

Grouper Culture in Netcages: WPU Experience

Augustus P. Avillanosa

Western Philippines University-Puerto Princesa Campus,
Puerto Princesa City, Palawan, Philippines

ABSTRACT

This paper documents the use of cages for rearing or holding juvenile groupers to marketable size as experienced by the Western Philippines University (WPU) - Puerto Princesa Campus. Groupers were cultured in floating netcages in a brackishwater pond and in floating netcages in the open waters of Puerto Princesa Bay. Both projects, the brackishwater grow-out pond in Sta. Monica and the floating netcages in Puerto Princesa Bay are owned and managed by the University.

The primary and secondary data on grouper culture, either as income-generating or research activity from 1998 – 2000 were used in the study. Discussed in the paper are the guidelines in site selection, cage construction, seed collection, proper stocking, sampling scheme, feeds, feeding and the use of fish aggregating device and lift net to collect trash fish.

Major findings are the performance and survival of the cultured grouper at varying densities. The average growth rate per day of cultured fish range from 0.90 to 1.0g for fish having size of 10-150g, it increases to 1.0 to 4.0g on big sized fish (159-450g) usually on the later part of culture period. The culture period ranged from 7 to 8 months from juvenile stage. Survival ranged from 80% to 95%. Based on a 9-unit netcage measuring 2.5m x 2.5m x 3.0m, an annual net income of PhP70,000.00 is expected with the ROI of 50% with less than 2-year payback period.

Since mortality of small-sized groupers is commonly observed, it is recommended that monthly sorting should be done to attain higher survival.

Keywords: *grouper culture, cage culture, WPU*

INTRODUCTION

Groupers are important highly-priced fishes of the tropics and subtropics and are always in demand in both local and foreign markets. It is a highly esteemed food fish because of its size, good flesh, texture and excellent flavor (Baliao *et al.* 1998, Baliao *et al.* 2000). In many parts of the world groupers have

been cultured intensively in shallow coastal areas. In the Philippines, groupers are mostly cultured in netcages. This provides an alternative means of fish production and supplements income, especially for the coastal communities.

The use of cages for rearing or holding juvenile or young fish to marketable size is an old practice all over the world. Netcaging provides venture for small or large-scale commercial aquaculture production. A netcage can carry about 5 to 15 kg/m³ or even up to 50 kg/m³ (Chua and 1979; Avillanosa 2003).

Based on the Food and Agriculture Organization (1999) the Southeast Asia aquaculture production contributed about 2,291 MT in grouper production. In 1997, the Philippines contributed about 605 MT grouper in the global market.

This paper aims to provide information on the culture of locally caught grouper particularly in the Province of Palawan and in the region.

METHODOLOGY

The WPU Fishcage Project in Tinguiban Cove, Puerto Princesa City is located at approximately 09°33' to 10°5' N latitude and 118°39' to 119°08' E longitude (Figure 1). It serves as an income-generating project and venue for several research activities conducted by the faculty and students of the University. The data resulted from these activities were gathered and documented in this study.

The paper discusses the grouper culture technology adopted by WPU. It includes the guidelines in site selection, cage construction, seed collection, proper stocking, sampling scheme, feeds, feeding and the use of fish aggregating device and lift net to collect trash fish.

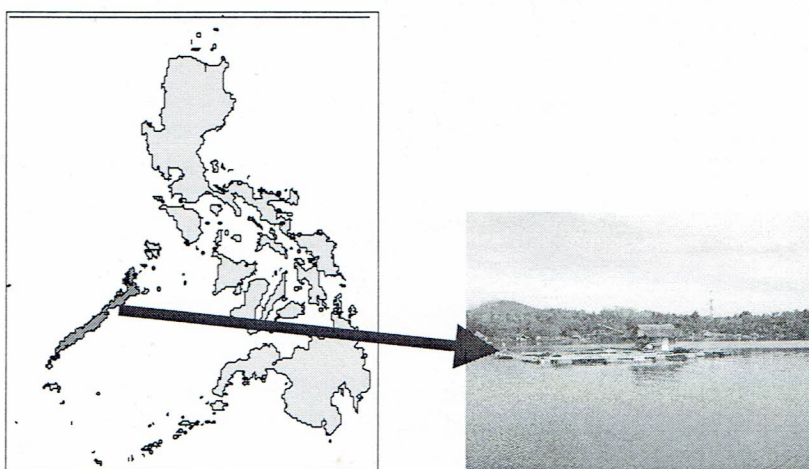


Figure 1. WPU-PPC Fishcage Project.

RESULTS AND DISCUSSION

Description of Cultivable Groupers

The species under the genus *Epinephelus* (Plate 1) are among the most important commercial fishes in the world. They are highly acceptable to consumers and command high market value. In the Philippines, three species of grouper are commonly cultured. These are *Epinephelus coioides*, *E. malabaricus* and *E. tauvina*.

Groupers are fast growing, easy to culture, spawn naturally and artificially, and tolerate a wide range of environmental conditions.

Criteria for Site Selection

The water in the area should be clear, free from pollution and siltation. The temperature and salinity should range from 22 to 31°C and 15 to 45 ppt, respectively. The desirable water pH ranges from 6.5 to 9.0.

The dissolved oxygen should be greater than 4 mg/l and turbidity should not be more than 100 ppm. For floating netcages, a 1.5 m water depth from the sea bottom is recommended.

The area should be protected from strong currents and big waves. The recommended current should be less than 10 cm/sec. A whole year round supply of fry or fingerlings and the area's accessibility to market are also important criteria for site selection.

Construction of Fish Cages

The frame can be made of bamboo (Plate 2), lumber or galvanized iron (G.I.) pipes depending on the initial budget and purpose. Plastic drums, styrofoam coated with cement, and bamboo poles can be used as floats. The anchor can be made either of concrete blocks or steel.

Types of net used in cages are: hapa net for nursery; b-net for transition; polyethylene or pamo net for grow-out.

The design of the netcages depends on the availability of materials. The most common designs are square and circular. The usual sizes for grow-out are 2.0 x 2.0 x 2.5 m, 2.5 x 2.5 x 3.0 m, 5.0 x 5.0 x 3.0 m. The WPU-PPC Fishcage Project adopted the square type of several dimensions as above.

Fingerlings Collection

To collect grouper fingerlings, bamboo traps and nets can be used. Brush lures, rock mounds, bamboo traps and fish pots are also effectively used in collecting grouper fingerlings. Collection can be done along the shoreline, estuary or in mangrove areas.

In Palawan, grouper are collected in Puerto Princesa Bay, Honda Bay, Roxas, Taytay, San Vicente, Araceli, Dumarán, Coron, Quezon, Brooke's Point and Bataraza.

Sorting, Acclimation and Stocking

Fry/fingerlings should be released into the netcage early morning or late afternoon. Prior to release plastic bags with fry/fingerling should be acclimated in the netcage for 30 minutes.

It is also necessary to sort all acclimated grouper fry/fingerlings into three different sizes (small, medium and large) to avoid cannibalism (Table 1). Before stocking, check nets for tears. Stock fry or fingerlings grouper in net with specified mesh size as follows:

Table 1. Recommended mesh size of net for grouper.

Mesh Size (cm)	Grouper size (g)
0.5	3 – 5
1.0	10 – 20
2.0	21 – 100
3.0	101 – 300
4.0	301 – 500

Sampling, Feeds and Feeding

In the present study stocks were sampled every 15 days. This helps to determine the right amount of feeds to be given and to monitor the size and condition of the fish stock.

Fish stock should be fed at 10% of the fish body weight per day during early part of the culture period (Table 2). Chopped trash fish, scrap meats or commercial feeds can be used to feed the cultured grouper. Feeding trays can be used to avoid feed wastage.

Table 2. Recommended stocking densities and feeding rate of grouper.

Size (g)	Stocking Density (pcs/m ³)	Days of Culture	Feeding Rate (% BW)
10-50 (s)	25	60	10
60-200 (m)	20	61-120	8
201-450 (l)	15	120-240	5

To lessen the cost of production having a fish aggregating device (FAD) could help in recruiting trash fish for used as feeds.

Fish Aggregating Device (FAD), Shelter and Liftnet

To lessen the cost of production having a FAD could help in recruiting trash fish in the vicinity. Moreover, it could serve as breeding area of the grouper and help in the recruitment of grouper fry.

It is also recommended that a bamboo or PVC pipes with 10 cm diameter and 10 inches length should be placed inside the netcages to serve as a shelter. This also prevents cannibalism inside the cage.

In catching FAD recruited fish, a lift net or lever net could be installed adjacent the fish cage. A light aided lift net could catch about 0.5 to 15 kg fish a night. This will reduced the expenses for fish feeds (Alcantara *et al.* 1995).

Growth and Survival of Groupers in Netcages

The growth rate (g/day) varies depending on fish size. During the early part of the culture period, 10 to 150g fish has a growth rate ranging from 0.90 to 1.10g/day. When they reached 150 to 450g, their growth rate increases to a range of 1.50 to 4.0g/day (Figures 2-4). The condition factor of the cultured grouper in Tiniguiban and Sta. Monica, Puerto Princesa City ranged from 1.5 to 1.8, while the cumulative Feed Conversion Ratio is from 4.0 to 6.5.

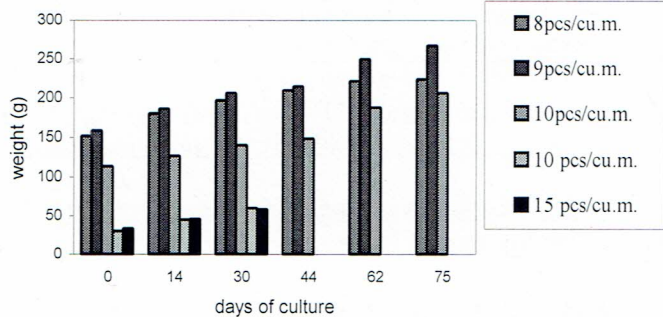


Figure 2. Growth of cultured grouper in floating netcages in Brackishwater Pond at Sta. Monica from 1999 to 2000.

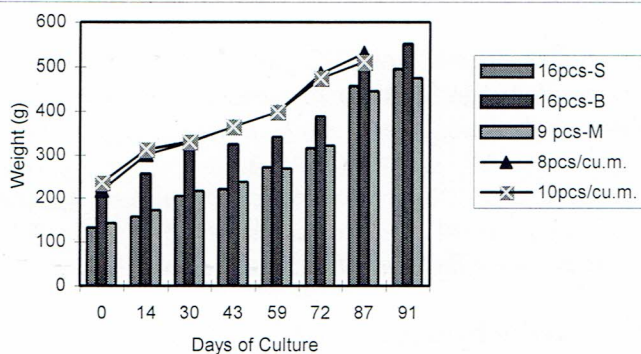


Figure 3. Growth of cultured grouper in floating netcages in Tiniguiban Cove from 1998 to 1999.

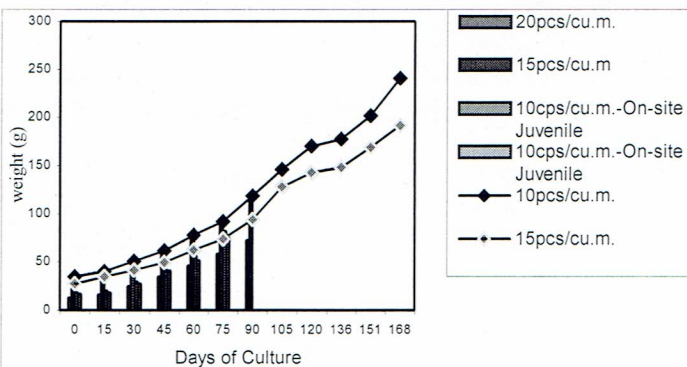


Figure 4. Growth of cultured grouper in floating netcages in Tiniguiban Cove in 1999.

Survival ranged from 80% to 95%. Mortality of smaller sized groupers is commonly observed. It is recommended that monthly sorting should be done to obtain higher survival.

Harvesting and Marketing

Marketable size grouper is about 400 g or more. During marketing, groupers were placed in oxygenated plastic bags with aeration. Ice are placed on top of the plastic bag to reduce temperature during transport. The price of live grouper varies from PhP 180.00 to 400.00/kg depending on the export market demand.

A 9-unit netcage measuring 2.5 x 2.5 x 3.0 m could have an annual net income of PhP70,015.00 with the return of investment of 50% with less than two years payback period (Table 3).

Table 3. Cost and Return of Grouper Cultured in Floating Netcages.

Assumptions:

Netcages:	9 units (2.5 x 2.5 x 3.0 m)	Total harvest:	911 kgs
Stocking Density:	15 pcs/m ³	Average Body Weight:	450 g/pc
Survival rate:	80%	Selling Price (PhP):	225/kg
Culture Period:	8 mos		

Gross Income (PhP) 205,200.00

Variable Cost	Qty	Unit Price	Total Amount (PhP)
Plastic Drum	16	1000/pc	16,000.00
Frame (G.I Pipe & Accessories)			12,800.00
Lumber (2 x 6 x 1")	16	35/bd.ft	6,720.00
Nets and Rope			37,250.00
Monofilament nylon	3	100/kl	300.00
Sinker	4	250/pc	1,000.00
Miscellaneous			330.00
Sub total			74,400.00
Labor (15% of the materials cost)			11,160.00
Total			85,560.00

Operation

Grouper juvenile	2,532	15/pc	37,980.00
Trash fish	4,800	5/kg	24,000.00
Technician	8	3,500/mo	28,000.00
Marketing cost and License			7,000.00

Depreciation, Repair and Maintenance	34,520.00
Total Cost/crop	131,500.00
Net Income	73,700.00
Net Income after Tax (5%)	70,015.00
Return of Investment	53.24%
Payback period (year)	1.88

LITERATURE CITED

- Alcantara, L.B., C.R. Dumadaug, R.G. Dolorosa, and R.T. Roche. 1995. The growth of *Lates calcalifer* (Bloch), *Cromileptes altiveles* (Valenciennes) and *Epinephelus* sp. in cages fed on-farm caught trash fish. Proc. of the 3rd Nat. Symp. In Mar. Sci., 53-57
- Avillanosa, A.P. 2003. Grouper culture in netcages. SPCP-PPC Aquaculture Manual No. 1. State Polytechnic College of Palawan, Puerto Princesa Campus, Puerto Princesa City, Palawan. 15 p.
- Baliao, D.D., M.A. Delos Santos, N.M. Franco and N.R.S. Jamon. 2000. Grouper culture in floating net cages. Aquaculture Extension Manual No. 29. SEAFDEC-AQD, Tigbauan, Iloilo, Philippines. 10 p.
- Chua, T.E. and S.K. Teng, S.K. 1979. Relative growth and production of the estuary grouper, *Epinephelus salmoides* under different stocking densities in floating netcages. Mar. Biol., 53: 363-372.
- Dumadag, G.V. 1996. Effects of different types of feeds on growth, survival and production of grouper, *Epinephelus suillus* in floating netcages, M.S Thesis. College of Fisheries, University of the Philippines Visayas, Iloilo. 56 pp.
- FAO. 1996. Aquaculture Production Statistics 1985-1994. Fishery Information, Data and Statistics Unit, FAO Department, FAO Fisheries Circular No. 815, Revision, 8, Rome pp. 156-157.
- Kohno, H., M. Duray and J. Juario. 1988. State grouper (Lapu-lapu) culture in the Philippines. SEAFDEC-AQD. Vol. X. No. 2, June, 1992. 4-8 pp.
- Teng, S. K. and T.E. Chua. 1977. Effect of stocking density on the growth of the estuary groupers, *Epinephelus salmoides* cultured in floating net-cages. Aquaculture, 15:273-287.

Acknowledgment

I thank WPU-PPC Aquaculture students SY 1997 to 2000 for conducting field sampling and Mr. Roche for his assistance. To Berlin Mata for his camera. My wife Arlene helped me through her valuable suggestions and endless encouragement.

Special thanks to Dr. Benjamin Gonzales and Dr. Sabine Schoppe for their review of this paper. To Dr. Concepto B. Magay, President of WPU and my colleagues at WPU-PPC for their support in the project.



Plate 1. *Epinephelus coioides*



Plate 2. Cages used for grouper culture.