

BRIEFLY NOTED

Regulators Kept a Fish Treading Water for Years

BY HENRY I. MILLER AND KATHLEEN L. HEFFERON

This is the story of a fish that spent years treading water.

The first U.S. sales of the AquaAdvantage salmon, a faster-growing, genetically engineered fish, have finally begun. The farmed fish grows to maturity almost twice as quickly as its non-engineered cohorts, and on much less feed. It is coming to market after

a quarter-century and close to \$100 million spent trying to get the approval of federal regulators. In addition to governmental foot-dragging, the journey was constantly dogged by activists opposed to genetically engineered food.

The salmon, produced by the biotechnology firm AquaBounty, was genetically engineered to incorporate a growth hormone gene from the closely related Chinook salmon along with a DNA regulatory sequence from another fish, the ocean pout. The result is a fish that, short of DNA sequencing or measuring growth hormone levels, is completely indistinguishable from its wild salmon counterparts.

Timid retailers / Having a salmon that is easy to grow and maintain, even far from the ocean, is a win-win-win for consumers, the fish industry, and the environment. Yet, dozens of grocery chains, restaurants, and food service companies are refusing to sell AquaAdvantage out of concern that the public could wrongly perceive the fish as dangerous because it was genetically engineered using modern molecular techniques.

As described in these pages previously, the AquaAdvantage salmon is almost too good to be true. (See “The Use and Abuse of Science in Policymaking,” Summer 2012; “How the FDA Virtually Destroyed

an Entire Sector of Biotechnology,” Winter 2017–2018). All of the farmed fish will be sterile females, which will only be raised in land-based facilities using recirculating aquaculture systems that recycle 95% or more of the water in which the fish are grown. Waste products are filtered out of the water (and the solids can be used by land farmers as fertilizer or soil amendments). The salmon eggs are produced in the company’s certified disease-free hatcheries, so there is no need for antibiotics or pesticides because the fish are not exposed to pathogens or parasites found in the natural environment outside of the farming facility.

Escapes from land-based recirculating aquaculture system facilities are extremely unlikely because of the many fail-safe measures: screens and filters in the piping of the facility tanks, pump impellers that would mince the fish, and chlorination of water leaving the facility. Even if a release were to happen—that is, if the fish were somehow transported to and released into the ocean—they are unlikely to survive because they are maladapted to conditions outside the farm. Couple this with the healthfulness of the fish as a food, and it’s difficult to see what sort of danger AquaAdvantage could pose.

What’s new is old / Market surveys indicate that many consumers are willing to accept a genetically engineered fish that provides so many environmental and health benefits. Yet, some food manufacturers are too timid (or intimidated) to sell AquaAdvantage, possibly for fear of being blacklisted

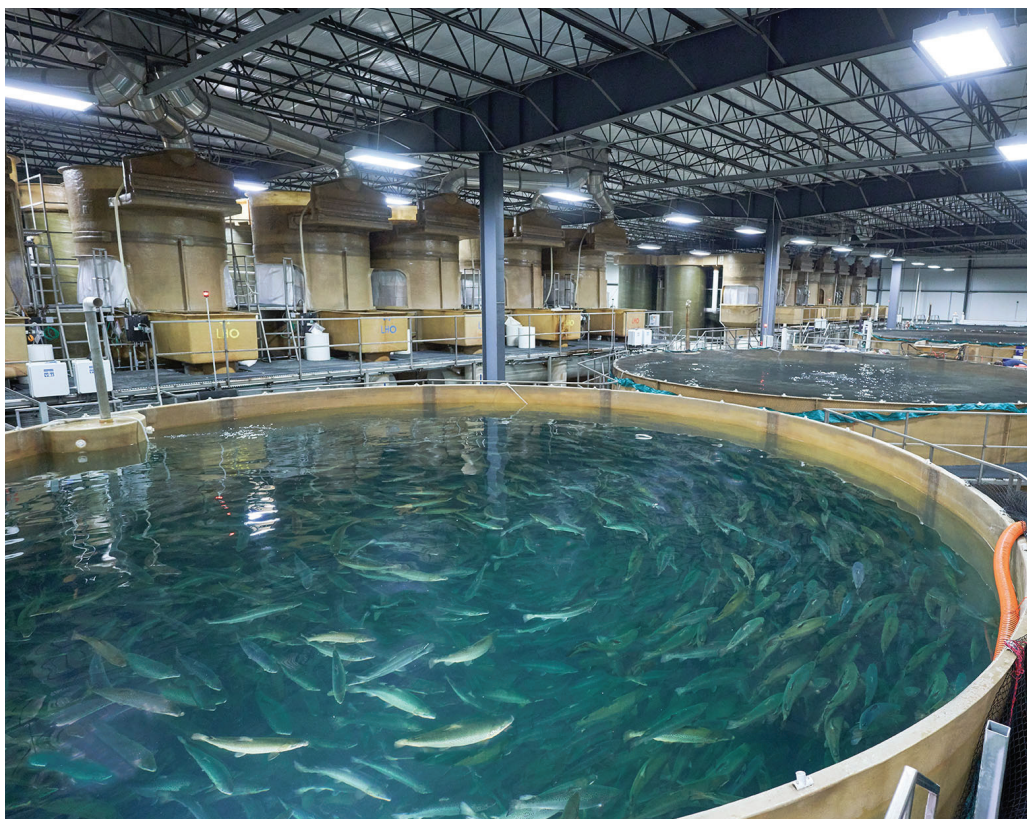
by consumers or—worse—having to contend with activists who oppose any application of genetically modified organisms (GMOs).

Interestingly, though these activists portray genetic engineering as unnatural, nature itself sometimes inserts genetic sequences from one organism into another. For instance, another fish, the rainbow smelt, includes the “antifreeze” gene from the herring that allows the fish to survive in very cold water. The smelt is thought to have acquired the gene some 20 million years ago. Other examples include aphids that harbor a fungal gene to avoid predators, whiteflies that have a plant gene to resist pesticides, and grasses that share genetic material between distant relatives. Also, for about a century, plant breeders have performed “wide cross” hybridizations in which genes are intentionally moved from one species or genus to another using pre-molecular techniques that do not raise the anti-GMO activists’ ire. Yet, despite the fact that genes of fish or other animals and plants transfer naturally to other species, and that AquaAdvantage has such commercial and environmental promise, the activists are unswayed.

Regulatory and political obstacles / AquaAdvantage is also a poster child for regulators’ incompetence and bad faith. More than a decade before the U.S. Food and Drug Administration issued its 2008 guidance on the regulation of genetically engineered animals, its officials had told AquaBounty to submit a marketing approval application for the fish to the agency, but without specifying a clear regulatory rationale or pathway. The FDA then held onto the application for almost 13 years as it tried to decide *how* the fish should be reviewed.

The agency ultimately decided to review the salmon as a “new animal drug,” a designation previously applied only to medicines for animals, like flea repellents and antibiotics. This review then took several more years. Finally, after two decades of regulatory process (that is to say, bureaucratic dithering), the FDA concluded what should have been obvious long before: the fish poses no unusual health or environmental risks.

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AquAdvantage salmon at a land-based recirculating aquaculture facility.

By contrast, in 1982 the agency took only five months to approve the first recombinant DNA-derived pharmaceutical, human insulin produced in genetically engineered bacteria. (The first author of this article was the medical reviewer and head of the review team.)

The last regulatory obstacle to farming and selling AquAdvantage in the United States was removed in March 2019—only to be replaced by political obstacles imposed at the behest of an industry competitor.

Alaskan salmon fisheries, despite operating at full capacity because of the heavy demand for their product, did not want AquAdvantage to come to market. Some fisheries may have been worried that consumers who wanted to avoid GMOs would stop buying salmon altogether, regardless of its origins. But others likely didn't want competition from the faster-growing aquaculture fish.

Responding to her constituents, U.S. Sen. Lisa Murkowski (R-AK) concocted various legislative hurdles to AquAd-

vantage. She attached a rider to the FY 2019 appropriations bill that required genetically engineered salmon approved prior to the labeling standards created by the U.S. Department of Agriculture's National Bioengineered Food Disclosure Standard regulation to include the words "genetically engineered" in its market name—a requirement seemingly intended to spook consumers. In contrast, though the USDA rule likewise requires labeling, it is flexible; food producers may comply via text, symbol, or electronic or digital link. Murkowski also tried to introduce an appropriations bill rider that would require the conducting of "a label comprehension study" before AquAdvantage could be sold. Such studies are usually intended for over-the-counter pharmaceuticals, to ascertain what language on drug labeling will be clear to consumers, and can take years to complete.

These shenanigans cross the line from constituent service to legislative malfeasance. The U.S. West Coast's Pacific salmon

industry comes nowhere close to meeting the nation's demand for this popular fish. As for Atlantic salmon, more than 90% currently sold in the United States are imported, largely from Norway and Chile.

AquAdvantage is only now reaching U.S. markets and restaurants. Worth noting: the fish was approved for marketing in Canada in 2016, is available in supermarkets without special labeling, and is very popular with consumers.

What should have happened/ Decades ago, the FDA faced the question of how to handle genetically engineered laboratory (i.e., non-food) animals created for medical research. The agency simply decided to magisterially invoke "enforcement discretion" and exempt the animals from the excruciating approval process under the Food, Drug and Cosmetic Act. The FDA also used enforcement discretion to obviate the need for review and approval of GloFish, genetically engineered varieties of fluorescent aquarium fish. Regulators' rationale was that the fish posed no threat to the food supply, and there was no evidence that they posed any more threat to the environment or public health than their unmodified counterparts.

Obviously, the AquAdvantage salmon is meant to be eaten and is, therefore, different from lab animals and GloFish. But there is no reason to think AquAdvantage presents any special danger to either consumers or the environment. Yet, the FDA has acted as if the opposite were the case. The agency's ostensible commitment to enlightened, science-based regulatory policy failed when it came to AquAdvantage and other genetically engineered food animals. As a result, this once-promising technology sector is on life support.

There is some good news on the commercial front, however. Wholesaler Samuels Seafood plans to sell the AquAdvantage salmon despite the decisions of other major U.S. foodservice companies. Brazil also recently approved sales of the fish, opening the market in Latin America to this food innovation. Let's hope this fish tale gets the happy ending it deserves. **R**