

# High Volume Low Density Culture of Milkfish (*Chanos chanos* Forsskal) in Floating Net Cages at North Bais Bay Manjuyod-side, Negros oriental

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**Abstract** - The study was conducted at Resources Production Technology (REPROTECH), Incorporated in north Bais Bay (Manjuyod side), Negros Oriental. The purpose of the study is to demonstrate the feasibility and viability of milkfish (*Chanos chanos* forsskal) cultured in 180-m<sup>3</sup> (6m x 6m x 5m) High Volume Low Density (HVLD) floating net cages and established a benchmark for cage farmers using a technology that offers a promising strategy that can have enormous impact on both socio-economic growth and food security. Results showed that bangus attained an average body weight (ABW) of 376.32 grams, after an average day of culture (DOC) of 163. It also showed an excellent survival rate of 111% and a very satisfactory feed conversion ratio (FCR) of 2.4. The average production per unit cage reached 2,480 kg or 13.78 kg/m<sup>3</sup> of cage volume. The project realized

a profit margin of Php. 34.94 per kilogram, indicating that even if the market price per kilogram is reduced by 10% the project is still gaining. Milkfish production in HVLD floating cages is economically viable for small and medium enterprise (SMI) fish farmers and promises a very attractive Return of Investment (ROI) estimated at 64.18% and a payback period of 0.4 year.

*Keywords* - Milkfish, culture, Bais Bay, Negros Oriental

## INTRODUCTION

Mariculture zones and parks are established as a strategy to develop the fishing industry in the country and support the Medium Term Philippine Development Plan 2005-2010 in line with President Gloria Macapagal-Arroyo's 10-Point Agenda. Mariculture projects addresses the pressing issues of declining productivity and resource depletion from capture fisheries, leading to the displacement of fisherfolk and persistent poverty among coastal communities (Adora, 2007).

Milkfish (*Chanos chanos* Forsskal) is an important aquaculture species with high quality flesh. It has metallic-silvery scales, a spindle shaped body and characteristic flavor that is savored in the country. Milkfish is the country's national fish and known locally as "bangus".

In 2004, the American Soybean Association (ASA), under the Soy-in-Aquaculture Program and in cooperation of REPROTECH, Incorporated in Punta Campuyo, Manjuyod, Oriental Negros, conducted a comparative study between 27-m<sup>3</sup> (3m x 3m x 3m) and 180m<sup>3</sup> (6m x 6m x 5m) cages. The objective was to establish feasibility of culturing milkfish at a high density in small cages using the ASA Low Volume, High Density (LVHD) cage technology, and to compare performance of the LVHD technology to the conventional HVLD cages technology of REPROTECH. The results showed that milkfish cultured within 145 days in all cages exhibited better Survival Rate (SR) and Feed Conversion Ratio (FCR) when cultured in HVLD cages using ASA technology and feed, milkfish performance appears to have been

similar between the two cage sizes for a majority of the demonstration and only in the final two months did it appear that the LVHD did not keep pace due to stress of sampling fish after achieving 250 g average size.

LVHD cage fish culture is the raising of fish in cage volumes of 1 to 4 m<sup>3</sup> at optimum densities of 300 to 500 individuals or 150 to 250 kg of fish/m<sup>3</sup>. Cage culture are most suited for freshwater lakes and reservoirs, but may be practiced in any environment suitable for fish life. (H.R. Schmittou et. al., 2004)

HVLD cage technology of REPROTECH, Inc. is the raising of fish in cage volume of 180 m<sup>3</sup> (6m x 6m x 5m) at optimum stocking densities of 5,500 to 8,500 fingerlings or 17 kg/m<sup>3</sup> of cage volume within 150 to 180 days of culture with a marginal average survival rate of 70 to 80%.

## **OBJECTIVES OF THE STUDY**

The objective of this study is to demonstrate the feasibility and viability of milkfish cultured in 180-m<sup>3</sup> (6m x 6m x 5m) HVLD floating net cages.

## **MATERIALS AND METHODS**

The project site is located at North Bais Bay (Manjuyod side), Oriental Negros. The area is ideal for the project because of the following factors:

The Bay is protected from Easterly winds and waves. Its water is clean. Some marginal fisher folks grow seaweeds. Just offshore from the mouth of the Bay, local tourism initiatives operate a whale-and-dolphin watch. All these indicate of the relative ecological health of the area.

Bais Bay has an estimated area of 2,000 hectares. As per Government Fishery rules and regulations only 10% of the total area can be utilize. At present there were existing structures/projects such as seaweeds farming ~ 85 hectares, fish corrals ~ 20 ha. fish pen ~ 2 ha. and floating fish cages ~ 4 ha. which occupies a minimal area. (BFAR R7). The area occupied by the entire fish cages at the Bay area of 7,200 square meters in North Bais Bay, Manjuyod-side, Oriental Negros. Average water depth in the fish cage area is seventeen (17) fathoms (102 ft.).

Fish cage refers to an enclosure which is either stationary or floating made up nets or screens sewn or fastened together and installed in the water with opening at the surface or covered and held in a place by wooden/bamboo posts or various types of anchors and floats (FAO 214 sec. 1 m).

Cage frame is made of fiberglass-coated welded GI pipes that are mounted to box-shape styrofoam floats. Rectangular nylon mesh (mesh size vary by size of fish) and double bag cage net hung at top of the frame are strong and durable enough to hold the collective weight of fish and yet allow relatively unrestricted exchange of water. Cage nets made up of soft and flexible enclosing materials (e.g. knotted or knotless nylon) are preferred and was suspended and weighed down to maintain cage shape against water current. Internal feed enclosure and blocking cover are provided to prevent waste feeds and escape of stocks as specified in the ASA, LVHD Manual "Principles and Practices of High Density Fish Culture in Low Volume Cages. Nets are changed every fifteen (15) days to avoid bio-fouling. The entire module is fixed to the sea bottom by weights and anchors. The floats are coated with cement to prevent them from chipping and from becoming waterlogged. One meter (1m) distance is maintained between units to provide water exchange (FAO 214 sec. 3h).

On the edge of the Bay, REPROTECH, Incorporated occupies a land area of 540.20 m<sup>2</sup> along the shore with existing improvements such as warehouse for feeds and materials, workshop for net cage construction and mending, sorting area of harvested bangus, fabrication shop for constructing cage frames and floaters, offices, dormitories, laboratory, and a dock for flat boats, and service / transport motorized boats from which the cages are just a seeing distance.

### *Fry and Fingerlings*

Healthy fry are purchased from standardized hatcheries with certificate of compliance for food quality and safety issued by the BFAR as Competent Agency (CA). Mortality to milkfish fry during transport to the nursery ponds are replenished by the supplier. Bangus fry are stocked into the company's nursery pond for 15 days of culture with an average of 70% survival rate and eventually transferred to transition pond for 45 to 60 days of culture with 80% average survival

rate. From the transition pond bangus fingerlings “Hatirin” of about 10 g are stocked at a density of 5,500 to 8,500 fish per cage for grow-out.

### ***Culture in Nursery Ponds***

Nursery ponds are stocked a maximum of two (2) million fry distributed into different compartments with a capacity of 500,000 pieces of fry per nursery pond for the whole year operation. No purchase orders are made during lean-months for fry production to avoid the high acquisition cost and low survival of fry (around 30%) harvested on these months. Fry are reared in nursery ponds within 15 days of culture.

Milkfish “Hatirin” are then, transferred into transition ponds in the areas of Sitio Balioco, and Sitio Canlabe, Village Campuyo, Manjuyod, Oriental Negros. Hatirin is cultured within 30 to 60 days or when its Average Body Weight is reached at about 10 grams up before transferring them into the fish cages.

### ***Transfer and Acclimatization***

Bangus fry and fingerlings are transported in two (2) aerated wooden box with size of 6' x 4' x 4' mounted to 6 wheeler truck with an average of 60,000 pieces for Hatirine and average of 10,000 pieces per box of fingerlings. Fingerlings are harvested for transfer by freshening or current method (pasulang). The bangus have a tendency to swim against the current. This behavior called negative rheotropism makes them congregate in the catching area or in the supply canal. Before harvest, the bangus should be confined to a pond devoid of food. This prevents pollution to the aerated water during transport. Upon reaching the coastline, stocks are transfered using plastic bags from the aerated box to the boat.

Acclimatization takes place during transport at the boat with pumps, drain and complete aeration system locally called as “petoya” with a capacity of 20,000 pieces fingerlings.

### ***Stocking***

Bangus fingerlings from transition ponds are transferred into the fish cage in the same Bay which results to an average of 70 to 80% survival of stocks. The reason for this significant survival rate is the elimination

of stress to milkfish brought about by varying water parameters as those taken from other culture environments which may be far and strenuous. Transfer of fish from petoya to the cage is done using plastic bags and placed in separate net inside the cage for counting. Counting of stocks is conducted by 2 to 3 cage feeder personnel. Using a scoop net, bangus fingerlings are scooped to determine the capacity of the scope net as basis for counting. Final stocking is 5,500 to 6,500 pieces of fingerlings per cage.

### ***Feeding***

Milkfish in all cages are fed twice daily, and as size increased, continuous feeding as long as it responds to feeding with extruded, floating, pelleted formulated feeds. One cage containing 8,500 pieces respectively at 70 to 80% survival juveniles requires 1,060.74 kilograms of starter crumbled feeds for 30 days; 3,182.21 kilograms of starter for 45 days; 6,364.41 kilograms of grower feeds for 60 days; and 10,607.35 kilograms of finisher feeds for 45 days. A total of 10,275.20 kilograms of feeds consumed per cage respectively at the cost of Php 24.32 per kilograms.

### ***Stock Management***

Recounting and sorting are done simultaneously after 30 days of culture. Bigger size bangus are separated from small once. Change used net every 15 days to avoid heavy infestation of fouling organisms. Sampling is done to determine the ABW of stocks for monitoring. Upon reaching 250 g, sampling is discouraged to avoid stress. Mortality and disease infected fish are excluded from the stocks and recorded for the survival rate.

### ***Harvesting and Chilling***

Bangus stocks are harvested after one hundred eighty (180) days of culture (DOC) period. Harvesting from net cages is easier; it will last only for less than an hour for 3.5 tons of bangus. The inner net cage which contains the cultured bangus is simply lifted and its contents are transferred by scooping into a flat boat with sea water and crushed ice. The flatboat served as transport vehicle and chilling tank for the harvested bangus.

### *Sorting, Weighing, Icing and Packing*

Chilled milkfish carried by the flatboat are transferred into plastic crates and sorted by sizes upon docking. Unwanted species that has grown with milkfish in the cages are eliminated during this process. Female office employees are in-charge in sorting and weighing of the products with the assistance of male workers. Sorting is done according to buyer's specifications. Jumbo size from 500 grams and above; 1st size from 333 grams to 500 grams; 2nd size from 200 grams to 332 grams; 3rd size from 100grams to 200 grams and undersize below 100 grams.

The milkfish are weighed and packed in plastic bags mounted inside plastic fish boxes. Packing is done by placing a layer of crushed ice on the bottom before the first layer of fish is placed. After which, the ice and fish are layered one after the other. The position of the fish during the packing is in a dorso-ventral position. The classification of sizes and temperature maintenance are according to buyers' specifications.

Certificate of compliance is issued by the ice plant which supplies the ice for icing to ensure safety and quality of the product as required.

After the packing and icing of the products, the Plastic fish boxes are loaded to the push cart and loaded into the transport van for delivery to processing plants or to local markets.

### *Cage Management*

Cage management operation of two (2) modules requires (2) two Cage Technicians and two (2) Junior Cage Technicians, fourteen (14) cage maintenance crew and ten (10) cage feeders. Numbers of grow-out cages correspond to the number of workers.

Repairs are made as the need arises. Cage frame is made up of GI pipes coated with fiber glass so there is less maintenance. Floaters are re-cemented after every harvest. Floater repair cost is estimated at Php 75.00/piece. Nets are changed every 15 days with maintenance cost estimated at P50.00/piece for the "Paamo thread 210/21" used for mending torn parts. Labor for washing and drying to kill fouling organisms is charged to direct labor. There are 15 to 20 net cages are scheduled for changing daily. Transport trucks repaired is estimated at Php 1,000/month. Service boats needs to be repainted and repaired

every two (2) months at an estimated cost of Php 3,000.00. Production cost of bangus (per kilo) is Php 69.46 with inflation of 2.5% for feeds cost and 5% for fry/fingerlings and other direct costs and 10% for direct labor per year.

## RESULTS AND DISCUSSIONS

There are five (5) replicates of 180m<sup>3</sup> (6m x 6m x 5m) HVLD floating cages was selected randomly for the study. Cages were stocked and harvested in different schedules following production program of the company. Total stocking is 29,500 of bangus fingerlings cultured in an average of one hundred sixty three (163) days of culture period with excellent survival rate of an average of 111% which exceeds 100% due to methods used in counting/stocking of bangus fingerlings. Bangus attained an ABW of 376.32 grams at 2.4:1 FCR; a cumulative feed used is 29,729 kilograms; a total production of 12.4 tons, an average production per cage is 2,480 kg or 13.78 kg/m<sup>3</sup> of cage volume. At Php 107.13 average price per kilogram, harvested bangus realized Php. 1,339,000.00 gross sales.

Cost of production includes: bangus fingerlings costing Php. 134,195.00 at Php 4.50 per piece; formulated feeds amounting to Php. 693,519.00 at Php. 23.36 per kilogram equivalent to 78% of the total inputs; salaries and wages amounting to Php. 32,453.00; direct cost totaling to Php. 27,196.00; commission and marketing expenses at Php. 5,430.00. Net income per kilogram of bangus produced is 34.95. The ROI is estimated at 49.98% and a payback period of 0.4 year promising an attractive high rate of investment return.



**Table 1. Harvest report of milkfish reared in 180-m<sup>3</sup> (6m x 6m x 5m) HVL D floating cages at North Bais Bay (Manjuyod side), Oriental Negros.**

Cage No.	B51	B15	B14	B13	B42	Average/ Total
Date Stocked	10/8/2008	11/10/2008	11/24/2008	11/26/2008	11/27/2008	
Date Harvested	5/8/2009	4/11/2009	4/20/2009	4/24/2009	4/30/2009	
Total Stocking (pcs.)	6,050	6,000	6,000	5,650	5,800	<b>29,500</b>
Days of Culture (DOC)	212	152	147	149	154	<b>163</b>
Percent Survival (%)	129.84	98.05	102.64	110.29	112.15	<b>111</b>
Cumulative Feeds (kg)	7,825.89	4,920.10	5,819.55	4,783.01	6,380.82	<b>29,729</b>
Feed Conversion Ratio (FCR)	2.49	2.24	2.44	2.41	2.37	<b>2.4</b>
Average Body Weight (g)	400.00	362.64	388.00	317.91	413.04	<b>376.32</b>
Production (kg)	3,142.01	2,200.60	2,389.35	1,981.10	2,686.80	<b>12,400</b>
<b>Gross Sales (Php.)</b>	356,279.76	227,467.49	253,003.50	196,724.00	305,525.16	<b>1,339,000</b>
<b>Average Price per Kilogram (Php.)</b>	113.39	103.37	105.89	99.30	113.71	<b>107.13</b>
<b>Cost of Sales:</b>						
<i>Bangus</i> fingerlings at Php. 4.50 per piece	27,521.44	27,293.99	27,293.99	25,701.84	26,384.19	<b>134,195</b>
Feeds at Php. 23.36/kg	181,666.60	116,958.21	135,865.73	112,190.60	146,837.94	<b>693,519</b>
Direct Labor	7,711.56	5,866.12	6,146.45	6,271.04	6,457.93	<b>32,453</b>
Other Direct Costs	6,522.39	4,973.33	5,144.59	5,220.71	5,334.89	<b>27,196</b>
Commission and Marketing Expenses	1,994.00	1,039.90	1,173.24	150.00	1,073.24	<b>5,430</b>

Total	225,415.99	156,131.55	175,624.00	149,534.19	186,088.19	<b>892,794</b>
Cost Per Kilogram (Php.)	71.74	70.95	73.50	75.48	69.26	<b>72.19</b>
Net Income	130,863.77	71,335.94	77,379.50	47,189.81	119,436.97	<b>446,206</b>
Net Income per Kilogram	41.65	32.42	32.39	23.82	44.45	<b>34.95</b>
Return of Investment (ROI) %	58.05%	45.69%	44.06%	31.56%	31.56%	<b>64.18%</b>
Payback Period (Year)	0.24	0.44	0.41	0.67	0.26	<b>0.4</b>

## CONCLUSIONS

Based on the findings, the following conclusions are drawn: Milkfish production in High Volume Low Density 180m<sup>3</sup> (6 meters x 6 meters x 5 meters) floating cages is economically viable for small and medium enterprise (SMI) fish farmers; Milkfish cultured in High Volume Low Density floating cages exhibit excellent survival rate and a very good feed conversion ratio (FCR) using any of the available quality formulated feeds in the market; and this project shows a very attractive Return of investment (ROI) (mean: 50%) and a very short payback period of 0.4 year.

## RECOMMENDATIONS

The following strategies are recommended to make milkfish culture in HVLD cages more economically viable and environmentally sustainable:

Practical training courses on the technology of milkfish culture in HVLD floating net cages should be conducted by the academe, other agencies engage in environment-friendly aquaculture.

The government should encourage Local Government Units with qualified areas with suitable coastal resources for mariculture zone to use sustainable and environment-friendly aquaculture like HVLD technology.

Academe with field of specialization in fisheries should collaborate with government and private sector as to economic enhancement strategy and food security through research and extension.

The feed millers should produce certified organic formulated feeds to support the fish cage operators and the Province of Negros for her advocacy of going organic to compete on global market.

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