Lesson Title: AquaAdvantage: GMO Salmon

Brief Description
Students will analyze a variety of articles concerning GMO Salmon

Duration of the lesson: 55 minute class period

Learning Objectives
Students will be able to:
• Define GMO, stakeholders, FDA,
• Describe AquaAdvantage Salmon
• Identify the risks and benefits of GMO salmon
• Describe the process which AquaAdvantage salmon will be grown and harvested
• Evaluate and defend their personal opinion about GMO salmon

Standards
• 3.1
Resources

**Student Worksheet #1**
Excerpted from an Opinion piece by the editors of The Chicago Tribune

**Student Worksheet #2**
Excerpted and revised from an article by Brady Dennis in The Washington Post

**Student Worksheet #3**
Excerpted from an article by Tamar Haspel in The Washington Post

**Student Worksheet #4**
Excerpted from Native America Calling Radio, January 5, 2016. Interview with, Valerie Segrest, Traditional Foods & Medicine Program Manager for the Muckleshoot tribe

*Center for Ecogenetics & Environmental Health* Fast Fact Sheet, *GMO Salmon*

**Instructional Activities**

1. Prior to lesson, students will have read and annotated the article *GMO Salmon Fast Fact Sheet*

2. Survey the class by using Forced Choice, “how many of you think GM Salmon is a good thing” ...“how many disagree?”

3. Teacher will survey the class to scaffold vocabulary and other relevant information from the GMO Fast Fact Sheet
   - What is a GMO?
   - What are GM fish?
   - What is AquaAdvantage Salmon?
• Who are the stakeholders with AquaAdvantage Salmon (you may have to define stakeholder)

4. Break class into groups of approximately 3 students

5. Assign one article (# 1 - #4) per grouping (approximately 3 groups will have the same article). * Each student will be provided with their own copy of the article to read along and/or annotate.

6. Each group will have a reader, recorder, and reporter. The reader will read the article out loud to the group; the recorder will scribe the answers to the questions on the worksheet, the reporter will share results with the class. *Students will need to be able to explain where the article came from, i.e. Editorial, Op-Ed, etc.

7. On the board the teacher will keep a running list answering the following from each article:
   • What is the main message of your article?
   • What arguments are used to support the main message?
   • What stakeholders are mentioned in your article?
   • What do you think is the writer’s attitude toward the AquaAdvantage salmon?

8. Pose the following questions to the class
   • For each question above, were there common themes?
   • Do you identify one of the stakeholders as being more important than the other?
   • Was there any language used to create a biased argument about GMO salmon?

9. Survey the class again with Forced Choice, “how many of you think GM Salmon is a good thing” ...“how many disagree?” “How many of you changed your mind?” Explain.

Accommodations
Pre teach vocabulary
Thoughtfully create groups
Extensions

Based on what you’ve learned, write an opinion piece (no more than one page) reflecting your opinion on GM salmon. This can be turned in via: paper turned into teacher, your preferred media platform (Instagram, Facebook…), and or posted to a blog or online forum. Evidence must be hard copied to the teacher or a picture of your post.
What is a GMO?
Scientists can place a gene* from one plant or animal into the cells of a different plant or animal. The plant or animal with the new gene is called a genetically modified (GM) organism (GMO). The reason scientists make GMOs is to improve or change the GM plant or animal. The procedure to add a gene is done in a laboratory.

Making genetically modified food and medicine began in 1983. As of 2012, more than 90% of corn, soybeans, and cotton in the US were GM. 70% of processed foods in the US has GM ingredients.

What are GM fish?
Right now, one GM fish is being developed for food. It is the AquAdvantage® salmon by a company in Massachusetts called Aqua-Bounty Technologies. When it is available, it will be the first GM animal sold as food in the US.

The AquAdvantage® salmon is an Atlantic salmon. These two genes from other fish are placed into its eggs: (1) a growth hormone (GH) gene from the Pacific Chinook salmon and (2) a “promoter” gene that prevents the fish from freezing. This gene is from an ocean pout fish that lives in the deep, cold ocean.

The GH gene makes the fish grow bigger, and the “promoter” gene makes it grow all year round instead of only in the spring and summer. The GM salmon grows to full size in 16 months instead of 30 months for natural Atlantic salmon.

*A gene is a section of DNA with the instructions to make a protein molecule.

How will AquAdvantage® salmon be grown?
Eggs of the AquAdvantage® salmon will be hatched in a factory building on Prince Edward Island in eastern Canada. Water will be released into a river that flows into the Gulf of St. Lawrence, where water in the winter is cold and salty so that young GM salmon probably could not survive.

Young GM salmon will then be shipped to a fish farm far from the ocean in Panama. They will grow up in Panama and be harvested and processed for sale. Dead fish will be covered with lime in burial pits, sealed with plastic, and covered up with soil.

AquAdvantage® salmon will be “triploid” females. This means they have 3 (instead of the normal 2) sets of DNA. Triploid fish are sterile and can’t reproduce.

Who regulates GM salmon? Is it approved for sale?
The US Food and Drug Administration (FDA) is responsible for approving AquAdvantage® salmon to sell in the US. Aqua-Bounty has been asking for FDA approval since 1995 and spent 19 years and invested $60 million in its GM salmon.

The FDA Center for Veterinary Medicine (CVM) studied whether the salmon would be safe for humans to eat, and safe for the environment. CVM decided that AquAdvantage® salmon is as safe to eat as natural Atlantic salmon, and that it is not a risk to endangered salmon populations or the environment.

The proposal to FDA allows AquAdvantage® salmon to be grown only outside the US. The FDA has not considered the effect of GM salmon on the environment in Canada or Panama.

In November 2015, the FDA decided that Aqua-Bounty Technologies has met the requirements for AquAdvantage® salmon to be approved. FDA decided GM salmon would be safe to eat. The agency approved GM salmon for sale in the United States.

Some benefits of GM salmon:
- GM procedure lets the fish grow to full size in about half the time
- More seafood is available with GM fish
- GM fish is a healthy protein food
- Having GM salmon is good for endangered wild fish populations because it provides another kind of salmon for food
• Land-based fish farming is better than ocean fish farming because wild fish are less likely to catch diseases from farm-raised fish

Some risks of GM salmon:
• Some people could be allergic to GM salmon
• If GM fish escape, they could breed with Atlantic or Pacific salmon, or compete for their food
• Environmental impacts: Using resources in Canada and Panama; Shipping eggs from Canada to Panama; Shipping processed fish from Panama to the US
• Disease in the farm-raised GM fish

Will GM salmon be labeled?
Congress passed a bill in July 2016 to require food companies to disclose GMOs but without requiring a GMO label on the package. Companies can use a website URL, phone number or QR code. Customers can scan the QR code with a smartphone to learn more. Aqua-Bounty Technologies has not yet announced how they will label AquAdvantage® salmon.

Who are the stakeholders?
A stakeholder is anyone who is involved in or affected by an event or a decision.
Some of the stakeholders in GM salmon are:
• Aqua-Bounty Technologies
• Biotechnology industry
• Shipping industry
• Commercial and tribal fishers
• Native American
• Environmentalists
• Grocery stores
• Consumers

Can I buy GM salmon?
No, at least not yet. Aqua-Bounty Technologies says the fish could be on grocery store shelves in about two years. When it is available, GM salmon may not be easy to find. PCC, Whole Foods, Trader Joe’s and Costco say they will not sell GM salmon.

Some ethical questions:
Ethics asks what is morally right or wrong. Here are some ethical questions to think about:
• Wild salmon runs are endangered because of overfishing and destruction of habitat. Should GM salmon be produced so wild salmon populations are less threatened, or should people work harder to save wild salmon?
• Is it right for the US FDA to decide if AquAdvantage® salmon will be produced and sold, when it will not be grown in the US?

Where to learn more:
• Food and Drug Administration: Genetically Engineered Salmon
• Debating Genetically Modified Salmon (NPR)
• AquAdvantage® salmon http://en.wikipedia.org/wiki/AquAdvantage®_salmon
• Video clip of GM fish farm in Panama http://www.theguardian.com/environment/video/2013/apr/25/gm-salmon-panama-video
• Genetically Engineered Salmon Approved for Consumption http://www.nytimes.com/2015/11/20/business/genetically-engineered-salmon-approved-for-consumption.html?_r=0

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“Is this salmon safe?”

The first genetically modified animal approved for human consumption is heading for a bed of ice at a grocery store near you. In November, 2015, the Food and Drug Administration (FDA) approved AquaAdvantage® Salmon for sale in the United States. Frankenfish for dinner, anyone?

Regulators have studied this creature in detail, and their findings about its healthful properties inspire confidence. As for its environmental impact, that’s another story. Doubt about that part of the federal analysis should be enough to keep an otherwise innovative product off America’s kitchen tables.

This bioengineered marvel represents real progress. Stimulated by a gene drawn from a different fish, it grows to market size in much less time than a conventional farmed salmon--16 months versus 30. With the world’s ocean stocks depleted and demand for protein on the rise, that genetic tweak holds promise for boosting seafood production.

Bioengineering already has transformed agriculture. We’ve eaten genetically modified corn and soybeans for years with no ill effects. It makes sense to extend the technology to aquaculture and livestock. But the introduction of this new organism must be handled correctly, with safeguards and nothing left to chance. Unfortunately, the FDA’s experts give no such assurance. Its finding show the new salmon will be as safe to eat as any salmon, but it leaves the remote possibility of an environmental hazard. That’s unacceptable. The FDA should determine with absolute certainty this fish will never wind up in the wild, breeding with native fish.

The company has gone to great lengths to prevent accidents. The salmon will be bred solely in landlocked areas, physically contained at multiple levels. Only females will be raised, and those will be effectively sterile. But sterility is not 100% guaranteed. And in its report, the FDA outlines a scenario where escape or malicious release of fertile broodstock could take root. Under the procedures proposed, the FDA concluded there is no chance of a mass release in a manner that would threaten wild Atlantic salmon. But, as Chicagoans know from our experience with Asian carp and zebra mussels, invasive species can spread swiftly. In transgenic salmon, sterile should mean sterile and escape should be impossible.

We want to see science put to use feeding the world. That can only be accomplished with due care.

(Article updated June, 2016)

Questions

1. What is the main message of your article?

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2. What arguments are used to support the main message?

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3. What stakeholders are mentioned in your article?

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4. What do you think is the writer’s attitude towards the AquAdvantage® salmon?

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Student Worksheet #2
Excerpted and revised from an article by Brady Dennis in The Washington Post 10/18/13

“A new method against genetically modified salmon: Get retailers to refuse to sell it”

Consumer and environmental activists, facing defeat* in their bid to block government approval of the first genetically engineered salmon, are trying a different tack to keep the fish off America’s dinner plates: Getting retailers not to sell it.

Some of the nation’s most recognizable chains – including Whole Foods, Trader Joe’s and Target – have agreed to steer clear of the fish. A spokeswoman for Safeway said they don’t have “any plans to carry GE salmon.”

“The goal is to make sure there is not an available market for GE seafood,” said Dana Perls of Friends of the Earth, an international network of environmental organizations helping to lead the effort to make the fish unwelcome. “People don’t want it, and markets are going to follow what people want.”

For years, opponents have argued there’s not enough data to prove the salmon is safe to eat. They have also warned there could be devastating environmental consequences if the fish were to escape confinement and breed with wild salmon. The FDA has concluded, however, that the genetically modified salmon does not pose a threat to the environment and is “as safe as food from conventional Atlantic salmon.”

With the agency approving* the fish, critics want to make it hard for consumers to find. They are urging supporters to “create a tsunami of messages” – via social media, e-mails and telephone calls – to pressure retailers not to stock it.

The campaign infuriates the AquaBounty chief executive Ron Stotish, who says that critics are engaging in “fear-mongering” and that his salmon could help reduce the over-fishing of wild salmon populations and bolster the world’s food supply and use fewer resources. “What we’re seeing...is dishonesty, fabrication and malicious acts from these groups... What these groups are trying to do is prevent people from having the right to choose. Frankly, I think that’s wrong.”

Despite the pledges some retailers have made not to sell his salmon, Stotish believes the companies will reconsider in coming years if the price is right and consumers regard it as safe and healthy.

“If it’s not a good product, people won’t buy it. All we’re asking for is the opportunity.”

*FDA approved AquAdvantage® salmon for sale in the United States in November, 2015

Questions

1. What is the main message of your article?________________________________________

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(June, 2016)
Student Worksheet #3
Excerpted from an article by Tamar Haspel in The Washington Post, 11.10.2015

“If the GMO salmon is as good as its maker says, label it”

You’ve probably heard the FDA approved the first-ever genetically engineered (GE) animal for human consumption. It’s an Atlantic salmon modified for fast growth with genes from two other edible fish, and it has been—and will undoubtedly continue to be—a lightning rod for all the issues associated with genetically modified (GM) foods: (1) safety, (2) escape into the environment, and (3) labeling, a trifecta of discord. The fish’s lengthy approval process—AquaBounty Technologies first approached the FDA 20 years ago—indicates how intense that discord has been.

(1) Safety. Consumers Union and Food & Water Watch have expressed concern about both safety and allergenicity. The FDA assessment won’t put their minds at rest since the agency determined that food from the GE salmon is as safe as, and no more allergenic than, food from any other Atlantic salmon, and concluded there is “reasonable certainty of no harm.”

(2) A larger issue is the possibility of escape. Escapees could outcompete or interbreed with native fish. AquaBounty says it has layers of safeguards to prevent that: Fish are raised on land, in tanks, and are all sterile females. The FDA calls the possibility of the salmon’s escape or interbreeding in the wild “highly unlikely”. Consumers Union say this assessment is built on “inadequate science and unfounded assumptions”, and the sterilization process isn’t 100% successful. Safety can’t be proved, only inferred from the absence of harm so far, so the question is whether the risk is outweighed by the benefits.

The benefits, according to AquaBounty are that the fish reaches market in half the time it takes conventional salmon and requires 25% less feed. Then what we have is a GMO that can benefit people and the planet, unlike the other GMO foods approved in the US which chiefly benefit farmers. This is a win for humans (more affordable salmon) and the environment (reduced food requirements and less pressure on forage fish).

(3) Labeling. Congress passed a bill in July 2016 (after this editorial was written) to require food companies to disclose GMOs but without requiring a GMO label on the package. Companies can use a website URL, phone number, or QR code for customers to scan with a smartphone to find out if the product is genetically engineered. Before Congress passed the bill to require labeling, AquaBounty had stated, "We’d like to label it as a premium product, but we’ll probably introduce it as Atlantic salmon." The company has not announced how they will label AquAdvantage® salmon.

AquaBounty has limited capacity to grow fish, so consumers won’t see the salmon in stores right away. AquaBounty estimates 2 years before it can get a regular supply to market.

Questions
1. What is the main message of your article? ____________________________________________

2. What arguments are used to support the main message? ________________________________
   ________________________________________________________________________________
   ________________________________________________________________________________

3. What stakeholders are mentioned in your article? ______________________________________
   ________________________________________________________________________________

4. What do you think is the writer’s attitude towards the AquAdvantage® salmon? _______
   ________________________________________________________________________________
   ________________________________________________________________________________
Genetically Modified (GM) Salmon

I find it very upsetting that GM salmon has been approved by the FDA. This is a direct attack on tribal efforts to revitalize our native food systems. Getting back to our wild, whole-food, seasonal, local-based diet is the answer to the challenges of disparities in tribal communities, things like diabetes, heart disease and cancers.

Tribes follow the laws of nature. As for GM salmon, a Chinook salmon would never breed with a poutfish eel from the East coast and then somehow magically be an Atlantic salmon. That is at the very core against our cultural practices. Tribes have been managing fish for 10,000 years, at least. It is a cultural pillar, a keystone species for Pacific Northwest tribes. To be a bearer of this beautiful food for so long, and to not even have a voice in this decision by the FDA about patenting a gene and having it owned by a corporation, is a crime.

AquaBounty claims their salmon will grow faster & bigger than wild or even farmed salmon. But it’s not the same. The flesh of this GM salmon is more inflamed, its skeleton is twisted, its jaw and gills are deformed. You’re not going to be laying this fish out as a whole fish, you’ll only see filets. The other issue is that people eat salmon because it’s heart healthy. The Omega 3 fatty acids reduce inflammation in your body. Omega 6 increases inflammation. The ratio of Omega 3 to Omega 6 in wild salmon is about 12, which is a really good ratio. AquaBounty’s own data says the ratio is 3.6 in their fish. So you’re not getting a product near as good. It’s going to taste mushy and it’s not going to help your heart much.

It’s important to remember that when you shop at a grocery store, you are looking at 40,000 products that are produced by corporations that do not always have your health in mind. With AquaBounty we’re talking about a corporation who wants to make money, capitalizing off the legacy of a food that’s become famous because of its Omega 3’s and high mineral and vitamin content. We all need more of this because our standard American diet promotes inflammation, and when your body is inflamed you get diseases like diabetes, heart disease, cancer, and Alzheimer’s. Everybody is facing these issues, not just tribal communities. For AquaBounty to sell a product that’s based on a legacy that requires that animal to be wild, to be spawning in rivers, take a beautiful journey through the ocean to tonify their mineral-rich bodies and then return...not many fish do that. It makes salmon a very smart fish.

But with GM salmon, we’re talking about a fish with a high metabolism marinating in a tank and not producing the actual medicine we need. So AquaBounty will market it based on our ability to identify it in the grocery store. We’ll say, “That’s a salmon. It may be genetically engineered but I can afford it and I can get the heart-healthy benefits.” Well, actually, the heart-healthy benefits are severely compromised in this particular fish. That, to me, is bad business.

Questions

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4. What so you think is the writer’s attitude towards the AquAdvantage® salmon? ________

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