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Before the

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INTRODUCTION:

Thank you Chairman Begich, Ranking Member Snowe and other members of the Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard. It's heartening to see this important issue debated on such a high level and I greatly appreciate your invitation to testify.

The historian Carl Popper once famously wrote, "science may be described as the art of oversimplification—the art of determining what we may with advantage omit."[2] I'd argue today that if science is the art of oversimplification, then science in the service of bringing a product to market is often an oversimplification of the already oversimplified. In the drive to get something saleable on supermarket shelves, omissions in research will inevitably occur and the time span needed to adequately assess the environmental risk of that new product is often insufficient. Dichlorodiphenyltrichloroethane or DDT was first synthesized in 1874[3]. It was not banned until 1972[4] long after it was proven that the insecticide had done profound damage to American birdlife[5]. Polychlorinated biphenyls or PCBs were launched commercially in this country in 1929. We did not get intimations that they were dangerous environmental chemicals until the 1930s and they were not determined a pollutant and banned until 1979, long after they had damaged Hudson River fisheries and other fisheries throughout the United States[6]. The genetic engineering of living organisms is a new science. In 1973 the first genetically engineered organism was created by humans[7]. We will not know the full environmental impact of their introduction into the food supply, for many, many years.

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[1] www.fourfish.org and http://www.nytimes.com/2010/08/01/books/review/Sifton-t.html?pagewanted=all

[2] Popper, Karl, *The Open Universe*, W.W. Bartley, 1992, p. 44

[3] Center for Disease Control, http://www.cdc.gov/malaria/about/history/

[4] Environmental Protection Agency, http://www.epa.gov/history/topics/ddt/01.html

[5] Environmental Protection Agency http://www.epa.gov/international/toxics/pop.html

[6] Envirmental Protection Agency http://www.epa.gov/osw/hazard/tsd/pcbs/pubs/about.htm

[7] Modern Genetics: engineering life, Lisa Yount, Chelsea House, 1997, p. 20

So if we take as a given that there are many unknowns about genetically engineered organisms, many potential downsides, then we should carefully weigh the factors that are motivating us to bring a genetically engineered organism into the American food system. Does that new organism have an over-weighing positive, like, for example, Golden Rice which through a gene modification was able to cheaply deliver vitamin A to nutrient deprived children in the developing world?[8] Does Aqua Bounty's AquAdvantage salmon offer anything of that importance? Nutritionally it is at best the same as other farmed salmon. So what else has it got? Instead of asking "why shouldn't we have genetically engineered salmon?" we should be asking "why should we have it?" If we look carefully at the arguments proponents of this fish have put forward in its defense then I believe a rational person would conclude that this fish doesn't really offer us very much. I'll touch on four areas where I feel the fish comes up short.

1. THE FISH SHORTAGE PROBLEM:

The proponents of the Aqua Bounty AquAdvantage salmon emphasize that the we are running out of wild fish[9]. Globally speaking it's true that there are not enough wild fish to meet demand and we will indeed need more aquaculture if we are going to feed 10 billion people. But which fish do we need more of? Certainly not salmon. The United States still has lots of it. This year's Alaska salmon harvest is projected to have been one of the largest since statehood, with over 200 million fish coming to market.[10] These salmon were harvested under strict supervision of the State of Alaska's Department of Fish and Game and nearly the entire Alaska salmon harvest has been certified as sustainable by the Marine Stewardship Council.[11] Even with these intense restrictions on salmon fishing in Alaska, we still have much more salmon than we can use. 70-80 percent of the United States' wild salmon catch is shipped abroad every year.[12] The real threat to American salmon is habitat destruction[13] or potential habitat destruction in the form of large-scale industrial development like the one proposed at the so-called Pebble Mine site in America's most important salmon fishery, the Bristol Bay watershed.[14] As long as we keep Alaska rivers clean and healthy America will have all the salmon it needs. As for the rest of the world, it will not be a cold-water Western fish like salmon

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[8] Ye, X; Al-Babili, S; Klöti, A; Zhang, J; Lucca, P; Beyer, P; Potrykus, I (2000). "Engineering the provitamin A (beta-carotene) biosynthetic pathway into (carotenoid-free) rice endosperm". Science 287 (5451): 303 5. doi:10.1126/science.287.5451.303. PMID 10634784

[9] http://www.aquabounty.com/PressRoom/#l0

[10] Bountiful Alaska salmon harvest forecast for 2011, Reuters, March 6, 2011 http://www.reuters.com/article/2011/03/06/us-alaska-salmon-idUSTRE7252OP20110306

[11] http://www.msc.org/track-a-fishery/certified/pacific/alaska-salmon

[12] Email from Andy Wink, McDowell Group, December 13, 2011 "regarding the percentage of Alaska salmon harvest sold to export markets. It depends on the year and the species of salmon, but in total, the majority of Alaska salmon is exported – typically 70-80% or more." AndyW@mcdowellgroup.net

[13] Lichatowich, James A. *Salmon Without Rivers*, Island Press; 1 edition (August 1, 1999)

[14] "Alaska's Choice: Salmon or Gold", *National Geographic,* December, 2010 http://ngm.nationalgeographic.com/2010/12/bristol-bay/dobb-text

that will provide protein for three billion additional people. It will be a naturally faster growing, feed-efficient, warm-water species like Indochinese swai and Nile tilapia that will do the job.[15] And lest engineers think tinkering with tilapia and swai is a good idea, I would venture that there is much improvement that can be made with the husbandry and diet of those fish, obviating the need for genetic engineering.

2. THE SALMON FEED PROBLEM

The overexploitation of wild forage fish for use as salmon feed is a grave concern. In the early days of salmon farming it could take 5 pounds of wild forage fish to grow a pound of salmon. But improvements in diet, husbandry, and plain old-fashioned selective breeding have cut what's called the "fish-in, fish-out" or FIFO ratio on the most efficient salmon farms in half.[16] The AquAdvantage salmon doesn't really bring much more in terms of feed efficiency.[17] This is an important point that media doesn't seem to get. Yes, the AquAdvantage fish can in ideal conditions grow significantly faster than non-engineered salmon. But, and this is a major "but", the engineered fish needs comparable amounts of food as the non-engineered salmon to reach market weight. AquaBounty's own predictions (and these are best case scenarios) put feed efficiency of the AquAdvantage salmon at only 10% better than unmodified salmon. This is not enough to justify the risks it entails. Moreover improved feed efficiency is just one pathway to decreasing farmed salmon's footprint. In the decade since the AquAdvantage fish was synthesized, vegetable-based salmon diets have been created that require no wild fish meal at all. Some of these new feeds are made from recycled agricultural byproduct that might otherwise go unused.[18] Developing alternative feed not alternative fish is, in my opinion, the critical next step for the aquaculture industry.

3. THE SEA CAGE PROBLEM

The AquAdvantage salmon proponents maintain that the modified salmon grows so fast that it can be cost-effectively produced in out-of-ocean tanks.[19] For many years, conservationists have worried that salmon grown in open ocean "sea cages" where there is frequent interaction with wild fish has led to disease transfer, escapes, and pollution.[20]

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[15] This is a commonly held hypothesis among aquaculture scientists. For a discussion of tilapia see Costa-Peirce, Barry *Ecological Aquaculture*, Wiley-Blackwell; 1 edition (January 15, 2003). For a discussion of swai also known as tra or Pangasius, see my New York Times Magazine article "A Catfish by Any Other Name" http://www.nytimes.com/2008/10/12/magazine/12catfish-t.html?pagewanted=all

[16] Naylor, Rosamond L. et al. "Feeding aquaculture in an era of finite resources", Proceedings of the National Academy of Sciences, 2009

[17] Environmental Assessment for AquAdvantage® Salmon, Aqua Bounty Technologies, August 25, 2010, Page 36

[18] Frederick T. Barrows, USDA Lead Scientist and Nutritionist
USDA, Agricultural Research Service Rick.Barrows@ARS.USDA.GOV

[19] Aqua Bounty Press Room, http://www.aquabounty.com/PressRoom/#l3

[20] Monterey Bay Aquarium, "Farmed Salmon" Seafood Watch Report, Mazure, Robert and Elliot, Matthew http://www.montereybayaquarium.org/cr/cr_seafoodwatch/content/media/MBA_SeafoodWatch_FarmedSalmonReport.pdf Page 2

Tank or "containment" growing, many argue is the only safe way to farm salmon but it is energy intensive and farmers worry that slow-growing fish would not allow a farm to cover its energy costs. This barrier has already been broken with two non-engineered fish. The arctic char, a fish native to North America and Europe and haling from the same taxonomic family as salmon, turns out to have a natural adaptation for living in close quarters and does well in containment facilities. Nearly all arctic char are grown in containment and their flavor, taste, and texture in my experience is so close to that of salmon as to be indistinguishable.[21] And for those who would prefer a true salmon over a char SweetSpring of Washington State is now growing Pacific coho salmon to harvestable weight entirely in containment in just 12 months. This is comparable to the growth speed of the AquAdvantage fish.[22] If these options exist for cost-effective containment growing of non-engineered salmonids, why should we even broach the possibility of genetic contamination in the form of genetically engineered salmon?

4. THE PUBLIC PERCEPTION PROBLEM

I support the development of an environmentally sound aquaculture sector in the United States. Seafood is a deficit item in the American trade portfolio and it is dismaying to me that more than 80% of our seafood comes from abroad. But there is a major obstacle to the growth of American aquaculture: consumer distrust. In the many dozens of lectures and presentations I have made throughout the country consumers have demonstrated high suspicion of farmed fish and a lack of fine-scale distinction of product. To the average consumer salmon are salmon. Nevertheless one subject that makes consumers pay attention is genetic engineering. People, at least the people who come to my lectures, don't want to eat engineered fish. And salmon farmers know this. As Scott Nichols, the director of the salmon aquaculture company Verlasso wrote me earlier this week, genetically engineered salmon would, "be bad for the salmon industry" and "bad for aquaculture." Nichols goes on to say that the response of supermarkets and other retailers to genetically engineered salmon "ranges from unease to trepidation" and that "there is real concern among retailers that genetically engineered salmon might elicit a negative perception of salmon as a category".[23] In other words genetically engineered salmon could give *all* American salmon a bad name whether they are farmed Atlantic salmon hailing from Maine or wild Pacific salmon from Alaska. Moreover the majority of Americans don't want genetically engineered salmon. An online poll by the Wall Street Journal showed that only about 36% of consumers would willingly eat genetically engineered salmon if it were labeled as such.[24] And in European markets 0% would eat

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[21] Artic Char Assessment, Blue Ocean Institute, http://www.blueocean.org/seafood/seafood-view?spc_id=94

[22] Sweet Spring http://www.sweetspringsalmon.com/local.shtml and email (October 19, 2011) with Per Heggelund, Director, SweetSpring per@sweetspringsalmon.com

[23] Nichols, Scott, Director of Verlasso, email December 13, 2011 scott@Verlasso.com

[24] http://online.wsj.com/community/groups/question-day-229/topics/would-you-eat-genetically-modified-salmon?commentid=1603615

it. Genetically engineered foods are heavily restricted in the European Union.[25] Thus having genetically engineered mixed in with non-engineered fish in the American trade portfolio would damage American exports—Europe will simply not buy it and Europe represents one of the top three markets for salmon in the world.[26]

CONCLUSION

In conclusion I would put forward that the AquAdvantage salmon is an idea whose time has passed, even if genetically engineered animals are perceived as belonging to the future. The problems that plagued the salmon farming industry when the AquAdvantage fish was first conceived over a decade ago – poor feed conversion, inability to grow salmon in containment, poor management of wild salmon fisheries – have been addressed in the intervening period. The AquAdvantage salmon is therefore a kind of Solyndra fish. A technology that has been made irrelevant by advances elsewhere in the marketplace yet which, for some reason still seems to draw taxpayer dollars in the form of research and development investment. This in spite its a lack of germane benefits to the improvement of the global food system. This fish is not worth the risk. We would be better pursuing a course of truly sustainable aquaculture and better management and use of our wild fisheries.

I am therefore fully supportive of Senator Begich's legislation, S.1717, to ban interstate commerce of genetically engineered salmon. Senator Begich's bill rightly protects the American people from a risk they should not be forced to take.

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[25] Wall Street Journal, February 22, 2011
http://online.wsj.com/article/SB10001424052748704476604576158230363494712.html

[26] The Great Salmon Run: Competition Between Wild and Farmed Salmon, Knapp, Gunnar et al. World Wildlife Fund, January, 2007 http://www.worldwildlife.org/what/globalmarkets/wildlifetrade/WWFBinaryitem4985.pdf