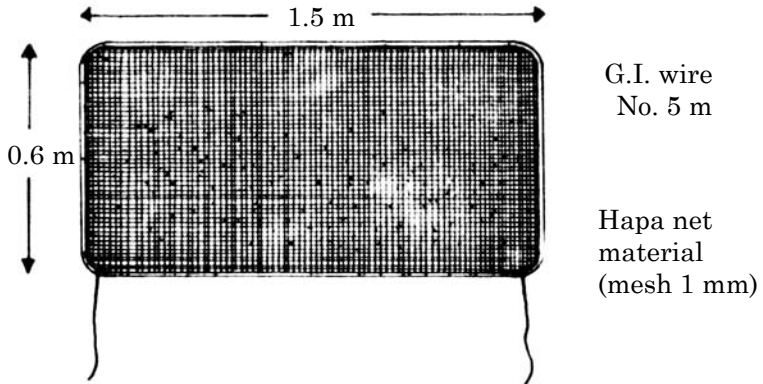


Fig. 5. Details of a feeding net

5. Stone Sinkers

Each stone sinker should weigh approximately 1 kg (with one piece of stone or several smaller pieces of stones). Wrap big stones individually and small stones together with a nylon net. Tie each sinker with a monofilament 1.5 m (Fig. 6a). Secure the sinkers to the upper bamboo frame and suspend them inside to prevent net folds (Fig. 6b).

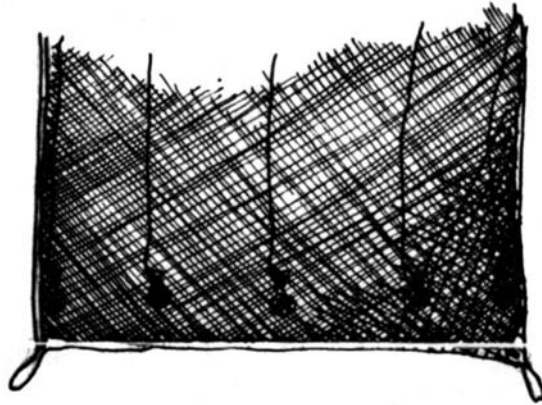


Fig. 6a Side view of the cage showing stone sinkers suspended from the upper bamboo cage frame

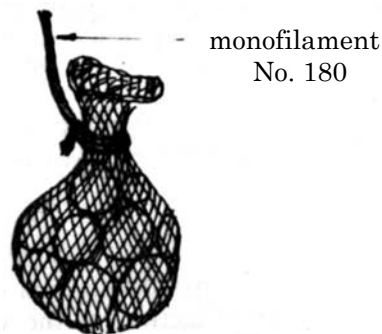


Fig. 6b. Details of a stone sinker

INSTALLATION OF FLOATING NURSERY CAGES

Install the floating nursery cages in the selected site. The cages should not touch the sea bottom even during extreme low tide. Allow at least one meter distance from the sea bottom (Fig. 7). Installed this way, the cages can sway with the waves; otherwise, they may be damaged.

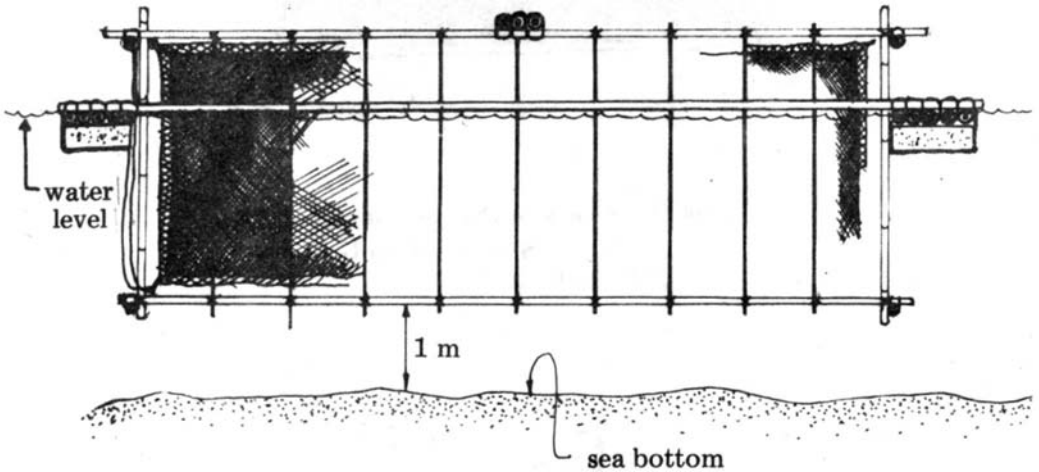


Fig. 7. Bottom net material of floating cage during low tide at least one (1) meter above the sea bottom.

Arrange the cages parallel to each other in alternate positions and facing the direction of the water current to allow efficient water exchange (Fig. 8). Allow a safe distance of at least 2-5 meters between the cages to prevent collision.

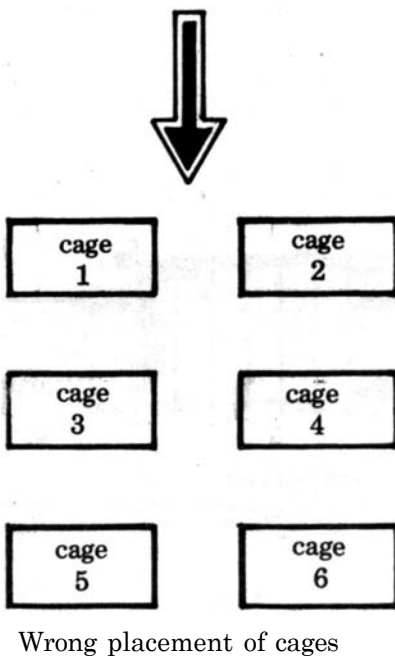
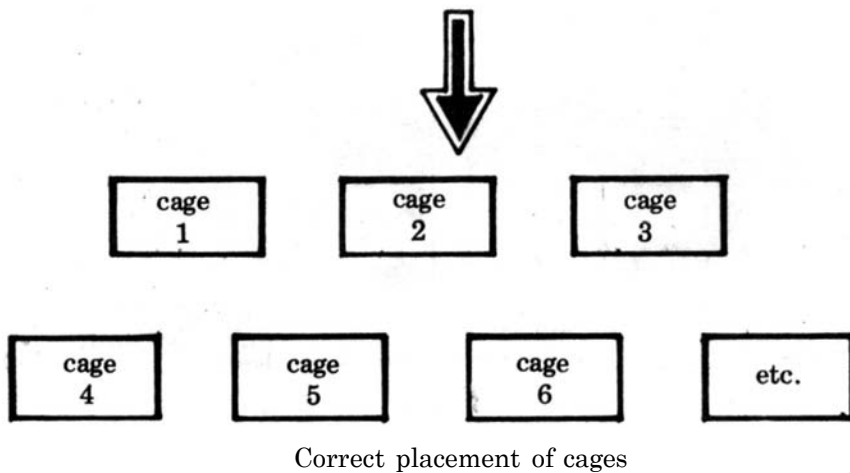


Fig. 8. Placement of cages facing water current direction.

Provide cages with anchors to prevent collision (Fig. 9).
Each anchor weighs about 50 kgs.

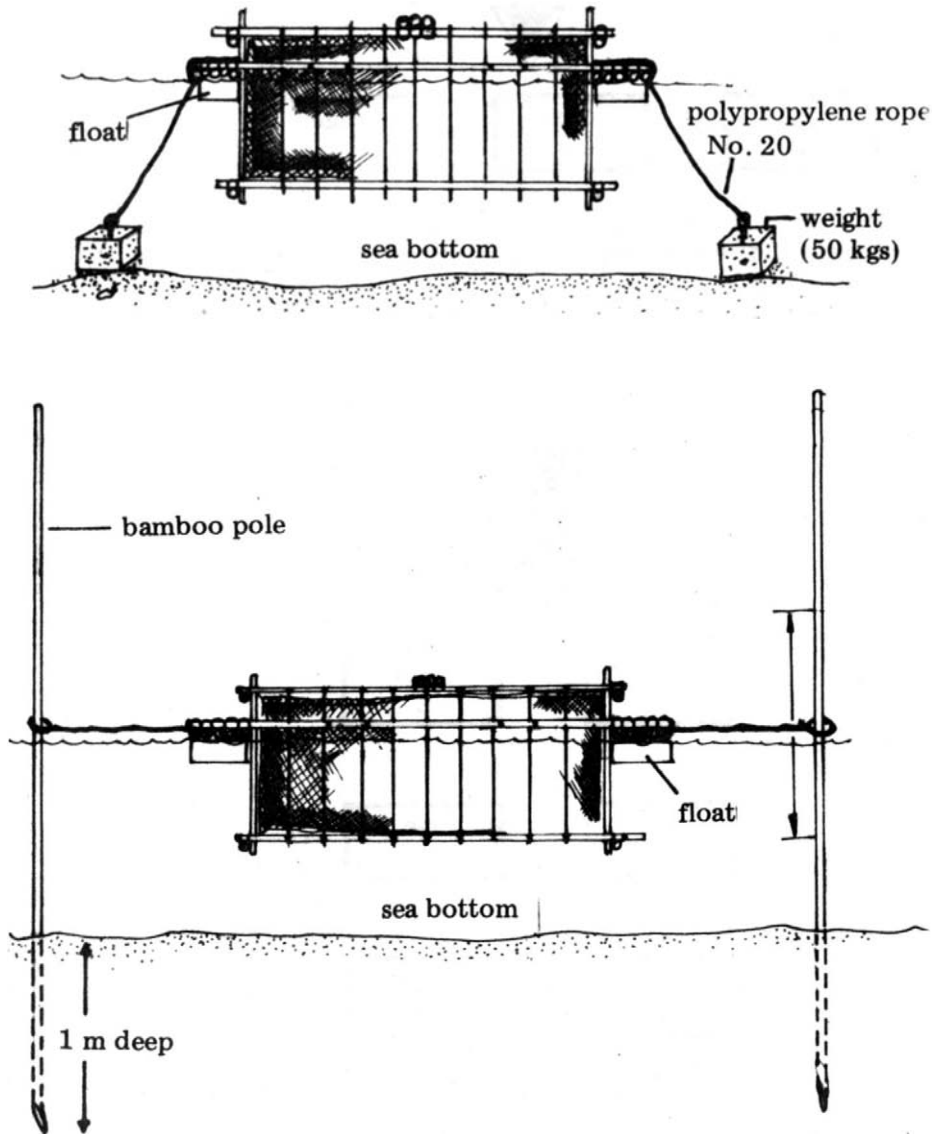


Fig. 9. Two methods of anchoring

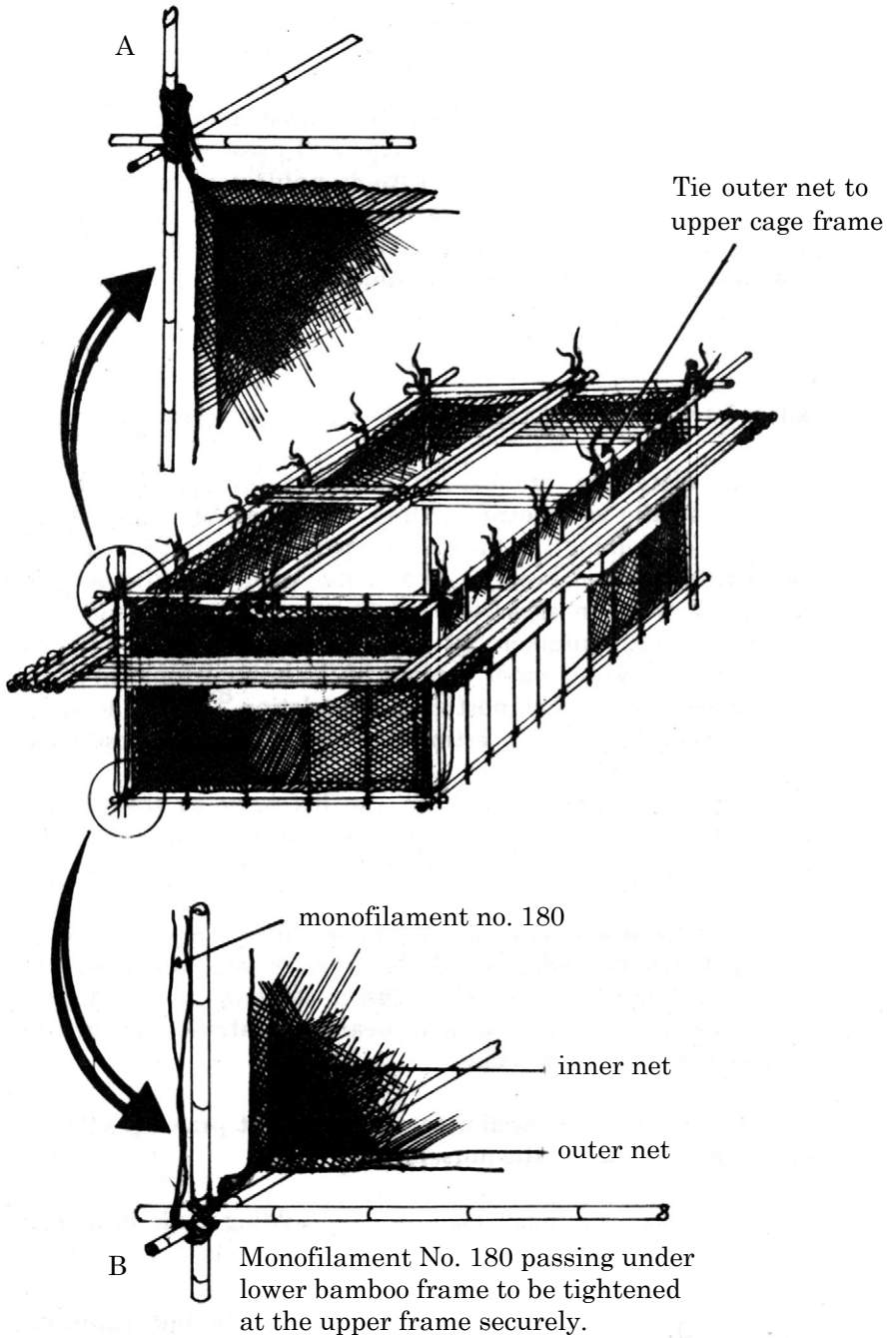


Fig. 10. Tie the nylon nets at the upper (A) and lower (B) portions.

Tie the outer and inner nets securely to the cage frame to maintain their rectangular shape and prevent the nets from folding. Secure the outer net with monofilament running down the lower cage frame and tie to the upper cage frame at one meter intervals as shown in Fig. 10. Repeat the procedure for the inner net and suspend stone sinkers.

STOCKING AND TRANSFER OF POSTLARVAE

Estimate the number of postlarvae (PL₈-PL₁₀) to be stocked by the volumetric method. Stir the water in the holding tank containing the harvested postlarvae from the hatchery to distribute them evenly. Scoop five random 1-liter samples and place them in separate containers. Count the number of postlarvae per container. Multiply the average count of these five samples by the water volume of the holding tank (in liters) to estimate the total postlarval population. Fig. 11 shows the 3 steps involved in estimating the number of postlarvae.

Stock the postlarvae from the hatchery to the nursery gradually to minimize stress due to sudden change in water salinity and temperature.

If there is a wide difference in salinity between the water in the hatchery and that of the nursery site, acclimate the postlarvae right at its source. Direct stocking can be done if the nursery cages are located near the hatchery where the seawater salinity is the same.

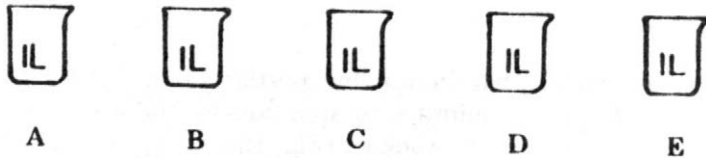
Here is how to acclimate and transport prawn postlarvae from the hatchery to the nursery.

- a. Place the postlarvae into a holding tank or plastic basin;
- b. Aerate or stir the water constantly but carefully;

GIVEN: Tank Y = 1,000 liters



PROCEDURE: Using 1-liter beaker get 5 samples



FORMULA:

$$\text{Larval Population (tank Y)} = \left(\frac{\text{larval count in A + B + C + D + E}}{5} \right) 1,000$$

Fig. 11. Estimating the number of postlarvae.

- c. Gradually add freshwater or seawater, as the case may be, every 10 minutes until the desired water salinity of the nursery site is attained.
- d. Transport the postlarvae using plastic bags.

Pack the postlarvae (PL_8 - PL_{10}) at 20,000-30,000 per plastic bag containing 4-6 liters of seawater. Add oxygen at about the same volume. Pandan bags or styrofoam boxes may be used as containers and protection for the plastic bags. Transport the postlarvae from the hatchery to the site either early in the morning or late in the afternoon to protect the fry from getting stressed due to high temperature.

The plastic bag containing postlarvae should be allowed to float for a few minutes to approximate the water temperature in the cage before stocking (Fig. 12).

Stock from 5,000 to 10,000 postlarvae (PL_8 - PL_{10}) per cubic meter in the cage already provided with feed. The density should be thinned out to around 3,000 to 4,000 per cubic meter when the postlarvae become PL_{20} - PL_{25} to reduce mortality due to overcrowding. This is done by transferring the postlarvae to other prepared nursery cages. When the inner net of the cage accumulates dirt, and water exchange becomes inefficient, the whole population of postlarvae should be transferred to another cage.

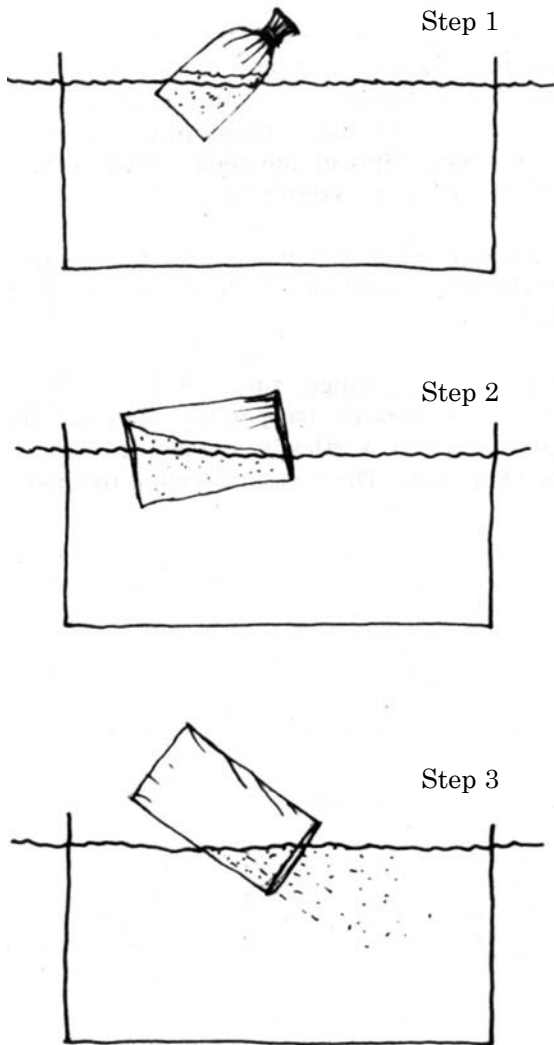


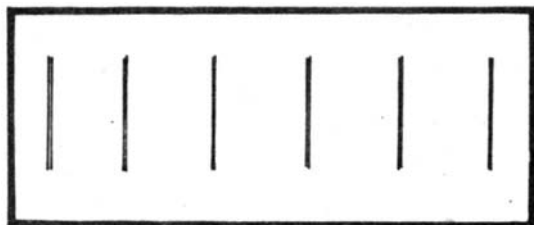
Fig. 12. Releasing postlarvae into the nursery cage

FEEDS AND FEEDING

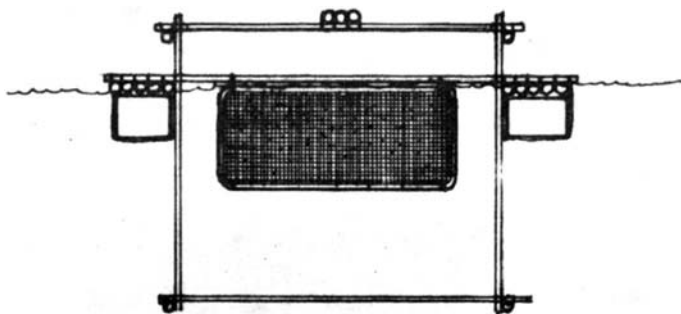
Feed the postlarvae every other day preferably in the morning with raw finely ground fish and mussel meat at about 1 kg per 50,000-75,000 population. Add more feed as the postlarvae grow and increase their consumption indicated by the absence of left-overs. Spread the feed evenly using your fingers, a spoon or a spatula in feeding nets.

At PL₁₅ or older, when the postlarvae start to become benthic (bottom dwelling), part of the feed (about 10%-20%) can be broadcast.

For efficient water exchange, suspend the feeding nets which also serve as substrates (suspended materials which provide more attachments) vertically parallel to the water current direction (Fig. 13). The postlarvae cling to these nets to feed.



Top view of feeding nets
inside the floating cage



Side view of feeding net

Fig. 13. Top and side view of feeding nets.

HARVESTING

Harvest after 2-3 weeks when the postlarvae become PL_{22} PL_{31} . Steps in harvesting postlarvae are shown in Fig. 14. (a) Remove sinkers and feeding nets; (b) untie the inner net; (c) concentrate the postlarvae at one end of the net; and (d) scoop and place them in basins using a scoop net (Fig. 15).

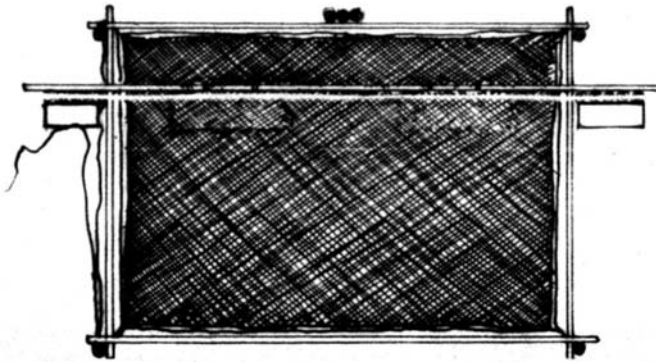


Fig. 14a

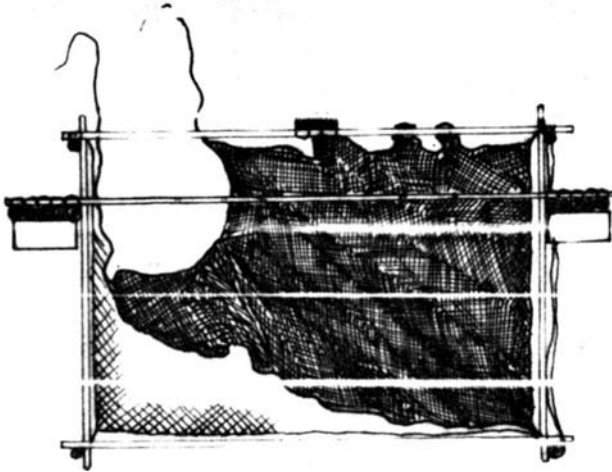


Fig. 14b

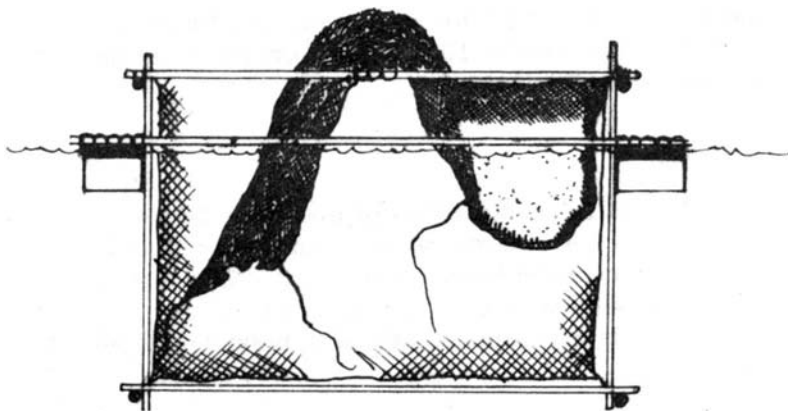


Fig. 14c

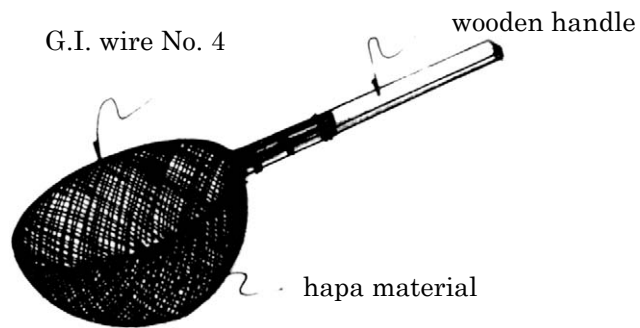


Fig. 15. Details of a scoop net.

Count and pack the postlarvae for disposal. Packing and transport are done similarly as in PL₈-PL₁₀, but reduce only the density to 2,000 for long distance transport (4-6 hours travel time) and up to 10,000 for short distance transport (less than one hour travel time).

A floating working area or house can be set conveniently adjacent to the floating cages. Counting and packing of postlarvae can be done here. Although it is optional, the floating house can serve as a working area, a guard house, and a storage for materials and supplies like nets, basins, pails, etc. (Fig. 16 and 17).

The size of the floating house depends on the capacity of the nursery cages. It should accommodate the activities of counting and packing postlarvae harvested from one cage.

FRY SURVIVAL

By adopting this culture system, one can be assured of survival of postlarvae as high as 90% or better. The average survival of 60% for the whole year is quite reasonable. These survival rates were based on 18 production runs conducted from March to November in 1983 and 1984 during new moon and full moon at the SEAFDEC AQD Batan Research Substation in Aklan, Panay Island.

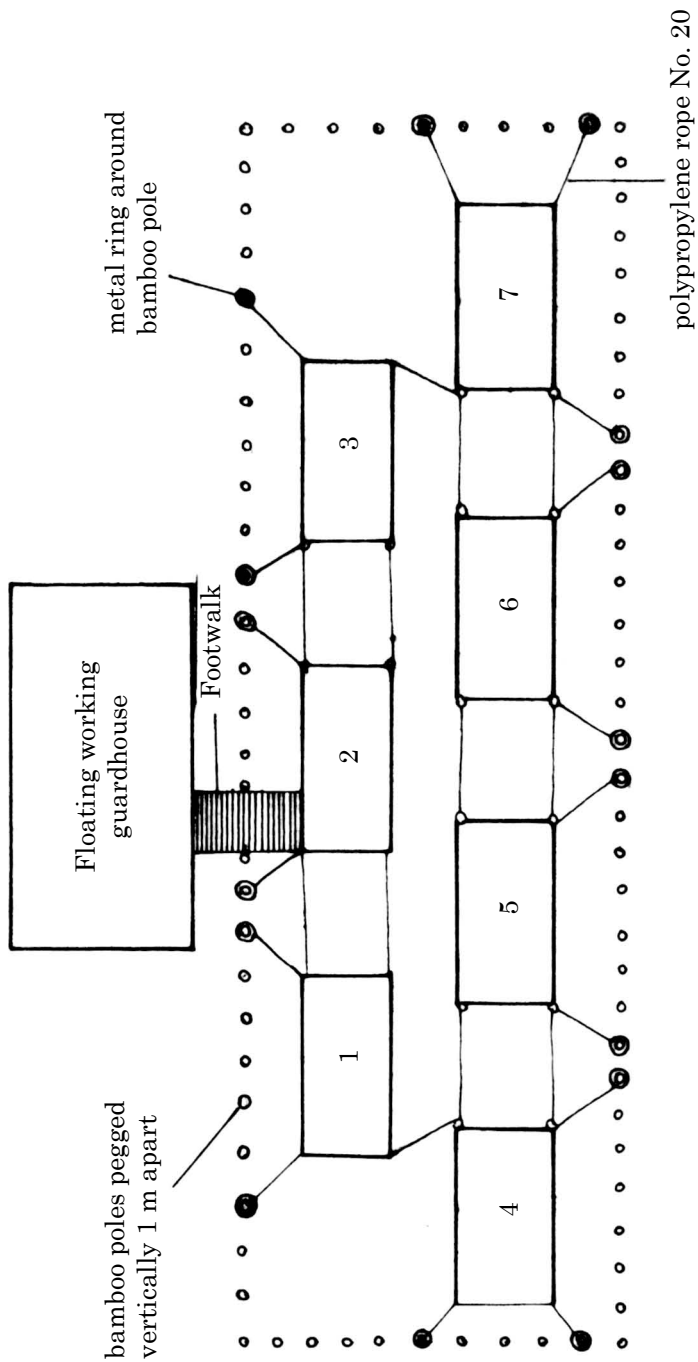


Fig. 16. Top view of floating cages with a floating working house.

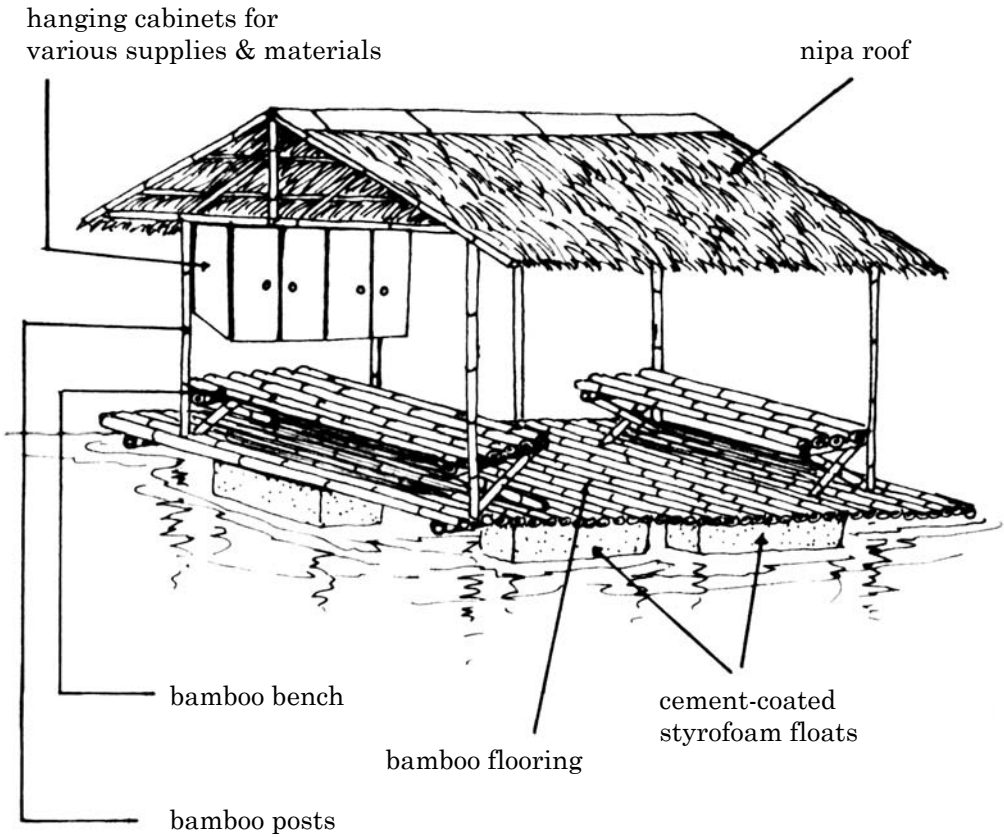


Fig. 17. Parts of a floating working and guardhouse.

CARE OF THE NETS

The net cages are normally changed twice every 30 days or less depending on the degree of siltation or clogging.

After harvesting, remove and clean the inner nets by following this procedure:

1. soak nets in freshwater for at least 2 days;
2. remove dirt and fouling organisms, like oyster spats from the nets using a nylon brush;
3. dry the nets under the sun; and
4. repair nets with holes by patching them with the same net material.

ECONOMICS

Presented below are estimates of costs and returns for a prawn floating cage nursery project scaled according to operational sizes of 2 cages. One can easily adjust the cost and return estimates for 4 cages and 8 cages. The comparative analysis provides prospective investors enough financial information necessary for deciding on the size of floating nursery operation. Technical estimates were based on 18 production runs conducted at the SEAFDEC AQD Batan Research Substation from March to November in 1983 and 1984 while financial elements were provided by the Aquaculture Economics Discipline of SEAFDEC AQD.

Table 1. Inventory of Physical Facilities and Schedule of Depreciation

<u>Item</u>	<u>Price/Unit</u>	<u>Economic Life</u>	<u>Total Cost</u>	<u>Salvage Value</u>	<u>Annual Depreciation</u>
A. Floating Cages	P 3,900.00	2 yrs	7,800.00	P2,400.00	P2,700.00
Bamboo poles	1,000.00	2 yrs	(2,000.00)		(1,000.00)
Labor	300,00	2 yrs	(600.00)		(300.00)
Nets (inner & outer)	400.00	2 yrs	(800.00)		(400.00)
Polypropylene ropes	200.00	2 yrs	(400.00)		(200.00)
Buoys	2,000.00	5 yrs	(4,000.00)		(800.00)
B. Bamboo quadrangle	5,000.00	2 yrs	5,000.00		2,500.00
C. Caretaker's hut	8,000.00	5 yrs	8,000.00	800.00	1,440.00
D. Floating house	10,000.00	5 yrs			
E. Banca	3,000.00	5 yrs	3,000.00	300.00	540.00
F. Miscellaneous		5 yrs	5,000.00		1,000.00
<u>Total</u>			<u>P28,800.00</u>	<u>P3,500.00</u>	<u>P8,180.00</u>

Note: Multiply the figures indicated for a 2-cage operation according to the number of cages you want to operate.

Table 2. Prawn Floating Cage Nursery and Returns Per Run of 12 Days

	Quantity/Cage	Price/Unit	2-Cage Operation Total Value
<i>Variable Costs</i>			
1. Fry PLs	75,000 ind.	P0.10	P15,000.00
2. Feeds (trash fish)	6 kg	30.00	360.00
3. Marketing			630.00
4. Sales Tax			315.00
5. Miscellaneous			815.00
<i>Fixed Costs</i>			
1. Labor	1 aide	1,000/mo	500.00
2. Repair & Maintenance			90.00
3. Depreciation			511.00
4. Interest			400.00
<i>Total Costs</i>			P18,621.00
<i>Revenues</i>	45,000 ind. (P ₂₀)	0.35	31,500.00
<i>Net Income Per Run</i>			
<i>Before Income Tax</i>			12,879.00
<i>Annual Net Income</i>			
<i>Before Income Tax</i>			206,064.00
<i>Income Tax</i>			62,122.00
<i>Annual Net Income</i>			143,942.00

Note: Multiply the figures indicated for a 2-cage operation according to the number of cages you want to operate.

Table 3. Investment Requirement

	<u>2-Cage Operation</u>
Fixed investment	P28,800.00
Working Capital	35,240.00
Total	<u>P64,040.00</u>

Table 4. Financial Indicators

	<u>2-Cage Operation</u>
A. Annual Net Income After Tax	P143,942.00
B. Payback Period	5 months
C. Return on Investment	225%

List 1. Technical and Financial Assumptions Used:

1. Survival rate from PL₈ to PL₂₀ is 60%.
2. Feeding per cage is at a rate of 1kg for every two days.
3. There are eight operational months per year and two operational runs per month.
4. Marketing cost is 2% of gross income.
5. Sales tax is 1% of gross income.
6. Miscellaneous cost is 5% of variable costs.
7. Labor is paid the minimum wage for plantation worker of P33.00 per day.
8. Repair and maintenance is 5% of fixed investments.
9. Interest is 25% per annum.
10. Investment requirement is 60% loaned and 40% owner's equity.
11. Working capital is total variable cost plus labor cost for one month of operation.
12. Prices indicated are as of April 1985.

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AUTHORS' ACKNOWLEDGEMENTS

The authors are grateful to Dr. Alfredo C. Santiago, Jr., Chief of the SEAFDEC Aquaculture Department, for supporting the research project on floating cage nursery on which this extension module is based; to Engr. Pastor L. Torres, Jr., Director for Training and Extension, and Dr. Rolando R. Platon, Director for Research, for their encouragement and support in the preparation of this publication; to Ms. Roela V. Rivera, for assisting the authors organize and edit the materials; and to Dr. Hiralal Chaudhuri for valuable comments on the manuscript.

Special thanks are also due to Mr. Renato F. Agbayani, Officer-in-Charge of Batan Research Substation, Mr. Danilo F. Israel, and the Aquaculture Economics Section for preparing the economic analysis of the culture system described in this publication.

The authors also wish to thank Mr. Romeo C. Mesa, Head of Igang Research Substation; Messrs. Porfirio G. Gabasa, Jr., Edgardo Reyes, and Einstein Laviña and the Crustacean Project Staff of Batan Substation for assistance and support in various ways; and the production staffs of AQD Information Services Office and Audio-Visual Production Unit.

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