

# Hybrid Catfish Production & Performance

S-1031 (2007-2013)

## *Challenges of Hybrid Catfish Production*

The channel catfish is the primary fish raised for food in the U.S., representing about 70% of all U.S. aquaculture production. Catfish production generates around \$500 million in farm revenue, and links with other industries raise that value to \$4 billion. In the South, the catfish industry is critical to the economic viability of many rural communities.

In recent years, catfish production has stagnated and decreased. Both large catfish producers and small family farms are struggling to keep pace with the increasing cost of inputs and competition with imported fish that is less expensive. Catfish farming in the U.S. needs to be more efficient and more productive in order to be competitive, sustainable, and profitable. One way to lower production costs is the use of hybrid catfish (channel catfish females mated with blue catfish males to produce hybrid offspring); however, specific technology for producing and harvesting hybrid catfish are needed to enable wide-scale commercial adoption of hybrid catfish.

## *Multistate Research Project Helps Stabilize Industry*

In 2007, researchers formed Multistate Research Project S-1031 to coordinate and conduct research to improve domestic hybrid catfish production. The multistate approach has allowed a larger, unified effort with quick and widespread impacts.

Over the past six years, the group's research and outreach have increased adoption of efficiency-boosting technology and practices among catfish farmers. For example, in 2008, 25 farmers began raising hybrid catfish, and one farmer adopted new grading technology (tools for sorting fish into groups by size). With the adoption of more efficient practices and cost-saving technology, the catfish industry has stabilized and farmer profits have increased.

The group's research has boosted domestic hybrid catfish production, which has decreased catfish trade deficit and improved domestic food security. When S-1031 research first got underway, hybrid fry production was approximately 16 million per year, and hybrid catfish were met with reluctance by the catfish industry. Four years later, hybrid fry production climbed to 110 million per year. In 2012, demand for hybrids actually exceeded supply, and production of hybrid fish accounted for 20% to 25% of total catfish processed. In 2014, 200 million hybrid catfish fry were produced. Hybrid catfish production and processing is expected to account for greater than 50% of the catfish industry in 2015.

## *Selected Research Highlights*

Over the past six years, S-1031 researchers have:

- Determined the most effective and affordable forms of hormone implants to induce ovulation and egg maturation.
- Altered female catfish diet to improve fecundity and embryo hatch rate. Studies showed that lipids and fatty acids played a major role in the quality of developing eggs, and incorporating catfish oil as a dietary supplement improved the subsequent reproductive performance of channel catfish.

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S-1031 research and the technology the group has developed are helping to increase the efficiency and lower the cost of hybrid catfish fry production in the U.S. The fast-growing, meaty hybrid fish are crosses between blue catfish males and channel catfish females. These hybrids will help the catfish industry compete with imported fish and meet rising demand for food fish from consumers. Photos by Les Torrans, ARS.

- Developed channel catfish that spawn in the early, peak, and late season, thus extending the spawning season for hybrids. Researchers also determined the ideal temperature for hybrid embryo hatching in late, peak, and early spawning strains.
- Conducted selective breeding to increase the presence of certain traits in the hybrid catfish population, including better growth, physical traits, feed conversion, disease resistance, oxygen tolerance, harvestability, and higher fecundity in channel catfish females
- Developed in-pond technology for grading, or sorting the fish into groups by size, that works well with hybrid catfish and helps prevent gilling (hybrid catfish have smaller heads than regular catfish, making it easier for them to get caught in traditional grading nets). This harvesting technology is being commercialized.
- Determined how densely channel catfish females should be stocked in order to maximize hybrid embryo production.
- Extended refrigerated storage and cryopreservation of sperm.
- Developed techniques for mass injection of embryos with stem cells. These techniques have a higher embryo survival rate, making them promising approaches to hybridization.
- Demonstrated that Fuller's earth was more effective at separating large egg masses into individual eggs than Bromelain (pineapple enzyme). Plus, Fuller's earth does not result in egg mortality if over-used. If not used correctly, Bromelain can cause the eggs to totally digest. Additionally, Fuller's earth was easier to use and reduces handling stress as egg de-adhesion, fertilization, and activation are done in the same step.
- Identified pheromones that attract male blue catfish to female channel catfish.
- Monitored behavior patterns and spawning rituals of hormone-stimulated catfish crosses in aquaria. In 2010, spawning success was 75% for channel x channel crosses, 40% for blue x blue, and 61.5% for channel x blue crosses. In 2011, spawning success dropped to 52.5%, 23.1% and 18.5% in channel x channel, blue x blue, and channel x blue crosses, respectively. Egg yields were 6,850, 2,910 and 5,444 eggs in 2010, and 8,155, 10,122 in 2011.
- Conducted gene transfer to increase the presence of certain traits in the hybrid catfish population, including better growth, feed conversion, and disease resistance.

## *Want to know more?*

This project was supported, in part, through USDA's National Institute of Food and Agriculture by the Multistate Research Fund established in 1998 by the Agricultural Research, Extension, and Education Reform Act (an amendment to the Hatch Act of 1888) to encourage and enhance multistate, multidisciplinary research on critical issues that have a national or regional priority. Additional funds were provided by contracts and grants to participating scientists. For more information, visit <http://saesd.ncsu.edu/>.

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### **List of Participating Institutions:**

- University of Arkansas, Pine Bluff
- Auburn University
- University of Maryland
- University of Memphis
- University of Minnesota
- Mississippi State University
- Southern Illinois University
- Eagle Aquaculture
- USDA-ARS

This Impact Summary was compiled and designed by Sara Delheimer.