AB 88 (HUFFMAN)

Food labeling: Genetically Engineered Food

CONSUMER'S RIGHT TO KNOW: GENETICALLY ENGINEERED FISH

Background Materials

OVERVIEW | LEGISLATION | ADMINISTRATIVE ACTION | NEWS | STUDIES & REPORTS

OVERVIEW

- *Elements of AB 88. This bill:*
  - Finds and declares that genetically engineered fish could pose environmental risks to California's already stressed wild fish populations and health risks to consumers. The introduction of genetically engineered fish could have negative impacts on California in the following ways:
    1) Human Health Risks: Uncertain health risks, including, but not limited to, potential allergenicity.
    2) Negative Impact on Fishing Industry: The introduction of genetically engineered fish into the market could cause confusion and lead consumers to avoid fish altogether, damaging California's already struggling fishing industry.
    3) Negative Environmental Impact: The escape of genetically engineered fish into California's waters could potentially pose a threat to the already stressed wild salmon population. This is why the Legislature already banned the farming of genetically engineered fish in state waters in 2004.
    4) Religious, Ethical, and Cultural Dietary Restrictions. If genetically engineered fish and fish products are not labeled, people with objections to genetic engineering will have no way to differentiate between genetically engineered and natural fish.
  - Reports that the United States Food and Drug Administration is currently considering approval of the first genetically engineered animal for human consumption – Aquabounty Technologies, Inc. patented "AquAdvantage" genetically engineered salmon. If approved, genetically engineered salmon could be sold in California. Arguably, FDA's current review of genetically engineered salmon does not fully address the potential environmental effects and health effects associated with genetically engineered salmon.
  - Cites public opinion polls indicate that 95 percent of the public want labeling of genetically modified foods and that nearly 50 percent of the public would not eat seafood that has been genetically engineered.
  - Provides that food is misbranded if the food is a genetically engineered fish or fish product, and its labeling does not conspicuously identify the fish or fish product as genetically engineered.

- *Need for AB 88*:

  Food and Drug Administration Review Insufficient
  - The Food and Drug Administration (FDA) is regulating genetically engineered salmon as a "New Animal Drug Application," and has assigned it to the "Veterinary Medicine Advisory Committee." This committee is composed mainly of veterinarians. The committee does not host a food safety scientist to speak to the risk of allergenicity, does not host an endocrinologist to speak on possible health effects from increased hormone levels in the fish, and does not host a fish ecologist to review the possible environmental implications.
  - The scientific data reviewed by FDA was developed by Aquabounty, the company-applicant that has engineered the fish. Some of the test results consisted of too-small sample sizes - as few as six fish – and reliable conclusions cannot be drawn from the tests[i]. Furthermore, random samples were not used – instead the fish were deliberately chosen and deformed fish were excluded from the analysis. Finally, the fish studied were raised at Prince Edward Island, while the actual planned location to raise the fish is in Panama – FDA admitted " the culture (e.g., water temperature, pH, alkalinity, etc.) were likely to be significantly different from the facility at PEI as a result of differences in, among others, water surface, facility design, and environmental factors due to geographic location. . . . the effect of the difference between the PEI and Panama facilities, especially temperature, on the resulting AquAdvantage phenotype is unknown."

- Potential Uncertain Health Risks
  - FDA review cites the presence of proteins to which some people are acutely allergic, and which may be elevated in the transgenic fish[ii].
  - Increased levels of the growth hormone IGF-1 (insulin-like growth hormone) are found in genetically engineered salmon. The long term health impacts are unclear; IGF-1 is a known human carcinogen[iii] [iv].
  - Chemical levels of folic acid, niacin, vitamin B6, magnesium, phosphorus and zinc, as well as Omega 3/Omega 6 ratio, are different for engineered salmon compared to natural salmon, which is possibly indicative of food quality differences[v].
  - The full range of potential health effects from the introduction of genetically engineered fish into our food supply is simply unknown and has not been proven to be either safe or unsafe. FDA has effectively taken a "safe until proven unsafe" position on genetically engineered fish, a position not shared by many scientists and consumers.
  - Studies of transgenic fish suggest that they have a higher tolerance to toxins that occur in the environment. This means that concentrations of these toxins in the genetically engineered salmon tissue may reach higher levels before the salmon succumbs to death or disease. These toxins would often still be present in the genetically engineered salmon tissue by the time the salmon reaches the market. Consequently, food from genetically engineered salmon is more likely to contain higher levels of toxins from the environment in which the salmon is raised than food made from conventional farmed salmon. The presence of higher levels of toxins in GE salmon at the point of sale constitutes a material difference from conventional salmon.
  - FDA's own Veterinary Medicine Advisory Committee (VMAC) raised numerous concerns regarding small sample sizes, incomplete data, questionable culling practices, the numerous physical abnormalities that may occur after genetically engineered fish reach market size. Full transcript from the VMAC meeting on the AquAdvantage Salmon is available here.
  - VMAC members expressed discontent with FDA's admission that the agency would be comfortable approving the GE fish without labeling despite the acknowledgement that many current health studies are inconclusive. In response, Committee member Dr. Craig Altier said, "I think that if there are uncertainties and there are admitted uncertainties, that they should be addressed prior to this fish being allowed on the market." (pg. 340)
  - Speaking to the general safety of the GE fish, one Committee member states, "I do not have adequate information to give an answer that -- to be able to answer that the data causes me to believe that it is safe." (pg. 343)
  - Farmed fish, including farmed salmon, are already given more antibiotics than any other livestock by weight. By AquaBounty's own admission, genetically engineered salmon will be weaker and more susceptible to disease than conventional salmon. This fact will require salmon farms to increase their use of antibiotics on the genetically engineered salmon they raise in order to prevent the spread of disease within their tanks or pens, meaning potentially higher levels of antibiotic residues in genetically engineered salmon tissue, which results in increased risk for the evolution of antibiotic-resistant bacteria.
- Potential Uncertain Natural Resource Risks
  - GE fish could pose serious threats to biodiversity, and to the viability of wild salmon should they escape from production facilities. The company claims that all the fish will be sterile females, but FDA interpretation of the data shows that the triploid sterilization process is not 100% effective. Because AquaBounty has orders for 15 million eggs, in practice, this could mean upward of 750,000 fertile, genetically engineered eggs which, should they escape, could negatively impact wild salmon, further threatening an already endangered population.
  - Despite being farmed in land-based facilities, the water used in those facilities is eventually released into the environment, and the genetically engineered fish or eggs can be unintentionally released into the environment along with that water. This type of breach has occurred in the past.
- Consumer's Legal Right to Know
  - Accurate and truthful labeling to describe whether farmed fish are genetically engineered is a common-sense way to provide transparency for consumers who seek to make market choices based on their religious beliefs, preferences, and health and environmental concerns.

Top of Document

LEGISLATION

- No related legislation is currently before the Legislature.

Top of Document

HISTORY & ADMINISTRATIVE ACTION

- **Federal**

  - **September 3, 2010**: FDA releases data and proposes decision to approve genetically engineered salmon for human consumption.
  - **September 28-29, 2010**: Forty Representatives And Senators Call On FDA To Halt GE Salmon Approval. (Letter from Congress. Letter from the Senate.)
  - **January 31, 2011**: Representative Don Young (R-AK) introduced two bills, one to prevent the approval of GE fish (H.R. 521) and a second to require labeling (H.R. 520) of any genetically engineered fish sold in the U.S..
  - Senator Mark Begich (D-AK) also introduced legislation in the Senate to prevent the approval of GE fish (S. 230) and to require mandatory labeling (S. 229) of any genetically engineered fish sold in the U.S.
  - In the 111th Congress, Representative Rosa DeLauro (D-CT) introduced H.R. 6235, which would require the labeling of genetically engineered animals, as part of comprehensive animal cloning legislation.

- **California**

  - **February 13, 2003**: SB245 (Chapter 871, Statues of 2003) bars the incubation, spawning, and cultivation of transgenic fish species within the waterways controlled by the state of California and up to 3 miles offshore in the Pacific Ocean. This bill was passed in the interest of protecting California's native wild salmon population.
  - **September 16, 2010**: 14 members of the California Legislature sent a letter and demanded that FDA reject Aquabounty's application for approval of GE Salmon.

- **Other States**
  - Alaska- HB 99 (GE FISH)
  - Connecticut- HB 5868 (GE FOOD- SPOT BILL)
  - Hawaii- HB 1534 (GE FOOD)
  - Illinois- HB 1249 (GE FOOD)
  - Iowa- HF 375 (GE FOOD- New section on GE Seeds)
  - Maryland- HB 1261 (GE INGREDIENTS)
  - New York- A01367 (GE MATERIAL, or ANIMAL FED GE MATERIAL)
  - North Carolina- HB 446 (GE FOOD, misbranded)
  - Oregon- HB 3346 (GE MATERIAL, or ANIMAL FED GE MATERIAL)
  - Rhode Island- H 5796 (GE MATERIAL, or ANIMAL FED GE MATERIAL)
  - Tennessee- HB 1928 (GE FOOD)
  - Vermont- H 123 (GE SALMON)
  - West Virginia- HB 2178 (GE FOOD)

Top of Document

NEWS

- **Bioengineered salmon: State bill seeks clear label**
  http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2011/01/07/BA6G1H5F4D.DTL

"Assemblyman Jared Huffman isn't taking any chances. If the U.S. Food and Drug Administration approves a bid to allow the human consumption of genetically engineered Atlantic salmon, the San Rafael Democrat wants every Californian to know what he or she is getting at the checkout aisle."

- **Biotech Battle: Are Genetically Engineered Fish Safe?**
  http://www.npr.org/templates/story/story.php?storyId=129939819
  "A battle is expected to be brewing in a hotel ballroom in suburban Washington, D.C., on Monday, over whether the Food and Drug Administration should approve the first genetically engineered animal for human consumption — a fast-growing Atlantic salmon. The salmon is being developed by a small biotech company from Massachusetts, AquaBounty Technologies, and contains an extra growth gene that makes it grow twice as fast as conventional farm-raised salmon. "This is a produce that we're very proud of, we think has a very important role in the future supply of a safe and sustainable seafood product to the citizens of our country," said Ron Stotish, president and CEO of AquaBounty, in a news conference with reporters last week. FDA seems to agree. In briefing documents posted before Monday's meeting, FDA says the studies conducted by AquaBounty show that the gene is safe for the salmon, safe for humans and safe for the environment But some scientists and consumer groups say the agency should slow down and get more information. A panel of scientific advisers to the agency is expected to make a formal recommendation Monday. The agency generally follows the advice of its advisers but doesn't always do so."

- **Officials worried over safety of genetically altered fish**
  http://californiawatch.org/dailyreport/officials-worried-over-safety-genetically-altered-fish-7085
  "Earlier this month, Food and Water Watch, an environmental watchdog group, posted a series of e-mails and internal U.S. Fish and Wildlife Service documents they acquired through the Freedom of Information Act. The e-mails show concern among Fish and Wildlife Service officials who said they were not involved in FDA's decision, that the service had not been consulted by FDA, and that FDA's decision could pose serious risk to the endangered Atlantic salmon. In one e-mail, a wildlife service geneticist expressed concern about the data FDA used to show that the genetically engineered salmon will be sterile and unable to breed: "There is no data to support the claims of low survival in the event of escape, which I agree with you all is a big concern. I also agree ... that using a triploid (genetically sterile) fish is not foolproof. Maybe they should watch Jurassic Park :)" In another e-mail, the wildlife service's Fisheries and Habitat Restoration branch chief in Fairbanks wrote this: "Approval of the proposal is premature, given the unknowns and uncertainties regarding the possible ecological and environmental effects of these fish. The proposal also presents a situation where FDA, whose jurisdiction is not focused on natural resources, is entrusted with the authority to approve an application which poses such a threat to the country's natural resources." Scientists from both the Fish and Wildlife Service and the Department of Interior also wrote letters to FDA expressing concern over the agency's review of environmental impacts and risks, saying FDA fell short in providing a reliable environmental risk assessment."

- **Polls On Genetically Engineered Fish**
  http://ge-fish.org/policy-comments/polls-on-genetically-engineered-fish/
  "Americans in near unanimity on their disapproval of genetically engineered fish and meat in the marketplace." 91% of Americans felt FDA should not introduce GE fish and meat into the marketplace.
  - Washington Post, 9/17/10: Should genetically-modified food be labeled? Yes – 95%
  - Washington Post, 9/6/10: If genetically engineered salmon wins FDA approval, will you buy it? NO – 57%
  - Time Magazine: Do you think FDA should approve genetically modified salmon? No – 67% Yes – 33%
  - CBC News, 9/14/10: Would you eat genetically altered fish? No- 65.77% Yes – 34.23%"

- **Genetically Engineered Salmon: FDA Says It's Safe, but Consumers Say 'No Way'**
  http://www.politicsdaily.com/2010/11/20/genetically-engineered-salmon-fda-says-its-safe-but-consumers/
  "Back in September, the U.S. Food and Drug Administration found that a genetically engineered fish grown in a lab was "as safe as food from conventional Atlantic salmon," and will "not have a significant impact on the quality of the human environment." Conclusions were based largely on data prepared by AquaBounty Technologies, the company that manufactures the synthetic salmon. "There is a reasonable certainty of no harm from consumption of food from this animal," FDA wrote. Since then, dozens of consumer and environmental organizations, commercial and recreational fishery associations, food-safety advocates, food retailers, and chefs have been putting pressure on FDA to continue researching the environmental and public health impacts of the fish before releasing it into the U.S. food supply. Consumer advocates argue that FDA's decision to approve this fish could open up a pandora's box of genetically engineered animals on the market without labels and that FDA is not taking these concerns seriously."

Top of Document

STUDIES & REPORTS

Kapuscinski, A. R. 2005. Current scientific understanding of the environmental biosafety of transgenic fish and shellfish. Revue scientifique et technique-Office international des Èpizooties 24 (1):309.
["The development of a growing diversity of genetically engineered fish and shellfish is advancing in spite of these existing weaknesses in environmental biosafety science. A transgenic ornamental fish is already on the market; at least one company in the USA is known to be actively seeking commercial approval for growth-enhanced transgenic salmon and perhaps trout; and other labs in Cuba and the People's Republic of China are moving in this direction (Table I). There is thus a clear need to increase national efforts and international cooperation to improve the status of the biosafety science, risk assessment and management of aquatic GEOs. It will be important to prioritise the kinds of weaknesses discussed in this paper and then design and implement cooperative programmes to support research to redress them. Input into this process should come not only from the scientific community but from legitimate representatives of all potentially affected parties."] Full text: ATTACHED

Sundstrom, L. F., M. Lıhmus, and R. H. Devlin. 2010. Migration and growth potential of coho salmon smolts: implications for ecological impacts from growth-enhanced fish. Ecological Applications 20 (5):1372-1383.
["Under natural conditions, larger wild-type fish may choose to reduce foraging in favor of survival, whereas larger transgenic fish appear to continue their relatively more rapid growth if resources permit.... When combining residence time in the stream (taking together survival duration and migration timing) with mass increase during this period and assuming a 15% higher feed conversion efficiency associated with GH transgenesis, hatchery-reared transgenic fish took a greater share of the stream resourcescompared to hatchery-reared wild-type fish. Thus, an escape of hatchery-reared transgenic fish into a stream environment could result in greater ecological impact on freshwater environments than an equivalent number of escaping wild-type salmon. However, our data also suggest that this effect would be diminished if the transgenic fish entered the stream environment at the fry stage, as little difference in growth and migration timing were observed between genotypes in this case. By extension, progeny that developed from transgenic parents that might spawn in nature could also be expected to have less of an impact than seen for hatchery-reared transgenic animals."] Full text: ATTACHED

Baxter, CV, KD Fausch, M Murakami, and P. Chapman. 2004. Fish invasion restructures stream and forest food webs by interrupting reciprocal prey subsidies. Ecology 85 (10):2656–2663.
["Here we report evidence from a large-scale field experiment in northern Japan that invasion of nonnative rainbow trout (Oncorhynchus mykiss) interrupted reciprocal flows of invertebrate prey that drove stream and adjacent riparian forest food webs. Rainbow trout usurped terrestrial prey that fell into the stream, causing native Dolly Varden charr (Salvelinus malma) to shift their foraging to insects that graze algae from the stream bottom. This indirectly increased algal biomass, but also decreased biomass of adult aquatic insects emerging from the stream to the forest. In turn, this led to a 65% reduction in the density of riparian-specialist spiders in the forest. Thus, species invasions can interrupt flows of resources between interconnected ecosystems and have effects that propagate across their boundaries, effects that may be difficult to anticipate without in-depth understanding of food web relationships."] Full text: ATTACHED

Smith, M. D., F. Asche, A. G. Guttormsen, and J. B. Wiener. 2010. Genetically Modified Salmon and Full Impact Assessment. Science 330 (6007):1052.
["As the U.S. Food and Drug Administration (FDA) considers approving a genetically modified (GM) Atlantic salmon (Salmo salar), it faces fundamental questions of risk analysis and impact assessment. The GM salmon—whose genome contains an inserted growth gene from Pacific chinook salmon (Oncorhynchus tshawytscha) and a switch-on gene from ocean pout (Zoarces americanus)—would be the first transgenic animal approved for human consumption in the United States. But the mechanism for its approval, FDA's new animal drug application (NADA) process, narrowly examines only the risks of each GM salmon compared with a non-GM salmon. This approach fails to acknowledge that the new product's attributes may affect total production and consumption of salmon. This potentially excludes major human health and environmental impacts, both benefits and risks. Regulators need to consider the full scope of such impacts in risk analyses to avoid unintended consequences, yet FDA does not consider ancillary benefits and risks from salmon market expansion, a result of what may be an overly narrow interpretation of statutes."] Full text: ATTACHED

Devlin, RH, JI Johnsson, DE Smailus, CA Biagi, E. Jonsson, and B.T. Bjornsson. 1999. Increased ability to compete for food by growth hormone transgenic coho salmon Oncorhynchus kisutch (Walbaum). Aquaculture Research 30 (7):479-482.
["In six consecutive feeding trials, the intake of contested food pellets by size-matched pairs consisting of one control (1 year older nontransgenic coho salmon) and one GH-transgenic coho salmon was compared... Calculated on the three first pellets offered at each feeding trial, the transgenic coho salmon consumed 2.5 times more contested pellets than the controls, supporting the hypothesis that GH transgenesis increases the ability to compete for food. Overall, the transgenic fish consumed 2.9 times more pellets that the non-transgenic controls, indicating a high feeding motivation of the transgenic fish throughout the feeding trials. It appears that GH transgenesis and GH treatments can induce similar changes in the feeding behaviour of salmonids. Depending on how transgenic and wild individuals differ in other fitness-related characters, escaped GH transgenic fish may compete successfully with native fish in the wild."] Full text: ATTACHED

Abrahams, Mark V., and Arnold Sutterlin. 1999. The foraging and antipredator behaviour of growth-enhanced transgenic Atlantic salmon. Animal Behaviour 58 (5):933–942.
["During these experiments, transgenic salmon had rates of consumption that were approximately five times that of the control fish and rates of movement approximately double that of controls. Transgenic salmon also spent significantly more time feeding in the presence of the predator, and consumed absolutely more food at that location. When there was a real risk of mortality, control fish almost completely avoided the dangerous location. Transgenic fish continued to feed at this location, but at a reduced level. These data demonstrate that the growth enhancement associated with the transgenic manipulation increases the level of risk these fish are willing to incur while foraging. If the genetic manipulation necessary to increase growth rates is achievable through evolutionary change, these experiments suggest that growth rates of Atlantic salmon may be optimized by the risk of predation."] Full text: ATTACHED

Hallerman, E. M., E. McLean, and I. A. Fleming. 2007. Effects of growth hormone transgenes on the behavior and welfare of aquacultured fishes: A review identifying research needs. Applied Animal Behaviour Science 104 (3-4):265-294.
["Elevation of GH increases rates of protein synthesis and lipid mobilization, affecting not only growth, but also feed conversion efficiency, metabolic rate, body composition, head and body morphometrics, osmoregulation, and age at maturity, with other modifications particular to species and transgenic lines. Because of heightened feeding motivation, transgenic fishes often prove more active, aggressive, and willing to risk exposure to predation. Swimming ability of some transgenic lines is reduced. While limited in scope, studies suggest that fish of some transgenic lines show lessened reproductive behavior. Welfare issues posed by morphological, physiological, and behavioral alternation in GH-transgenic fishes have not been well characterized. The use of weaker promoters in expression vectors and by selection of transgenic lines with physiologically appropriate levels of GH expression may reduce welfare issues that do arise. Also, markers of welfare for GH-transgenic fish under production conditions can be monitored to determine how culture systems and practices can be modified to promote fish welfare.GH-transgenic fish may be the first transgenic animals commercialized for food production; with other transgenic fishes likely to become widely produced, a range of behavioral and welfare issues will follow."] Full text: ATTACHED

Muir, W. and R. D. Howard (2001). Fitness Components and Ecological Risk of Transgenic Release: A Model Using Japanese Medaka (Oryzias latipes). The American Naturalist 158(1): 1-16.
["Our model predicted that, for a wide range of parameter values, transgenes could spread in populations despite high juvenile viability costs if transgenes also have sufficiently high positive effects on other fitness components. Sensitivity analyses indicated that transgene effects on age at sexual maturity should have the greatest impact on transgene frequency, followed by juvenile viability, mating advantage, female fecundity, and male fertility, with changes in adult viability, resulting in the least impact."] Full text: ATTACHED

William Muir et al. (1999). Possible ecological risks of transgenic organism release when transgenes affect mating success: Sexual selection and the Trojan gene hypothesis, 96 PNAS 13853-13856, at 13853.
[" 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."] Full text: ATTACHED

Uh et al. (2006) Transgene constructs in coho salmon (Oncorhynchus kisutch) are repeated in a head-to-tail fashion and can be integrated adjacent to horizontally-transmitted parasite DNA. Transgenic Research 15(6):711-727.
This paper shows that (a) insertion sites in salmon can be properly analyzed and (b) transgene insertion in salmon can result in substantial deletion and rearrangement of endogenous DNA.

Centre for Aquaculture and Environmental Research. (2009) Ecological Risk Assessment of Transgenic Salmon. Study commissioned by the European Union, the Swedish Research Council Formas and the University of Gothenburg. Vancouver, Canada.
["… transgenic fish might prove to be more resistant to environmental toxins, which may entail the accumulation of toxins that ultimately end up in consumers."]

National Research Council of the National Science Foundation (2002). Animal Biotechnology: Science-Based Concerns. National Academies Press, Washington, D.C: 11.
["Cultivated salmon have escaped into the wild from fish farms and these salmon already pose ecologic and genetic risks to native salmon stocks."]

Kimbrell, A and Letterman, T. (2005). The Catch with Seafood: Human Health Impacts of Drugs and Chemicals Used in the Aquaculture Industry. The Center for Food Safety.
["Antibiotics used in fish farms can be dangerous to human health for many reasons. Several antibiotics that have been banned in the United States due to their human health risks may be used illegally in fish farms that export tons of fish to this country. Chloramphenicol, one such antibiotic, leads to an increased risk of developing cancer, and in very low concentrations may trigger aplastic anemia, a disease that causes bone marrow to stop producing red and white blood cells and is often irreversible and fatal. Chloramphenicol has been detected in imported fish, and although exporting countries claim to have banned its use, monitoring of imported seafood by FDA is lax and may not detect such contamination."] Full text: ATTACHED

Top of Document

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CONSERVATION STRATEGY GROUP

[i] Veterinary Medicine Advisory Committee, Briefing Packet – AquAdvantage Salmon, at 26, *available at* http://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/VeterinaryMedicineAdvisoryCommittee/UCM224762.pdf (last visited Nov. 17, 2010). (Herein after "VMAC")
[ii] VMAC 75-76.
[iii] VMAC 68-72; *see also* Velcheti V, Govindan R. (2006), ☐Insulin-like growth factor and lung cancer,‖ Journal of thoracic oncology: official publication of the International Association for the Study of Lung Cancer 1 (7): 607–10, *available at* http://www.ncbi.nlm.nih.gov/pubmed/17409926. The FDA reviewed two tests of IGF-1 levels in AquaBounty salmon; both tests are inadequate for testing IGF-1 levels. One test from 1992 tested extremely small fish, only 2 ounces in size (not the size that people would eat), and the sample size included only 5 GE salmon. The plasma levels of growth hormone in the GE salmon (39.9 ng/ml) was 41% higher than that of their non-GE siblings (28.2 ng/ml) control fish and 95% higher than the control fish, but neither difference was statistically significant, due to the extremely small sample size.

[iv] The second study looked at a number of hormones, including growth hormone and IGF-1 in GE salmon (both diploid and triploid), non-engineered counterparts raised at the company's Canadian facility and in non-salmon from another commercial fish farm. This study used market size fish, used a larger sample size (30 GE salmon, 33 sponsor controls and 10 farmed controls), and looked at hormone levels in the skin and muscle rather than plasma. Unfortunately, however, the sensitivity of the test methods used were inadequate and the detection limit was inappropriately high. We should have seen some growth hormones in these fish that produce growth hormones year round, but the detection limit was so high that no growth hormone was detected in any of the 73 samples. (see Table 15 in VMAC briefing packet).

[v] VMAC at 87-88