

Growth Performance of Sub-Market Size Yellow Croaker Weaned from Fresh Fish to an Extruded, Soymeal-Based Feed

Results of ASA/China Feeding Trials 35-00-120 and 35-00-123

Michael C. Cremer, Zhang Jian and Zhou Enhua
American Soybean Association
Room 902, China World Tower 2
No. 1 Jianguomenwai Avenue
Beijing 100004, P.R. China

ABSTRACT

Sub-market size yellow croaker (*Pseudosciaena crocea*) were weaned from a fresh fish diet to an extruded pellet feed and grown to market size in cages in ASA feeding trials at Nanji Island, Wenzhou, and Xiangshan, Ningbo. The extruded feed was a soymeal-based ration containing 43% crude protein and 12% fat and fed in extruded, floating pellet form. Yellow croaker were stocked in 22.5-m³ cages at 31 fish per m³ in the Wenzhou trial, and at 75 fish per m³ in 8-m³ cages in the Ningbo trial. In the Wenzhou trial, yellow croaker grew from 164 g to 327 g in 123 days on the extruded feed, with an FRC of 1.67:1 and 96.7% survival. Net income for the Wenzhou trial was RMB 7,043 per cage, or RMB 313/m³ for the 22.5-m³ cages. ROI was 83.2%. In the Ningbo trial, yellow croaker grew from 103 g to 248 g in 118 days on the extruded feed, with an FRC of 2.24:1 and 93.3% survival. Net income for the Ningbo trial was RMB 3,480 per cage, or RMB 435/m³ for the 8-m³ cages. ROI was 72%. Fish growth and FCR in the Ningbo trial were affected by a parasitic infestation midway through the trial. Both trials demonstrated good croaker growth performance and economic return with the soymeal-based, extruded feed. High net income and ROI demonstrated the feasibility of weaning sub-market size yellow croaker from fresh fish to an extruded feed and growing them to market size on the extruded feed. The added benefits of quality consistency, less nutrient loading of the aquatic environment, ease in shipping and storing, and absence of potential pathogens make extruded feed a superior choice than fresh fish for feeding yellow croaker in cages.

INTRODUCTION

The American Soybean Association (ASA), in cooperation with the Ping Yang County Fisheries Bureau of Zhejiang Province, the Ningbo Municipal Fisheries Bureau, and the National Fisheries Extension Center in Beijing, conducted two wean and growout feeding trials with yellow croaker (*Pseudosciaena crocea*) in cages. The objectives of the trials were to determine the feasibility of weaning yellow croaker from a fresh fish diet to an extruded feed, and to determine post-weaning fish growth performance with the extruded feed.

MATERIALS AND METHODS

Wenzhou Trial

Six, 22.5-m³ floating cages at Nanji Island off the coast of Wenzhou, Zhejiang Province, were used for the trial. Cages were constructed of mesh netting with a rigid top frame and opaque covers. The cages were fitted with feed enclosures to contain floating feed pellets.

Cages were stocked with sub-market size yellow croaker with an average weight of 164 g per fish. Yellow croaker were stocked in the three trial cages at a density of 31 fish per m³.

Trial fish had previously only been cultured on a diet of chopped, fresh fish. After stocking in the trial cages, yellow croaker 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 croaker were being fed 100% extruded feed. After weaning, fish in all cages were fed to satiation twice daily with the extruded feed.

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.

Ningbo Trial

Three, 8-m³ cages in the vicinity of the Ningbo Haiwan Aqua Stock Breeding Center, Xiangshan County, Ningbo, Zhejiang Province, were used for the trial. Cages were constructed of mesh netting with a rigid top frame and opaque covers. Three of the cages were fitted with feed enclosures to contain floating feed pellets.

Cages were stocked with sub-market size yellow croaker with an average weight of 103 g per fish. Yellow croaker were stocked in the three trial cages at a density of 75 fish per m³.

Trial fish had previously only been cultured on a diet of chopped, fresh fish. After stocking in the trial cages, yellow croaker 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 croaker were being fed 100% extruded feed. After weaning, fish in all cages were fed to satiation twice daily with the extruded feed.

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.

RESULTS

Wenzhou Trial

Yellow croaker were fed for 123 days between 11 May and 11 September 2000. Croaker fed the ASA extruded feed grew from 164 g to 327 g with an FCR of 1.67:1 (Figure 1; Table 2). Mean gross and net production for the three, 22.5-m³ trial cages were 9.84 kg/m³ and 4.74 kg/m³, respectively (Table 2).

Net income was RMB 7,043 per cage, or RMB 313/m³ for the 22.5-m³ trial cages (Table 2). Average ROI was 83.2%.

Average fish survival was 96.7% (Table 2). No diseases were experienced with fish in the trial cages, although fish were stressed during one incidence of red tide and two typhoons that impacted the trial site. In comparison, croaker in adjacent cages that were fed fresh fish under the same circumstances had a high disease rate.

Ningbo Trial

Yellow croaker were fed for 118 days between 15 June and 15 October 2000. Croaker fed the ASA extruded feed grew from 103 g to 248 g with an FCR of 2.24:1 (Figure 2; Table 3). Mean gross and net production for two of the 8.0-m³ trial cages were 17.34 kg/m³ and 9.73 kg/m³, respectively (Table 3).

One cage replicate was eliminated from analyses because of a $\geq 50\%$ fish mortality that resulted from a pump breakdown when fish were removed from the trial cage for a prophylactic freshwater bath to treat external parasites. Fish growth and FCR in the other two cages were affected by a parasitic infestation midway through the trial that significantly impacted growth for approximately 30 days (Figure 2). Average fish survival in was 93.3% (Table 3), and was reported to be 10-15% higher than fish survival using traditional culture techniques.

Net income was RMB 3,480 per cage, or RMB 435/m³ for the 8-m³ cages (Table 3). Average ROI was 72%.

SUMMARY AND CONCLUSIONS

Results of the trials demonstrated that sub-market size yellow croaker 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. 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 yellow croaker in cages.

ACKNOWLEDGEMENTS

ASA gratefully acknowledges the Ping Yang County Fisheries Bureau, Ningbo Municipal Fisheries Bureau, and Director and staff of the National Fisheries Extension Center for their assistance and support for this aquaculture trial. ASA participation in this trial was jointly funded by U.S. soybean farmers and the U.S. Foreign Agricultural Service.

Chinese Currency and Production Unit Conversions:

$$\begin{aligned} \text{RMB } 8.26 &= \text{US\$1.00} \\ 1.0 \text{ kg} &= 2.2 \text{ lb} \end{aligned}$$

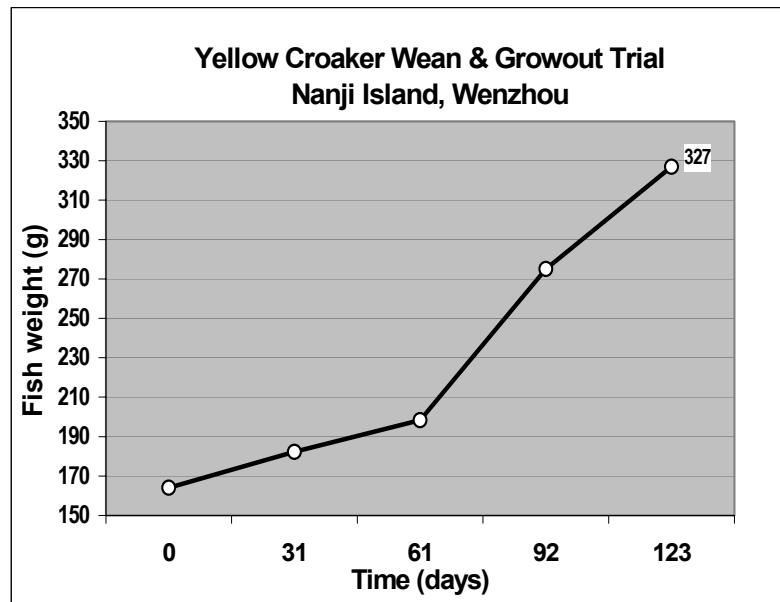


Figure 1. Growth curve for sub-market size yellow croaker weaned from a fresh fish diet to a soymeal-based extruded feed and grown to market size in an ASA cage culture trial conducted at Nanji Island, Wenzhou, China.

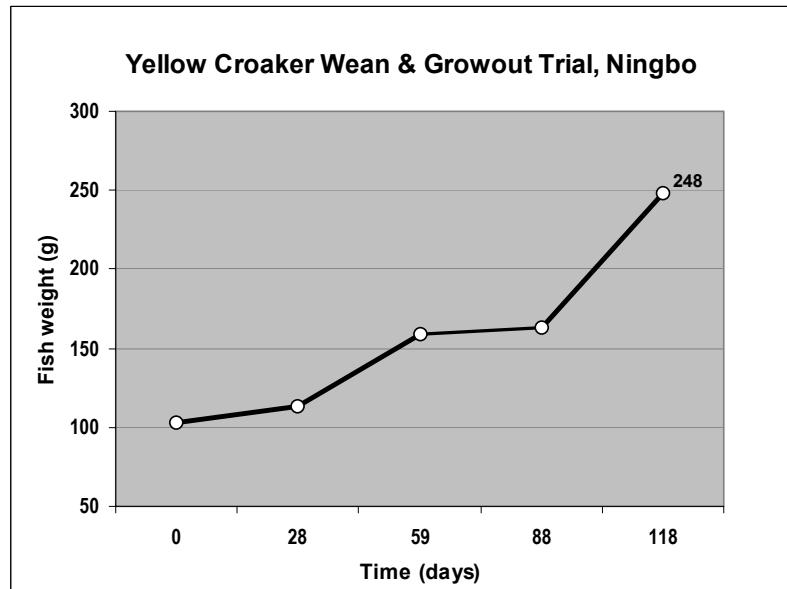


Figure 2. Growth curve for sub-market size yellow croaker weaned from a fresh fish diet to a soymeal-based extruded feed and grown to market size in an ASA cage culture trial conducted at Xiangshan, Ningbo, China. Fish growth between days 59 and 88 was slow following treatment for external parasites.

Table 1. Formula for the ASA 43/12, soymeal-based marine fish feed used in the 2000 yellow croaker wean and growout trials conducted at Wenzhou and Ningbo, 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

¹The 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 yellow croaker weaned from a fresh fish diet to a soymeal-based, extruded feed in 22.5-m³ cages at Nanji Island, Wenzhou.

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 (%)
10	31	164	123	338	10.19	5.08	96.8	1.57	7,537.5	335	88.6
11	31	164	123	312	9.47	4.43	97.6	1.80	6,547.5	291	78.1
12	31	164	123	331	9.87	4.74	95.8	1.64	7,042.5	313	82.9
Mean	31	164	123	327	9.84	4.74	96.7	1.67	7,042.5	313	83.2

¹P_G = Gross fish production

²P_N = Net fish production

Table 3. Results of the 2000 ASA cage aquaculture trial that evaluated growth performance of sub-market size yellow croaker weaned from a fresh fish diet to a soymeal-based, extruded feed in 8-m³ cages at Xiangshan, Ningbo

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	75	103	118	243	16.64	8.92	91.3	2.43	3,134.4	391.8	64.8
3	75	103	118	252	18.04	10.54	95.4	2.04	3,825.6	478.2	79.1
Mean	75	103	118	248.3	17.34	9.73	93.3	2.24	3,480.0	435.0	72.0

¹P_G = Gross fish production

²P_N = Net fish production