

Sponsors: McConnell/Hackett

**CITY AND BOROUGH OF SITKA**

**RESOLUTION NO. 2013-02**

**A RESOLUTION OF THE CITY AND BOROUGH OF SITKA STRONGLY OPPOSING AN APPLICATION FROM AQUABOUTY TECHNOLOGIES, INC. TO THE U.S. FOOD AND DRUG ADMINISTRATION (FDA) TO MARKET GENETICALLY ENGINEERED ATLANTIC SALMON**

**WHEREAS**, genetically engineered salmon would jeopardize the health of wild salmon stocks if released into the wild; and

**WHEREAS**, Alaska wild salmon are a critical sector of Sitka and Alaska's economy through commercial, sport/charter and subsistence fishing, and genetically engineered salmon could erode the strength of the wild seafood industry and harm this economy; and

**WHEREAS**, AquaBounty Technologies, Inc. has submitted an application to the FDA for approval of the "AquaAdvantage Salmon", a genetically engineered salmon, for human consumption and marketing in the United States; and

**WHEREAS**, neither Sitka nor the State of Alaska support approval of genetically engineered salmon for sale; the risks and impacts on Alaska's wild fisheries, an economic engine for our community and state, is far too dangerous to justify the potential benefits; and

**WHEREAS**, interbreeding, diseases, parasites, and other problems associated with farmed salmon have the potential to devastate natural populations including Alaska's wild stocks; and

**WHEREAS**, rigorous scientific research needs to be completed to ensure consumption of genetically engineered salmon is safe for a large sector of the population, including children and expectant mothers, and allowing a company to sell a genetically engineered product that has not completed this testing could undermine consumer confidence and cause avoidance of all salmon products, which could cripple Alaska's salmon industry; and

**WHEREAS**, should the FDA approve AquaBounty's application to market its genetically engineered salmon it is of critical importance that their product be mandated to be clearly labeled "Genetically Modified" in an easy to read font size, prominently displayed in a contrasting color.

**THEREFORE, BE IT RESOLVED**, that the Assembly of the City and Borough of Sitka, Alaska by this resolution opposes approval of genetically engineered salmon for sale in the United States and stands in strong opposition.

**PASSED, APPROVED AND ADOPTED** by the Assembly of the City and Borough of Sitka, Alaska on this 12th day of February 2013.

---

Mim McConnell, Mayor

ATTEST:

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Colleen Ingman, MMC  
Municipal Clerk

STATE CAPITOL  
PO Box 110001  
Juneau, Alaska 99811-0001  
907-465-3500  
Fax: 907-465-3532



Governor Sean Parnell  
STATE OF ALASKA

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www.gov.alaska.gov  
Governor@alaska.gov

December 14, 2011

The Honorable Mark Begich  
Chairman  
U.S. Senate Subcommittee on Oceans,  
Atmosphere, Fisheries, and Coast Guard  
420A Hart Senate Office Building  
Washington, DC 20510

The Honorable Olympia Snowe  
Ranking Member  
U.S. Senate Subcommittee on Oceans,  
Atmosphere, Fisheries, and Coast Guard  
227 Hart Senate Office Building  
Washington, DC 20510

Re: Environmental Risks of Genetically Engineered Fish

Dear Chairman Begich and Ranking Member Snowe,

I commend the subcommittee for its attention to the environmental risks associated with genetically engineered fish. My administration continues to have strong concerns regarding AquaBounty's application to market genetically engineered Atlantic salmon. Due to the significant potential threats genetically engineered salmon pose to the environment, consumer health, and the wild seafood industry, we have urged the United States Food and Drug Administration (FDA) to withhold approval of this application. Furthermore, we question whether the application has received sufficient scientific and public scrutiny, and are troubled by the lack of transparency that has marked the review process.

**Threat to Wild Salmon Stocks**

Like many, we fear genetically engineered salmon could jeopardize the health of wild salmon stocks if released into the wild. Genetically engineered salmon could spread disease, cross-breed with wild salmon, and out-compete them for food and mates. The United States Fish and Wildlife Service (FWS) and National Oceanic and Atmospheric Administration (NOAA) have recognized these risks, and warned the FDA about the potential dangers associated with escaped genetically engineered fish in a joint letter to the FDA in 2001, and the National Academy of Sciences in a 2002 study.

While AquaBounty proposes containment measures to reduce the chance of genetically engineered salmon escapes, these measures would not eliminate the risk. That risk would grow if AquaBounty supplies genetically engineered salmon eggs to a network of commercial farms, as the company intends. Alaskans are well aware that fish farming containment measures are not fail-safe. Commercial fishermen in Alaska have caught hundreds of Atlantic salmon, escaped from fish farms in Canada and the state of Washington.

The Honorable Mark Begich  
The Honorable Olympia Snowe  
December 13, 2011  
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### **Insufficient Consultation with National Marine Fisheries Service (NMFS)**

We have urged the FDA to honor a provision authored by the late Senator Ted Stevens and Senator Lisa Murkowski, which became law as part of the Food and Drug Administration Amendments Act of 2007 (P.L. 110-85). The provision requires the Commissioner of FDA "to consult with the Assistant Administrator of the NMFS of the National Oceanic and Atmospheric Administration to produce a report on any environmental risks associated with genetically engineered seafood products, including the impact on wild fish stocks." This statutory language was intended to ensure NOAA played a role in the FDA's approval process for genetically engineered seafood products. We are not convinced that this statutory obligation has been fully met.

### **Threat to Human Health and Consumer Confidence in Salmon**

Before genetically engineered salmon is allowed into the United States' food supply, more rigorous scientific research is necessary to ensure its long-term consumption is safe for a large cross section of the population, including sensitive populations such as young children and expectant mothers. As you know, salmon is widely recognized for its health benefits, and many consumers purchase salmon for this reason. Allowing a company to sell a genetically engineered product that has not been the subject of sufficient long-term testing would undermine consumer confidence in all salmon products as well as the health benefits of salmon consumption.

### **Economic Impact on Wild Seafood Industry**

Genetically engineered salmon could also erode the strength of the wild seafood industry, especially if appropriate labeling is not mandated. For Alaska, the results could be devastating. Alaska's salmon industry is critically important to the state's economy, and is the primary source of employment and revenue in many of our coastal villages. Farmed salmon has already threatened the position of Alaska's wild salmon in the seafood market. Alaska salmon, however, regained its status thanks to significant investments in infrastructure, product quality, and marketing. Marketers focused on distinguishing the health benefits and taste properties of Alaska salmon. Studies still show, however, that consumers struggle to distinguish seafood in the marketplace. Adding genetically engineered salmon to the store shelf could further complicate the efforts of consumers seeking healthy, wild seafood products.

### **Lack of Public Participation and Transparency**

In addition, my administration is disturbed by the process employed by the FDA to review AquaBounty's application. The environmental and public health implications associated with genetically engineered salmon and the significance of approving the first genetically modified animal for consumption in the United States warrants the highest level of public participation and transparency. We do not believe that FDA's review process for veterinary drugs allows for a sufficiently public and transparent process.

### **Lack of Genetically Engineered Labeling**

FDA's statements that suggest it may not be able to require labeling for AquaBounty's genetically engineered salmon is also troubling. The State of Alaska does not support approval of genetically engineered salmon for sale. If, despite significant environmental and human health concerns, the FDA approves such an application, genetically engineered salmon sold in the United States should

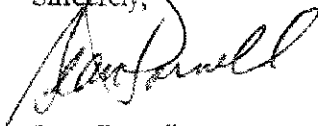
The Honorable Mark Begich  
The Honorable Olympia Snowe  
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be clearly labeled "genetically modified," so consumers can make an informed choice. This label should be prominently displayed on the front of the package in a contrasting color, and a minimum print size should be required. Alaska statutes require the conspicuous labeling of such products sold in the state.

For the reasons mentioned above, I support legislation to prevent the FDA's approval of genetically engineered salmon for human consumption and to require appropriate labeling for any genetically engineered seafood products.

I appreciate your consideration of Alaska's position on this important issue and respectfully request that this letter be included in the hearing record.

Sincerely,



Sean Parnell  
Governor

cc: The Honorable John Rockefeller, Chairman, United States Senate Committee on Commerce, Science, and Transportation  
The Honorable Kay Bailey Huchison, Ranking Member, United States Senate Committee on Commerce, Science, and Transportation  
The Honorable Lisa Murkowski, United States Senate  
The Honorable Don Young, United States House of Representatives  
The Honorable Cora Campbell, Commissioner, Alaska Department of Fish and Game  
The Honorable Larry Hartig, Commissioner, Alaska Department of Environmental Conservation

# Genetically modified salmon concerns Interior Alaska lawmakers

FAIRBANKS — The state's Interior delegation is urging federal regulators to reject a company's plan to sell genetically modified salmon, saying the risk to wild stocks represents "a grave threat" to one of the state's economic engines.

Federal agencies are considering allowing the modified salmon on commercial shelves.

Some in the state are skeptical and Gov. Sean Parnell wrote to federal regulators last month opposing the plan. Concern focuses partly on the chance modified salmon could impact wild fisheries. The company proposing the plan has developed fish to grow much faster than natural fish and said its plan addresses the risk that stocks from engineered fish could impact wild stocks.

Sen. Joe Thomas, D-Fairbanks and chairman of the Interior delegation, circulated a letter this week asking regulators to object to the plan. As of late Monday about three-quarters of the delegation, where lawmakers' districts cover the Fairbanks and Denali boroughs and in some cases beyond, had signed or signaled their support, according to Thomas' office. "We feel there are too many unanswered questions concerning the potential dangers of this product," the letter reads, stating the risk that engineered salmon would escape and breed with wild salmon is too dangerous to justify the potential benefits. "Interbreeding could devastate natural populations."

The letter is directed to the federal Food and Drug Administration, the state's congressional delegation and the White House.

The issue of modified fish touches on broader debate about genetically modified organisms. Much of that discussion focuses on modified — and typically more disease-resistant — crops, with proponents highlighting increased yields and opponents citing scientific questions and aesthetic, among other, concerns. International treaties aimed at protecting biodiversity have adapted to address, as the Cartagena Protocol on Biosafety puts it, "the potential risks posed by living modified organisms resulting from modern biotechnology." The delegation's letter states AquaBounty, the Massachusetts company proposing the salmon plan, has fallen short of conducting "definitive scientific research" needed to relieve anxieties here. Potential health hazards, the letter states, "have not been fully investigated." The delegation said it worries the FDA might not require the company to label its fish as modified.

"If these fish are not labeled, a wary public may avoid salmon altogether, harming our economy," the letter states.

**Mary Lochner**

The Alaska State Legislature is considering a house resolution "opposing AquaBounty's petition to produce genetically engineered salmon," and calling for it to be labeled as "genetically modified" if it goes to market.

The Food and Drug Administration released a Draft Environmental Assessment in December 2012 that found AquaBounty's GE Atlantic salmon posed no risk to the environment. The FDA has already ruled that the fish is safe for human consumption. It is taking public comments on its environmental assessment through Feb. 24. After that, the FDA is widely expected to approve AquaBounty's fish for U.S. markets.

The fast-growing Atlantic salmon has been genetically engineered to carry DNA coding from two other species: a Chinook (King) salmon, and an ocean pout (a slender fish that looks like but is not technically an eel). The Chinook DNA makes the GE fish grow bigger faster, and the ocean pout DNA makes it grow year-round.

Alaska has already passed a law requiring genetically engineered salmon sold in the state to be labeled as such. The current resolution supports a federal labeling law, something all three members of Alaska's congressional delegation have advocated for. Governor Sean Parnell has also written a letter to the FDA urging it to deny AquaBounty's application to sell its fish for human consumption in the U.S.

Federal Drug Administration regulations do allow for labeling of GE food in cases where the new food is materially different from its conventional form. But when that happens, the resulting label might not be what the public expects. An FDA white sheet on GE (also called genetically modified organism, or GMO) labeling gives one example. When oil derived from GE soy beans was found to have significantly higher levels of oleic acid than from conventionally grown soy beans, the FDA ruled that it had to be labeled. But the ingredient label on food packages doesn't say "oil from genetically engineered soybeans." Instead it carries a description of the material difference; the FDA requires that it carry the modifier "high oleic acid."

In the FDA's review documents of AquaBounty's application, the agency has so far described the GE Atlantic salmon as having no material difference from its conventionally farmed Atlantic salmon counterpart.

Alaska House Representative Geran Tarr introduced HJR 5, the anti-GE salmon resolution, which currently has five other sponsors.

She said she introduced the bill out of concern for the economic impacts on the Alaska fishing industry, as well as what she called potential health effects on consumers.

"I see this as a threat to the Alaska fishing industry," Tarr said, "and the 70,000 jobs provided by the fishing industry, and revenues and associated benefits.

Tarr said she thinks putting AquaBounty's GE fish on the market could damage public perception of salmon in general, including Alaska salmon.

"We've put a lot of effort into our marketing of Alaska seafood," she said. Tarr thinks AquaBounty's salmon should be explicitly labeled as "genetically engineered" or "genetically modified" so consumers aren't confused into thinking that Alaska's salmon might carry other species' DNA.

Alaska's congressional delegation has petitioned the FDA to extend the public comment period another two months beyond Feb. 25, and Tarr said she's been encouraging constituents to weigh in.

"They've already received 400,000 comments from the public on this," Tarr said. "It's going to take as many comments as possible."

But public comments aren't a popularity contest for one view or another. And right now, the FDA is taking public comments only on its Draft Environmental Assessment and the resulting Finding of No Significant Impact for AquaBounty's application – not the whole application.

"I think it's important that we're speaking in one unified Alaskan voice," Tarr said.

Public comments can be submitted online at [www.regulations.gov](http://www.regulations.gov), where you can also find copies of the Environmental Assessment and the Finding of No Significant Impact documents. Comments can also be mailed to:

**Division of Dockets Management (HFA-305)**

**Food and Drug Administration**

**5630 Fishers Lane, Rm. 1061**

**Rockville, MD 20852**

**CITY OF GUSTAVUS, ALASKA  
RESOLUTION 2010-26**

**A RESOLUTION OF THE GUSTAVUS CITY COUNCIL EXPRESSING  
OPPOSITION TO ALLOWING AQUABOUNTY TO MARKET  
GENETICALLY-ENGINEERED SALMON.**

**WHEREAS**, wild salmon are vitally important to subsistence, sport, and commercial fishermen in our community; and

**WHEREAS**, despite the best efforts of those who raise them, farmed salmon often escape; and

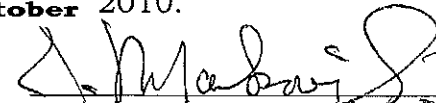
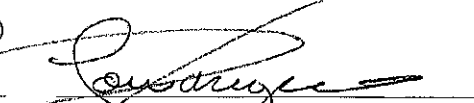
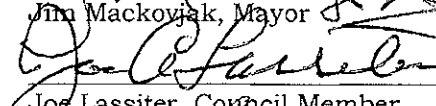
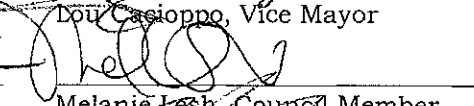
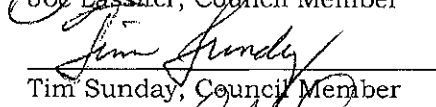
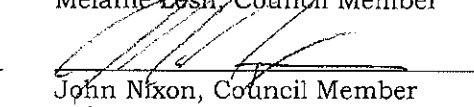
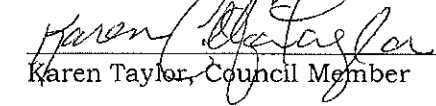
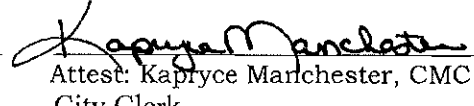
**WHEREAS**, the potential effects of escaped genetically-modified salmon on our wild salmon stocks include a potential to spread disease to wild stocks, to out-compete wild stocks, and even to interbreed with wild stocks; and

**WHEREAS**, any one or a combination of the potential effects noted above could be disastrous for the resource that has sustained many generations of Alaskans; and

**WHEREAS**, To the best of our knowledge, AquaBounty's salmon would be the first genetically-modified animal food product on the market, and if they are not labeled as genetically-modified, a wary public may avoid purchasing salmon altogether, harming our economy by diminishing the market for Alaska's wild salmon.

**NOW, THEREFORE BE IT RESOLVED** that the Gustavus City Council is opposed to allowing Aquabounty to market genetically-engineered salmon.

PASSED AND ADOPTED by the Gustavus City Council this 28th day of  
**October** 2010.

 _____ Jim Mackoyjak, Mayor	 _____ Don Casiozzo, Vice Mayor
 _____ Joe Lassiter, Council Member	 _____ Melanie Losh, Council Member
 _____ Tim Sunday, Council Member	 _____ John Nixon, Council Member
 _____ Karen Taylor, Council Member	 _____ Attest: Kapryce Manchester, CMC City Clerk





**CITY OF PETERSBURG**  
P.O. BOX 329 • PETERSBURG, ALASKA 99833  
TELEPHONE (907) 772-4519  
FAX (907) 772-3759

2010 OCT 12 A 6:19

To: U.S. Food & Drug Administration

Date: October 11, 2010

RE: Food and Drug Administration  
Docket No. FDA-2010-N-0385

Fax: 301-827-6870

Please find attached the City of Petersburg, Alaska's Resolution #1952 opposing AquaBounty Technology, Inc.'s application to market genetically engineered Atlantic salmon in the United States. Please file this resolution along with other comments received regarding the "AquAdvantage Salmon".

If you have any questions, please feel free to contact me at (907) 772-4425, ext. 21 or by email at [depclerk@cl.petersburg.ak.us](mailto:depclerk@cl.petersburg.ak.us).

Thank you,

Debra K. Thompson  
Deputy City Clerk

FDA-2010-N-0385

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**RESOLUTION #1952****A RESOLUTION OPPOSING AN APPLICATION FROM AQUABOUNTY TECHNOLOGIES, INC. TO THE U.S. FOOD AND DRUG ADMINISTRATION (FDA) TO APPROVE AND MARKET GENETICALLY ENGINEERED ATLANTIC SALMON IN THE UNITED STATES**

WHEREAS, AquaBounty Technologies, Inc. has submitted an application to the FDA for approval of the "AquAdvantage Salmon", a genetically engineered Atlantic salmon, for human consumption and marketing in the United States; and

WHEREAS, this is the first genetically engineered animal intended to be used as food in the United States; and

WHEREAS, the "AquAdvantage Salmon" was bred by inserting a recombinant DNA construct (also called a transgene) comprised of a Pacific Chinook salmon growth hormone gene and an Ocean Pout antifreeze protein gene into fertilized eggs of wild Atlantic salmon. The breeding of six subsequent generations led to an "AquAdvantage Salmon" line which bears a single copy of the integrated transgene. The broodstock used in spawning of "AquAdvantage Salmon" are females containing two copies of the transgene that have been scientifically sex-reversed for breeding purposes, therefore labeled neomales. The neomales are crossed with female Atlantic salmon that do not possess the transgene to produce eggs containing a single copy of the transgene. The fish that develop from these eggs have an enhanced growth rate compared to non-transgenic Atlantic salmon; and

WHEREAS, AquaBounty proposes fertilization and incubation to the eyed-egg stage on Prince Edward Island, Canada; shipment of the eyed-eggs to Panama; grow-out and processing of fish in Panama; and, shipment of processed fish to the United States for retail sale. While AquaBounty maintains the land based rearing of the "AquAdvantage Salmon" to be safely contained with a minimum risk of escapement into the wild; and, in the event there is an escape, believes the geographical area of the salmon rearing is unfavorable to the survival of "AquAdvantage Salmon", Alaskans know all too well that fish farming containment measures are not fail-safe. In addition, AquaBounty does not address the possibility of eyed-eggs making their way into the streams that run into the Northern Atlantic Ocean; and

WHEREAS, Petersburg City Council urges you to honor the Food and Drug Administration Amendments Act of 2007 provision (P.L. 110-85) requiring the FDA Commissioner "to consult with the Assistant Administrator of the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration to produce a report on any environmental risks associated with genetically engineered seafood products, including the impact on wild fish stocks"; and

WHEREAS, the development of "AquAdvantage Salmon" has been ongoing for approximately 15 years, yet the product has not been the subject of thorough scientific research and testing to ensure its consumption is safe in the long term; and


WHEREAS, many salmon consumers purchase the product for its widely recognized health benefits, this lack of safe consumption testing could weaken consumer confidence in all salmon products; and


WHEREAS, Alaska's wild seafood industry, which is extremely important to the state's economy and is the largest industry in Petersburg, could be severely impacted by the sale of genetically engineered salmon if proper labeling is not required. Should the FDA approve AquaBounty's application to market their product in the United States, it is critical that the product be mandated to be clearly labeled "Genetically Modified" to allow consumers to make an informed choice. Alaska statutes require such labels be prominently displayed on the front of the package.

THEREFORE BE IT RESOLVED THAT the City Council of the City of Petersburg by this resolution does not support approval of genetically engineered salmon for sale in the United States.

BE IT FURTHER RESOLVED THAT if despite strong environmental and human health concerns the application is approved by the FDA, product labeling requirements should include the words "Genetically Modified" prominently displayed in a minimum font size and a contrasting color on the front of the package.

PASSED and APPROVED by the City Council of the City of Petersburg, Alaska this 4th day of October, 2010.

  
\_\_\_\_\_  
Kathy O'Rear, City Clerk

  
\_\_\_\_\_  
Alan W. Dwyer, Mayor



Company    Products    Technology    Investors    Contacts

**AquaAdvantage® Fish**

**AquaAdvantage® Fish**

AquaBounty is developing advanced-hybrid salmon, trout, and tilapia designed to grow faster than their conventional siblings.

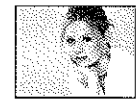
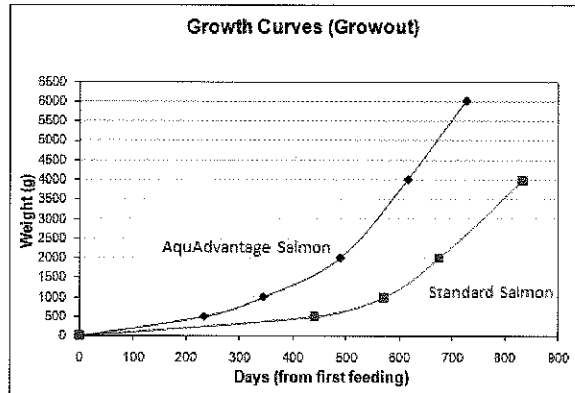
**AquaAdvantage® Salmon**

AquaAdvantage® Salmon (AAS) include a gene from the Chinook salmon, which provides the fish with the potential to grow to market size in half the time of conventional salmon. In all other respects, AAS are identical to other Atlantic salmon.

AAS is an environmentally sustainable alternative to current farmed salmon. AAS will be grown as sterile, all-female populations in land-based facilities with redundant biological and physical containment. As a result, AquaAdvantage® Salmon cannot escape or reproduce in the wild and pose no threat to wild salmon populations.

AAS raised in land-based facilities reduce the environmental impact on coastal areas, eliminate the threat of disease transfer from farms to wild fish and grow more fish with less feed. Additionally, facilities located near major consumer markets reduce the environmental impact associated with air and ocean freight.

AquaAdvantage® Salmon is the future of salmon aquaculture.



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## Our Technology

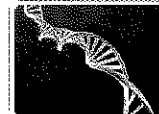
AquaBounty has identified life science strategies that have the potential to improve the health and productivity of important aquaculture species, using a variety of biotechnologies for our current and pipeline products. These include:

- gene and protein identification and analysis
- regulation of gene expression
- receptor identification and blocking technologies, and
- transgenesis.

The company is developing products to address critical production constraints in the most popular farmed species, focusing initially on salmon, trout and shrimp.

The AquAdvantage® fish program is based upon a single, specific molecular modification in fish that results in more rapid growth in early development. This enables shorter production cycles and increased efficiency of production. In the case of AquAdvantage® Salmon, these benefits will permit the use of alternative production systems which have substantial environmental and fish health benefits which are not economical for conventional Atlantic salmon.

It is important to note that AquAdvantage® Salmon is a well defined and unique product. It has been thoroughly studied and its attributes clearly established. Its properties and benefits stem from the regulated expression of its specific gene construct, integrated in a specific and stable location in the Atlantic salmon genome.



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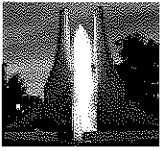
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## Purdue News

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April 2000

### **Transgenic fish could threaten wild populations**

WEST LAFAYETTE, Ind. – Purdue University researchers have found that releasing a transgenic fish to the wild could damage native populations even to the point of extinction.

A transgenic organism is one that contains genes from another species. The Purdue research is part of an effort by Purdue and the U.S. Department of Agriculture to assess the risks and benefits of biotechnology and its products, such as genetically modified fish. The study was published in November in the Proceedings of the National Academy of Science.

Purdue animal scientist Bill Muir and biologist Rick Howard used minute Japanese fish called medaka to examine what would happen if male medakas genetically modified with growth hormone from Atlantic salmon were introduced to a population of unmodified fish. The research was conducted in banks of aquariums in a laboratory setting.



**[Download Photo Here](#)**  
**Photo caption below**

The results warn that transgenic fish could present a significant threat to native wildlife. "Transgenic fish are typically larger than the native stock, and that can confer an advantage in attracting mates" Muir says. "If, as in our experiments, the genetic change also reduces the offspring's ability to survive, a transgenic animal could bring a wild population to extinction in 40 generations."

Extinction results from a phenomenon that Muir and

Howard call the "Trojan gene hypothesis." By basing their mate selection on size rather than fitness, medaka females choose the larger, genetically modified but genetically inferior medaka, thus inviting the hidden risk of extinction.

The transgenic medaka were produced by inserting a gene construct consisting of the human growth hormone driven by the salmon growth promoter into medaka. The viability of groups of modified and conventional fish were measured at three days of age, and 30 percent fewer transgenic fish survived to that age. The researchers calculated that large males had a four-fold mating advantage, based on observations of wild-type medaka. Computer models then were used to predict the consequences of the transgenic mating advantage combined with the reduced viability of the young.

The study represents scientists policing science, Muir says. "I hope people understand that scientists are investigating the risks of biotechnology as well as the benefits, so decisions can be made with as much information as possible. It's important to understand the risks so they can be addressed."

Muir also cautions that the results of his laboratory study should be interpreted conservatively. "The study does confirm there are significant risks to natural animal populations associated with the release of transgenic animals. We assumed a consistent environment with only one variable – sexual preference for size coupled with low life expectancy for the transgenic. The natural world is not nearly as orderly, and genetic background changes could negate the Trojan gene," he says.

The dominance of sexual preference over Charles Darwin's classic theory of survival of the fittest is not unknown to wildlife specialists and geneticists. Muir likes to use the example of the male bird of paradise with its long swells of gloriously colored plumage as an example: "The male bird of paradise with the longest, thickest tail attracts the most females. Subsequent offspring also exhibit the long tail and also compete well for females. Unfortunately, the birds with the biggest tails also have the biggest problem escaping predators who appreciate large birds pinned in place by their plumage. Obviously the bird with the most sex appeal is the also the worst choice as a fit mate. Not unlike high school, some

might say."

The researchers' next goal is to replicate the study with larger fish of economic importance in a bigger environment. They're looking for an indoor swimming pool where they can raise tilapia and check the results of the medaka study.

Sources: Bill Muir, (765) 494-8032;  
[bmuir@purdue.edu](mailto:bmuir@purdue.edu)

Rick Howard, (765) 494-8136

Writer: Chris Sigurdson, (765) 494-8396;  
[sig@aes.purdue.edu](mailto:sig@aes.purdue.edu)

Purdue News Service: (765) 494-2096;  
[purdue news@purdue.edu](mailto:purdue news@purdue.edu)

**NOTE TO JOURNALISTS:** Copies of the journal article are available from Bill Muir, (765) 494-8032; [bmuir@purdue.edu](mailto:bmuir@purdue.edu).

**PHOTO CAPTION:**

Purdue animal scientist Bill Muir and colleagues hope to extend their research on bioengineered fish to species that may be used in fish farming, such as this tilapia. (Purdue Ag Communications Photo by Tom Campbell)

*A publication-quality photograph is available at the [News Service Web site](#) and at the [ftp site](#). Photo ID: [Muir.trojan](#)*

[Download Photo Here](#)

**ABSTRACT**

**Possible ecological risks of transgenic organism release when transgenes affect mating success: Sexual selection and the Trojan gene hypothesis**

*William M. Muir and Richard D. Howard*

Widespread interest in producing transgenic organisms is balanced by concern over ecological hazards, such as species extinction if such organisms were to be released into nature. An ecological risk associated with the introduction of a transgenic organism is that the transgene, though rare, can spread in a natural population. An increase in transgene




frequency is often assumed to be unlikely because transgenic organisms typically have some viability disadvantage. Reduced viability is assumed to be common because transgenic individuals are best viewed as macromutants that lack any history of selection that could reduce negative fitness effects. However, these arguments ignore the potential advantageous effects of transgenes on some aspect of fitness such as mating success. Here, we examine the risk to a natural population after release of a few transgenic individuals when the transgene trait simultaneously increases transgenic male mating success and lowers the viability of transgenic offspring. We obtained relevant life history data by using the small cyprinodont fish, Japanese medaka (*Oryzias latipes*) as a model. Our deterministic equations predict that a transgene introduced into a natural population by a small number of transgenic fish will spread as a result of enhanced mating advantage, but the reduced viability of offspring will cause eventual local extinction of both populations. Such risks should be evaluated with each new transgenic animal before release.

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# Farm Raised Salmon vs Wild Salmon

Written by Gloria Tsang, RD   
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## Wild Salmon vs Farm Raised Salmon

- **David Suzuki Foundation:** In January 2001, BBC News produced a program "Warnings from the Wild, The Price of Salmon". The program cited a pilot study conducted by Dr Easton with David Suzuki Foundation. The study found that farm raised salmon and the feed they were fed appeared to have a much higher level of contamination with respect to PCBs, organo-chlorine pesticides and polybrominated diphenyl ethers than did wild salmon. It concluded that it seems that contamination in farm fish comes from the feed.
- **EWG Report:** In July 2003, the Environmental Working Group EWG released a report stating that farm raised salmon purchased in the United States contain the highest level of PCBs in the food supply system. In the report, EWG reported that farm raised salmon have 16 times PCBs found in wild salmon, 4 times the levels in beef, and 3.4 times the levels in other seafood. EWG recommends that consumers choose wild salmon instead of farm raised salmon, and they should eat an 8 oz serving of farm raised salmon no more than once a month.
- **Science Journal:** In January 2004, the journal Science warned that farm raised salmon contain 10 times more toxins (PCBs, dioxin, etc.) than wild salmon. The study recommends that farm raised salmon should be eaten once a month, perhaps every two months as they pose cancer risks to the human beings.

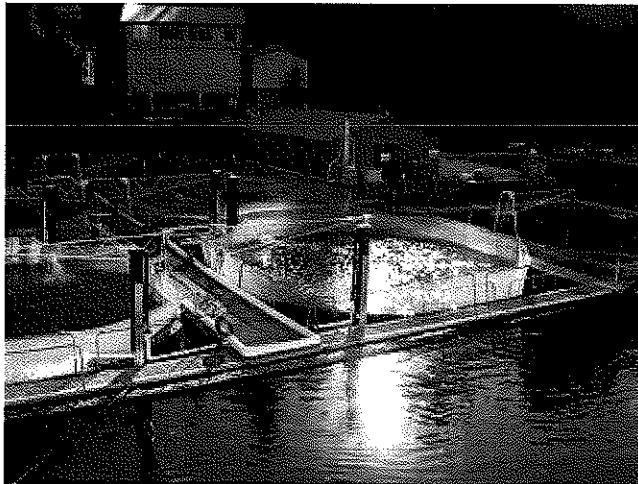
## Why do Farm Raised Salmon contain more PCBs than Wild Salmon?

- **Fishmeal/Feed:** Studies found that the fishmeal fed to farm raised salmon is highly contaminated with PCBs
- **Farm Raised salmon are "fatter":** farm raised salmon are generally bigger in size and contain more fat than wild salmon. PCBs are stored in fat and remain there for an extended period of time, therefore farm raised salmon contain more PCBs.

Last week I noted in my [podcast with Jimmy Moore](#) how expensive genuine wild salmon can cost. Since then, I've received a healthy number of emails asking for more info, tips, and the real benefits behind buying "wild."

What exactly are salmon "farms"? How does the farm setting change the nutritional content of salmon? Is there really that much of a difference? Is farmed salmon even worth buying?

First off, **salmon farms of some kind make up about 80% of salmon on the market today.** (In the United States, the number is higher – 90% by some estimates.) Thirty percent come from traditional hatcheries, and the remaining 50% are raised in aquaculture or "open pen nets" just off shore. Farms can "raise" up to a million salmon at a time. I'll throw in a visual.



Yup, gets more than a little crowded in there.

Because the farmed salmon are largely confined and fed a steady diet of formulated protein pellets, they're inevitably fattier. "But isn't that a good thing?" you might ask. "More omega-3s per serving, right?" The answers are "no" and "not really" to the above. I'll explain.

Many assessments have found **fewer omega-3s per ounce in farmed salmon compared with wild salmon**, but we know the farmed stuff also comes with a hefty (not healthy) wallop of other fats including omega-6s. We then deal with the problem that the omega-6s and omega-3s compete for the same receptors in our bodies. Consequently, the "net" omega-3 gain will always be less than what you'll get with a wild serving. Here's a nifty chart that compares the fat content of some popular wild versus farmed fish varieties (including salmon) from this [PDF](#).

FISH 100-GRAM SERVING*	FAT PER SERVING GRAMS	PERCENT TOTAL FAT THAT'S OMEGA-3	TOTAL CALORIES
WILD ATLANTIC SALMON	6.34	27%	142
WILD COHO SALMON	5.93	22	146
WILD TROUT	3.46	20	119
WILD CATFISH	2.82	19	95
FARMED TROUT	5.40	17	138
FARMED ATLANTIC SALMON	10.65	17	183
FARMED COHO SALMON	7.67	16	160
FARMED CATFISH	7.59	5	135

\*approximately 3 ounces      Data: USDA Nutrient Database

And because the farmed fish are fattier, you'll get less protein per serving as well.

To truly whet your appetite, I can't skip the added ingredients you'll get with a farmed fillet: dioxins, PCBs, fire retardants (those da-n things are everywhere, aren't they???), pesticides (especially for sea lice), antibiotics, copper sulfate (to take care of algae on the nets), and – oh yeah – canthaxanthin (a dye associated with retinal damage used to make gray farmed fish various shades of "wild" pink).

As for dioxins, PCBs, and fire retardants, they show up in wild varieties as well, but the concentrations are vastly different. Tests have shown that farmed salmon contains 16 times more cancer-linked PCBs than wild salmon. The reason behind this difference? It's those nasty little protein pellets – nuggets of mostly mashed fish and fish oil. The intense concentration of toxins from the fish feed builds up in the raised salmon over time – from fish farm to your fish dinner. Bon Appétit, by the way!

O.K., so you're no fan of the farm anymore. **To cloud the issue further, a "wild" label may only be telling a half truth.** (They're generally the less expensive "wild" brands offered in your grocery store.) As I described a few months back in Encore on Omegas, many to most "wild" salmon actually spend half their lives in hatcheries before being released. While these quasi-wild fish are a better nutritional deal than fully farmed salmon, they still bear the burdens of early exposure to toxins (dioxin, PCBs, etc.) and a less impressive omega 6:3 ratio.

So, what about truly wild salmon? As suggested, the genuine wild article only accounts for about 20% at most of the harvest. Some of the reasons it's so darn expensive? The flood of farmed fish (and subsequent drop in asking price) has forced many traditional fishermen/women out of business. Add to this scenario the ongoing destruction of wild

salmon populations by aquaculture farms, and we all end up paying a premium for the real thing.



Because the farm pens are essentially open, the enormous amount of disease- and parasite- (a.k.a. sea lice – yum!) laden waste is routinely allowed to contaminate the waters around the farm. Add to this environment the megadoses of pesticide-, toxin-, and antibiotic-laced waste, and the farms create a deadly environment for wild stocks that inhabit the areas. For more on the environmental destruction caused by aquaculture farms, check out these resources from the National Geographic, the New York Times, and the L.A. Times.

**Your best bet finally is this: buy less salmon in order to afford the real deal.** It's all about bang for your buck after all. A smaller wild fillet will give you equal nutrition with fewer toxins. Additionally, look for Alaskan over Northwestern salmon. And don't rule out canned salmon for big savings. Apparently, farmed salmon doesn't can well, which means the majority of canned salmon is wild. (Pink salmon, the most commonly canned variety, doesn't contain as much good fats as other kinds.) It's one way to make salmon a more affordable addition to your Primal-style salad!

Finally, if you do choose to eat farmed salmon, the Environmental Working Group (applying EPA health standards) suggests eating no more than one serving of farmed salmon a month.

Read more: <http://www.marksdailyapple.com/salmon-factory-farm-vs-wild/#ixzz2K4sESufo> Working Group (applying EPA health standards) suggests eating no more than one serving of farmed salmon a month.