SRAC Publication No. 303

Southern Regional Aquaculture Center

September 2008
Revision

# Hybrid Striped Bass: Pond Production of Food Fish

Louis R. D'Abramo[1] and Michael O. Frinsko[2]

During the past 20 years, the pond culture of hybrid striped bass has developed into a successful sector of the United States aquaculture industry; annual production has grown exponentially from 10,000 pounds to nearly 12,000,000 pounds during that period. A three-phase production system has been used. Phase I (nursery phase) consists of producing 30- to 45-day-old fingerlings in fertilized "fry" ponds (SRAC Publication #302). In Phase II, these fingerlings (approximately 1 g) are stocked into ponds at a density of 12,000 to 18,000 per acre. The advanced fingerlings produced during phase II are harvested at weights of 125 to 225 g, graded, and then stocked into the Phase III (grow-out) ponds at a density of 3,000 to 4,400 per acre and grown to market size (SRAC Publication #303, 1989).

However, a new two-phase system is now in use that eliminates the traditional Phase II component. This new system, termed direct stock, no longer requires the grading and transfer of Phase II juvenile fish for stocking into Phase III ponds and saves both time and the expense of labor. Without the need for grading, the common and costly fish mortality caused by the stress of handling is eliminated. Handling stress can result from physical injury or from environmental conditions. Even experienced producers have handling losses when fish are transferred at times other than the recommended seasonal transition periods, when extremely high or low water temperatures can result in pathogenic fungal or bacterial infections. With the elimination of phase II, fish no longer have to be held until phase III ponds are available for stocking. As a result, the costs of labor and feed during this maintenance period are eliminated.

Enterprise budgets based on the two management systems having the same water surface area indicate that the direct-stock system increases production efficiency and reduces overall production cost (D'Abramo et al., 2002). Recent results from commercial ponds have demonstrated that the direct-stock strategy decreases the time from initial stocking to harvest by 20 percent or more. Based on these encouraging results, the direct-stock system is preferred to the three-phase system. The following descriptive information is based on using the direct-stock system for the pond production of hybrid striped bass food fish.

## Direct stock protocol

The pond grow-out phase of the direct-stock system begins with the stocking of graded fingerlings of a uniform mean weight of 3 g. This size is notably larger than the l-g fish commonly stocked into phase II fingerling ponds in the three-phase system. These larger, more uniform-sized fingerlings are stocked at a density of 3,750 to 4,000 per acre, from June to September. The success of the direct-stock system depends on the stocking of larger fingerlings that already aggressively feed on a formulated diet ("feed trained"). Stocking either poorly graded or inadequately feed-trained fish usually results in lower survival, because of cannibalism, and stunted populations with an unacceptable percentage of undersized (unmarketable) fish at the planned harvest time. These fish have to remain in the grow-out ponds until they reach a marketable size.

Once fish have been stocked, feeding must begin immediately and it is critical that fish consume adequate amounts of formulated feed to meet their nutritional requirements. A way to congregate or localize the fish to an easily observed area of the pond is needed unless the pond is less than 2 acres. In larger ponds (≥ 5 acres), placing an aerator in the area where fish will be fed is effective for congregating fish. In smaller ponds, stationary floating rings can be oriented so that feed placed inside them will not be scattered by the wind and will attract most of the fish in the pond. If fish fail to feed after a few days, a fingerling seine can be pulled through the pond to concentrate a small group of fish into a holding area where feed is broadcast to stimulate them to begin feeding. The seine must be small

[1]Mississippi State University
[2]North Carolina State University

**Figure 1.** After being seined (harvested) from a direct stock production pond, hybrid striped bass are concentrated into a sock for eventual transfer to a live haul truck (background) and transport to an on-site processing facility.

enough to avoid gilling the fish. A Rochelle knotless-type net, with about ⅛-inch mesh, works well. The seine is pulled through about three-quarters of the long axis of the pond to concentrate the fingerlings. As the fish in the pond are retrained to feed, additional space for growth is created by pulling back the seine and eventually removing it completely. The sound and physical activity that occur during the initial feeding of the congregated fish usually attract the rest of the fish in the pond.

Fingerlings are initially fed small (1.5- to 2.5-mm), extruded, floating pellets in equal amounts two to four times per day. The amount fed depends upon the number and weight of fish in the pond. Trout, salmon or hybrid striped bass starter diets are commonly used; these usually contain 45 percent or more crude protein and high levels of fish oil that serves as a top-coating to reduce fines. The fish oil presumably also acts as a natural feed attractant. After 2 to 3 weeks, the initial feed is gradually replaced by a ⅛-inch pellet that is fed for the next 6 to 8 months. This diet commonly contains 40 percent crude protein and 10 percent crude fat, or 38 percent crude protein and 8 percent crude fat. During the final months of grow-out, a ¼-inch feed formulated to contain 35 to 40 percent crude protein and 10 to 12 percent fat is typically used. Other feeds have been used to correspond with seasonal water temperatures that influence feed intake and growth rates. The formulations of these feeds are based on cost, ingredient availability and nutrient composition (protein:energy ratio, etc.) For example, some producers feed nutrient-dense (high-protein, high-fat) diets during mid-winter and mid-summer to reduce feed waste and nutrient loading in ponds.

Throughout the grow-out period, fish are feed to satiation once or twice per day depending on time and labor constraints. Fish are usually not fed when water temperatures consistently fall below 60 °F (16 °C). Calculated feed conversion ratios range from 2.5 to 2.8 in larger ponds and sometimes are less in smaller (≤ 4 acres) ponds.

**Figure 2.** Hybrid striped bass feeding in a direct stock production pond on a special, seasonally based, formulated feed.

## Water quality requirements and management

Water quality management is a critical component of a successful farm. The level of dissolved oxygen in production ponds requires the most attention, but temperature, total ammonia, unionized ammonia, alkalinity and hardness are also important.

Dissolved oxygen levels need to be kept above 4 ppm to ensure good growth and reduce the susceptibility to stress-related disease outbreaks. Therefore, dissolved oxygen should be monitored daily (SRAC Publication #4601). When levels are less than 4 ppm or are expected to decrease to less than 4 ppm, based on environmental conditions such as extensive cloud cover or algal die-off, corrective measures need to be taken. A mechanical aerator, usually an electric paddlewheel type that floats and is moored to an adjacent levee, is used. These aerators are usually located at the deep end of the pond and sized at 2 horsepower per acre to ensure a rapid transfer of oxygen. PTO–driven paddlewheel aerators are often used during periodic emergencies, either alone or in combination with the floating aerators.

Hybrid striped bass tolerate a wide range of water temperatures, from 39 °F (4 °C) to 84 °F (29 °C); however, maximum growth occurs between 25 and 27 °C. Therefore, in the temperate zone of the U.S., the highest growth rates will occur from March through June and from September through November. Water temperatures and the amount of feed consumed for each production pond should be recorded daily. The amount of feed consumed decreases substantially at about 59 °F (15 °C) and ceases at 46 to 50 °F (8 to 10 °C). When water temperatures exceed 86 °F (30 °C), a large number of fish will sometimes be observed floating upside down at the pond surface. This is presumably caused by the fishes' inability to digest food efficiently at high water temperatures. Gas from partly digested feed accumulates, and food may not pass through normally. Recovery depends upon a number of factors that need to be investigated. However, the composition of the feed, size of the fish, and duration of undesirable water temperatures are believed to be implicated. In some instances, inserting a pencil (eraser end) or other slender, blunt object into the mouth will release gas from the stomach and intestine. Large groups of fish affected by this condition have been saved by this "burping" technique, though it would be time-consuming and impractical if the number of fish were very large. The best way to prevent this problem seems to be reducing feeding when water temperatures are higher than 86 °F (30 °C).

Although most cases of bloat appear to be related to feeding at high water temperatures, one incidence of bloating was observed when water temperatures were 23 to 26 °C. Necropsy revealed that partially digested feed was mixed with fibrous plant material. In this case, adult hybrid striped bass had consumed submerged pondweed (*Najas guadalapensis*) while consuming feed pellets that had drifted into its dense mats. Obviously, it is important to control weed infestations (see later discussion) to prevent this condition, as well as to make fish feeding and harvest efficient and eliminate a substrate for snails, which can be intermediate hosts of certain fish parasites.

When fish are intensively fed commercial diets with high levels of protein, the amount of ammonia produced by fish excretion and unconsumed/undigested feed can rise to problematic levels. The growth of hybrid striped bass was adversely affected by brief daily exposure to ~ 1.8 ppm total ammonia nitrogen (TAN) at pH 9.0 (Hargreaves and Kucuk, 2001). Daily exposure at a higher level, 2.5 ppm TAN (pH = 9.0), led to mortality. The proportion of TAN that is in the toxic, unionized form increases with increasing pH and temperature (SRAC Publication #463). When levels reach approximately 3 ppm TAN, sufficient ammonia is in the unionized form to cause mortality. Chronic levels of > 2 ppm TAN are more common and can be recognized by fish lethargically swimming along the pond edge and/or near the water surface, even when the oxygen level is adequate. If not corrected, these ammonia levels may cause a stress-induced bacterial infection, most commonly *Flavobacterium columnare* (columnaris). Keeping ammonia below chronically harmful levels will help reduce the incidence of disease. When the concentration of total ammonia nitrogen exceeds 2 ppm, flushing the pond by adding clean water from an appropriate source is the most common choice of management (SRAC Publications #463 and #4603). As new water enters the pond, there will be an area of water without a high ammonia concentration where fish can find refuge until the ammonia is diluted to a safe level. This practice has only limited effectiveness and is not considered to be an environmentally responsible use of the water resource.

Occasionally, filamentous algae can become a nuisance. Its spreading can be controlled by applying an aquatic dye to reduce light penetration and algal growth. However, the dye is not effective as a treatment for mat-forming filamentous algae that float high in the water column, and may actually promote its growth. Approved aquatic herbicides can also successfully treat specific nuisance algae; however, herbicide application must be evaluated relative to expense, special application and licensing needs, and the potential consequences of the dramatic oxygen depletions that result from algal death and decomposition.

## Harvest

Production ponds are usually harvested over a period of several months. Decisions to harvest are based upon the mean size (weight) of fish and market demand. Yield per production pond ranges from 6,500 to 7,000 pounds per acre, based upon a mean survival of 80 percent. Fish are harvested using a 1.5-inch, soft-mesh seine. The size classes of fish that are currently sold are small (1.0 to 1.5 pounds per fish), medium (1.5 to 2.0 pounds per fish) and large (≥2.0 pounds per fish). Therefore, harvest must be carefully planned to anticipate possible changes in buyers' demands for different size classes, while also ensuring that the product is available throughout the year. Fulfilling these two demands is critical to the economic success of a pond production enterprise.

## References


D'Abramo, L.R., C.L. Ohs, T.R. Hanson and J.B. Taylor. 2002. Production and economic analysis of two-phase and three-phase culture of sunshine bass in earthen ponds. *North American Journal of Aquaculture* 64 (2):103-112.

Hargreaves, J.A. and C.S. Tucker. 2004. Managing ammonia in fish ponds. Southern Regional Aquaculture Center Publication Number 4603, 7 pp.

Hargreaves, J.A. and C.S. Tucker. 2002. Measuring dissolved oxygen concentration in aquaculture. Southern Regional Aquaculture Center Publication Number 4601, 6 pp.

Hargreaves, J.A. and S. Kucuk. 2001. Effects of dial un-ionized ammonia fluctuation on juvenile hybrid striped bass, channel catfish and blue tilapia. *Aquaculture* 195: 163-181.

Hodson, R.G. and M. Hayes. 1989. Hybrid striped bass: Pond production of foodfish. Southern Regional Aquaculture Center Publication Number 303, 2 pp.

Ludwig, G.M. 2004. Hybrid striped bass: Fingerling production in ponds. Southern Regional Aquaculture Center Publication Number 302, 7 pp.

SRAC fact sheets are reviewed annually by the Publications, Videos and Computer Software Steering Committee. Fact sheets are revised as new knowledge becomes available. Fact sheets that have not been revised are considered to reflect the current state of knowledge.

The work reported in this publication was supported in part by the Southern Regional Aquaculture Center through Grant No. 2006-38500-16977 from the United States Department of Agriculture, Cooperative State Research, Education, and Extension Service.