Growth Performance of Japanese Sea Bass (*Lateolabrax japonicus*) in 8-m^3 Cages with Soymeal- and Fishmeal-based Feeds

Results of ASA/China Feeding Trials 35-99-74 & 35-00-117

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ABSTRACT

Japanese sea bass (*Lateolabrax japonicus*) growth in cages was evaluated from small fingerling to market size during the 1999 and 2000 production seasons at Nan Ji Island along the east coast of China. Growth from fingerling to sub-market size was evaluated in 1999 with soymeal-based and fishmeal-based feed rations formulated to contain 43% protein and 12% fat, and from sub-market to market size in 2000 with the 43/12 soymeal-based feed ration. The soymeal- and fishmeal-based rations were formulated to be isonitrogenous and isocaloric and were fed in an extruded pellet form. In June 1999, fish were stocked in 8.0-m^3 cages at 350 fish per m^3 and fed for 153 days. Sea bass grew from 3 g to 297 g with the soymeal-based ration, and from 3 g to 289 g with the fishmeal-based ration. There was no significant difference ($P>0.05$) in fish growth or feed conversion efficiency with the two feeds. FCR averaged 1.53:1 and 1.55:1 for the soymeal- and fishmeal-based rations, respectively. Survival averaged 50% for all cages and treatments. The sea bass were over-wintered and restocked in 8.0-m^3 cages at 175 fish per m^3 in late April 2000. Sea bass grew from 302 g to 527 g in 90 days on the soymeal-based ration, with an average FCR of 1.54:1. Fish survival averaged 93%. Gross fish production averaged 85.9 kg/m^3. Net profit was RMB 28,559 for the three trial cages, or RMB 1,190/m^3, at an August 2000 market price of RMB 36/kg.

INTRODUCTION

The American Soybean Association (ASA), in cooperation with the Ping Yang County Fisheries Bureau of Zhejiang Province and the National Fisheries Extension Center in Beijing, conducted a two-year feeding trial in 1999 and 2000 to evaluate Japanese sea bass (*Lateolabrax japonicus*) growth in cages using ASA LVHD technology and manufactured feeds. Prior to this, sea bass production along the coast of China depended on wild caught fresh fish for feeding fish in cages. The objectives of the trial were to demonstrate the technical and economic feasibility of producing Japanese sea bass with extruded feeds, to begin establishing feed-based parameters for this species, and to evaluate the feasibility of using high protein, dehulled soybean meal as a significant protein source in feed for sea bass.

MATERIALS AND METHODS

1999

Fish for the 1999 component of the trial were 3.0-g Japanese sea bass (*Lateolabrax japonicus*) fingerlings. The fingerlings had been fed from the advanced fry stage to 3 g with wild caught fresh

fish ground to a paste. Prior to starting the trial, the fingerlings were weaned from the fresh fish paste to one of two extruded feed rations. Weaning was done over a 5-day period by gradually replacing the fresh fish paste with extruded feed pellets.

Six, 8.0-m^3 cages (2 m x 2 m x 2 m) outfitted with opaque covers and enclosures for floating feed were used for the trial. Fish in three of the cages were fed a fishmeal-based ration (Table 1). Fish in the other three cages were fed a soymeal-based ration formulated with 40% dehulled soybean meal (Table 1). The two manufactured rations were formulated to be isocaloric and isonitrogenous, with 43% protein and 12% fat. Both rations were fed in extruded (floating) pellet form, with an initial pellet size of 1.5 mm. Feed pellet size was increased as the fish grew. Fish were fed to satiation, with fish in all cages receiving the same amount of feed. The two feed rations were randomly assigned to the six cages, with three replicates of each feed ration.

The fish were stocked in cages at Nan Ji Island, off the coast from Wenzhou, Zhejiang Province, China, on 10 June 1999. Cages were arranged according to ASA guidelines, with a minimum of one cage width of open space between cages in all directions. Fish in all cages were sampled once per month on approximately the same date each month. At the conclusion of the trial, all cages were emptied and the fish in each cage counted and weighed to determine average fish weight, gross and net production, feed conversion and fish survival. Fish were then returned to cages for over-wintering.

2000

The over-wintered sea bass from the 1999 trial were restocked in three, 8.0-m^3 cages at 175 fish per m^3 on 30 April 2000. Average fish size at restocking was 302 g. Sea bass in the three cages were fed to satiation daily with the 43/12 soymeal-based ration (Table 1), beginning 1 May 2000. Fish in all three trial cages were fed the same amount. Fish in all cages were sampled once per month on approximately the same date each month. At the conclusion of the trial, all cages were emptied and the fish in each cage counted and weighed to determine average fish weight, gross and net production, feed conversion and survival. Gross and net economic return were calculated from records of production input costs and fish sales receipts.

RESULTS

1999

Sea bass in the six trial cages were fed a total of 153 days between 10 June and 11 November 1999. Fish fed the soymeal-based ration grew from 3 g to 297 g during the 153-day feeding period (Table 2; Figure 1). Fish fed the fishmeal-based ration grew from 3 g to 289 g (Table 2; Figure 1). Fish growth was not significantly different ($P>0.05$) with the two feed rations.

Net fish production averaged 50.3 kg/m^3 and 49.5 kg/m^3 for fish fed the soymeal- and fishmeal-based rations, respectively (Table 2). FCR was 1.53:1 with the soymeal-based ration and 1.55:1 with the fishmeal-based ration. FCR was not significantly different ($P>0.05$) with the two feed rations. Fish survival was 50.3% and 49.5%, respectively, with the soymeal- and fishmeal-based rations, and was not significantly different ($P>0.05$).

2000

Sea bass in the three trial cages were fed a total of 90 days between 1 May and 29 July 2000. Sea bass grew from 302 g to 527 g during the 90-day feeding period (Table 2; Figure 2). Average FCR

for the 43/12 soymeal-based feed was 1.54:1. Average gross fish production at harvest for the three cages was 687 kg per cage, or 85.9 kg per m^3.

Total sea bass production cost was RMB 45,651. Total income from sea bass sales was RMB 74,210. Net profit was RMB 28,559, or RMB 1,190/m^3 for the three trial cages. Return to investment averaged 62.6%. Average feed cost per kilogram of fish growth was RMB 7.73 with the soymeal-based ration.

SUMMARY AND CONCLUSIONS

Feed-based production of Japanese sea bass in 8-m^3, LVHD cages using manufactured, extruded feed rations was demonstrated to be both technically and economically feasible in this ASA trial. The use of high protein, dehulled soybean meal at an inclusion rate of 40% produced equivalent fish growth and feed conversion as a ration formulated with predominantly fishmeal. Sea bass grew from 3 g to 527 g in 243 days on the soymeal-based ration with an average FCR of 1.54:1. Although feed conversion was the same in 1999 with the soymeal- and fishmeal based feeds, the price of the soymeal-based feed (RMB 5,000/mt) was 10% less than that of the fishmeal-based ration (RMB5,500/mt), which yielded significant cost savings for feed.

Feed cost per kilogram of fish weight gain averaged RMB 7.73 for the soymeal-based feed used in this ASA trial. In comparison, the estimated cost per kilogram of fish weight gain with traditional wild caught fresh fish was significantly higher at RMB 15.73. This estimate is based on an average cost for wild caught fresh fish of RMB 1.70/kg over the duration of the trial, and an average FCR for wild caught fresh fish of 9.25:1.

Results of this trial show that there is no economic incentive to using fresh fish to feed Japanese sea bass. Use of the ASA soymeal-based feed can significantly reduce feed cost and increase profit for cage fish farmers in comparison to traditional production with wild caught fresh fish. In addition, use of the ASA feed provides management, fish health and environmental benefits through improved water quality, reduced pollution, reduced disease, better consistency in feed quality and availability, and easier feed handling and storage.

ACKNOWLEGEMENTS

ASA gratefully acknowledges the Ping Yang County Fisheries Bureau, the Zhejiang Provincial Fisheries Extension Center, and the 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:

RMB 8.26 = US$1.00
1.0 kg = 2.2 lb

TABLE 1. Diet formulations for the soymeal-based and fishmeal-based ASA aquafeeds tested in the 1999-2000 Japanese sea bass (*Lateolabrax japonicus*) cage trial at Nan Ji Island, Zhejiang Province, China. The two feeds were formulated to be isocaloric and isonitrogenous, with 43% protein and 12% fat.

Ingredient	Soybean Meal Based Ration	Fishmeal Based Ration
Dehulled soybean meal (47.5%)	40.00	18.50
Fishmeal, anchovy 65/10	34.00	44.00
Wheat, SWW	16.50	25.00
Fish oil	8.03	7.03
Corn gluten meal (60%)	1.00	5.00
Mineral premix	0.25	0.25
Vitamin premix Roche 2118	0.20	0.20
Ethoxyquin	0.02	0.02
TOTAL	100.00	100.00

TABLE 2. Results of the 1999-2000 ASA aquaculture trial that evaluated Japanese sea bass (*Lateolabrax japonicus*) growth performance in 8.0-m^3 cages with soymeal-based and fishmeal-based aquafeeds.

Feed ration	Stocking rate (fish/m^3)	No. days fed	Fish harvest weight (g)	Gross production (kg/m^3)	Survival (%)	FCR
1999						
Soymeal-based	350	153	297[a]	52.3[b]	50.3[c]	1.53:1[d]
Fishmeal based	350	153	289[a]	50.1[b]	49.5[c]	1.55:1[d]
2000						
Soymeal-based	175	90	527	85.9	93.2	1.54:1

Data with the same superscripted letters are not significantly different (P>0.05)

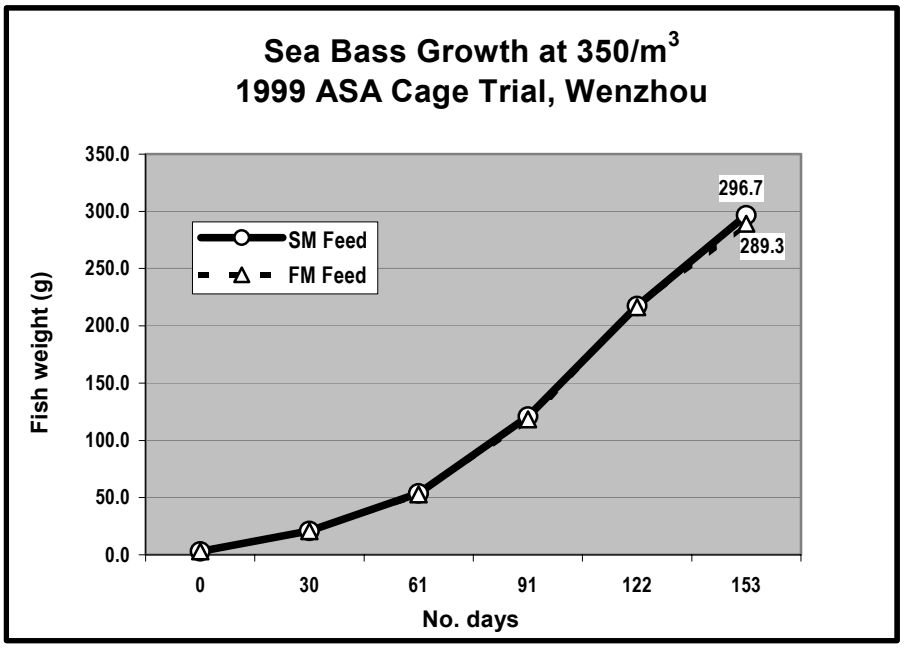

Figure 1. Growth curves for cage cultured Japanese sea bass (*Lateolabrax japonicus*) fed isocaloric and isonitrogenous aquafeeds with dehulled soybean meal (SM) and fishmeal (FM) as the respective base ingredients. Growth performance of sea bass fed the two feeds for 153 days in 1999 was not significantly different (P>0.05).

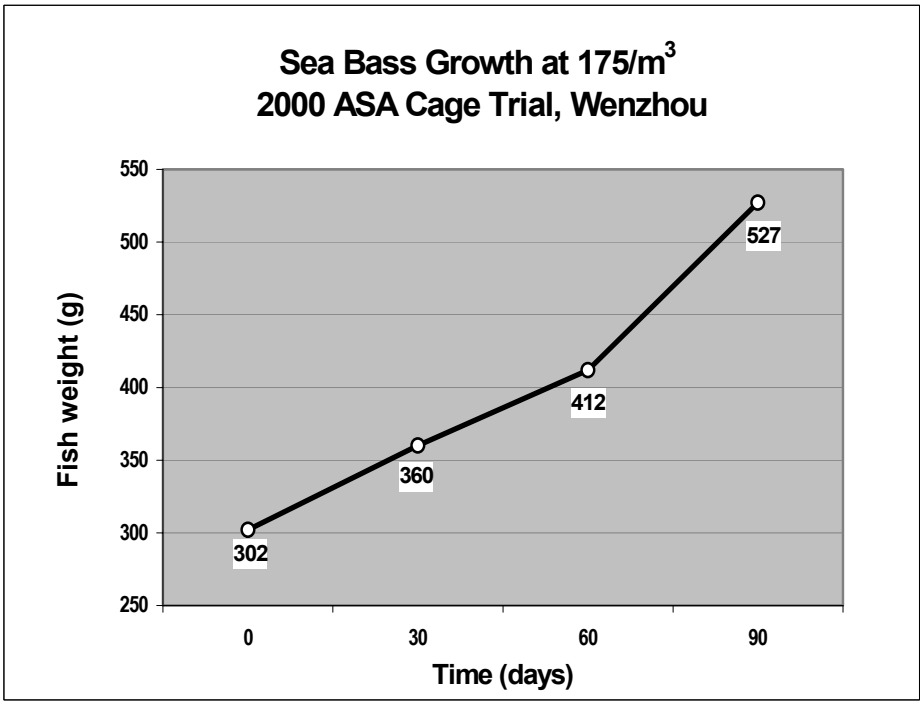

Figure 2. Growth curve for cage cultured Japanese sea bass (*Lateolabrax japonicus*) fed an ASA soymeal-based aquafeed for growout from sub-market size (300 g) to market size (≥500 g) in 2000. Sea bass fed for 90 days on the soymeal-based feed grew from 302 g to 527 g with an average FCR of 1.54:1.