

# **Growth Performance of Yellow Croaker Fingerlings On Extruded Feeds in Coastal Cages at Ningbo, China**

## **Results of ASA/China Feeding Trials 35-01-122 and 35-01-123**

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### **ABSTRACT**

Yellow croaker (*Pseudosciaena crocea*) growth performance in coastal cages was evaluated during the fingerling production cycle with two feeds in a two-part ASA feeding trial at Ningbo, Zhejiang Province, China. Yellow croaker were stocked in six, 2.25-m<sup>3</sup> cages at a density of 2,500 fish per cage and fed to satiation daily for 30 days with a 47% crude protein and 15% crude fat (47/15 feed) extruded feed in the first stage of the trial. After 30 days, fish were transferred to six, 8-m<sup>3</sup> cages and stocked at a density of 200 fish per m<sup>3</sup> for the second stage of the trial. Fish in three of the 8-m<sup>3</sup> cages were continued on the 47/15 feed, while fish in three other replicate cages were fed the ASA marine fish growout feed formulated to contain 43% crude protein and 12% crude fat (43/12 feed). Both feeds were fed in extruded, floating pellet form. Fish in all six cages were fed to satiation, three times daily for the first month, and twice daily thereafter. Yellow croaker grew from 2.2 g to 5.7 g in the 30-day, stage one component of the trial. Average FCR with the 47/15 feed during stage one was 1.20:1. Average fish survival was 99.6%. In the second stage, yellow croaker fed the 47/15 feed grew from 5.8 g to 42.4 g in 93 days, while yellow croaker fed the 43/12 feed grew from 5.8 g to 42.8 g. Survival averaged 84.7% for fish fed the 47/15 feed, and 85.6% for fish fed the 43/12 feed. FCR averaged 1.66:1 for fish fed the 47/15 feed, and 1.63:1 for fish fed the 43/12 feed. There was no significant difference ( $P>0.05$ ) in fish growth, survival or FCR for the two feed treatments. Results of the trial indicate that yellow croaker perform well on the 47/15 feed during the first 30 days of the fingerling production cycle, exhibiting excellent growth performance, survival and FCR, but that production performance is not enhanced by feeding the 47/15 feed beyond 30 days. Fish growth performance, survival and FCR were equivalent with the 47/15 and 43/12 feeds during the 93-day, stage-two trial period. At a 23% cost premium for the 47/15 feed, no benefits were demonstrated that would justify use of the higher cost feed after fish attain a size of approximately 5 g. ASA recommends use of the ASA 47/15 feed for culturing yellow croaker from 2 g to 5 g in size, followed by feeding with the ASA 43/12 feed from fish size 5 g to market size.

### **INTRODUCTION**

The American Soybean Association (ASA), in cooperation with the Ningbo Municipal Fisheries Bureau and the Ping Yang County Fisheries Bureau of Zhejiang Province, conducted a two-stage feeding trial to evaluate yellow croaker (*Pseudosciaena crocea*) growth in cages using ASA LVHD technology and extruded aquafeeds. The objective of the trial was to determine whether yellow croaker growth performance during the fingerling production cycle improved with a feed higher in protein and fat in comparison to ASA's standard 43/12 marine growout feed.

## **MATERIALS AND METHODS**

### **Stage One**

Six, 2.25-m<sup>3</sup> cages (1.5 m x 1.5 m x 1 m) in the vicinity of the Ningbo Haiwan Aqua Stock Breeding Center in Xiangshan County, Ningbo, Zhejiang Province, were used for the first stage of the trial. Cages were constructed of mesh netting with a rigid top frame and opaque covers. The six cages were stocked with 2-g yellow croaker at a density of 2,500 fish per cage.

Fish in all cages were fed the ASA 47/15 (47% crude protein and 15% crude fat) marine fingerling feed in extruded, floating pellet form (Table 1). The 47/15 feed was formulated by ASA and produced by the Shanghai DaJiang aquafeed mill. Initial feed pellet size was 2.0 mm. Fish were fed to satiation three to four times daily, depending on environmental and tidal conditions. The first stage of the trial was terminated when fish reached an average size of about 5 g.

### **Stage Two**

Fish from the six stage-one trial cages were pooled and 9,600 fish randomly selected and restocked in six, 8.0-m<sup>3</sup> cages (2 m x 2 m x 2 m) for growout to approximately 40-g fingerlings. Croaker were stocked in the 8.0-m<sup>3</sup> cages at a density of 200 fish per m<sup>3</sup>. Cages were constructed of nylon mesh netting over rigid frames, with opaque covers and a feed enclosure to contain floating, extruded feed pellets. Cages were positioned in two rows, with a minimum of one cage width between and on all sides of each cage to allow good water exchange.

Croaker in three of the cages were fed the ASA 47/15 marine fingerling feed. Fish in the other three cages were fed the ASA 43/12 marine growout feed (Table 2). Both feeds were fed in extruded, floating pellet form. Fish in all cages were fed to satiation, three times daily for the first month, and twice daily thereafter. Fish in replicate cages of each feed treatment were fed identically. Feed treatment replications were randomly assigned to the six trial cages.

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.

## **RESULTS**

### **Stage 1 Trial**

Yellow croaker were fed the 47/15 feed for 30 days between 14 June and 13 July 2001 in the first stage of the trial. Croaker grew from 2.2 g to an average of 5.7 g in the 30-day feeding period (Table 3). Average FCR with the 47/15 feed was 1.20:1 for fish in the six replicate cages. Average fish survival was 99.6%.

## **Stage 2 Trial**

Yellow croaker in the six, 8.0-m<sup>3</sup> trial cages were fed for 93 days between 14 July and 15 October 2001. Croaker fed the 47/15 feed grew from 5.8 g to an average weight of 42.4 g during this period (Figure 1; Table 3). Croaker fed the 43/12 feed grew from 5.8 g to an average weight of 42.8 g (Figure 1; Table 3). FCR averaged 1.66:1 with the 47/15 feed and 1.63:1 with the 43/12 feed. Fish survival was 84.7% for fish fed the 47/15 feed, and 85.6% for fish fed the 43/12 feed. There was no significant difference ( $P>0.05$ ) in fish growth, survival or feed conversion with the two feed treatments.

Net income and ROI were significantly different ( $P<0.05$ ) for the two feed treatments. Net income and ROI for fish fed the 43/12 feed were RMB 125.7/m<sup>3</sup> and 55.6%, in comparison to RMB 109.3/m<sup>3</sup> and 46.3% for fish fed the 47/15 feed. Net income and ROI were reduced with the 47/15 feed because of its 23% higher cost (RMB 5.9/kg) in comparison to the 43/12 feed (RMB 4.8/kg). The higher cost of the 47/15 feed is largely due to the higher inclusion level of fishmeal, in comparison to the 43/12 feed. Lower cost soybean meal is used as a partial replacement for fishmeal in the 43/12 feed.

## **SUMMARY AND CONCLUSIONS**

Results of the trial indicate that yellow croaker perform well on the nutrient dense, 47/15 feed during the first 30 days of the fingerling production cycle. Croaker exhibited excellent growth performance, survival and FCR with the 47/15 feed during the initial 30-day feeding period, but production performance was not enhanced by feeding the 47/15 feed beyond 30 days. Fish growth performance, survival and FCR were equivalent with the 47/15 and 43/12 feeds during the 93-day, stage-two trial period. At a 23% cost premium for the 47/15 feed, no benefits were demonstrated that would justify use of the higher cost feed after fish attain a size of about 5 g. Higher net income and ROI were achieved with the 43/12 feed that utilizes lower cost, soybean meal to partially replace fishmeal in this feed. ASA recommends use of the ASA 47/15 feed for culturing yellow croaker from 2 g to 5 g in size, followed by feeding with the ASA 43/12 feed from fish size 5-g to market size.

## **ACKNOWLEDGEMENTS**

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## **Chinese Currency and Production Unit Conversions:**

RMB 8.26 = US\$1.00

1.0 kg = 2.2 lb

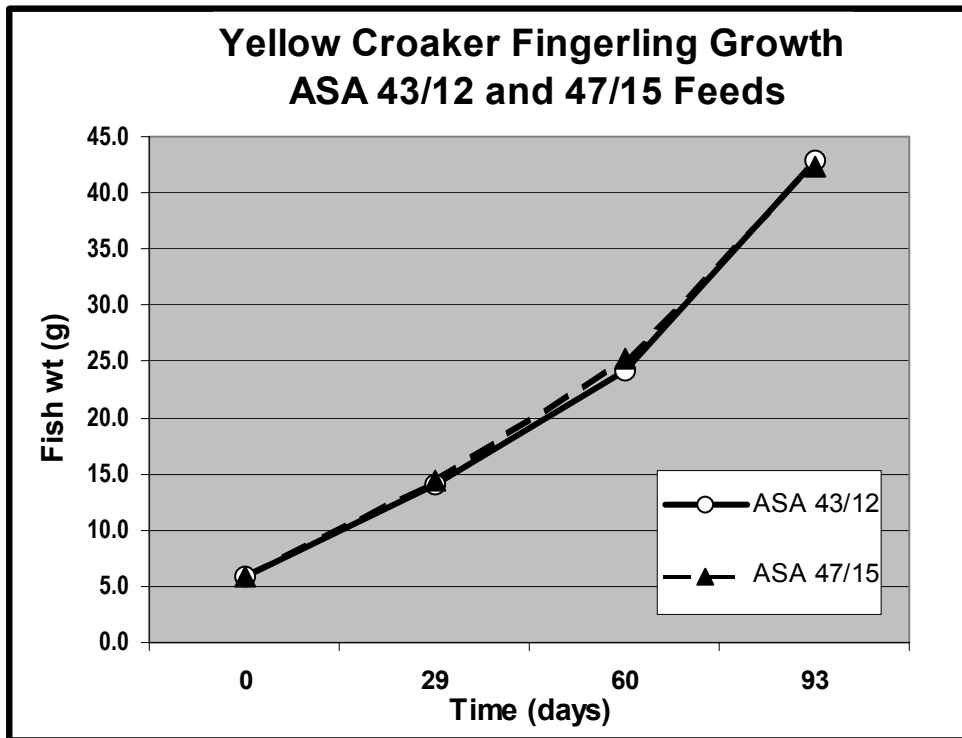


FIGURE 1. Growth curves for yellow croaker fed 47/15 and 43/12 feeds in a two-stage fingerling production trial conducted at Xiangshan, Ningbo, China. Growth performance of yellow croaker was not enhanced with the higher protein and fat, 47/15 feed.

Table 1. Formula for the ASA 47/15 marine fingerling feed used in the 2001 yellow croaker fingerling trial conducted at Ningbo, Zhejiang Province, China.

Ingredient	Percentage of feed
Fishmeal, anchovy 67/7-8	48.70
Wheat flour 10	20.00
Soybean Meal 43	10.00
Wheat gluten 68	10.00
Fish Oil, Unspecified PV=10<20	10.50
Min PMX T&S 1	0.25
Vit PMX F2	0.50
Stable Vit C35	0.03
Ethoxyquin 66	0.02
TOTAL	100.00

<sup>1</sup>The numerical component of the feed description refers to the percentage of protein and fat, respectively, in the ration, i.e. 47/15 indicates 47% crude protein and 15% crude fat.

Table 2. Formula for the ASA 43/12 marine fish growout feed used in the 2001 yellow croaker fingerling trial conducted at Ningbo, Zhejiang Province, China.

Ingredient	Percentage of feed
Soybean Meal 43	35.00
Fishmeal, anchovy 63/6.5	37.00
Wheat Flour 10	14.20
Wheat Gluten	4.60
Fish Oil, Unspec.	8.40
Vit PMX	0.50
Min PMX	0.25
Stable Vitamin C35	0.03
Ethoxyquin	0.02
TOTAL	100.00

<sup>1</sup>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 3. Results of the 2001 ASA aquaculture trial that evaluated yellow croaker growth performance in 8.0-m<sup>3</sup> cages with 47/15 and 43/12 extruded aquafeeds in a two-stage trial at Xiangshan, Ningbo.

Cage No.	Feed	Stocking rate (fish/m <sup>3</sup> )	Initial fish weight (g)	No. days fed	Fish harvest weight (g)	Survival (%)	FCR	Net income (RMB/m <sup>3</sup> )	ROI (%)
<u>Stage 1</u>									
1	47/15	1,111	2.0	30	5.8	99.4	1.10		
2	47/15	1,111	1.8	30	5.3	99.6	1.18		
3	47/15	1,111	2.5	30	5.9	99.5	1.23		
4	47/15	1,111	2.4	30	5.9	99.8	1.19		
5	47/15	1,111	2.2	30	5.6	99.6	1.20		
6	47/15	1,111	2.3	30	5.6	99.4	1.27		
Mean	47/15	1,111	2.2	30	5.7	99.6	1.20		
<u>Stage 2</u>									
1	43/12	200	5.8	93	42.3	84.5	1.68	115.2	50.5
2	43/12	200	5.7	93	43.0	86.3	1.60	131.2	58.6
3	43/12	200	5.8	93	43.1	86.1	1.60	130.6	57.7
Mean	43/12	200	5.8	93	42.8	85.6	1.63	125.7	55.6
1	47/15	200	5.9	93	42.5	86.9	1.62	116.7	49.0
2	47/15	200	5.7	93	41.6	84.1	1.71	101.0	43.0
3	47/15	200	5.7	93	43.2	83.1	1.66	110.1	46.9
Mean	47/15	200	5.8	93	42.4	84.7	1.66	109.3	46.3