

Genetically Modified Salmon

What are GMOs?

Scientists can use laboratory techniques to delete, modify, or add genes from one organism to another in order to manipulate the traits of a given plant, animal, or microorganism. The result is what is known as a genetically modified (GM) organism (GMO). GMOs typically express a desired quality such as resistance to disease, tolerance of herbicides, or enhanced nutrition.

Making genetically modified food and medicine began in 1983. According to the United States Department of Agriculture (USDA) by 2023, 97% of cotton, 95% of soybeans, and 93% of corn grown in the U.S. were genetically modified.

What are GM fish?

The world's first GM fish intended as food was initially developed in 1989 and approved for commercial production in 2015. It was known as the AquAdvantage salmon and was developed by a Massachusetts company called AquaBounty Technologies.

The AquAdvantage salmon is an Atlantic salmon with two genetic additions: 1. a gene for growth hormone (GH) from the Pacific Chinook salmon and 2. a "promoter" gene that controls the expression of the GH gene. This promoter gene comes from an eel-like ocean pout fish that lives in deep, cold ocean waters. These modifications make the AquAdvantage salmon grow year round instead of only in the spring and summer. As a result it grows to full size in 16 months instead of 30 months like natural Atlantic salmon.

How were AquAdvantage salmon grown?

AquAdvantage salmon were raised in two freshwater facilities—one in Canada where breeding stock were kept and one in Panama where fish were grown for market using eggs from the Canadian facility. Fish would be grown to a harvestable size in Panama, harvested, and imported back to the United States. Eventually the company opened a farm in Indiana and had another one under development in Ohio.

The land-based facilities were physically contained to prevent AquAdvantage salmon from escaping into the wild. Fish were modified to be triploid, containing three sets of chromosomes rather than the typical two to make it impossible for them to breed. They were also all female.

Critics point out that a small percentage of AquAdvantage salmon eggs only contained two sets of chromosomes, making breeding a possibility either with wild salmon or with a closely related species such as brown trout. In this way the modified



An AquAdvantage salmon compared to a same age natural Atlantic salmon

genes could be passed to wild populations and have ecological consequences.

Who regulates GM salmon in the US?

The U.S. Food and Drug Administration (FDA) was responsible for approving AquAdvantage salmon to sell in the United States. AquaBounty first sought approval for its GM salmon in 1995.

The FDA studied whether the salmon would be safe for humans to eat and safe for the environment. Ultimately the FDA decided that AquAdvantage salmon is as safe to eat as natural Atlantic salmon and is not a risk to endangered salmon populations or the environment.

In November of 2015 the FDA announced that AquaBounty Technologies had met the requirements for AquAdvantage salmon to be approved for sale and consumption in the United States, although at first raising or farming the fish in the United States was not allowed.

In the period leading up to AquaBounty's approval the FDA received more than two million comments—the most the agency had ever received about a single issue. Many people

wanted the salmon to be identified as GM, but the FDA did not require labeling because it was not found to be substantially different from a natural product.

In 2022, a new regulation went into effect requiring that most foods sold in the U.S. be labeled as a "bioengineered food" if they contain genetic material that has been modified through a laboratory process. This regulation is known as the National Bioengineered Food Disclosure Standard.



Some benefits of GM salmon:

- GM technology allows the fish to grow to full size in about half the time, meaning resources can be used more efficiently to produce food.
- GM salmon is as healthy a source of protein as natural salmon.
- Land-based fish farming has advantages over ocean fish farming because wild fish are less likely to catch diseases from farm-raised fish and land-based farming can be more efficient at nutrient recapture.
- GM salmon could help make land-based fish farming more economically viable, providing an alternative to ocean fish farming and wild harvest.

Some risks of GM salmon:

- If GM fish escape they could breed with wild salmon or another related species or compete with them for food.
- Production is resource-intensive and will have environmental impacts associated with water usage on farms and shipping eggs and meat among Canada, Panama, and the United States.

Who are the stakeholders?

A stakeholder is anyone who is involved in or affected by an event or decision. Some of the stakeholders in GM salmon are:

- AquaBounty Technologies
- Biotechnology industry
- Shipping industry
- Commercial fishers
- Tribal fishers and communities
- Environmentalists
- Towns near the farms where the salmon are reared
- Grocery stores
- Consumers

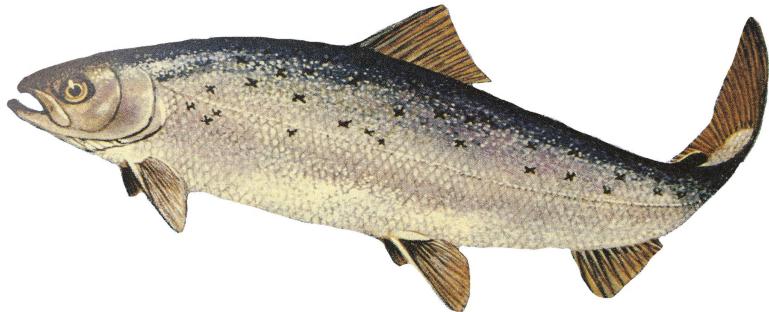
Can I buy GM salmon?

No, AquaBounty closed its operations in December of 2024 after being unable to make a profit. Grocery stores like Walmart, PCC, Whole Foods, Trader Joe's and Costco had all said they would not sell GM salmon.

Some ethical questions:

Ethics asks what is morally right or wrong. Here are some ethical questions to think about:

- Wild salmon runs are endangered because of overfishing and destruction of habitat. Should GM salmon be produced so wild salmon populations are less threatened?
- Is it right for the US FDA to decide if AquAdvantage salmon will be produced and sold, when it will be grown outside the United States?
- Is it a big deal to insert genes from other fish species into the AquAdvantage salmon? What is right or wrong about it?
- The FDA takes public comments when deciding whether to approve a new food or drug. What would you communicate to the FDA about AquAdvantage salmon? Write a public comment.



Where to learn more:

- AquaBounty AquAdvantage salmon fact sheet. <https://aquabounty.com/wp-content/uploads/2019/03/AquAdvantage-Salmon-flyer.pdf>
- Debating genetically modified salmon. 2011. National Public Radio. <https://www.npr.org/2011/12/09/143453487/debating-genetically-modified-salmon>
- FDA AquAdvantage salmon fact sheet. 2025. <https://www.fda.gov/animal-veterinary/aquadvantage-salmon/aquadvantage-salmon-fact-sheet>
- Friends of the Earth. 2024. Genetically engineered salmon production ends as AquaBounty shutters last facility. <https://foe.org/news/aquabounty-ge-salmon-ends/>
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- Smith, C. 2023. Pushback continues against genetically modified salmon being raised at Indiana farm. Indiana Capital Chronicle. <https://indianacapitalchronicle.com/2023/10/10/pushback-continues-against-genetically-modified-salmon-being-raised-at-indiana-farm/>