Success Story

AquaFish CRSP: Sustainable Aquaculture and Fisheries for a Secure Future

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Putting Bacteria to Work for Tilapia Farmers

Masculinization Systems for Tilapia Are Made Safe with Steroid-Eating Bacteria

"With MT being removed by the bacteria and also the growing importance of bioflocs in aquaculture, this is going to be a great success for sure."

— Wilfrido Contreras-Sánchez, AquaFish CRSP researcher

Tilapia is one of the most popular fish used in developing country aquaculture. It's an easy, economical fish for poor farmers to raise as food for their families and to sell. But, tilapia are prolific breeders, quickly overpopulating ponds with too many fish stunted in growth and too small to profitably market. One solution is for farmers to stock their ponds with only male fingerlings purchased from local fish hatcheries. An all-male population will grow more quickly than a mixed-sex population, producing larger, more uniformly-sized fish and tidy profits for farmers.

To turn young tilapia into males — starting at the fry stage, when they're no larger than an inch — hatcheries feed them food containing the synthetic steroid methyltestosterone (MT). After three to four weeks of MT treatment, the young fish are masculinized. But MT treatment carries an environmental cost. As the young fry feed on MT-laced feed, they excrete unused hormone back into the hatchery water in their urine and feces. This MT residue does not naturally degrade. With hatcheries producing thousands of MT-treated fish each year, disposal is a growing problem.

AquaFish CRSP graduate student Lucero Vazquez Cruz examines a Petri dish with bacteria that can degrade the tilapia masculinization hormone methyltestosterone.

MT is a member of a class of hormones that can cause cancers and other health problems under prolonged exposure. Hatchery workers are exposed to MT when they wade into treatment ponds to collect fingerlings ready for sale. Many hatcheries routinely discharge MT-laced water into local streams and rivers where it can harm wildlife. "The health of local residents who swim in or wash clothes in these bodies of water also might be at risk," according to CRSP researcher Dr. Wilfrido Contreras-Sánchez at the Autonomous Juarez University of Tabasco in Mexico.

Contreras-Sánchez has developed a simple, cost-effective system for removing MT from the hatchery water. By using bio-filters covered with bacteria that eat MT, the residue is eliminated from the water. These are

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Mexican workers net tilapia broodstock at a government hatchery. Broodstock such as these produce fry that are treated with MT to generate all-male fingerling populations for sale to fish farmers.

Dr Wilfrido Contreras-Sánchez scoops young tilapia from an experimental MT-treatment tank fitted with the bio-filtration system.

common bacteria typically known as the agents of disease and spoilage — *Pseudomonas aeruginosa* (pneumonia and other ailments), *P. fluorescens* (milk spoilage), and *Bacillus ceresus* (food poisoning). Contreras and his colleagues initially discovered these species among healthy bacterial colonies populating a hatchery's water filtration system. Their bet that some of these bacteria fed on MT proved right. In a series of experiments, the UJAT team identified these three species and also discovered that *P. aeruginosa* acts as a probiotic by enhancing fish growth and survival.

This MT elimination technology is now ready for commercial scale-up. For the initial transfer step, UJAT has partnered with the Mexican fish farm Pucte del Usumacinta, which masculinizes up to 750,000 fry each month. The company is excited about the probiotic effect, and its industrial applications in bioflocs. As Contreras-Sánchez enthusiastically phrased it, "With MT being removed by the bacteria and also the growing importance of bioflocs in aquaculture, this is going to be a great success for sure."

The CRSP MT-removal technology will scale-up from this simple filtration tank to commercial-sized systems capable of filtering MT-treatment water in large hatcheries.

To view an AquaFish CRSP video on the MT-Elimination project at UJAT, see www.aquafishcrsp.oregonstate.edu/video/index.php?video=1

Photo of Mexican workers by Jim Bowman; all others by Tiffany Woods, Oregon State University

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