YSI Environmental

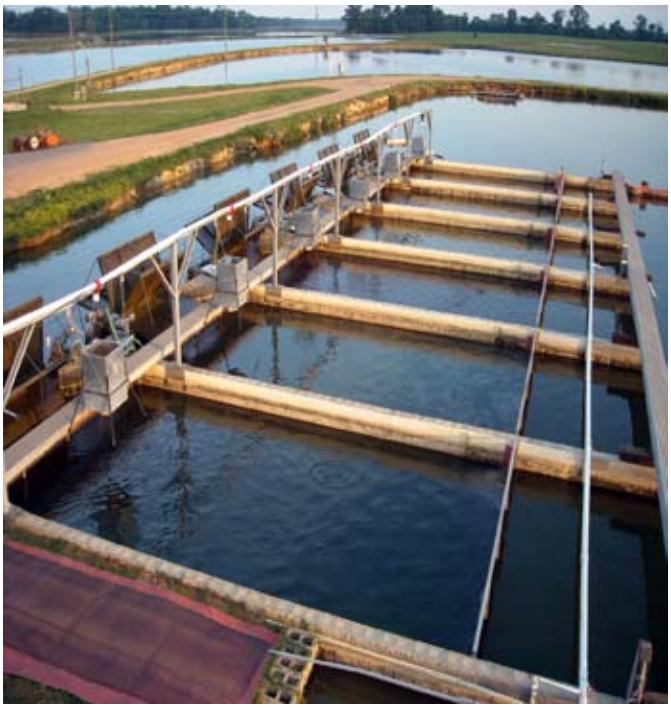
Application Note

High-Intensity Raceway Production Could Put Catfish Producers in the Fast Lane

An experimental, high-intensity raceway production system designed by researchers at Auburn University could drive Alabama producers' catfish production costs – currently well above 70 cents per pound – down to about 50 cents by improving feed and energy efficiency.

Carefully managing fish in tightly populated raceways could yield 25,000 to 35,000 pounds of catfish per acre per year, more than three times the state's average of 8,000 pounds per acre per annum.

"The main goal of the system is to produce a high volume of fish in a small area with minimal energy input and lower production costs than traditional methods," says graduate research assistant Travis Brown, who is managing the project as part of his dissertation through Auburn's Department of Fisheries and Allied Aquacultures. Though converting a traditional earthen pond to a raceway system may cost as much as $7,000 to $8,000 per acre, Brown says the reduction in input costs associated with increased production, as well as the tripling of production are likely to pay off quickly.



An innovative raceway production system being tested by Auburn University researchers could reduce per-pound production costs by half while tripling annual yield per acre. [Photo: Travis W. Brown].

Butch Wilson, president of the Alabama Catfish Producers Association and the producer hosting the research project on his 450-acre (182-hectare) farm near Marion Junction, Ala., says his industry's future depends upon cutting per-pound production costs and boosting output. "If we're going to compete in a world market, it's critical," he says.

Tight Fit

The high-volume system packs an acre's worth of fish into each of six concrete raceways that are 32 feet long, 16 feet wide and 4 feet deep (9.75 meters by 4.9 meters by 1.2 meters). The raceways are arrayed side-by-side in a portion of a traditional, 6-acre (2.4-hectare) earthen pond.

The series of raceways comprises a multi-stage system. Though they contain fish of a uniform size and age – minimizing predation – each is stocked at different times throughout the year to stagger harvest dates and prevent the pond from carrying a full load of harvest-weight fish in each raceway at one time.

In addition to concentrating fish in the raceways, the system concentrates aeration efforts where the fish are located, notes Brown. Instead of running conventional paddlewheel aerators that require three to five horsepower per acre, the Auburn system requires just 0.5 horsepower per raceway to operate a slow-turning paddle wheel.

"Our paddles are just for current flow, not for aeration," Brown says. "We have a large paddle running at 1.2 rpm to create a constant current through the raceway, counterclockwise around the pond. We can evacuate the water from the raceway every three minutes, and we're trying to keep the entire quantity of water thoroughly mixed to prevent stratification during the summer months."

An air diffuser system located at the head of each channel is operated by 1.5 horsepower, low-pressure blowers activated intermittently by the system's water quality monitoring instruments to provide supplemental oxygen in each raceway as needed.

As the water travels away from the raceways and out into the rest of the pond, it encounters an array of biological treatments – a menagerie of aquatic species that keep it aerated and clean. A stable bloom of algae thrives on dissolved nutrients from manure and bits of feed, adding oxygen to the water. However, notes Brown, pumping solid manure out of a trough at the end of the raceways minimizes nutrient overloading that can cause boom-and-bust algal blooms.

(continued)

Brown says a bloom heavy enough to consistently maintain 20 to

+1 937 767 7241 Fax +1 937 767 9353 environmental@ysi.com www.ysi.com/aquaculture
0808 A569

30 cm of Secchi disk visibility represents the ideal level of algae to manage the system's water.

Beneath the surface, paddlefish graze on zooplankton. Tilapia control blue-green algae that can cause off-flavors in the catfish. Fathead minnows eat the flatworms that can cause proliferate gill disease, or "hamburger gill." And red-eared sunfish or "shell crackers" keep mollusks under control.

Boosting Feed Efficiency

Keeping fish in a raceway also makes it easier to deliver food to them quickly, efficiently and frequently, notes Prof. Jesse Chappell, who heads up the study. "We're not trying to feed the same way other growers are feeding," he says. "We're feeding multiple times per day, getting feed efficiency in line with what the animal will do. We try to reduce stress and get the animal in the best possible position to obtain the best possible feed efficiency."

Chappell points out that most Alabama catfish farmers achieve feed conversion ratios (FCR) in the range of 2.8:1 to 3.0:1. His goal through intensive feeding is to improve FCR to 1.5:1. With today's feed costs nearly double what they were in early 2007, improving feed efficiency has a profound impact on the producer's bottom line.

In any fish production system, a significant proportion of the nutrient inputs end up as waste. Brown points out that collecting waste solids in a trough at the end of the raceways will allow high-intensity producers to recapture some of their feed investment.

"Only 30 to 35 percent of the nutrients in the feed are utilized in fish growth and maintenance," he explains. "If we can reclaim some of that money by using the fish waste in a slurry on farmland or as compost, we have made this even more profitable."

A Closer Watch

Intensifying production requires more careful scrutiny of conditions in the raceways. To keep a close watch on temperature and dissolved oxygen levels, Brown and Chappell placed a YSI 5200 multiparameter monitoring and control instrument at the tail end of each raceway, and a seventh 5200 monitors the quality of incoming water. If oxygen or temperature drift outside of acceptable levels, the instruments call Brown's cell phone with an alarm message. A low-oxygen reading will also activate an emergency blower system as necessary.

Brown points out that he can also set the instruments to automatically dispense feed in each raceway. YSI software can automatically adjust feed timing and quantity based on biomass in the pond. He says he plans to bring the automatic feeding capabilities online soon. In the meantime, the YSI 5200s keep constant watch on water quality.
"The more intensive the operation, the better management and control you need to have," says Tim Grooms, Global Business Development Manager for YSI. "If you push the envelope too far, you can create a lot of stress."

Each raceway is monitored with a YSI 5200 multiparameter monitoring and control instrument that tracks oxygen and temperature. The YSI 5200s activate oxygen blowers as needed; they will soon also be used to automatically deliver feed, adjusting for growing biomass. [Photo: Travis W. Brown]

Surprisingly, Wilson – whose Dean Wilson Catfish Farm encompasses 34 ponds – points out that the raceway system was actually his most stable pond during a power failure this summer.

"We had a six-hour outage, which was very rare," he recalls. "All we did in that pond was stick in a tractor with a portable aerator. That pond never got close to killing fish. In our other ponds, we were running around, putting in aerators to keep fish alive." A backup generator now provides peace of mind, he adds.

Seeing the raceway system succeed on his farm provides another kind of peace of mind for Wilson – hope that his state's catfish industry, battered for years by high production costs and competition from imports, can prevail through more intensive management.

For additional aquaculture information including specifications on YSI instruments, please visit:

www.ysi.com/aquaculture or www.ysi.com/5200

For additional information please contact ***YSI***
Tel.+1 937 767 7241
US 800 897 4151
Email. environmental@ysi.com
Web. www.ysi.com/aquaculture