Improving Sunshine Bass Production

Hybrid striped bass production began in the mid 1980s and is now a major aquaculture industry. Demand for the farm-raised hybrid species resulted from diminished supplies of wild-caught striped bass. Although wild stocks have rebounded enough that commercial fishing is once again permitted in some locations, their numbers plummeted from 6,800 metric tons in 1973 to 450 metric tons in the late 1980s.

Most hybrid striped bass that consumers purchase are a cross between female white bass and male striped bass. Known commonly as sunshine bass, they have a high market value, which means they're relatively expensive. Sunshine bass are very popular with Asian immigrant populations because the fish are similar to species found in their native countries. Hybrid striped bass could still find more room for growth in the market, considering wild striped bass were in record demand in the 1970s.

The palmetto bass is a cross between female striped bass and male white bass. All three are popular sports fish.

Sunshine bass fry are commonly raised in outdoor rearing ponds until they're 35-40 days old. Fingerlings, as they're then called, are generally available in the southeastern United States from April through August. If more fingerlings were available—especially year-round—they could increase production of market-size fish and stabilize seasonal price fluctuations. In fact, the industry has identified development of a year-round supply of fingerlings as one of its highest priorities.

Sunshine bass reach market size at 1.5 to 2 pounds, usually after 15 to 18 months.

"They have a nice white, flaky, firm-texture fillet," says Gerald Ludwig, a biologist with ARS's Harry K. Dupree Stuttgart National Aquaculture Research Center, in Arkansas. "It's the type of fillet you can prepare any way. It has a mild flavor that complements many dishes."

Ludwig studies the ecology of fish culture ponds and develops new methods of rearing fry and their food source indoors to increase production of sunshine bass fingerlings.

Because fry demand live food instead of feed, producers typically fill ponds with well water and use fertilizers to develop zooplankton populations. Different aquatic zooplankton communities dominate in different stages—first protozoans, then rotifers, and finally crustaceans. Wild striped bass fry can eat crustacean zooplankton called copepods and cladocerans, but sunshine bass fry are smaller (3-5 millimeters long) and need the smaller rotifers, which are available for only a limited time. Ludwig determined that sunshine bass must be stocked just before rotifers dominate. He developed equations to predict when rotifers will appear in outdoor fry-rearing ponds.

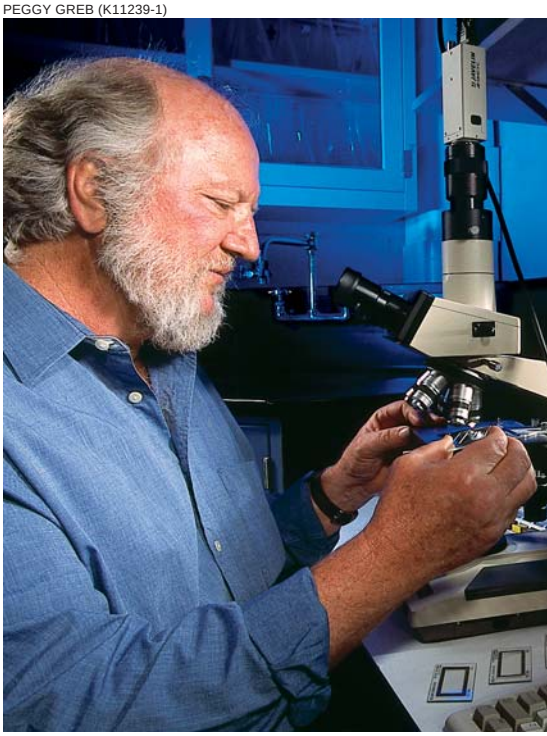
These predictive formulas are used to indicate exact timing for fry stocking and are based on studies of how environmental factors can influence the sequence of zooplankton types and sizes present at a given time. Sunshine bass farmers can estimate how long it takes to get a rotifer bloom in fry culture ponds, which helps them stock at the optimal time. Ludwig says there are many factors involved in timing fry stocking just right, including water temperature and amount of rainfall, which further cools the water and causes a cloudiness that slows algae growth.

"During experiments to field-test the formulas," Ludwig reports, "fry survivability increased from an average of 10 percent to 35-55 percent. Fish farmers using this technique in their ponds now average 30-40 percent fry survival over the entire spawning season."

Raising Rotifers, Fry in Tanks

In temperate climates, indoor production is required if producers are to have a year-round supply of fingerlings. Ludwig was able to produce sunshine bass fry in indoor tanks for the first time

PEGGY GREB (K11239-1)



Jerry Ludwig, fishery biologist, examines a roughly 8-day-old, 7-mm larval sunshine bass that has filled itself with rotifers, microscopic animals that Ludwig cultures to feed the tiny fish.

PEGGY GREB (K11248-1)

The fish held by fish nutritionist Steve Rawles has an implanted microchip that allows him and technician Matt McEntire to scan for growth rate.

PEGGY GREB (K11252-1)

Hybrid striped bass, also known as sunshine bass.

by feeding them freshwater rotifers, which he also cultured indoors.

Ludwig also developed a method of harvesting zooplankton from outdoor ponds with a rotating drum filter. His predictive equations reveal when maximum concentrations of rotifers will be available for harvest. The collected rotifers are then used for fry feed in indoor tanks. This is followed by feeding larger zooplankton collected from the ponds.

In another step toward the affordable, year-round production of sunshine bass, Ludwig developed an automated indoor feeding system for rotifers with Tim Pfeiffer, an ARS agricultural engineer. It ensures that fry will have live rotifers available throughout the year. Tanks are filled with saltwater and a starter population of rotifers. The temperature is kept between 77˚F and 86˚F, and a paste composed of concentrated micro algae is diluted and constantly fed to the rotifers through peristaltic pumps.

When sunshine bass fry were fed rotifers grown with this system, followed by larger brine shrimp larvae, different amounts of feeding resulted in 22, 35, and 58 percent survival rates only 28 days after fry hatching. This is much better than the 7 percent survival rate reported by industry.

Once there are 1,500 rotifers per milliliter, a third of the culture can be harvested daily. Culture reached desired concentrations 70 percent of the time.

"In our latest indoor rearing experiments, we were able to move 50 percent of the fry from rotifers to commercial feed after only 21 days," Ludwig says. "That's a good survival rate in much less time than the typical 30-40 days needed to move fry in ponds to commercial pellets." He'll conduct more studies to substantiate these results. His future goals include determining the optimum stocking density for sunshine bass fry culture in tanks and the optimum feeding density of rotifers and brine shrimp. He also wants to find alternative diets for fry and train them to take feed sooner.

Finding Fish Feed Formulas

More than 40 percent of the variable cost of hybrid striped bass farming is attributed to feed. One strategy to reduce costs is to find other, less expensive ingredients to use in commercial diets. ARS physiologist Steven Rawles is studying nutrition in adult hybrid bass. He's interested in the digestibility and metabolism of nutrients and energy from commercially available feed ingredients and blended components for extruded hybrid striped bass diets.

Rawles says fish evolved on high-quality protein as predators of smaller fish, insects, and other aquatic animals. So, sunshine bass require protein-rich diets that are high in fats but low in carbohydrates. High-protein ingredients, such as fishmeal, are expensive because supplies are limited and in demand for other animal feeds. Ingredients in commercially formulated diets vary from company to company.

Many carbohydrate-rich ingredients used in other animal feeds, such as wheat, corn, or rice, are inexpensive, but fish do not use them well. Most carbohydrates appear to be wasted through excretion or stored as fat. Producers would like to increase the amount of carbohydrates in sunshine bass diets and still see good growth performance. Ultimately, they would prefer fish to use carbohydrates for immediate energy needs and spare dietary proteins for growth.

"Grains such as rice, corn, oats, and barley might be substituted for wheat and wheat middlings," Rawles says. "We're evaluating the production performance of fish fed these alternative carbohydrates to see whether they perform as well as fish fed diets that contain wheat or wheat middlings."

Rawles collaborated with Delbert M. Gatlin, III, a professor at Texas A&M University's Department of Wildlife and Fisheries Sciences, to determine nutrient availability in 19 common feedstuffs for hybrid striped bass and red drum. They used commercial methods and

equipment to manufacture extruded feed, in which ingredients are combined under high temperature, pressure, and shear force and ejected as bite-sized pellets. Nutrient digestibility values were determined and made available to feed mills and producers. This research could lead to lower-cost feeds.

Rawles and colleagues are currently working with a major poultry processor and a fish-feed manufacturer to explore use of poultry-byproduct meal as the primary protein source in sunshine bass diets. So far, the fish are readily consuming several experimental diets consisting of poultry byproducts and supplemental amino acids, but it is too early to tell whether those fish are performing as well as some being fed diets containing mostly fishmeal.

Rawles is also studying a diet containing meal from poultry meat, bone, feather, and blood instead of supplemental amino acids. These byproducts are high in protein and less expensive than feed-grade amino acids. Initial work indicated that the nutrients in these byproducts are highly digestible, but unfortunately the mix doesn't appeal to the bass. Rawles is investigating ways to increase the combination's palatability by adding fish solubles, betaine, or other ingredients.

Rawles says research is continuing on diets containing animal byproduct blends. "If any of the byproduct meal/amino acid-supplemented diets perform as well as the fishmeal diet, then we're on our way to a less expensive diet for hybrid striped bass," Rawles says.—By **Jim Core,** ARS.

This research is part of Aquaculture, an ARS National Program (#106) described on the World Wide Web at www.nps.ars.usda.gov.

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PEGGY GREB (K11243-1)

To make an experimental diet for hybrid striped bass, technician Rebecca Jacobs first prepares to mix ingredients.

PEGGY GREB (K11247-1)

Fishery biologists Ray Carter, back left, and Scott Snyder, front left, with technician Matthew McEntire, right, sample hybrid striped bass fingerlings to assess growth performance in ponds. They'll evaluate the fish for weight gain, fillet yield, and fat content.