



What ARS Does: Improving Crop, Livestock, and Aquaculture Production

The ARS aquaculture research program is assessing new technologies and more cost-effective solutions for a variety of aquaculture problems. Meeting the seafood demands of a growing global population also requires minimizing the impact of sustainable aquaculture production on natural resources. ARS scientists are creating strategies such as vision systems that are improving aquaculture farm health and methods for determining fish population biomass to eliminate fish stress, which supports sustainable domestic aquaculture production.



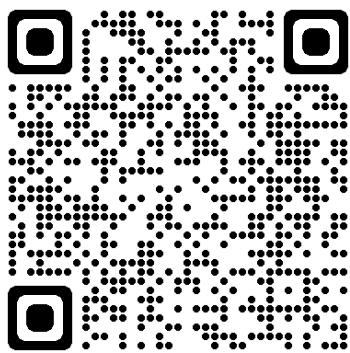
The following accomplishments in 2022 highlight ARS advancements in real-time fish monitoring, disease prevention, and breeding selection.

Precision aquaculture technologies for recirculating systems. Although precision agriculture technologies have not been widely applied to U.S. aquaculture, they could eliminate fish stress associated with the traditional, hands-on methods for estimating population biomass. ARS-funded scientists in Shepherdstown, West Virginia, developed an artificial intelligence (AI)-aided computer vision system for real-time fish monitoring of fish size and numbers in recirculating aquaculture systems. Underwater images and videos were acquired to train an AI fish detection model, and the developed vision system detected whole and partial fish in the field of view with more than 85 percent precision. These findings demonstrate the capability for precision technology to assist non-invasive fish condition monitoring and biomass estimation, benefiting fish health, welfare, and production efficiency. [\(NP 106\)](#)

Marker-assisted selection for resistance to bacterial cold-water disease. Bacterial cold-water disease (BCWD) is one of the most devastating diseases in rainbow trout aquaculture. Improving resistance to BCWD using traditional family-based selective breeding or genomic selection with markers spanning the entire genome is promising but limited because these methods are labor intensive and costly, and the resistance trait cannot be measured directly in potential breeders. For these reasons, marker-assisted selection is advantageous because it can directly and relatively inexpensively predict the genetic merit of potential breeding animals using a small number of DNA markers. ARS researchers in Leetown, West Virginia, identified a set of six DNA markers that can be used to predict the genetic merit of breeding animals as accurately or even more accurately than traditional family-based selective breeding approaches for genomic selection. Using these markers is simpler and less expensive, and the effectiveness of this approach was demonstrated in a commercial breeding population, indicating that it can further improve the efficiency and sustainability of rainbow trout aquaculture in the United States. [\(NP 106\)](#)

New strategy for controlling snails. Trematode infestations on catfish farms have been linked to significant production losses and farm closures. Trematodes were initially recognized as an emerging pest in the late 1990s, and management strategies targeted the trematode life cycle by eradicating the snail intermediate host in the pond environment. Copper sulfate is the most widely used treatment option and is highly effective against snails with a single application of 3 ppm, but this treatment level can result in increased mortality in fish, especially when water temperatures are elevated. ARS researchers in Stoneville, Mississippi, and Mississippi State University researchers demonstrated that weekly low-dose copper treatments (1.0-1.5 ppm) spread across 4 weeks are as effective in killing snails and treatment rates <0.1 ppm can halt snail reproduction and kill snail embryos. This approach is being combined with a new delivery system to better manage snail populations and reduce trematode populations in catfish ponds. The system utilizes a radar groundspeed sensor and a logic-based control system to distribute granular copper sulfate evenly and accurately along the pond margins in a single pass. [\(NP 106\)](#)

Development of an effective oral enteric septicemia of catfish vaccination platform. Enteric septicemia of catfish is considered the most problematic bacterial disease affecting catfish fingerling production. Historically, management strategies relied on using medicated feed and feed restrictions to limit the oral infection routes. While both strategies can be effective, the overuse of medicated feeds results in the development of antibiotic resistance, rendering the medication useless, and feed restrictions severely limit growth. In efforts to develop more proactive management strategies, ARS researchers in Stoneville, Mississippi, developed a live attenuated vaccine and a mechanized delivery system enabling in-pond vaccination during the early stages of fingerling production. The oral vaccine is currently available by veterinarian prescription and has dramatically increased survival and profitability of fingerling catfish production. Currently, more than 90 percent of catfish produced in Mississippi and Alabama are vaccinated with the delivery platform, which is applicable to other live attenuated vaccines as well. The vaccine also provides cross protection against *Edwardsiella piscicida*, an emerging pathogen in hybrid catfish production. [\(NP 106\)](#)



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