AQUACULTURE EXTENSION MANUAL NO. 30 APRIL 2000

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Foreword

Since the start of AQD's Technology Verification Program in 1996, several extension manuals based on field tests of various aquaculture technologies have been published. This manual is no exception.

The technical and financial viability of this undertaking has been verified and demonstrated in San Julian Dam, Tapaz, Capiz, Panay Island, central Philippines.

Net cage culture of tilapia in dams and small farm reservoirs has been found to be a low-cost yet high-income earning farm activity and offers an excellent option as an alternative livelihood for poor inland fisherfolks.

With proper regulation by concerned local government units and with proper training on selective breeding and broodstock management, this project will prove to be sustainable and environment-friendly.

We hope this manual would be useful to fishfarmers, particularly to those in areas which are land-locked, extensionists and students of aquaculture not only in the Philippines but in other tropical areas in Southeast Asia, Africa and Latin America.

ROLANDO R. PLATON, Ph.D.
Chief, SEAFDEC Aquaculture Department

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Net cage culture of tilapia in dams and small farm reservoirs

Introduction

Tilapia, *Oreochromis spp*, production in freshwater ponds, pens and net cages has been gaining popularity in the Philippines. This popularity is partly due to growing market acceptability in the various regions of the country. Tilapia's tolerance to a wide range of environmental factors is another reason for its ease in culture. This makes the fish a potential source of cheap protein and supplemental income.

The refinement of tilapia culture technology in the Philippines has contributed to an increase in production by more than 75%. Since the 70s and 80s, tilapia research at AQD focused on genetics and in finding ways to make tilapia farming environment-friendly. Fish cages should not occupy more than ten percent of the water body area of lakes, dams and reservoirs to prevent eutrophication.

Simple selective breeding methods have been verified on-farm. Techniques for the culture of all-male tilapia have been adopted in small farm water impoundments. These techniques have been adopted for the benefit of small-scale farms, non-government organizations, and local government units.

Growing tilapia in cages is a way of gaining experience before undertaking a large scale enterprise, as in ponds. The advantages of cage culture are: 1) many of our freshwater bodies such as rivers, streams, and man-made lakes and reservoirs can be used for tilapia cage culture, and 2) tilapia culture requires a relatively small investment. Due to the increasing demand for viable fry or fingerlings for stocking, breeding techniques including hybridization as well as genetic improvement have been established resulting to an increased production yield and better survival.

Characteristics of a suitable site

Reservoirs with an area of about 5,000 to 20,000 m² and a minimum water depth of 2-3 meters even during the dry season, can be used for tilapia culture in net cages. A nearby spring is preferred as its direct source of freshwater. Cheap labor and materials must be readily available from surrounding communities. The site must be easily accessible to vehicles and must be secure from poachers.

Design of the net cages

THE FLOATING CAGE. A single floating module usually consists of 6 net cages.

The following factors should be considered in constructing a floating net cage module.

Dimension. Each of the six (6) cages measures 5m x 5m x 3m. Since the water depth in the impoundment may vary from time to time, the cage bottom must have a clearance of at least one (1) m from the bottom of the reservoir.

Frames. Each net cage must be supported by a frame made of bamboo poles with an inner dimension of 5m x 5m x 3m (Fig. 1. A). It should be so constructed to withstand stress caused by waves and the increase in weight during the culture operation. A vertical beam made of bamboo poles or strong wood with chain rings at the far end is provided as attachment for rigging the net cage.

Floats. Strategic corners of the net cage frame are fitted underneath with plastic drums (0.6m dia x 1m depth) that serve as floats (Fig. 1. B). A total of at least ten (10) drums is sufficient to keep the module afloat. Other materials that can be used as floats are closed empty plastic containers and styrofoam.

Cage netting. The following types of nets with their respective mesh sizes are used in constructing cages: 1) “B” net (0.5-1 cm mesh size), 2) “CC” net (1-1.5 cm mesh size), and 3) “DD” net (1.5-2 cm mesh size). The type of net to be used depends on the size of the tilapia to be stocked. It is fabricated as an inverted mosquito net to prevent the stock from escaping. Each net cage is reinforced with a polyrope that is inserted along the sewn borders of the net and held in place by a clove hitch with overhand knot. An eye splice is provided at each end corner for attachment when rigging the net cage.

Anchors. To hold the floating cage module in place, the four strategic corners are anchored to the bottom of the reservoir by concrete blocks weighing 1-2 tons each. Equivalent weights like boulders may also be used. The other end of the rope can be pegged to the bottom. Generally, the weight of the anchor should be two times the weight of the entire floating cage module.

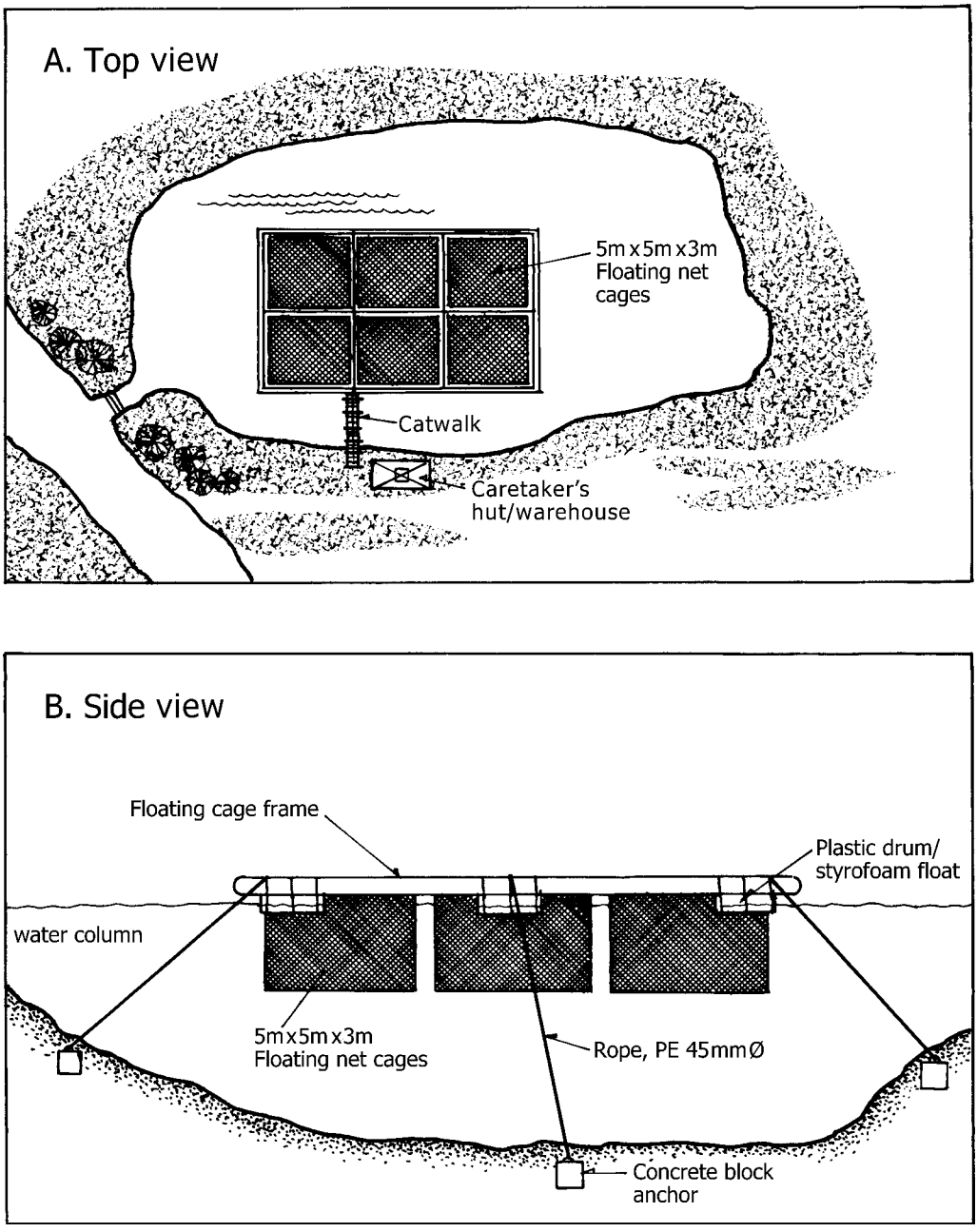


Fig. 1. Schematic drawing of a floating net cage module

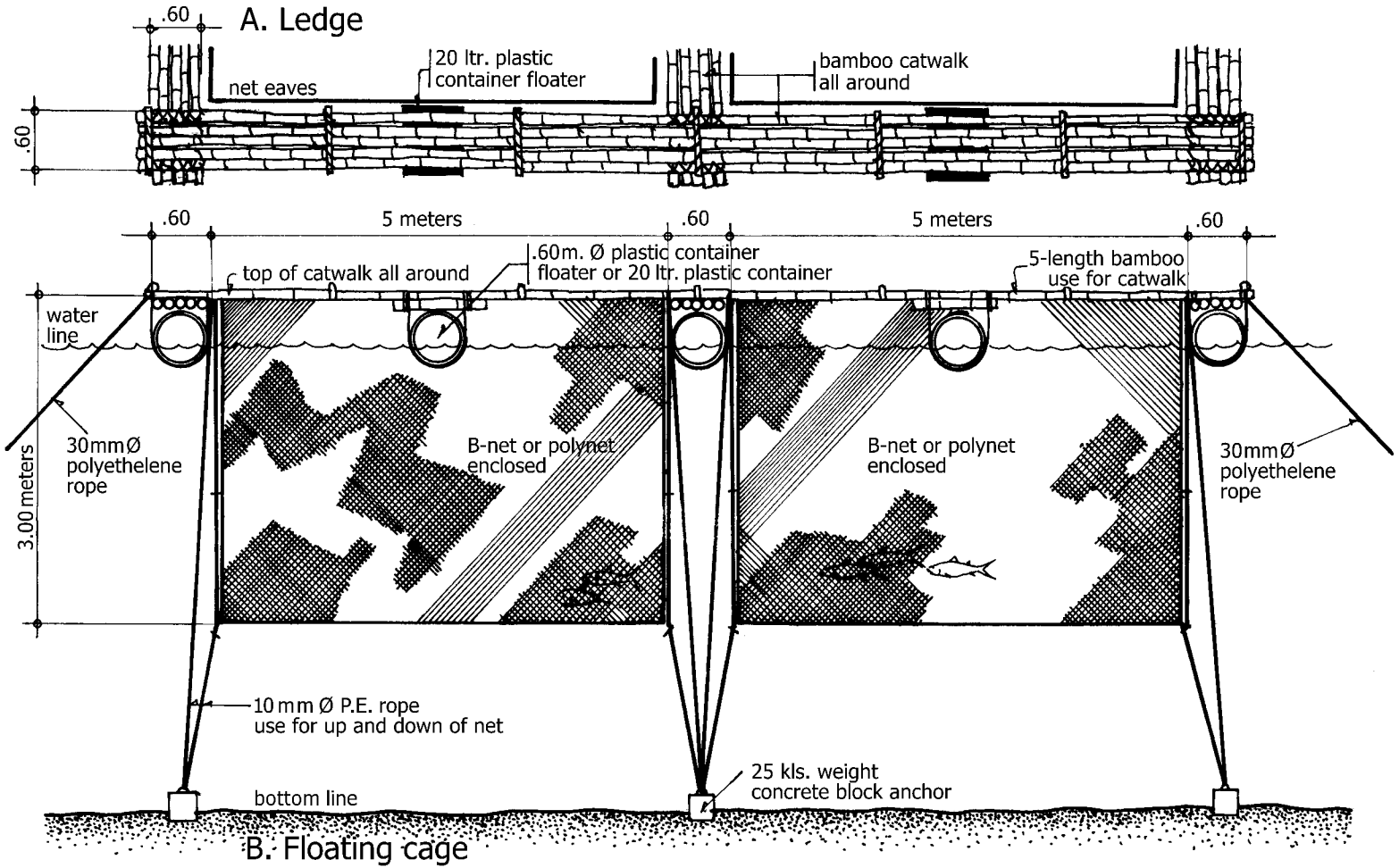


Fig. 2. Details of a floating net cage module

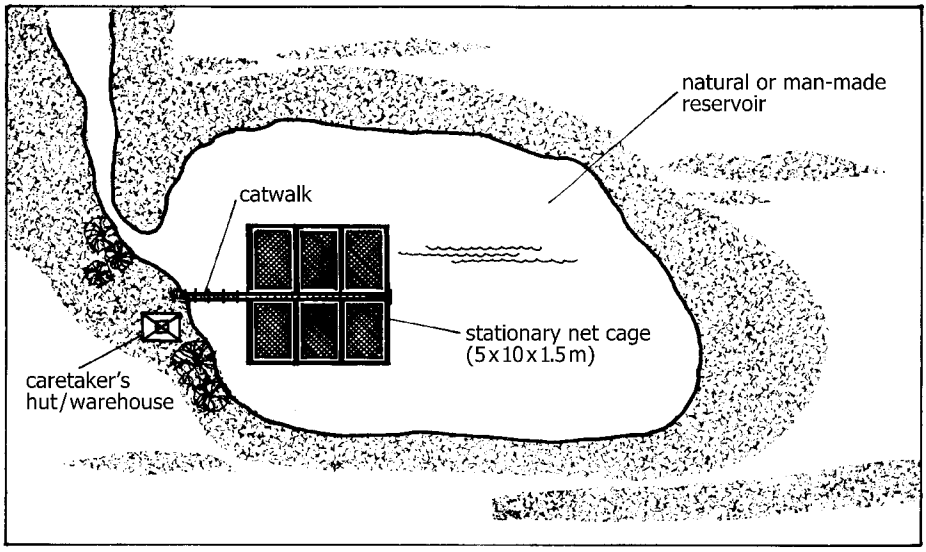
THE STATIONARY/FIXED NET CAGE. Like the floating net cage, a stationary net cage module also has six compartments.

Dimension. The six (6) units of rectangular net cages each measure 5m x 10m x 1.5m.

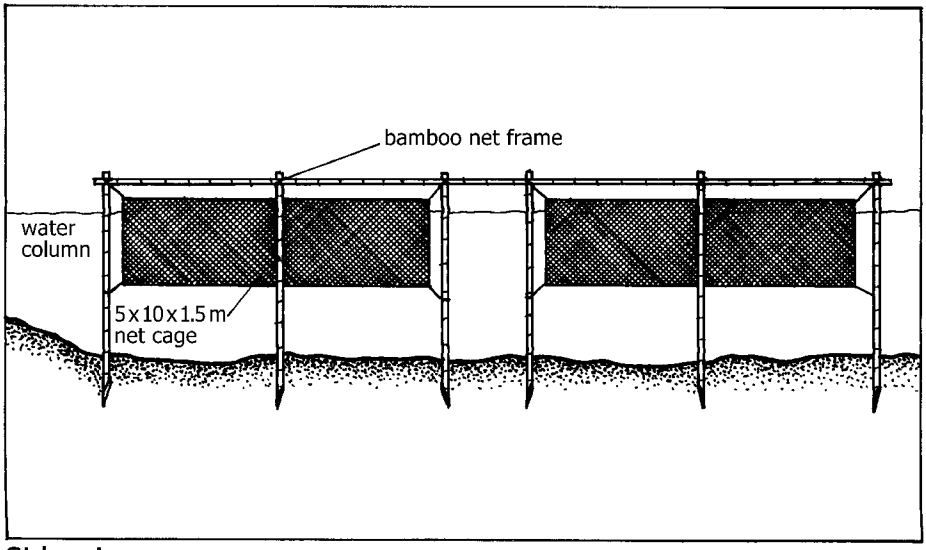
Cage netting. The nets used for the stationary net cages are the same as in the floating net cages. They are the "B" net (0.5-1 cm mesh size), the "CC" net (1-1.5 cm mesh size), and the "DD" net (1.5-2 cm mesh size). The size of the tilapia to be stocked determines the net that will be used. It is fabricated as an inverted mosquito net to prevent the stock from escaping. A polyrope that is inserted into the sewn borders supports the net cage. It is provided with eye-splice at each end corner for attachment when rigging the net cage. The upper part of the net cage must have a clearance of at least 25 cm above the water surface while the lower portion must be at least 1-2 m from the bottom.

Frames. The cages are mounted on fixed bamboo frames whose posts are staked one (1) meter deep into the substrate. The upper ends are braced with bamboo poles.

Fig. 3. The stationary/fixed net cage module



Top view



Side view

Fig. 4. Schematic drawing of a stationary/fixed net cage module

Stocking the net cages

Source of juveniles. As much as possible, certified all male tilapia fingerlings from accredited hatcheries or genetically improved tilapia should be stocked in cages. Thus, it is recommended that breeding should be made a component of the project to make the tilapia cage culture a sustainable operation. Breeding and nursery cages may be established to supply the fry requirements all year round. Furthermore, genetically improved breeders are already available from accredited private hatcheries and fishery research institutions. Good quality breeders can each produce about 300-500 fry. With proper training on selective breeding and broodstock management, the production of an adequate supply of quality seeds for a tilapia cage culture operation can be achieved and sustained.

Fig. 5. Proper training on selective breeding and broodstock management ensures steady supply of quality seeds for tilapia cage farming

Stocking rate. Stock 50-75 fingerlings per cubic meter of water in a floating or stationary net cage.

Stocking time. Stock fingerlings early in the morning or late in the afternoon when the water temperature is low. This will allow the fingerlings more time to adjust to the increasing temperature during the day.

Acclimation. Newly arrived fingerlings should be acclimated to the water temperature in the cage by allowing the plastic transport bags

containing the fingerlings to float on the water of the cages for about 30 minutes. Water from the cage is then gradually added into the plastic bags until the temperature of the water in the bag is the same as the temperature of the cage water. Then the fingerlings are released gently into the cage water by tilting the bag opening to allow the fingerlings to swim out freely.

Management of the cages

Fig. 6. Feeding is done twice a day by broadcasting

Feeds and feeding. Various brands of commercial feeds for tilapia ranging from starter to finisher are now available in the market. These are either the sinking or the floating type. The fish are fed twice daily at three to five percent (3-5%) of the body weight. The daily ration is divided into two, half is given in the morning and the other half is given in the afternoon. Feeding is done manually by broadcasting.

Monitoring activities. Physico-chemical parameters of the water such as pH, dissolved oxygen (DO), temperature, and transparency should be monitored once in the morning and once in the afternoon at least twice a week. Transparency is measured with a secchi disc.

The condition of the cages should be inspected regularly. Fouling organisms should be removed by brushing the sides of the cages. Damaged frames, floaters, and torn nets should be repaired or replaced immediately. Guarding the cages at night will discourage poaching.

Harvesting

Tilapia may be harvested as soon as they obtain the marketable size of about 200 g. The stock are either partially or totally harvested depending on the market demand.

Fig. 7. Partial harvest may be done by scooping the desired fish sizes

Partial harvest. Harvest is normally done at the end of the culture period. However, it is common to have fish of varying sizes towards the end of the culture period. If this happens, partial harvest of the stock is done by taking only the fish of the desired sizes. This is done by lifting the cage nets and scooping the fish. The small fish are left in the cage to grow further to marketable size.

Total harvest. When an average body weight of at least 200 g is obtained, the fish are totally harvested by lifting the net cage. The harvested fish are placed in styrofoam boxes with crushed ice ready for transport to the market.

Fig. 8. When the fish reaches an average body weight of 200 grams, it can be harvested

Profitability analysis of net cage culture of hybrid tilapia in San Julian Dam, Tapaz, Capiz

A. TECHNICAL INFORMATION

Size of cage	:	5m x 5m x 3m
Number of cages	:	14 units (one for breeders, 13 for grow-out)
Culture period	:	145 days
Stocking density	:	1750 fry/cage
Croppings/year	:	2
Survival rate	:	98%
Average body weight	:	195 g
Yield/cage/crop	:	335 kg
FCR	:	1.33
Selling price	:	P50.00/kg (ex-farm)

B. INVESTMENT REQUIREMENT

	Unit	Price	Amount
Bamboo poles, big sizes	300 pcs	P 30.00	P 9,000.00
Nylon nets	14 rolls	P 1,500.00	21,000.00
Mononylon twine for tying #120	15 kgs	P 150.00	2,250.00
Evelon cord, #9 (4.5 mm)	2 rolls	200.00	400.00
Anchors and big ropes	4 units	500.00	2,000.00
Caretaker's hut	1 unit	—	5,000.00
Labor for cage frame, hut, & nets	—	—	9,800.00
Wages of caretaker/feeder	7 months	4,000.00	28,000.00
Fry	22,750 pcs	0.75	17,063.00
Feeds	5,793 kgs	15.00	86,895.00
Total investment requirement			**P 181,408.00**

C. OPERATING COST	per crop	annual
Fry	P 17,063.00	P 34,126.00
Feeds	86,895.00	173,790.00
Wages of feeder/caretaker	24,000.00	48,000.00
Depreciation of cages & hut	12,363.00	24,725.00
Transportation	2,500.00	5,000.00
Repairs/maintenance	2,000.00	4,000.00
Total operating cost	**P 144,821.00**	**P 289,641.00**
D. REVENUE	**P 217,750.00**	**P 435,500.00**
E. NET PROFIT	**72,929.00**	**P 145,859.00**
F. RETURN ON INVESTMENT		**80 %**
G. PAYBACK PERIOD		**1-2 years**

References

Eguia, RV, MRR Eguia and ZU Basiao. 1996. Simpleng gabay sa pagtitilapia. Pagpapalaki ng Tilapia. Aquaculture Extension Manual No. 22. SEAFDEC AQD, Iloilo City, Philippines.

Aypa, SM. 1996. Review of Philippine freshwater aquaculture systems (with focus on sustainability). In: Seminar on Fish Conservation on the occasion of the 10th Annual Meeting of the Society of Aquaculture Engineers of the Philippines (SAEP), Quezon City, MM, Philippines. 19 pages.

Guerero, RD III. 1991. Farming Tilapia in the Philippines. Infofish International (Nov-Dec): 40-42.

PCAMRD. 1990. Brackishwater pond culture of tilapia in the Philippines. Fisheries Technology Manual Series No.5. Los Baños, Laguna, Philippines.

PCAMRD. 1991. Seacage farming of tilapia in the Philippines. Fisheries Technology Manual Series No.9. Los Baños, Laguna, Philippines.

DD Baliao, MA de los Santos, NM Franco, NRS Jamon. 2000. Grouper culture in floating net cages. Aquaculture Extension Manual No. 29. SEAFDEC AQD, Iloilo City, Philippines.

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The Authors

About SEAFDEC

The Southeast Asian Fisheries Development Center (SEAFDEC) is a regional treaty organization established in December 1967 to promote fisheries development in the region. Its Member Countries are Japan, Malaysia, the Philippines, Singapore, Thailand, Brunei Darussalam, the Socialist Republic of Viet Nam, and Myanmar.

Representing the Member Countries is the Council of Directors, the policy-making body of SEAFDEC. The chief administrator of SEAFDEC is the Secretary-General whose office the Secretariat, is based in Bangkok, Thailand.

Created to develop fishery potentials in the region in response to the global food crises, SEAFDEC undertakes research on appropriate fishery technologies, trains fisheries and aquaculture technicians, and disseminates fisheries and aquaculture information. Four departments were established to pursue the objectives of SEAFDEC.

- The Training Department (TD) in Samut Prakan, Thailand, established in 1967 for marine capture fisheries training
- The Marine Fisheries Research Department (MFRD) in Singapore, established in 1967 for fishery post-harvest technology
- The Aquaculture Department (AQD) in Tigbauan, Iloilo, Philippines, established in July 1973 for aquaculture research and development
- The Marine Fishery Resources Development and Management Department (MFRDMD) in Kuala Terengganu, Malaysia, established in 1992 for the development and management of the marine fishery resources in the exclusive economic zones (EEZs) of SEAFDEC Member-Countries.