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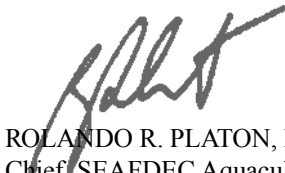
FOREWORD

AQD's manuals are end results of verification studies conducted in farms in consideration of profit. Usually, the studies that are verified in farms are first conducted in controlled conditions to investigate a particular problem using the scientific method. In turn, the actual farm studies show the viability and profitability of such studies, thus, the manuals are instructional and production oriented.

AQD's verification activities are conducted by the Technology Verification and Extension Section. Since the section was created in 1996, manuals on grouper in brackishwater ponds, mudcrab, and milkfish have been published.

This volume on grouper in floating cages gives a farming option for grouper growers. It is also a production alternative to the farmed species being done today such as shrimp, milkfish, and tilapia.

AQD appreciates the cooperation of farmers who collaborated in this project. We hope this volume would start the development of options of fish producers who are in search of aquaculture alternatives.



ROLANDO R. PLATON, PhD
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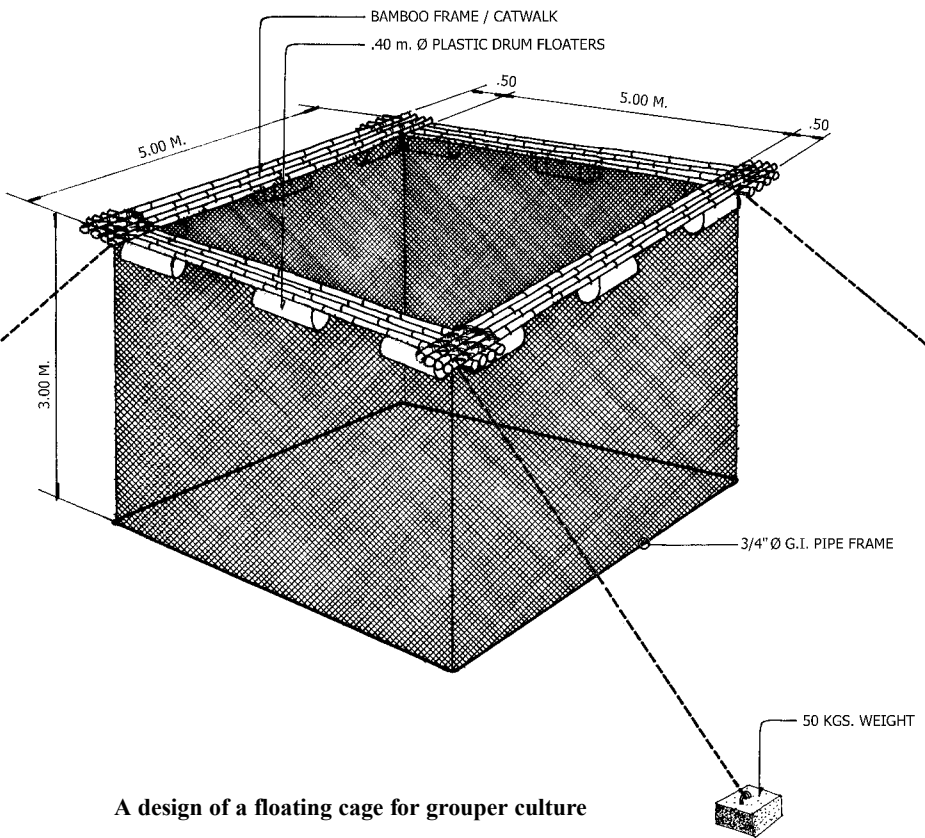
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A design of a floating cage for grouper culture

Grouper culture in floating net cages

Grouper (*Epinephelus* spp.) locally known as *inid* or *lapulapu* has been cultured in net cages, and to some extent in ponds in Southeast Asia for more than a decade. Valued for the excellent texture and flavor of its flesh, this finfish species has great potential in aquaculture. The demand for grouper in the international market is fast growing particularly in Hongkong, Japan, and Singapore. Its export price is expected to increase in the near future. Culture of grouper could therefore become another dollar earner for the country.

Species identification for commercially cultured groupers

There are about 40 species of grouper distributed in tropical waters and 2 species are popularly cultured commercially at the present time.

Epinephelus coioides

(Hamilton, 1822)

Common name:

Orange spotted
grouper

Local name:

Inid or *lapulapu*

(Ilonggo)

Distinguishing characteristics: Body color is light yellowish-brown dorsally, shading to whitish on the side and belly, numerous brownish-orange or brownish-yellow with unequal sized spots scattered on the head, body, and fins. The chin or underside of head and belly is whitish or creamy white without spots.



Epinephelus malabaricus (Block and Schneider)

Common name: Black spotted grouper

Local name: *Inid* or *lapulapu* (Ilonggo)

Distinguishing characteristics: Body color is light brown on the upper part of the body, belly and ventral side light gray; body with 5 distinct

broad dark brown oblique bars which tend to bifurcate ventrally. Head and body with numerous small, well separated black spots especially on chin; fins scattered with small black spots.



Source of stock

At present, supply of grouper fry for commercial cage/pond production is still dependent from the wild. Grouper fry is collected in nominal quantity using various devices e.g., scare lines or brush piles. The size of the fry varies from 1 to 9 cm and are usually collected by fish trap from coastal waters near mangrove areas. In the Philippines, the major sources of grouper fry include provinces of Pangasinan, Cavite, Mindoro, Quezon, Masbate, Bulacan, Cagayan, Dadiangas, Zamboanga del Sur, and Negros Occidental.

Dependence of fry or fingerlings from wild source for stocking are still being resorted to pending refinement of broodstock and seed production technique being done by R & D institutions like SEAFDEC/AQD or other progressive finfish hatchery operators elsewhere.

Classification of grouper seedstock for pond and net cages

	BL (cm)	BW (g)	Price (P/pcs)
Fry	1-2	1-3	6-8
Fry 1	3-4	4-5	8-10
Fry 2	5-7	6-9	15-20
Fry 3	8-9	10-13	25-30
XL	1-12	15-24	45-65
Undersize	13-20	30-160	55-75
Goodsize	30-70	400-700	260-280

BL - Body length

BW - Body weight

SITE SELECTION

Net cages should be set up in calm waters, e.g., sheltered lagoons, coves, inlets, bay, behind an island or a river mouth. This will avoid damage caused by strong waves and current.

Area should be protected from strong winds, waves, and current. An ideal area would be a protected bay, sheltered cove or inland sea.

Salinity should range between 20-34 pp.

Water depth should be not less than 3 meters during lowest low tide.

Site should have good water exchange to maintain good water quality.

Site must be relatively free from any source of pollution (industrial, agricultural, and domestic) and protected from environmental hazards such as typhoons, floods, erosions, etc. It must be accessible and preferably secure from vandals and poachers.

Site should be situated in areas where supply of trash fish is cheap and abundant.

Net cage specifications

A floating cage module usually has 4 to 12 compartments supported by a framework.

In constructing a floating net cage module the following should be considered:

Cage frame – made of galvanized iron pipe, wood or bamboo. Construction should be durable enough to withstand stress caused by wave action and increased weight during the culture period. Dimension - 5m x 5m x 3m

Sinkers – Concrete blocks, plastic containers filled with sand, and galvanized pipes are used as sinkers suspended by ropes, placed to the bottom of four corners of the net cage for rigging.

Flotation materials – Plastic drums or empty plastic containers (20 liter capacity). Four pieces





Check and mend nets of floating cages regularly.

tied together used as floats are placed on each side of the cage between the two pipes or bamboos (3 on each side). To prevent the floaters from drifting especially when the module is subjected to strong wave action, the floaters should be securely tied to the cage frame using a rope 5 mm in diameter.

CAGE NETTING

Nursery net; “B” net (0.5 to 1 cm mesh size; knotless).

Production net; “PE” net (2 to 5 cm mesh size).

Nets are fabricated like inverted mosquito nets. Each net cage is supported with polyethylene rope (5 mm diameter) inserted along the sewed portion of the net and held together using a clove hitch with overhand knot.

Each cage should have layered nets to avoid loss of stock due to tearing and other mechanical damages.

Anchor

The rope length from the float to the anchor should be the same as the water depth at high water spring tide (HWST). The raft structure needs 14 concrete blocks (0.5 to 1 ton each), 8 being placed at the ebb end (ebb tide being stronger than the flood tide) and four at the flood end with two in the mid section.

Generally, the weight of the anchor should be 2 times the weight of the entire floating cage module.

Hides and shelters

Sawed off bamboos or PVC pipes, 5 cm in diameter and 15 cm in length (for grow-out cages) tied in triangular bundles @ 10 pcs/bundle) and sunken in strategic areas inside the net cage.

Nursery net cage operation

Nursery net cages are necessary when fry of size 2 to 10 cm total length (TL) are the only ones available.

Sorting should be done every three days to separate the shooters (bigger sized; more than 10 cm) and prevent cannibalism. The shooters may be stocked directly in production net cages. Utmost care in handling the fry should be strictly observed to minimize stress and mortality after sorting operation

Stocking rate: 10 to 20 fish/m³. Feeds include mysid shrimps or finely chopped trash fish given at the rate of 10% of the total body weight. Feeds are divided and given two to four times daily.

Install 50 W incandescent lamp (hover type) inside the cages about half a meter above the water line at night to attract live food (mysids, copepods, and other young fishes).

Production net cages

Production net cages are necessary when stock size available are more than 10 to 15 cm TL.



Hides (left); incandescent lamp placed above the cages attract live food such as mysids, copepods, and other young fish (right).

Stocking rate: 10 to 20 fish/m³. Chopped trash fish are given at a rate of 5% of the total body weight. Feeds are divided and given two times daily.

Monitor pH, dissolved oxygen, salinity and water temperature twice a week.

Sample stock every 15 days to determine feed requirement and growth rate of grouper stocks.

Procedure for sampling is by scooping 10 to 15 samples and measuring its weight and length.

Inspect nets for leakage. Clean/remove dirt, debris and fouling organisms attached on nets. Repair/replace damaged net. Change nets at least once a month.

Harvesting

Harvest depends on the demand of the local and export market. It is normally done towards the end of the culture period. Fish are harvested by lifting the net. Care must be taken not to excite and damage the fish. They are not given feeds a day prior to harvest.

Post harvest

Scoop live, marketable size grouper (more than 400 g) from net cages. Hold grouper temporarily inside the conditioning tank and provide aeration for about one to two hours. Adjust water temperature gradually to 18°C by adding packed ice. Place 3 to 5 fishes inside double-sheet plastic bags, oxygenated, and with water of 3 to 5 cm or at least covering the nostrils of the fish. Crushed ice are placed on top of the plastic bags to maintain coolness of water during transport. Place plastic bags inside the square styrofoam box (30 x 30 x 20 cm) with the carton cover having a tag “live fish.” These are then ready for transport.

Profitability analysis of grouper cage culture

There are some important considerations for converting grouper culture into a highly profitable business, namely: survival and growth rates, adequate and cheap supply of raw meat i.e., trash fish and mollusk meat, quantity/quality seedstocks, and marketing.

Actual nursery operations in SEAFDEC/AQD reveal that survival rate of 79% from tiny to XL can be achieved, and this is about 20% higher than the rate used in this profitability analysis. Proper care of the fry can significantly result in reducing cost of operation.

Abundant and cheap supply of trash fish, cockles, or brown mussel should be ascertained as this constitutes the biggest chunk in operating expenses. Higher price for these feeds would significantly reduce the projects' profitability.

The most important consideration before venturing into grouper culture is the availability of buyers or exporters who would purchase the product.



Manual handling of live grouper immediately from a netcage, (top); live grouper being readied for transport in styrofoam boxes, (bottom).



Grouper are popular food fish in many specialty restaurants when they weigh 400g or more.

Cost and return of growing grouper in cages

One crop, one module

TECHNICAL DATA

Size of net cage	5m x 5m x 3m
Total number of net cages/module	6 units
Stocking rate per net cage	500 pcs
Size of initial stock	2.5 to 3 inches
Total number of stocks in one module	3,000 pcs
Culture period	5 to 7 months
Survival rate	80%
Average body weight at harvest	450 grams
Croppings per year	1
Total harvest	1,080 kilograms
Selling price	₱ 280.00
Feed conversion ratio	5 is to 1

INVESTMENT REQUIREMENT

	Quantity	Unit Cost	Total Cost
Bamboo poles, big sizes	80 pcs	₱ 30	₱ 2,400.00
Nylon nets, 1/2 inch mesh size	5 rolls	1,500.00	7,500.00
GI pipes, 1 in diameter, 5 m long	24 pcs	100.00	2,400.00
GI elbow, 1 in diameter	24 pcs	30.00	720.00
Plastic container, 20 l capacity	105 pcs	55.00	5,775.00
Mononylon twine # 120	15 kgs	150.00	2,250.00
Evelon Cord #9 (4.5 mm)	2 rolls	200.00	400.00
Anchors and rope	4 pcs	500.00	2,000.00
CW nails	2 kgs	50.00	100.00
Netting needle	3 pcs		
Labor for cage construction			7,000.00
Grouper fingerlings	3,000	22.00	66,000.00
Feeds	5,400 kgs	10.00	54,000.00
Wages of one caretaker/feeder	8 mo	4,000.00	32,000.00
Caretaker's hut			5,000.00
TOTAL INVESTMENT REQUIREMENT			₱ 187,545.00
ANNUAL OPERATING COSTS			
Grouper fingerlings			66,000.00
Wages of caretaker			32,000.00
Feeds			54,000.00
Depreciation of cages and hut			11,848.00
Repairs and maintenance @ 3%			1,066.00
Interest @ 14%			26,256.00
TOTAL OPERATING COSTS			₱ 191,170.00
ANNUAL INCOME			302,400.00
NET PROFIT			111,230.00
BREAK EVEN VOLUME (BEV)			684 kg
BREAK EVEN SELLING PRICE (BESP)			₱ 177/kg
RETURN ON INVESTMENT			59%
PAYBACK			1.68 years

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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, and the Socialist Republic of Viet Nam.

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) at Changi Fisheries Complex, 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.