



## GM Salmon - What's happening and what you can do

16 September 2010

### Background

A US company called AquaBounty have developed a genetically modified salmon after 14 years of work at a cost of US\$50 million. At the beginning of September 2010 the US Food and Drug Administration (FDA) announced that the GM fish was safe for human consumption and release into the environment, opening the door for it to be deregulated (approved) for commercial production and on sale very soon.

The "AquAdvantage" Salmon application will be subject to a public hearing in the US on 19 and 20 September 2010.

### GM Salmon

AquaBounty have genetically modified Atlantic Salmon with a growth hormone gene from Chinook Salmon (native to the Northern Pacific) and a promoter gene from Ocean Pout (an eel-like fish native to the NW Atlantic), resulting in elevated levels of growth hormone in the Atlantic Salmon. The GM event is known as the "AquAdvantage construct". These genes result in the GM salmon growing much faster than non-GM fish in their first year and reaching marketable weight sooner than non-GM fish. The construct also includes a bacterial plasmid "backbone" (from E coli) and some synthetic linking DNA based on materials from Chinook Salmon and Ocean Pout.

AquaBounty are planning their GM fish farming operations at two locations. Canada will host the production facility and Panama is the chosen location for the intensive rearing of salmon for the market, thereby bypassing the need for more rigorous environmental impact statements under US law<sup>i</sup> (and presumably because labour and other costs are cheaper there). In January 2010 Panamanian authorities ordered the destruction of AquaBounty GM salmon in order to comply with international biosafety commitments and denied exporting would occur.<sup>ii</sup>

### Feeding GM salmon

Salmon are carnivores in the wild and therefore require high protein feed for fast growth in captivity. Traditionally, farmed salmon have been fed on fishmeal (obtained from wild marine stocks) supplemented with soya meal. Soya meal would most likely be Monsanto's RR GM soya grown in North and South America.

Neither source of feed can be described as sustainable because of declining global marine fisheries and the monocultural nature of GM soya production.<sup>iii</sup> GM RR soya is dependent on Monsanto's herbicide glyphosate to control weeds, and its overuse has led to significant weed resistance developing in soya belts in the US and South America. To control the resistant weeds cocktails of weed killers are now used that greatly increase the toxic burden on the environment and local communities<sup>iv</sup>. Soya plantations have also been highly destructive of forest and other habitats and rural communities and economies in Argentina, Paraguay and Brazil.<sup>v</sup>

### AquAdvantage GM Salmon and Risk

In addition to the host of animal welfare and environmental problems caused by intensive fish farming there are specific concerns related to GM fish including:

#### 1. Animal welfare risks

These include the unexpected consequences of genetic engineering events on metabolic rates or endocrine controls, influencing a variety of functions such as reproduction, immune defence, nutrition, development and growth. "In practice the most frequently observed phenotypic contribution derived from these changes is growth enhancement, and may also affect resistance or tolerance to threats such as disease, parasites or other adverse environmental conditions changes in gene expression."<sup>vi</sup> Any of these alone or in combination could have serious impacts on the welfare of the fish.

#### 2. Human Health risks – including the potential for new toxins, altered allergenicity, hormone changes and nutritional changes in salmon to enter the human food chain

Fish allergies can cause severe reactions including anaphylactic shock and death. They are more likely in adults than children and the allergies tend to persist through life.<sup>vii</sup> Salmon are known to cause fish allergies. Changes in the nature of proteins during genetic engineering events can alter their allergenicity.

This has already been recorded when bean protein, transferred by genetic engineering into peas, resulted in greatly enhanced immune system responses in laboratory animals.<sup>viii</sup>

AquaBounty's risk assessment sent to the USFDA admits that data on the allergenicity of their GM salmon is not complete:

*"Triploid ABT salmon pose no additional allergenic risk than control Atlantic salmon. Insufficient data and information were available from which to draw a conclusion regarding possible additional allergenic risk posed by diploid ABT salmon."*<sup>ix</sup>

This is significant because the process used to create sterile triploid female fish is not 100% effective (see below).

### **3. Environmental risks – including escapes and ecological impacts, such the competition with wild species for food**

Farmed fish have a notorious record for escaping into the wild from salmon cages in the sea. Up to two million farmed fish are reported to escape into the Atlantic each year. This places increased pressure on wild stocks:

*"Faster growing farm fish can displace smaller wild fish. One research team concluded that interaction of farm with wild salmon results in lowered fitness, with repeated escapes causing cumulative fitness depression and potentially an extinction vortex in vulnerable populations."*<sup>x</sup>

AquaBounty plan to farm the GM salmon in ponds both at the "production facility" (egg production and hatchery) on Prince Edward Island, Canada, and in the grow out facility (production of adults for sale) in Panama, employing a number of biological and physical methods to prevent escapes and limit harm if escapes took place<sup>xi</sup>:

- Siting production on land in Canada and Panama (where there is no indigenous salmon population).
- Chemical and physical barriers.
- Producing and farming only sterile female fish.

Multiple failures of biosecurity measures due to the breakdown of several mechanisms, often in combination with human error, have contributed to a number of environmental disasters. BP blamed the 2010 Gulf of Mexico oil disaster on "a complex and interlinked series of mechanical failures, human judgements, engineering design, operational implementation and team interfaces".<sup>xii</sup>

AquaBounty's risk assessment concedes that production of sterile female-only hatching, achieved by making all fish triploid instead of diploid (ie, producing fish with an additional set of chromosomes), can fail at a rate of over 1% at times, or 2 in every 1,000 on average ("*...that conditions used in the production facility can reliably produce batches of eggs that are on average 99.8% triploid (range: 98.9 to 100%.*").<sup>xiii</sup>

Although the company deals with escape prevention at both the hatchery in Canada and the growing site in Panama, there is no mention of risk during transportation to Panama aside from details of transportation and labelling – the assumption being that nothing could happen in transit leading to escape of eggs into the wild.

The company also seem to be able to predict future weather events that might impact on the biosecurity at either facility:

*"Unanticipated natural events such as floods and hurricanes must also be considered in evaluating the effectiveness of site location in ensuring containment. In that regard, and as previously stated, no such natural disasters have occurred, or are known to occur, in proximity to the facilities on PEI or in Panama."*<sup>xiv</sup>

### **Object Now**

There are several grounds on which to object to the AquaBounty application aside from moral and ethical concerns about genetic modification of animals and fish farming. These revolve around the uncertainties in the application (see examples above), including that weather conditions may be such as to undermine the assumption in the risk assessments (especially as the climate changes due to global warming). The applicants also fail to take into account Murphy's Law ("Anything that can go wrong, will go wrong") and the possibility of several failures in biosecurity occurring together for a variety of reasons leading to the mass escape of fish that would never be retrieved. The company relies on the surrounding environment and

predation to prevent the escapes becoming a problem – an assumption that can only be tested if an escape takes place.

**Please email your objections to <http://www.whitehouse.gov/contact> as soon as possible, and send a copy to the US FDA at <http://www.fda.gov/AboutFDA/ContactFDA/default.htm>. Be sure to put a heading on your objection:**

RE: Docket No. FDA-2010-N-0001 and Docket No. FDA-2010-N-0385 VMA Meeting on approval of AquAdvantage genetically engineered salmon; Labeling of AquAdvantage genetically engineered salmon

**Please ask President Obama to direct the FDA to reject the approval of genetically engineered salmon.**

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<sup>i</sup> See [www.cbc.ca/health/story/2010/09/10/pei-gmo-salmon-aquabounty-584.html](http://www.cbc.ca/health/story/2010/09/10/pei-gmo-salmon-aquabounty-584.html).

<sup>ii</sup> See <http://fis.com/fis/worldnews/worldnews.asp?l=e&ndb=1&id=35111>.

<sup>iii</sup> GM Freeze, 2010. *Thirteen reasons why the Round Table on Responsible Soy will not provide Responsible or Sustainable Soy production*. See [www.gmfreeze.org/uploads/13\\_reasons\\_rtrs\\_final.pdf](http://www.gmfreeze.org/uploads/13_reasons_rtrs_final.pdf).

<sup>iv</sup> GM Freeze, 2010. *Resistance is growing*. See [www.gmfreeze.org/uploads/resistance\\_full\\_Briefing\\_final.pdf](http://www.gmfreeze.org/uploads/resistance_full_Briefing_final.pdf).

<sup>v</sup> Friends of the Earth, 2008. *What's feeding our food? The environmental and social impacts of the livestock sector*.

<sup>vi</sup> Le Curieux-Belfond O et al, 2009. Factors to consider before production and commercialization of aquatic genetically modified organisms: the case of transgenic salmon. *Environmental Science and Policy* 12 pp 170-189.

<sup>vii</sup> Food Standards Agency. See [www.eatwell.gov.uk/healthissues/foodintolerance/foodintolerancetypes/fishallergy/](http://www.eatwell.gov.uk/healthissues/foodintolerance/foodintolerancetypes/fishallergy/)

<sup>viii</sup> Prescott, VE, et al, 2005. Transgenic Expression of Bean  $\alpha$ -Amylase Inhibitor in Peas Results in Altered Structure and Immunogenicity *Journal Of Agricultural And Food Chemistry* Volume 53, pp 9023 – 9030.

<sup>ix</sup> AquaBounty, 2010. BRIEFING PACKET Food and Drug Administration Center for Veterinary Medicine Veterinary Medicine Advisory Committee.

<sup>x</sup> McGinnity, P, Prodohl, P, Ferguson, A, Hynes, R, Maoileidigh, NO, Baker, N, Cotter, D, O'Hea, B, Cooke, D, Rogan, G, Taggart, J, Cross, T, 2003. *Fitness reduction and potential extinction of wild populations of Atlantic salmon, *Salmo salar*, as a result of interactions with escaped farm salmon*. *Proc. Roy. Soc. B* 270, 2443–2450.

<sup>xi</sup> AquaBounty, 2010. Environmental Assessment for *AquAdvantage*® Salmon Paragraph 6.1.2.1.

<sup>xii</sup> See [www.bp.com/sectiongenericarticle.do?categoryId=9034902&contentId=7064891](http://www.bp.com/sectiongenericarticle.do?categoryId=9034902&contentId=7064891).

<sup>xiii</sup> AquaBounty, 2010. Environmental Assessment for *AquAdvantage*® Salmon Paragraph 6.1.2.1.

<sup>xiv</sup> AquaBounty, 2010. Environmental Assessment for *AquAdvantage*® Salmon Paragraph 6.3.