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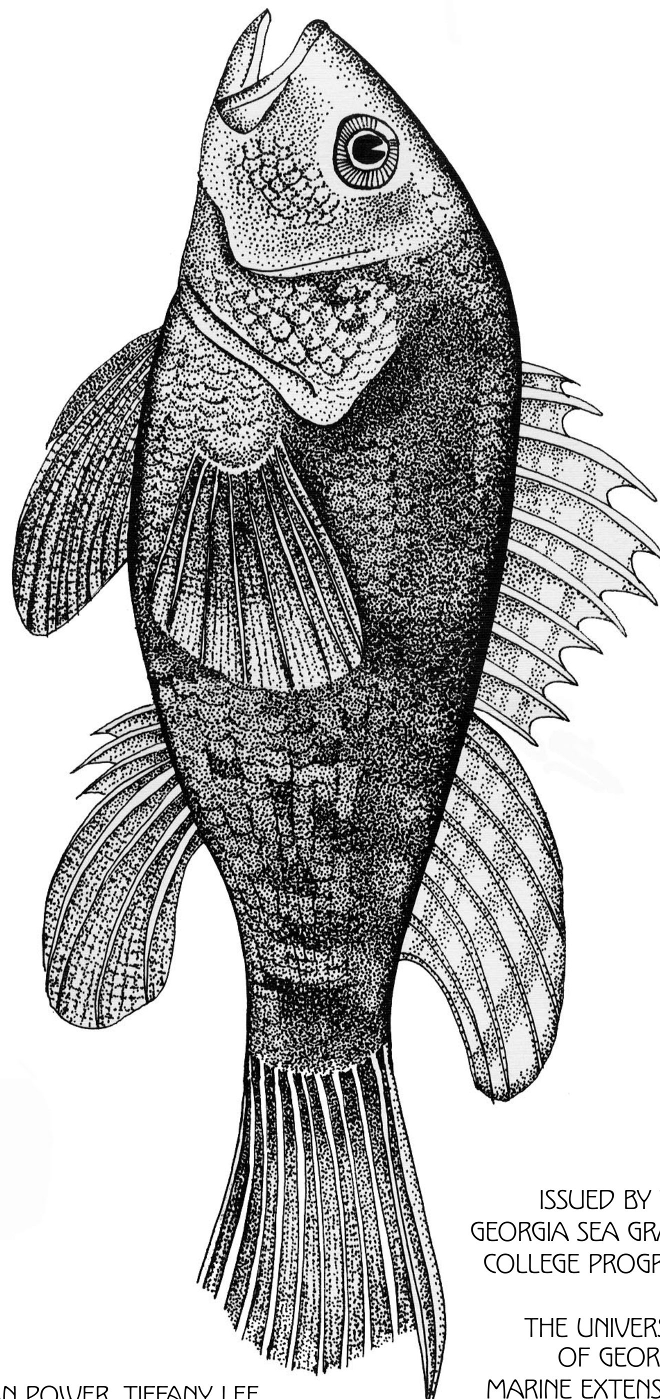

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# THE GROWTH AND SURVIVAL OF JUVENILE BLACK SEA BASS, *CENTROPRISTIS STRIATA* (LINNAEUS, 1758), ON AN ARTIFICIAL (SALMON CHOW) VERSUS A NATURAL (GRASS SHRIMP) DIET

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# ABSTRACT

This study examined growth and survival rates of juvenile black sea bass *Centropristis striata* (Linnaeus, 1758), that were fed two distinct dietary treatments, - one, a commercially available salmon chow and the other a diet consisting of natural live grass shrimp (*Palaemonetes pugio*, Holthuis, 1949). The diets were fed at a 2.5% ration (grams dry weight of food/ grams wet weight of fish). Fish were reared in replicated (N=3 per dietary treatment) 65-liter flow-through tanks for six weeks between May 7 and June 25, 2001. The fish provided with live shrimp had a mean survival of 69 ± 5.9% and increased in size from an initial mean wet weight of 20.7 grams to 30.4 grams - a growth rate of 0.194 grams per day. A higher mean survival of 80 ± 6.7% and a slightly lower growth rate of 0.184 grams per day (mean wet weight increase from 20.4 grams to 29.6 grams) were recorded for fish fed the salmon pellet diet. However, there were no statistically significant differences detected in either growth (p=0.7849) or percent survival (p=0.4999) between dietary treatments. Based on these results, we recommend using the commercially available salmon chow because of its convenience and supplementing it occasionally with grass shrimp to provide essential amino acids common in natural diets.

# INTRODUCTION

The University of Georgia Marine Extension Service is currently investigating the biological potential for developing a black sea bass, *Centropristis striata* (Linnaeus, 1758), aquaculture industry for coastal Georgia. One local fisherman, Mr. Gary Kinard, has been pot trapping fish of minimal legal size (25.4 cm, 250kg) and transporting them to land-based tanks where they are reared to a 900-kg size for sale in the lucrative United States and Canadian sushi markets. Black sea bass already are caught both commercially and recreationally. Resource managers have expressed concern that additional harvesting pressure for aquaculture purposes might result in overfishing of native stocks. Mr. Kinard has therefore requested assistance from the Marine Extension Service to develop and test grow-out methods for this fish species in all the hatchery, nursery and production phases.

Prior dietary studies on subadult black sea bass have shown that this species can grow well on several commercially available fish pellet foods. However, optimum growth occurs when these fish are fed salmon chow instead of trout chow (Kupfer *et al.* 2000; Walker and Moroney 2000; Cotton and Walker 2001). Black sea bass are omnivorous. Their natural diet consists of a variety of organisms including crabs, shrimp, mollusks, fish, and worms (Mercer 1989; Hood *et al.* 1994). Harpster *et al.* (1977) showed that juvenile black sea bass cultured in tanks grew better when fed chopped squid over commercially available fish chows. Mortality rates for fish fed the squid diet, however, were very high, presumably due to fouling of the tanks. The present study examines the growth of juvenile black sea bass when fed the optimum diet of salmon chow versus a more natural diet consisting of live shrimp. The grass shrimp (*Palaemonetes pugio,* Holthuis 1949) is a common salt-marsh crustacean that is abundant enough to be used as a food source for the developing black sea bass aquaculture industry.

# MATERIALS AND METHOD

Juvenile black sea bass were purchased from Southland Fisheries (Edisto , South Carolina). Ninety fish were weighed (size range of 12.3 to 37.5 g), and 15 were randomly assigned using random table numbers to each of six 65-L flow-through fiberglass tanks. No significant difference (p=0.8445) occurred between the initial mean fish weights for those receiving the salmon chow ($\bar{x}$ = 20.7 g) and the shrimp ($\bar{x}$ = 20.4 g) dietary treatments. All tanks received ambient seawater at a rate of 1.8 LPM from the nearby Skidaway River. Prior to entering the tank, the seawater passed through a gravel filter. Seawater from each tank drained through a standpipe that had a mesh screen covering the drain to prevent the fish from escaping. A transparent top was placed over each tank to prevent fish and shrimp from jumping out. Skidaway River water temperature and salinity readings were determined each morning Monday through Friday at 0800 hr. Tanks were stocked with fish on May 7, 2001 and the study was terminated on June 25, 2001.

Two dietary treatments - one a commercial salmon chow and the other consisting of live grass shrimp - were assigned according to random table numbers to six tanks (three replicates each). Fish were allowed to acclimate to the tanks and environmental parameters for one week prior to the initial feeding. Subsequent to this period, once a day all tanks received a diet of either salmon chow or live shrimp at a 2.5% ration (grams dry weight of food to grams mean wet weight of fish). The salmon chow diet was Nelson and Sons' (Murray, Utah) Silver Cup Salmon pellets (3/32 inch). The pellets consisted of 48% protein, 11% fat, 3% fiber, and 12% ash. Grass shrimp for the natural diet were caught as needed from the Skidaway River using a cast-net. To relate the living wet weight of shrimp to dry weight, fifty shrimp were weighed and subsequently placed in an oven at 100˚C for 24 hr, allowed to cool in a desiccator, reweighed, and a regression analysis was performed (Fig 1). Fish from each tank were weighed once every two weeks. While the fish were being weighed, the tanks were cleaned. The ration for each tank was also adjusted biweekly according to the new mean weight of the fish per tank and the remaining number of surviving fish.

The statistical analysis of growth and survival data was performed with Analysis of Variance (ANOVA)($\alpha = 0.05$) using SAS (SAS Institute Inc., Cary, North Carolina, USA) at each sampling period to determine if significant differences occurred between treatments. Survival data was arc-sine transformed prior to analysis.

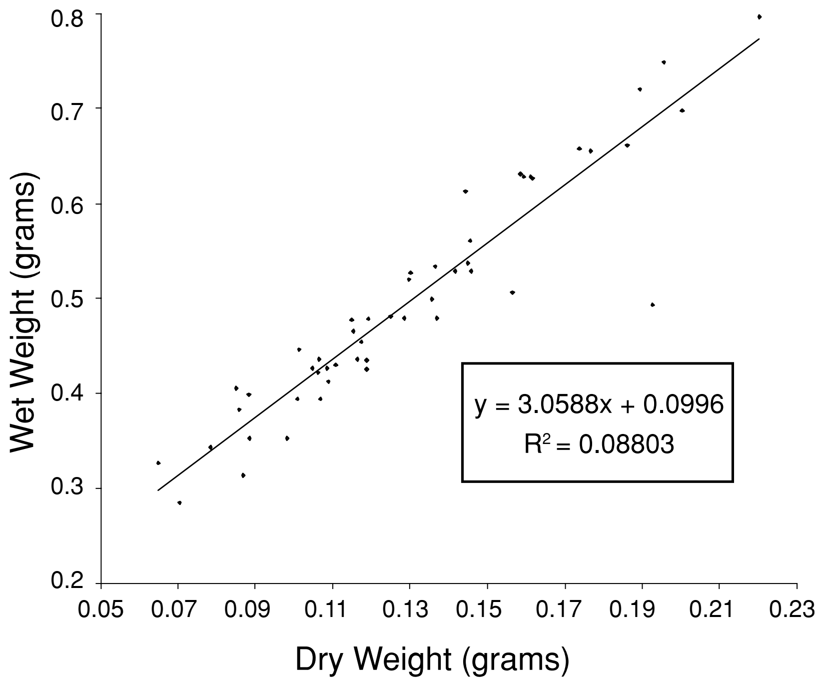


**Figure 1** Regression of wet weight (g) of live shrimp to dry weight (g) of shrimp (N=50).

# RESULTS

Water temperature and salinity changed little over the course of the experiment. Temperatures increased from a mean of 24°C to 27.4°C, and salinity ranged from 29.5 ppt to 31.3 ppt (Fig 2).

There were no significant differences in mean fish weights between treatments at week 2 (p=0.0938), week 4 (p=0.2701) or week 6 (p=0.7849) (Fig 3). Similarly, there were no significant differences in survival between treatments at week 2 (p=0.0626), week 4 (p=0.2100), or week 6 (p=0.4999). Fish fed live shrimp had an overall mean survival of 69 ± 5.9 (S.E.)%, and their weight increased from an initial 20.7 grams to 30.4 grams (a growth rate of 0.194 grams per day). Fish

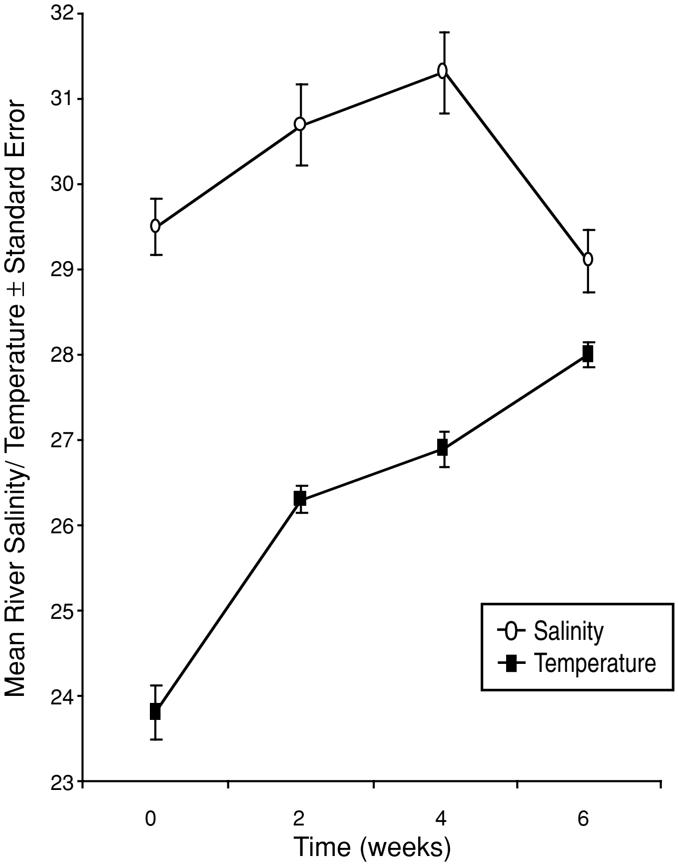


**Figure 2** Mean water temperature (± S.E.) and salinity (±SE) of the Skidaway River between May and July 2001.

that were fed salmon pellets had an overall mean survival of 80 ± 6.7% and grew from 20.4 grams to 29.6 grams (a rate of 0.184 grams per day) (Fig 4).

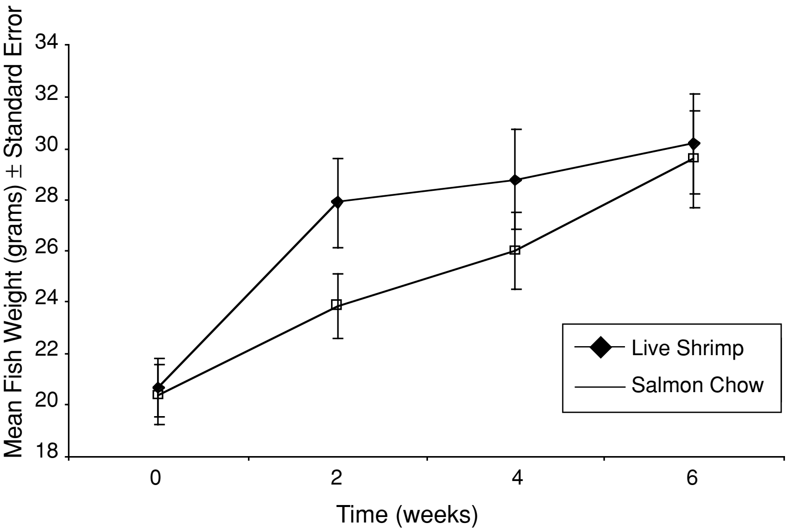


**Figure 3** Mean growth in wet weight (g ± S.E.) of juvenile black sea bass fed either salmon chow or live grass shrimp between May 7 and June 25, 2001.

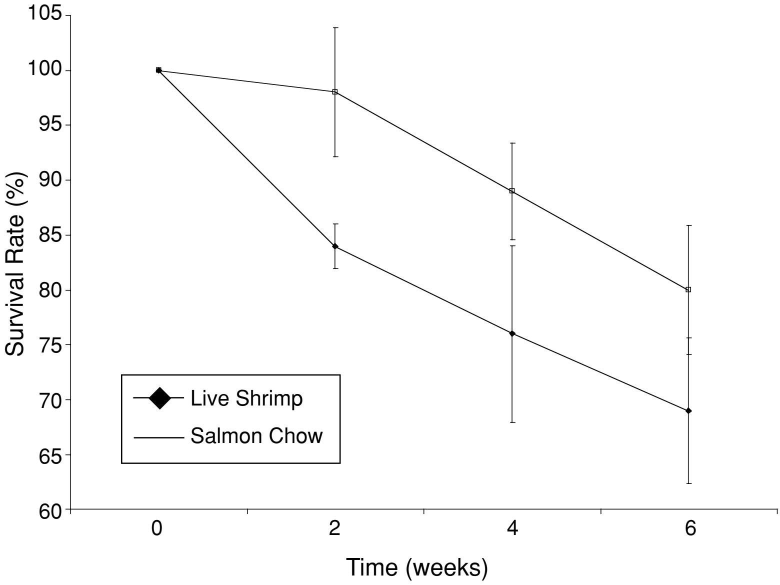


**Figure 4** Mean survival (% ± S.E.) of juvenile black sea bass fed either salmon chow or live shrimp between May 7 and June 25, 2001.

# DISCUSSION

Over the six-week experimental period, there were no statistically significant differences in growth and survival of juvenile black sea bass reared on live grass shrimp versus salmon chow. The growth rates obtained in this study were 0.194 and 0.184 grams per day for fish fed shrimp and salmon chow, respectively. These growth rates are lower than those previously reported for cultured adult black sea bass. Walker and Moroney (2000) reported growth rates of 1.1 grams per day for fish fed trout chow and 2.28 grams per day for fish feed salmon chow. The growth rates obtained in the present study are, however, comparable to growth rates reported for juvenile black sea bass in other studies using commercial artificial diets e.g., 0.03 grams per day on Nelson's Silver Cup Trout Crumbles; 0.112 grams per day on Zeigler's Salmon Starter; 0.077 grams per day, and 0.099 grams per day on a 2.5% and 7.5% ration of Zeigler's Salmon Starter, respectively (Cotton 2002). Harpster *et al.* (1977) recorded growth rates of juvenile Southern Sea Bass *Centropristis melana* (Ginsburg) that were reared in tanks for 10 weeks on diets of chopped squid, marine ration 30, catfish chow, and trout chow as 0.232, 0.07, 0.083 and 0.223 grams per day, respectively.

The convenience of the salmon diet makes it the preferred diet. Considerable daily effort is required to gather the grass shrimp; whereas, the salmon chow is readily available. Collecting large amounts of shrimp to feed black sea bass also requires that you care for and feed them on a daily basis. Additionally, during the winter, grass shrimp availability is low. However, the occasional use of grass shrimp as a food supplement is recommended. Invertebrates, especially crabs, make up an important component of the black sea bass diet in nature (Steimle and Fegley 1996). Complete artificial diets contain all the known essential nutrients in the proper amounts necessary for growth of a species Unfortunately, black sea bass is a new aquaculture candidate, and there is no commercially available fish diet that contains all the specific ingredients required to raise this species. By occasionally providing grass shrimp, some essential amino acids common in natural diets may be provided to fish grown in captivity.

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