Results of Coastal Cage Fish Trials in Guangxi Province with Red Drum, Japanese Sea Bass and Blackfin Sea Bream

Results of ASA/China 2000 Feeding Trials 35-00-127/128/129

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INTRODUCTION

The American Soybean Association (ASA), in cooperation with the China National Fisheries Extension Center (NEC) and the Guangxi Provincial Fisheries Extension Station, conducted cage feeding trials with red drum (*Sciaenops ocellata*), Japanese sea bass (*Lateolabrax japonicus*), and blackfin sea bream (*Acanthopagrus* sp.) at Longmen Town, Qingzhou City, Beihai in 2000. The objective of the trials was to demonstrate that sub-market size fish of each of the three test species could be weaned from a fresh fish diet to a soymeal-based, extruded feed and economically grown to market size on the extruded feed.

MATERIALS AND METHODS

Nine, 6.4-m^3 floating cages at Longmen Town, Qingzhou City, Beihai were used for the feeding trials. Cages were constructed of mesh netting with a solid frame, opaque wooden cover and square wooden feed enclosure. Cages were attached in rows to floating pier systems in a narrow sea channel across from the Longmen Town boat dock. Cage orientation was in two lines parallel to the tidal flow, with six cages in a line on one side of the cage farm and three cages in a line on the other side of the cage farm.

All cages were stocked with sub-market size fish. Three cages were stocked with 117-g red drum, three cages with 53-g Japanese sea bass, and three cages 61-g blackfin sea bream. Fish stocking density in all cages was 156 fish per m^3. Fish of each species were of uniform size and age at stocking. Target fish market size was 500 g for red drum and sea bass, and 200 g for blackfin sea bream.

Red drum and sea bass had previously only been cultured on a diet of chopped, fresh fish. After stocking in the trial cages, red drum and sea bass were weaned from fresh fish to the ASA 43/12 marine feed in extruded, floating pellet form (Table 1). Weaning was accomplished by replacing 10% or more of the fresh fish diet each day, up to a maximum of ten days, with the extruded ASA feed until red drum and sea bass were being fed 100% extruded feed. Blackfin sea bream had previously been weaned from fresh fish to a manufactured feed, and were switched to the

ASA feed after stocking in the trial cages. After weaning, fish in all nine trial cages were fed to satiation twice daily with the ASA extruded feed. Fish in replicate cages of each fish species were fed identically.

Trial management was based on the ASA LVHD cage production model. Fish in all cages were sampled once per month on the same date each month. All cages were harvested at the conclusion of the trial to determine average fish weight, gross and net production, feed conversion ratio (FCR) and survival. Production input costs were recorded throughout the trials and net income and return on investment (ROI) calculated at the end of the trials.

RESULTS

Red Drum Wean and Growout Trial

Red drum were weaned from fresh fish to the extruded ASA feed in 10 days without difficulty using the ASA weaning methodology. Red drum were fed the ASA feed for 150 days between 2 May and 29 September 2000. Red drum grew from 117 g to 732 g in the 150-day feeding period (Figure 1; Table 2). Mean gross and net production were 53.8 kg/m^3 and 35.5 kg/m^3, respectively (Table 2).

Average red drum survival was 47.2% (Table 2). Low fish survival was attributed to a combination of water temperature and salinity fluctuations, disease and pollution. Water temperature in the Longmen channel fluctuated between 31^{o}C and 33^{o}C in early July and was followed by high fish mortality. Flooding caused a drop in water salinity from approximately 20 ppt in early July to near 0 ppt on July 22, and was followed by fish disease and high fish mortality. Bio-pollution from too many fish culture cages caused bio-fouling of the trial cages that was difficult to clean and that restricted water exchange in the trial cages. Industrial pollution from the disassembling of three decommissioned warships within 100 m of the cage farm was also suspected to have contributed to poor water quality in the Longmen channel.

FCR based on actual feed fed and fish harvested was 2.50:1. This FCR did not include adjustment for fish mortality. After discounting the estimated weight of dead fish, actual FCR for the ASA extruded feed was approximately 1.4:1.

Average net income from the three red drum cages was RMB 3,475 per cage, or RMB 543/m^3 for the 6.4-m^3 cages (Table 2). Average ROI was 50.8%.

Japanese Sea Bass Wean and Growout Trial

Japanese sea bass were weaned from fresh fish to the extruded ASA feed in 10 days without difficulty using the ASA weaning methodology. Sea bass were fed the ASA feed for 124 days between 29 May and 29 September 2000. Sea bass grew from 53 g to 362 g in the 124-day feeding period with an average FCR of 1.77:1 (Figure 2; Table 3). Mean gross and net production were 45.5 kg/m^3 and 37.2 kg/m^3, respectively (Table 3).

Average fish survival was 80.6% (Table 3). Sea bass were more tolerant to poor and fluctuating water quality than red drum. Red drum mortality was approximately twice that of sea bass under the same culture conditions. Sea bass growth performance, however, was significantly depressed in August following fluctuations in water quality in late July.

Average net income from the three Japanese sea bass cages was RMB 3,782 per cage, or RMB 591/m^3 for the 6.4-m^3 cages (Table 3). Average ROI was 76.3%.

Blackfin Sea Bream Wean and Growout Trial

Blackfin sea bream were fed the ASA feed for 106 days between 15 June and 29 September 2000. Sea bream grew from 61 g to 226 g in the 124-day feeding period (Figure 3; Table 4). Mean gross and net production were 17.8 kg/m^3 and 8.3 kg/m^3, respectively (Table 4).

Average fish survival was 50.5% (Table 4). Over 60% of the fish mortality occurred soon after stocking fish in the trial cages at the Longmen site. The sea bream were transferred to Long Men from a cage site from several kilometers away that had significantly better water quality than the Longmen site. Fish mortality continued throughout the trial because of poor water quality conditions at the Longmen cage trial site.

FCR based on actual feed fed and fish harvested was 2.97:1. This FCR did not include any adjustment for fish mortality. After discounting the estimated weight of dead fish, actual FCR for the ASA extruded feed was approximately 1.5:1.

Average net income from the three sea bream cages was RMB 485 per cage, or RMB 75.7/m^3 for the 6.4-m^3 cages (Table 4). Average ROI was 14.3%.

SUMMARY AND CONCLUSIONS

Results of the trials demonstrated that sub-market size red drum and Japanese sea bass could be efficiently weaned from a fresh fish diet to a soymeal-based, extruded feed and grown to market size with the extruded feed. The soymeal-based extruded feed yielded good fish growth performance and high economic return with both of these species. Use of the extruded feed greatly reduced labor and increased work efficiency in comparison to feeding fresh fish. The added benefits of quality consistency, less nutrient loading of the aquatic environment, ease in shipping and storing, and absence of potential pathogens make the ASA extruded feed a better choice than fresh fish for feeding these species in cages.

Blackfin sea bream did not perform well in the trial. FCR was estimated to be good with the ASA feed, but overall growth performance at the Long Men site was poor and yielded a low economic return.

Industrial and bio-pollution, too many culture cages, high water temperatures and variable salinity made Longmen a poor cage culture site. It is not possible to adequately assess fish culture feasibility or culture variables at this site because of the poor quality of the coastal

aquatic environment. It is recommended that the Guangxi Provincial Fisheries Extension Station eliminate the use of this site for further cage demonstration and research trials.

ACKNOWLEGEMENTS

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Chinese Currency and Production Unit Conversions:

RMB 8.26 = US$1.00
1.0 kg = 2.2 lb

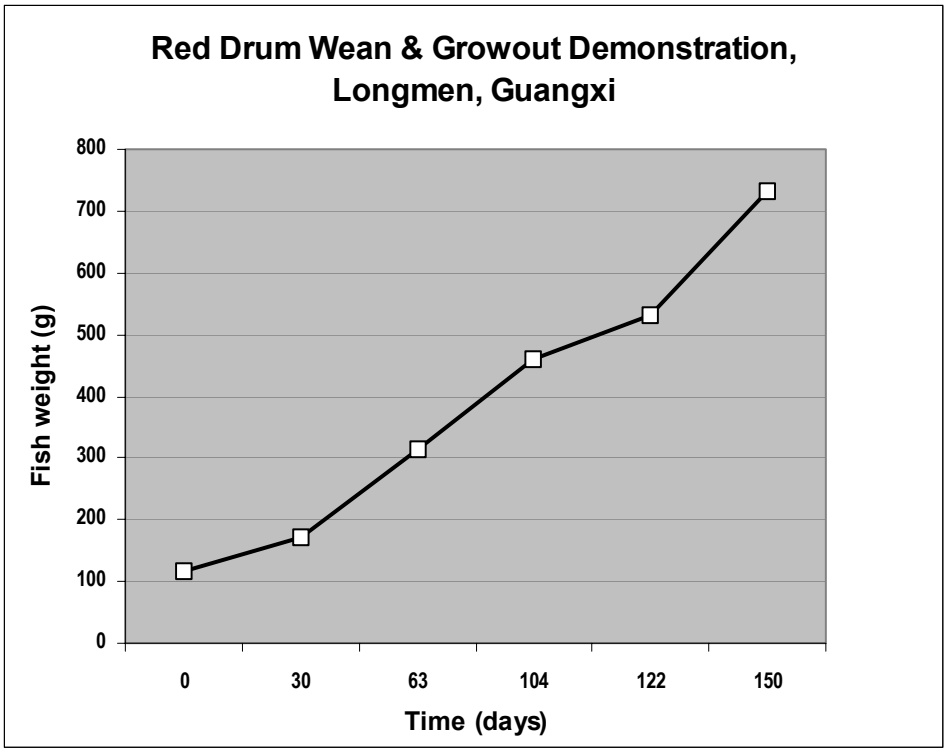

Figure 1. Growth curve for red drum weaned from a fresh fish diet to an ASA 43/12 extruded, floating feed and grown to market size on the extruded feed in a cage trial conducted at Longmen Town, Beihai, Guangxi Province. Fish growth performance was significantly impacted by poor water quality at the trial site .

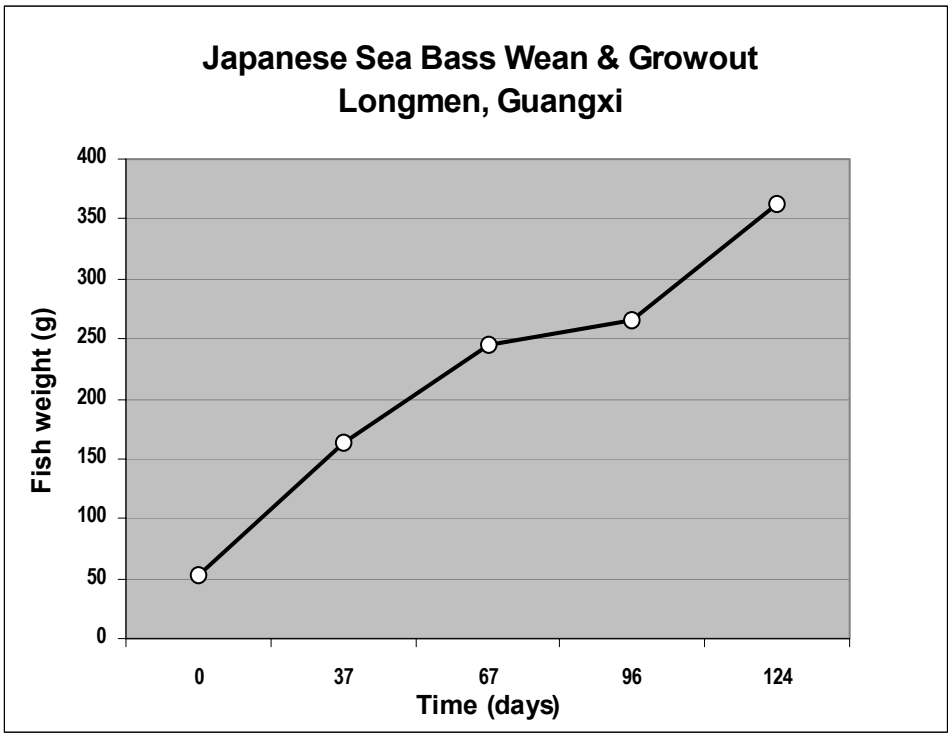

Figure 2. Growth curve for Japanese sea bass weaned from a fresh fish diet to an ASA 43/12 extruded, floating feed and grown to market size on the extruded feed in a cage trial conducted at Longmen Town, Beihai, Guangxi Province. Fish growth performance was significantly impacted by poor water quality at the trial site .

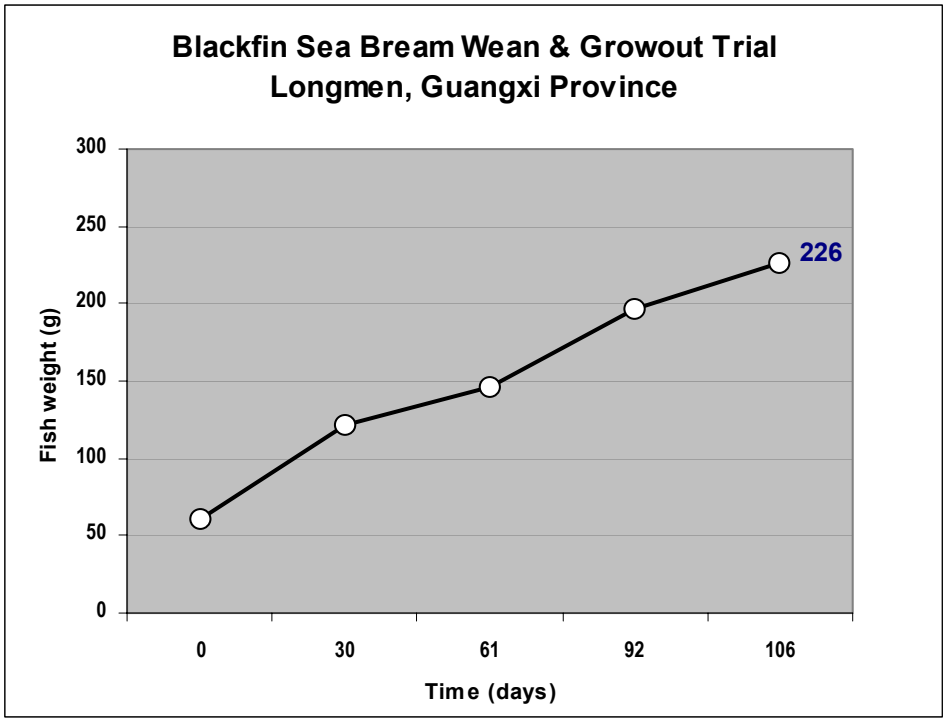

Figure 3. Growth curve for blackfin sea bream fed an ASA 43/12 extruded, floating feed in a wean and growout cage trial conducted at Longmen Town, Beihai, Guangxi Province. Growth performance was significantly impacted by poor water quality at the trial site .

Table 1. Formula for the ASA 43/12, soymeal-based marine fish feed used in the 2000 wean and growout trials with red drum, sea bass and sea bream conducted at Longmen Town, Beihai, Guangxi Province, China.

Ingredient	Percentage of feed
Soybean Meal 47.5	40.00
Fishmeal, anchovy 65/10	34.00
Wheat, SWW	16.50
Fish Oil, Unspec.	8.03
Corn gluten meal	1.00
Vit PMX Roche 2118	0.20
Min PMX F-1	0.25
Ethoxyquin	0.02
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. 43/12 indicates 43% crude protein and 12% crude fat.

Table 2. Results of the 2000 ASA cage aquaculture trial that evaluated growth performance of sub-market size red drum weaned from a fresh fish diet to a soymeal-based, extruded feed in 6.4-m^3 cages at Longmen Town, Beihai, Guangxi Province.

Cage no.	Stocking rate (fish/m^3)	Initial fish weight (g)	No. days fed	Fish harvest weight (g)	P_G[1] kg/m^3	P_N[2] kg/m^3	Survival (%)	FCR	Net income (RMB/cage)	Net income (RMB/m^3)	ROI (%)
1	156	115	150	705	56.3	38.3	51.1	2.30	3,962	619	57.9
2	156	121	150	727	55.0	36.1	48.6	2.44	3,712	580	54.2
3	156	115	150	763	50.0	32.0	41.9	2.75	2,752	430	40.2
Mean	**156**	**117**	**150**	**732**	**53.8**	**35.5**	**47.2**	**2.50***	**3,475**	**543**	**50.8**

[1]P_G = Gross fish production

[2]P_N = Net fish production

* FCR does not include any adjustment for fish mortality. After discounting the estimated weight of dead fish, actual FCR for the ASA extruded feed was approximately 1.4:1.

Table 3. Results of the 2000 ASA cage aquaculture trial that evaluated growth performance of sub-market size Japanese sea bass weaned from a fresh fish diet to a soymeal-based, extruded feed in 6.4-m^3 cages at Longmen Town, Beihai, Guangxi Province.

Cage no.	Stocking rate (fish/m^3)	Initial fish weight (g)	No. days fed	Fish harvest weight (g)	P_G[1] kg/m^3	P_N[2] kg/m^3	Survival (%)	FCR	Net income (RMB/cage)	Net income (RMB/m^3)	ROI (%)
1	156	52	124	362	44.7	36.6	79.1	1.79	3,622	566	73.0
2	156	55	124	358	45.1	36.5	80.7	1.84	3,699	578	74.6
3	156	53	124	365	46.8	38.5	82.0	1.70	4,026	629	81.2
Mean	**156**	**53**	**124**	**362**	**45.5**	**37.2**	**80.6**	**1.77**	**3,782**	**591**	**76.3**

[1]P_G = Gross fish production

[2]P_N = Net fish production

Table 4. Results of the 2000 ASA cage aquaculture trial that evaluated growth performance of sub-market size blackfin sea bream fed a soymeal-based, extruded feed in 6.4-m^3 cages at Longmen Town, Beihai, Guangxi Province.

Cage no.	Stocking rate (fish/m^3)	Initial fish weight (g)	No. days fed	Fish harvest weight (g)	P_G[1] kg/m^3	P_N[2] kg/m^3	Survival (%)	FCR	Net income (RMB/cage)	Net income (RMB/m^3)	ROI (%)
1	156	58	106	222	18.1	9.1	52.3	2.69	550	85.9	16.2
2	156	60	106	217	17.3	7.9	51.1	3.10	376	58.7	11.1
3	156	65	106	239	18.0	7.8	48.1	3.14	528	82.5	15.6
Mean	**156**	**61**	**106**	**226**	**17.8**	**8.3**	**50.5**	**2.97***	**485**	**75.7**	**14.3**

[1]P_G = Gross fish production

[2]P_N = Net fish production

*FCR does not include any adjustment for fish mortality. After discounting the estimated weight of dead fish, actual FCR for the ASA extruded feed was approximately 1.5:1.