Growth Performance of Milkfish Fed Soy-Based Feed in Marine Cages in Malalag Bay, Mindanao Island, Philippines

Results of ASA-IM/Soy-in-Aquaculture 2007 Feeding Demonstration Project

Lukas Manomaitis and Michael C. Cremer
American Soybean Association International Marketing (ASA-IM)
12125 Woodcrest Executive Drive, Suite 140
St. Louis, MO 63141 USA

ABSTRACT

A feeding demonstration was conducted at Malalag Bay in Santa Maria, Davao del Sur, Philippines to demonstrate the growth of milkfish (*Chanos chanos*) in marine cages using a soy-based, extruded feed. Milkfish fingerings of about 56 g were stocked into three, 216-m^3 cages at 6,875 fish per cage. Fish in all cages were fed a 34% protein, 9% fat (34/9) feed formulated with soybean meal as the primary protein source. The feed was produced domestically in the Philippines. After 213 days of culture, milkfish reached an average size of 665 g with a gross average harvest of 4,136 kg/cage (19.1 kg/m^3), an average survival of 91% and an average FCR of 2.60:1.

INTRODUCTION

The American Soybean Association International Marketing (ASA-IM), under the Soy-in-Aquaculture (SIA) Project and in cooperation with Alsons Aquaculture Corporation in Santa Maria, Davao del Sur, Philippines, conducted a 213-day feeding demonstration with milkfish in marine cages. The objectives of the project were to demonstrate the feasibility of culturing milkfish using many of the ASA-IM Low Volume High Density (LVHD) cage techniques, and to investigate the performance of a new soy-based aquafeed formulation.

MATERIALS AND METHODS

Three, 216-m^3 (6 m x 6 m x 6 m) cages at the Alsons cage farm site at Malalag Bay in Santa Maria, Davao del Sur, Philippines, were used for the demonstration. The cages were constructed with a floating bamboo frame from which a rectangular nylon mesh net was suspended and weighted down to maintain the cage shape against water currents. Cage net mesh size was

increased as the fish grew to maximize water exchange. Each cage was equipped with an internal feed enclosure and a light blocking cover as specified in the ASA-IM LVHD Manual "Principles and Practices of High Density Fish Culture in Low Volume Cages". The three demonstration cages were placed at the outside edge of the cage farm and spaced to provide at least one cage length of open water on all sides of each cage to facilitate water exchange. Cage nets were replaced on a 10- to 15-day cycle to combat bio-fouling.

Milkfish fingerlings of about 56 g were obtained from existing stocks being held in cages on site. Milkfish were stocked in the 216-m^3 demonstration cages at a density of 6,875 fish per cage. Fish in all three cages were of uniform size and age at stocking. Milkfish production targets were 750 g per fish and 5,156 kg per cage, or 23.9 kg/m^3 of cage volume.

Milkfish in all cages were fed three times daily, with extruded, floating, pelleted feeds formulated to contain 34% crude protein and 9% crude lipid (34/9). This feed was least-cost formulated by ASA-IM, and contained, depending on the date of manufacture and ingredient cost, approximately 25-30% soybean meal by volume as a percentage of total feed ingredients. The feed was produced domestically in the Philippines (Tables 1-3). The three demonstration cages were treated as replicates of a single feed treatment, with fish in all cages fed the same amount at the same time using the ASA-IM satiation feeding technique.

Cage management was based on the ASA-IM LVHD cage production model. Fish in all cages were sampled once per month on about the same date each month by an ASA-IM SIA project member to determine growth. At the conclusion of the project, all cages were completely harvested and all fish weighed. All of the harvested fish were enumerated when weighed to obtain an average fish size and fish survival. Results were used to determine fish survival, average fish weight, gross fish production and feed conversion ratio (FCR).

RESULTS

Milkfish were cultured a total of 213 days between 14 April and 13 November 2007. Milkfish in all cages grew from an average of 56 g to 665 g in this period (Figure 1; Table 4). Gross production averaged 4,136 kg per cage (19.1 kg/m^3 of cage volume) and average survival rate was 91% (Figure 2; Table 4). Average FCR was 2.60:1 (Figure 3; Table 4).

SUMMARY AND CONCLUSIONS

This was a demonstration with a first time cooperator in a new area for the ASA-IM, the southern Philippine island of Mindanao. There were several issues that likely impacted the project results. In particular, the initial fingerling grading to obtain even sized cohorts was not well accomplished, as there was significant size variation in the fish at stocking. Stocking with uniform size fish is critical to minimizing size variation at harvest.

Variation in the fish size impacted sampling results. In the first sampling the estimated FCR was 3.73:1, but at the next sampling was 1.31:1. Uneven fish size may also explain why an average fish size of over 750 g was estimated in October, but a smaller average size was found at the harvest in November.

Skin coloration was noted by the cooperator as a problem. As harvest time approached, it was noticed that the fish had a grayish skin color. This did not affect the taste or quality of the fish, but negatively affects marketability as fish that are grey are considered "less fresh" than fish that are black. To try to darken the fish, the covers were removed from the cages two weeks prior to the harvest. This improved fish coloration, and suggests that cage covers should not be used in marine cage production of milkfish.

Alsons Aquaculture Corporation expressed satisfaction with the results of the project, particularly as they began to transfer the lessons learned from this demonstration to their own pond and cage culture operations. They found by using the ASA-IM satiation feeding technique that they were able to significantly improve the performance of their commercial operations. The use of soy-based feed was also shown to be economically advantageous. Further testing of soy-based rations in field trials is needed to better quantify milkfish growth and feed efficiency on this type of diet, and to determine if further modifications to the diet are needed.

ACKNOWLEGEMENTS

The ASA-IM SIA Program gratefully acknowledges the help and support of the local ASA-IM Philippines staff, the SIA Local Coordinator Mr. Levy Manalac and the ASA-IM SEA regional office staff.

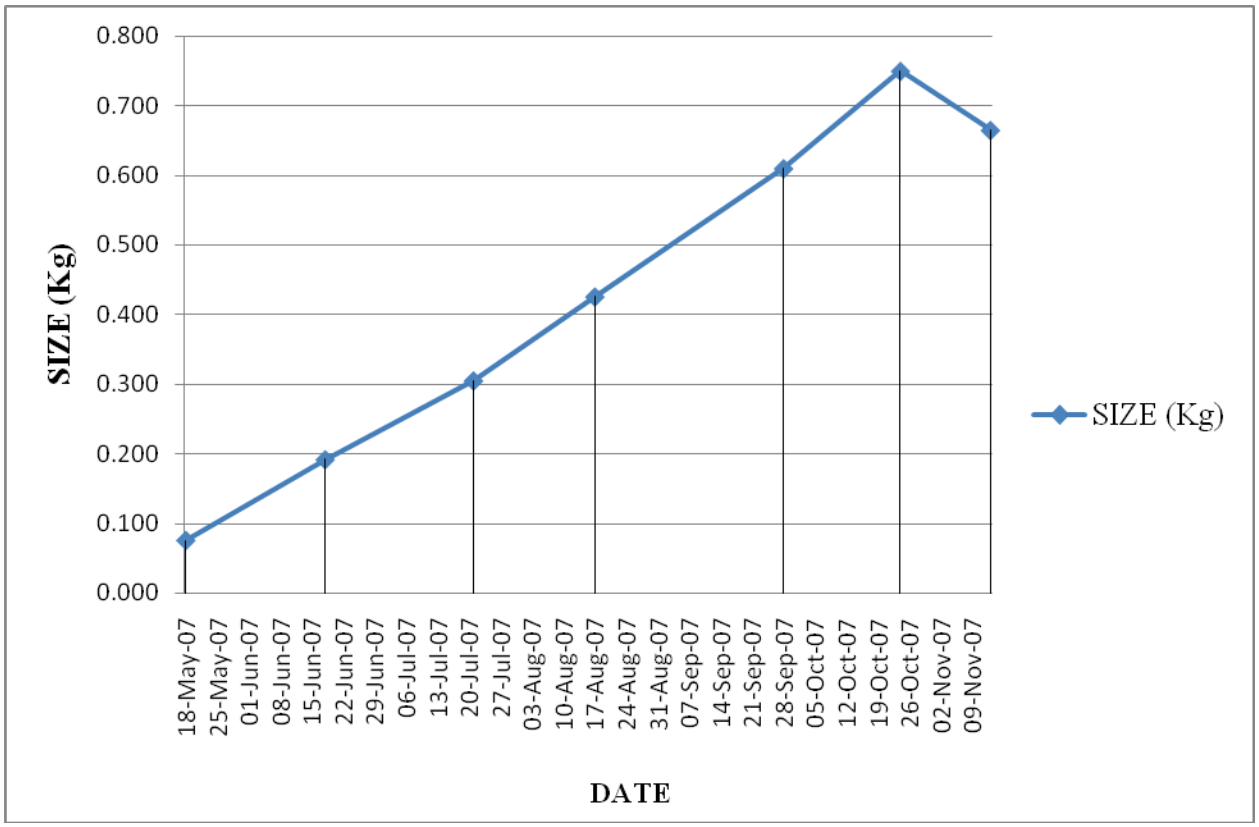

FIGURE 1. Growth curve for milkfish in marine cages over a 213-day culture period in the 2007 ASA-IM SIA Milkfish Demonstration Project at Malalag Bay in Santa Maria, Davao del Sur, Philippines. Milkfish grew from 56 g to 665 g in the 216-m^3 marine cages during this period.

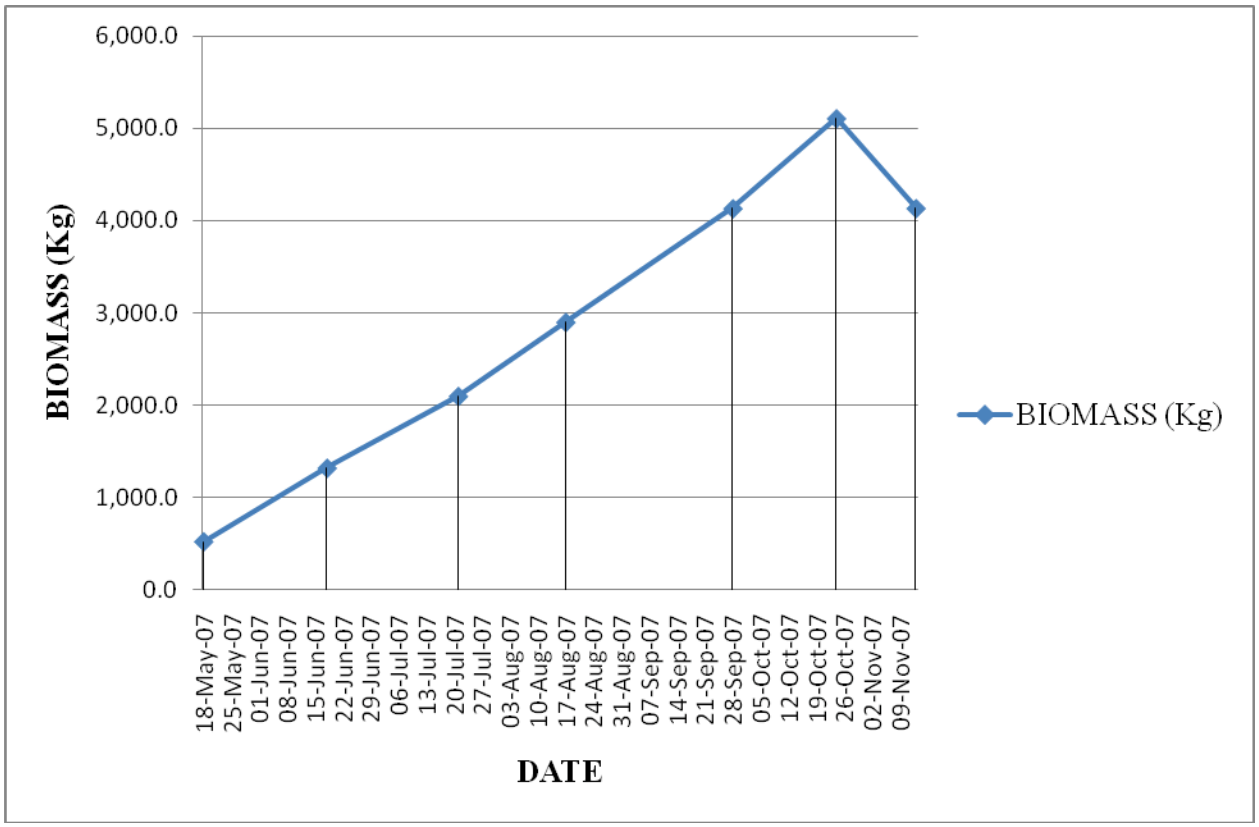

FIGURE 1. Biomass curve for milkfish in marine cages over a 213-day culture period in the 2007 ASA-IM SIA Milkfish Demonstration Project at Malalag Bay in Santa Maria, Davao del Sur, Philippines. The final average biomass in the three 216-m^3 cages was 4,136 kg/cage (19.1 kg/m^3).

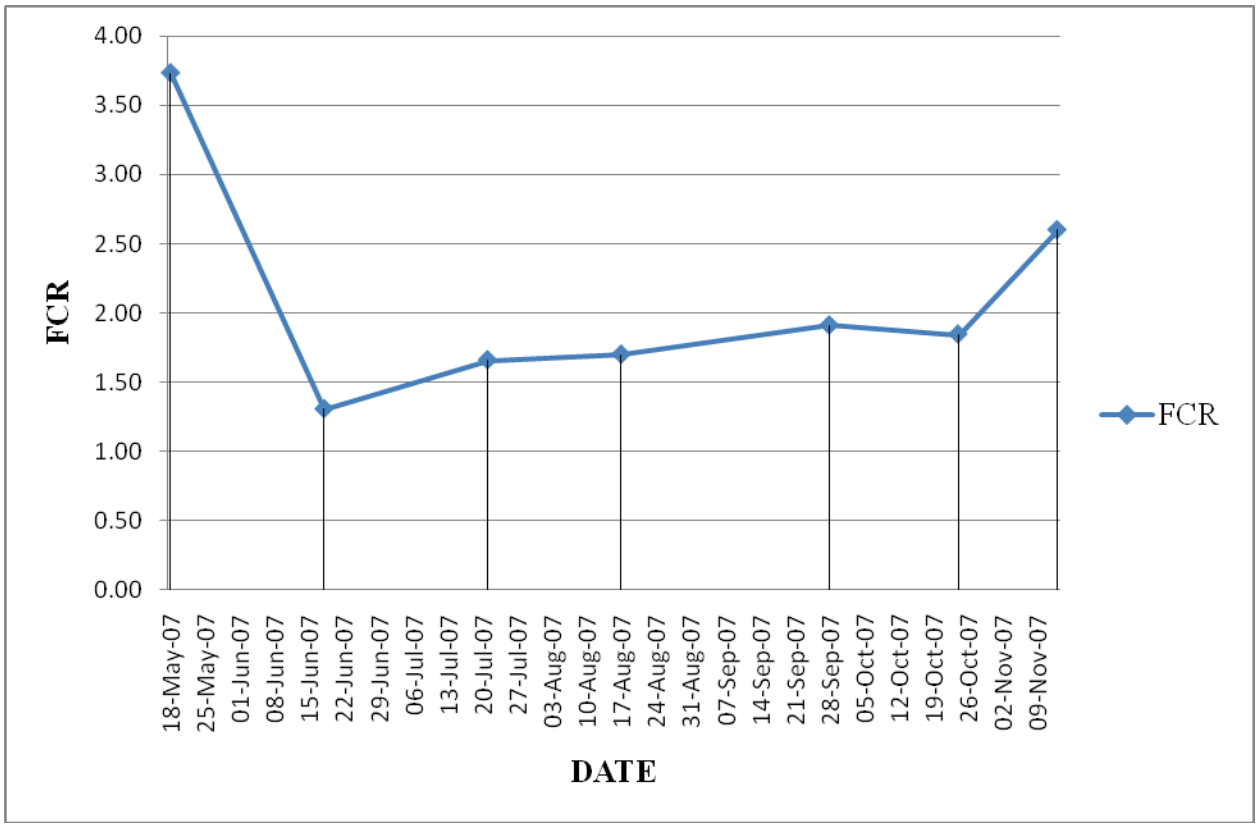

FIGURE 3. FCR curve for milkfish in 216-m^3 cages in the 2007 ASA-IM SIA Milkfish Demonstration Project at Malalag Bay in Santa Maria, Davao del Sur, Philippines. Average FCR during the 213-day culture period was 2.60:1.

TABLE 1. First formula provided to the local feedmill for the ASA-IM 34/9[1], soymeal-based feed used in the 2007 ASA-IM SIA Milkfish Demonstration Project at Malalag Bay in Santa Maria, Davao del Sur, Philippines. The feed was fed in 3 mm, extruded pellet form.

Ingredient	% Inclusion Rate
Soybean Meal - 45%	25.00
Fish, Local - 64.5/6	22.00
Rice, broken	15.00
Poultry BP - 65.8, low ash	15.00
Fish Oil	7.50
Corn Gluten ML 61/0.5	6.00
Wheat, Feed Flour - 12%	5.00
Blood ML 90/0.5	2.50
Soy Lecithin	1.00
Vitamin Premix-F2	0.50
Mineral Premix F-1	0.25
Stay C - 35%	0.06
Remoxin	0.05
Oxistat	0.0125
Calcium carbonate	0.1275
Total	**100.00**

[1]The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, i.e. 34/9 indicates 34% crude protein and 9% crude fat.

TABLE 2. Second formula provided to the local feedmill for the ASA-IM 34/9, soymeal-based feed used in the 2007 ASA-IM SIA Milkfish Demonstration Project at Malalag Bay in Santa Maria, Davao del Sur, Philippines. The feed was fed in 3 mm, extruded pellet form.

Ingredient	% Inclusion Rate
Soybean Meal, USA	29.80
Fish, Local	7.82
Poultry BP (Argentine)	9.30
Fish Oil, Local	5.54
Corn Gluten ML 61/0.5	5.77
Wheat, feed flour	6.90
Blood ML 90/0.5	2.67
Soy Lecithin	1
Vitamin Premix-F2	0.5
Mineral Premix F-1	0.25
Stay C - 35%	0.06
Remoxin	0.05
Oxistat	0.0125
Calcium Phosphate Mono	1.359
Feed wheat	28.98
Total	**100**

TABLE 3. Vitamin and mineral premix formulas produced by Progressive Laboratories and provided to the domestic feedmill for the ASA-IM 34/9 soymeal-based feed used in the 2007 ASA-IM SIA Milkfish Demonstration Project at Malalag Bay in Santa Maria, Davao del Sur, Philippines.

Vitamin Premix PMX-F2[1]

Nutrient	Unit	As fed
Vitamin A	IU/kg	1200000
Vitamin D3	IU/kg	200000
Vitamin E	IU/kg	20000
Biotin	mg/kg	40
Folic acid	mg/kg	1800
Niacin	mg/kg	40000
Pantothenate	mg/kg	20000
Pyridoxine (B6)	mg/kg	5000
Riboflavin (B2)	mg/kg	8000
Thiamin (B1)	mg/kg	8000
Vitamin B12	mcg/kg	2000
Ethoxyquin	mg/kg	500

Mineral Premix PMX-F1[1]

Nutrient	Unit	As fed
Iron	ppm	40000
Manganese	ppm	10000
Copper	ppm	4000
Zinc	ppm	40000
Iodine	ppm	1800
Cobalt	ppm	20
Selenium	ppm	200

[1]Premix ingredient quantities are per kg of premix.

TABLE 4. Results of the 2007 ASA-IM SIA milkfish demonstration project at Malalag Bay in Santa Maria, Davao del Sur, Philippines that demonstrated growth performance of milkfish using the ASA-IM LVHD production techniques and a soymeal-based, least-cost formulated 34/9 feed.

Cage No.	Stocking size (g)	Stocking rate (fish/cage)	No. days cultured	Harvest weight (g)	Gross Production		Survival (%)	FCR
					(kg/cage)	(kg/m^3)		
25	56	6875	213	668	4,158.0	19.3	91	2.59
26	56	6875	213	651	4,016.0	18.6	90	2.68
27	56	6875	213	676	4,233.0	19.6	91	2.53
Mean	**56**	**6875**	**213**	**665**	**4135.7**	**19.1**	**91**	**2.60**