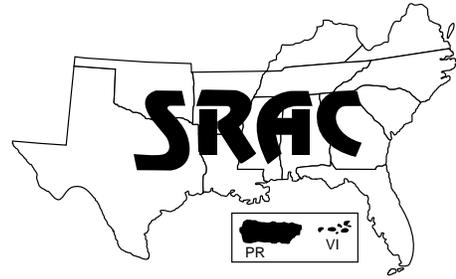


Southern Regional Aquaculture Center



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Improving Feeds for Hybrid Striped Bass

Aquacultural production of hybrid crosses between striped bass (*Morone saxatilis*) and white bass (*Morone chrysops*) has expanded in recent years because of high market value and diminished supplies of wild-caught striped bass. Both the original cross (female *M. saxatilis* X male *M. chrysops*), known as the palmetto bass, and the reciprocal cross (female *M. chrysops* X male *M. saxatilis*), known as the sunshine bass, have considerable potential for aquaculture because of their rapid growth rate and tolerance of a wide range of environmental conditions. However, increased production of hybrid striped bass will require the development of cost-effective feeds that are specifically designed to meet the nutritional needs of these fish. Feeds significantly influence fish growth, product quality and body composition, and they generally constitute 40 to 60 percent of variable costs in fish production. Although knowledge of many basic nutrient requirements of *Morone* hybrids has been accumulating in recent years, research is still needed to more precisely determine other nutritional needs of these hybrids so that cost-effective diets can be formulated to satisfy those requirements without excessive supplementation.

The Southern Regional Aquaculture Center has supported a regional research project, "Improving Production Efficiency of Warm Water Aquaculture Species Through Nutrition," to investigate nutritional aspects that are most limiting in the production of hybrid striped bass. This publication was compiled by Wendy M. Sealey, Daniel E. Barziza, James T. Davis, and Delbert M. Gatlin III, based on research conducted at East Carolina University, Kentucky State University and Texas A&M University.

Protein and Protein:Energy Ratio

Protein is an essential nutrient that must be included in the diet at appropriate levels to ensure adequate growth and health of fish. However, because protein is the most expensive component of most aquaculture diets, supplying protein in excess is not economical. Similarly, it is important to maintain a proper ratio of protein to energy in the diet. Adequate energy must be supplied so that



Hybrid striped bass have considerable aquaculture potential.

dietary protein is used for growth (protein synthesis) rather than metabolized for energy. Conversely, excessive energy can cause reduced intake resulting in decreased growth.

A feeding trial was conducted at Kentucky State University to determine the effect of dietary protein and lipid level on growth and body composition of sunshine bass reared in cages. Juvenile sunshine bass were fed diets formulated from practical ingredients to contain various protein, lipid and energy levels. Results demonstrated that a diet with 41 percent protein and a protein to energy ratio of 99 mg protein/kcal energy produced growth and feed conversion values similar to those in fish fed diets containing higher levels of protein and higher protein to energy ratios. However, fish fed diets containing 41 percent protein and a lower protein to energy ratio had decreased dress-out percentage because they had more abdominal fat and lipid in the carcass, and less protein in the carcass. Therefore, dietary protein levels may be decreased without sacrificing growth, but body composition will be altered through increased fat deposition.

One adverse effect of feeding fish diets with decreased protein and increased energy from lipid is that the storage quality of frozen fillets may suffer. A study at Kentucky State University determined the

effect of dietary protein level on the storage quality of fillets from sunshine bass. Fish were fed diets with various protein levels ranging from 29 to 45 percent of the diet. Lipid and energy levels were relatively constant in all of the diets. At the end of the feeding trial, both skin-on and skin-off fillets were frozen at -20 degrees C for up to 6 months. Dietary protein had little effect on lipid oxidation or textural characteristics of frozen sunshine bass fillets.

Protein source can also impact the growth and body composition of fish. Fish meal has been an important source of protein in the diets of carnivorous fish species such as the *Morone* hybrids because of its high protein quality and palatability. However, fish meal is quite expensive and can substantially increase feed costs. Total or partial substitution of fish meal with less expensive plant and animal protein feedstuffs may help to reduce feed costs, although these sources may be lower in digestibility, palatability and essential amino acids. A study conducted at Kentucky State University determined that juvenile palmetto bass could be fed diets containing as little as 15 percent fish meal without adversely affecting growth or body composition as long as crude protein was maintained at 40 percent of the diet by using soybean meal and meat-and-bone meal.

Another study was conducted at Texas A&M University to determine the protein digestibility of several feed ingredients for sunshine bass. These ingredients included low-temperature-processed menhaden meal, regular menhaden fish meal, anchovy meal, meat-and-bone meal, poultry by-product meal, soybean meal, and cottonseed meal. Low-temperature-processed menhaden fish meal had the highest protein digestibility coefficient. Meat-and-bone meal and poultry by-product meal had lower protein digestibilities than any of the ingredients of fish or plant origin. Higher protein digestibility values were recorded for anchovy



Hybrid striped bass efficiently digest soluble carbohydrate in practical diets.

meal and regular menhaden meal than for the two plant feedstuffs.

Carbohydrates

Carbohydrates may be an inexpensive energy source in the diet. However, there are large variations in the extent to which fish can utilize dietary carbohydrates. Although carnivorous fish species generally have a limited ability to use carbohydrates for energy, hybrid striped bass are relatively adept at it. For this reason, a series of experiments was undertaken at East Carolina University to determine the digestibility of dextrin, wheat starch, wheat flour, wheat middlings, potato starch and corn starch by palmetto bass. Digestibility trials were conducted using two size classes of palmetto bass, small (0.01-pound) and medium (0.21-pound). Digestibility coefficients for the carbohydrates were generally high (83.3 to 100 percent), indicating that both simple carbohydrates and complex carbohydrates were digested efficiently by these hybrids. One exception was potato starch, which was not well digested (66 percent) by fish of either size class.

Conclusions

These studies show that diets for *Morone* hybrids may be refined by decreasing the dietary protein level, using alternate protein sources, and increasing carbohydrate in the diet. Although protein will always comprise a large portion of aquaculture feed costs, including the minimum required level of protein in the proper relationship with dietary energy, and

replacing a large percentage of fish meal with less expensive plant and animal protein feedstuffs, should lower feed costs. In addition, digestibility values for protein and carbohydrate in practical feedstuffs for *Morone* hybrids should allow greater flexibility and precision in formulating diets for these fish. With these results, more cost-effective diets that maintain adequate growth and product quality can now be produced for hybrid striped bass.

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