

# Farmed Salmon Contaminated With Toxic Flame Retardants

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## STORY AT-A-GLANCE

- › Aquaculture promotes itself as a sustainable solution to overfishing, but it actually takes 1.5 to 8 kilograms (3.3 to 17.6 pounds) of wild fish to produce a single kilogram (2.2 pounds) of farmed salmon
- › Fish farms pollute the aquatic environment and spread disease to wild fish. Farmed fish are also an inferior food source, in part by providing fewer healthy nutrients; in part by containing more toxins
- › Research shows farmed salmon contain five times more toxins than any other food tested, including higher levels of PCBs and dioxin
- › Research also warns that farmed Atlantic salmon may contain PBDEs, toxic flame retardant chemicals that have been restricted or banned in the U.S. and many European countries due to their effects on child development
- › Toxins in the fish feed and environmental concentrations of the chemicals have been identified as the two primary culprits

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Fish are an important part of the ecosystem and the human diet. Unfortunately, overfishing has depleted many fish stocks, and the proposed solution – fish farming – is creating far more problems than it solves. Not only are fish farms polluting the

aquatic environment and spreading disease to wild fish, farmed fish are also an inferior food source, in part by providing fewer healthy nutrients; and in part by containing more toxins, which readily accumulate in fat.

## **Farmed Salmon = Most Toxic Food in the World**

Salmon is perhaps the most prominent example of how fish farming has led us astray. Food testing reveals farmed salmon is one of the most toxic foods in the world, having more in common with junk food than health food.<sup>1,2</sup> Studies highlighting the seriousness of the problem date back more than a decade and include:

- A global assessment<sup>3</sup> of farmed salmon published in 2004, which found 13 persistent organic pollutants in the flesh of the fish. On average, polychlorinated biphenyl (PCB) concentrations in farmed salmon was eight times higher than in wild salmon, prompting the authors to conclude that "Risk analysis indicates that consumption of farmed Atlantic salmon may pose health risks that detract from the beneficial effects of fish consumption."

The International Agency for Research on Cancer and the Environmental Protection Agency classify PCBs as probably carcinogenic.

According to the U.S. Centers for Disease Control and Prevention, PCBs elicit a significant number of health conditions in animal studies, including cancer, immunosuppression, neurotoxicity and reproductive and developmental toxicity.<sup>4</sup> Disturbingly, research suggests contaminated fish is the most common source of PCB exposure, as the chemicals accumulate and build up in the fat tissue.<sup>5</sup>

- A 2005 investigation<sup>6</sup> by another group of scientists concluded even relatively infrequent consumption of farmed salmon may be harmful to your health thanks to the elevated dioxin levels in the fish.
- Toxicology researcher Jerome Ruzzin, who has tested for toxins in a number of different food groups sold in Norway, discovered farmed salmon contain five times more toxins than any other food tested. In light of his own findings, Ruzzin has

stopped eating farmed salmon, even though some fishery experts disagree that all farmed salmon is a problem.<sup>7</sup>

- A 2011 study<sup>8</sup> published in PLOS ONE found chronic consumption of farmed salmon caused insulin resistance, glucose intolerance and obesity in mice, thanks to the persistent organic pollutants (POPs) found in the fish.

According to the authors, "Our data indicate that intake of farmed salmon fillet contributes to several metabolic disorders linked to Type 2 diabetes and obesity, and suggest a role of POPs in these deleterious effects. Overall, these findings may participate to improve nutritional strategies for the prevention and therapy of insulin resistance."

## **Researchers: Farmed Salmon May Contain Fire Retardants**

In 2018, researchers warned<sup>9,10</sup> that farmed Atlantic salmon sold in the U.S. and U.K. may also contain polybrominated diphenyl ethers (PBDEs), toxic POPs that have been restricted or banned in the U.S. and many European countries due to their toxic influence on child development.<sup>11</sup> As reported by The Star,<sup>12</sup> "[A] new study by the University of Pittsburgh has found evidence of PBDEs in food fed to farmed salmon – even in those in supposedly PBDE-free environments."

PBDEs are a class of chemicals that for years were used as flame retardants, and while restrictions were placed on some of the chemicals in this class in 2004, they can still be found in older products – and in the environment. China, Thailand and Vietnam – three areas that process significant amounts of electronic waste – are known to have higher levels of PBDEs in the environment.

In more recent years, flame retardant pollution has raised serious concern, as these chemicals build up in the environment over time and are in many areas now found in both ground water and open waters.

Health risks associated with these chemicals, including PBDEs, include infertility, birth defects, neurodevelopmental delays,<sup>13</sup> reduced IQ,<sup>14</sup> hormone disruptions<sup>15</sup> and cancer.

In fact, flame retardant chemicals have been identified as one of 17 "high priority" chemical groups that should be avoided to reduce breast cancer.<sup>16</sup>

## **Toxic Fish Food Blamed for Farmed Salmon Toxicity**

You're probably familiar with the saying that "you are what you eat." However, a key take-home message here is that "you are what your food eats." In other words, whatever the animal you eat consumed, you consume also, which means you really need to know the source of the animals' feed as well. In the case of farmed fish, toxins in the fish feed and environmental concentrations of the chemicals have been identified as the two primary culprits.

According to the authors, when the fish are raised in areas with high PBDE concentrations in the water, the feed becomes a relatively minor contributor. In PBDE-free waters, on the other hand, elevated concentrations of these toxins in the feed may be high enough to end up on your plate. As noted by lead author Carla Ng, assistant professor of civil and environmental engineering at the University of Pittsburgh's Swanson School of Engineering:<sup>17</sup>

*"[I]n otherwise clean and well-regulated environments, contaminated feed can be thousands of times more significant than the location of the farm for determining the PBDE content of salmon fillets ... The international food trade system is becoming increasingly global in nature and this applies to animal feed as well.*

*Fish farming operations may import their feed or feed ingredients from a number of countries, including those without advanced food safety regulations. The United States and much of Europe banned several PBDEs in 2004 because of environmental and public health concerns. PBDEs can act as endocrine disruptors and cause developmental effects. Children are particularly vulnerable."*

## **What Makes the Fish Feed so Toxic?**

One of the main ingredients in farmed salmon feed is fatty fish such as eel, selected for their high protein and fat content. The problem is, many toxins readily bind to fat, and the fish feed industry is using fish deemed unfit for human consumption due to elevated toxicity. As you might expect, when the fish used in fish feed contain toxic levels of pollutants, they get incorporated into the feed pellets.

One significant source of fish for farmed salmon feed is the Baltic Sea, which is well-known for its elevated pollution levels. Nine industrialized countries dump their toxic waste into this closed body of water, which has rendered many Baltic Sea fish inedible. In Sweden, fish mongers are actually required to warn patrons about the potential toxicity of Baltic fish.

According to government recommendations, you should not eat fatty fish like herring more than once a week, and if you're pregnant, fish from the Baltic should be avoided altogether. As mentioned by Ng, fish farms may also import their feed, or individual ingredients from other countries with lax regulations and significant pollution.

## **Toxic Manufacturing Processes Add to the Problem**

Some of the toxicity also stems from the manufacturing process of the feed pellets. The fatty fish are first cooked, resulting in protein meal and oil. While the oil has high levels of dioxins and PCBs, a chemical called ethoxyquin is added to the protein powder as an "antioxidant," which further adds to the toxicity of the final product. Ethoxyquin, developed as a pesticide by Monsanto in the 1950s, is one of the best kept secrets of the fish food industry – and one of the most toxic.

The use of ethoxyquin is strictly regulated on fruits, vegetables and in meat, but not in fish, because it was never intended for such use. Fish feed manufacturers never informed health authorities they were using this pesticide as a preservative to prevent the fats from oxidizing and going rancid, so its presence in farmed fish was never addressed.

Disturbingly, testing reveals farmed fish can contain levels of ethoxyquin that are up to 20 times higher than the level allowed in fruits, vegetables and meats.

What's more, the effects of this chemical on human health have never been established. The only research done on ethoxyquin and human health was a thesis by Victoria Bohne, a former researcher in Norway who discovered ethoxyquin can cross the blood-brain barrier and may have carcinogenic effects. Bohne was pressured to leave her research job after attempts were made to falsify and downplay her findings.

## **Environmental Pollution Is Also Affecting Some Salmon**

Salmon is one fish species looked to as an indicator of environmental conditions, and salmon have become increasingly toxic. While farmed salmon is by far the worst, even wild salmon can contain unwanted pollutants. In a study<sup>18</sup> of salmon found in Puget Sound, researchers discovered 40 contaminants, including drugs, in the flesh of the fish.

Some of the drugs were found at levels known to interfere with growth, reproduction and behavior. No one knows exactly how this chemical cocktail affects the fish, especially as they are exposed in combination. In all, the study found 81 of 151 contaminants tested for in Puget Sound off the coast of Washington.

Aside from toxins already mentioned above, such as PCBs, PBDEs and other POPs, researchers have also found a long line of pesticides – including the long-banned DDT – at concerning levels in fish off the coast of California.<sup>19</sup> And despite the Clean Water Act, enacted nearly 40 years ago, there are areas of the U.S. where the water is so contaminated with mercury that residents are warned to refrain from eating any locally caught fish.<sup>20</sup>

## **Microplastic Pollution Is Another Common Seafood Hazard**

The fish you eat may also come with a side order of microplastic;<sup>21</sup> in 2016 as 13 metric tons of plastic was entering the waterways every year. Once consumed, microplastic

particles tend to remain in the body and accumulate, becoming increasingly concentrated in the bodies of animals higher up the food chain.

Scientists are still unsure of the effect this may have on those who eat the fish, but common sense would suggest it might not be entirely harmless, considering the fact that microplastic fibers soak up toxins like a sponge, concentrating PCBs, flame retardant chemicals, pesticides and anything else found in the water.

Evidence also suggests these microscopic particles can cross cellular membranes, causing damage and inflammation inside the cell. According to a 2016 report<sup>22</sup> by the British Department for Environment Food and Rural Affairs [DEFRA], microplastics have been found in a wide variety of sea creatures, from zooplankton to whales and everything in between.

According to this report, "microplastics are present in seafood sold for human consumption, including mussels in North Sea mussel farms and oysters from the Atlantic."

Eating six oysters could introduce about 50 plastic microbeads into your body and, according to DEFRA, this kind of contamination may indeed "pose a threat to food safety." Other studies have found one-third of the fish caught in the English Channel contain microbeads, as do 83 percent of scampi sold in the U.K.<sup>23</sup>

## **Nutritional Differences Between Farmed and Wild Salmon**

As mentioned at the beginning, farmed salmon is also nutritionally less desirable than wild, which actually ties in with its toxicity. One significant nutritional difference is the fat content. Wild salmon contains about 5 to 7 percent fat, whereas the farmed variety can contain anywhere from 14.5 to 34 percent.

This elevated fat content is a direct result of the processed high-fat feed that farmed salmon are given, and since they contain more fat, they also accumulate higher amounts of toxins. Even when raised in similarly contaminated conditions, farmed salmon will absorb more toxins than the wild fish because of this.

But farmed salmon doesn't just contain more fat overall; another nutritional travesty is its radically skewed ratios of omega-3 to omega-6 fats.<sup>24</sup> Half a fillet of wild Atlantic salmon contains about 3,996 milligrams (mg) of omega-3 and 341 mg of omega-6.<sup>25</sup> Half a fillet of farmed salmon from the Atlantic contains just a bit more omega-3 – 4,961 mg – but an astounding 1,944 mg of omega-6;<sup>26</sup> more than 5.5 times more than wild salmon.

While you need both omega-3 and omega-6 fats, the ratio between the two is important and should ideally be about 1-to-1. The standard American diet is already heavily skewed toward omega-6, thanks to the prevalence of processed foods, and with farmed salmon, that unhealthy imbalance is further magnified rather than corrected.

A 2011 Norwegian report on farmed fish feed ingredients<sup>27</sup> titled "Today's and Tomorrow's Feed Ingredients in Norwegian Aquaculture" talks about the negative impacts of the antinutritional factors of plant proteins and other additives in the feed.

Some of the most common ingredients in farmed fish feed include soybeans, rapeseed/canola oil, sunflower meal and oil, corn gluten meal from corn grains, wheat gluten, pulses (dry, edible seeds of field peas and faba beans), palm oil, and peanut meal and oil – none of which are natural wild salmon foods.

However, as the Food and Agriculture Organization of the United Nations (FAO) explains,<sup>28</sup> Atlantic farmed salmon feeds can also contain animal by-products from poultry, meat meal, blood and hydrolyzed feathers. Additives such as enzymes, crustacean products (to color the salmon flesh), vitamins and selenium are also added – and again, none these are ingredients that any wild salmon has ever encountered and all are about as far from a species-appropriate diet as you can get.

## **Salmon Farming Is Not a Green Solution**

By 2016 more than half the fish Americans were eating came from fish farms.<sup>29</sup> Aquaculture promotes itself as a sustainable solution to overfishing, but when you consider it takes 1.5 to 8 kilograms (3.3 to 17.6 pounds) of wild fish to produce a single



kilogram (2.2 pounds) of farmed salmon, you start to realize there are significant holes in that claim. In reality, the aquaculture industry is actually contributing heavily to the depletion of wild fish stocks rather than saving it.<sup>30</sup>

A salmon farm can hold upward of 2 million salmon in a relatively small amount of space. As with land-based factory farms where animals are kept in crowded conditions, fish farms are plagued with diseases that spread rapidly among the stressed fish. Sea lice, pancreas disease and infectious salmon anemia virus have spread all across Norway, yet consumers have not been informed of these fish pandemics, and sale of diseased fish continues unabated.

To stave off disease-causing pests, a number of dangerous pesticides are used, including one known to have neurotoxic effects. Workers who apply this pesticide must wear full protective clothing, yet these chemicals are dumped right into open water, where it spreads with local currents.

The pesticides used have been shown to affect fish DNA, causing genetic effects. Estimates suggest about half of all farmed cod, for example, are deformed due to genetic mutations. What's worse, female cod that escape from farms are known to mate with wild cod, spreading the genetic mutations and deformities into the wild population.

## **Genetically Engineered Salmon Is Now a Commodity**

It's become quite clear that fish farms are not a viable solution to overfishing. If anything, they're making matters worse, destroying the marine ecosystem at a far more rapid clip. Consumers also need to be aware that some farmed salmon may also be genetically engineered (GE).

AquaBounty salmon, engineered to grow twice as fast as typical farm-raised salmon, received U.S. Food and Drug Administration approval in November 2015; it hit grocery store shelves and restaurants in 2021.<sup>31</sup> Originally, it had been scheduled for marketing in 2020, but was delayed due to the COVID pandemic.

Crazy enough, the FDA is not regulating AquaBounty's salmon as food. It chose to review it as a drug. All GE animals, it turns out, starting with this GE salmon, will be regulated under the new animal drug provisions of the Federal Food, Drug and Cosmetic Act, "because the recombinant DNA (rDNA) construct introduced into the animal meets the definition of a drug."

Interestingly, when AquaBounty announced that the GE fish was coming to market, they told The Associated Press that it would be going to "restaurants and away-from-dining services where labeling as genetically engineered is not required."<sup>32</sup> Yet the reason the FDA gave for not requiring the fish to carry some form of GE label is that it's nutritionally equivalent to conventional farm-raised Atlantic salmon.

The unnatural growth rate was achieved by inserting the DNA from two other fish, a growth-promoting gene from a Chinook salmon and a "promoter" gene from the eel-like ocean pout. This genetic tweaking results in fish with a chronic, continuous release of growth hormone. While a typical salmon might take up to 36 months to reach market size (and grow only in spurts during warm weather), AquaAdvantage GM salmon are ready for market in just 16 to 18 months.

The fish are being grown on land and have several other supposed safeguards in place to prevent both escape and breeding with wild populations but, in nature, nothing is foolproof. This became readily evident in 2017, when thousands of land-based Atlantic salmon escaped when the pens were broken asunder by a passing storm, creating what regulators called an "environmental nightmare."<sup>33</sup>

## **Are There Any Healthy Seafood Options Left?**

So, what's the answer? Unfortunately, the vast majority of fish – even when wild caught – is frequently too contaminated to eat on a frequent basis. Most major waterways in the world are contaminated with mercury, heavy metals, POPs and agricultural chemicals.

This is why, as a general rule, I no longer recommend eating fish on a regular basis. There are exceptions, however. One is authentic wild-caught Alaskan salmon, the nutritional benefits of which I believe still outweigh any potential contamination. The risk of wild Alaskan salmon accumulating high amounts of mercury and other toxins is reduced because of its short life cycle, which is only about three years.

Alaskan salmon (not to be confused with Atlantic salmon) is not allowed to be farmed, and is therefore always wild-caught. Canned salmon labeled "Alaskan salmon" is a less expensive alternative to salmon fillets. Remember that wild salmon is quite lean, so the fat marks – those white stripes you see in the meat – are on the thin side.

If a fish is pale pink with wide fat marks, the salmon is likely farmed. Avoid Atlantic salmon, as salmon bearing this label are almost always farmed.

Another exception is smaller fish with short lifecycles, which also tend to be better alternatives in terms of fat content, such as sardines and anchovies. With their low contamination risk and higher nutritional value, they are a win-win alternative. Other good choices include herring and fish roe (caviar), which is full of important phospholipids that nourish your mitochondrial membranes.

## Sources and References

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- <sup>1</sup> [Fillet O Fish Documentary, YouTube, October 9, 2014](#)
- <sup>2</sup> [Gateway to South America March 3, 2019](#)
- <sup>3</sup> [Science 2004 Jan 9;303\(5655\):226-9](#)
- <sup>4</sup> [Centers for Disease Control and Prevention, Polychlorinated Biphenyls Toxicity](#)
- <sup>5</sup> [Clearwater News and Bulletins, Health Effects of PCBs](#)
- <sup>6</sup> [Environmental Health Perspectives 2005 May;113\(5\):552-6](#)
- <sup>7</sup> [Inspirement Is Farmed Salmon the Most Toxic Food in the World? April 19, 2019](#)
- <sup>8</sup> [PLOS ONE 2011; 6\(9\): e25170](#)
- <sup>9</sup> [Science News July 10, 2018](#)
- <sup>10</sup> [Environmental Science & Technology 2018; 52\(12\): 6965–6973](#)
- <sup>11, 12, 17</sup> [The Star July 12, 2018](#)
- <sup>13</sup> [Environmental Health Perspectives 2013 Feb;121\(2\):257-62](#)
- <sup>14</sup> [Environmental Health Perspectives August 2014; 122\(8\); DOI:10.1289/ehp.1307562](#)
- <sup>15</sup> [Environmental Health Perspectives 2010 May;118\(5\):699-704](#)
- <sup>16</sup> [Environmental Health Perspectives September 2014; 122\(9\): DOI:10.1289/ehp.1307455](#)

- <sup>18</sup> Environmental Pollution, 2016; 213:254
- <sup>19</sup> California Environmental Protection Agency OEHHA, Chemicals in Fish
- <sup>20</sup> Courier-Journal, February 18, 2016
- <sup>21</sup> The Guardian, August 31, 2016
- <sup>22</sup> Environmental Impact of Microplastics (PDF)
- <sup>23</sup> Daily Mail August 28, 2016
- <sup>24</sup> Lipids volume 40, pages 529–531 (2005)
- <sup>25</sup> Self Nutrition Data Wild Atlantic Salmon
- <sup>26</sup> Self Nutrition Data Farmed Atlantic Salmon
- <sup>27</sup> ResearchGate December 2011
- <sup>28</sup> FAO, Atlantic Salmon – Feed Production
- <sup>29</sup> Quartz The Future Is Here. February 14, 2016
- <sup>30</sup> Overfishing.org
- <sup>31, 32</sup> AP Genetically Modified Salmon Head to US Dinner Plates May 27, 2021
- <sup>33</sup> NPR August 24, 2017