Appendix 1: The Scottish Salmon Scam (August 2014)

Here's some background information on the fundamental differences between farmed and wild salmon and why consumers deserve better labelling:

**Genetic differences between wild salmon (Salmo salar) and farmed salmon (Salmo domesticus):**

There are fundamental differences between wild Atlantic salmon and farmed Atlantic salmon. In fact, scientists have argued that there should be a new genus for farmed salmon - *Salmo domesticus* - as opposed to wild Atlantic salmon (*Salmo salar*).

Salmon farmed in Scotland owe their origins to Norway and a genetic stock called the Mowi strain from the Vosso river. In fact, imports of salmon eggs from Norway have increased over the last decade with the majority of 'Scottish' farmed salmon now of direct Norwegian origin.

According to the Scottish Government's latest fish farm production survey for 2012 - published in September 2013, foreign eggs accounted for 54% of total eggs laid down on Scottish salmon farms (34.7 million out of 63.2 million). Norway accounted for nearly 70% of imported eggs (23.8 million out of 33.9 million).

<table>
<thead>
<tr>
<th>Import Year</th>
<th>EU Member States</th>
<th>EFTA</th>
<th>Third Countries</th>
<th>Total</th>
<th>Parr and Smolts</th>
</tr>
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<tr>
<td>2001</td>
<td>8,173</td>
<td>10,833</td>
<td>-</td>
<td>20,626</td>
<td>2,475</td>
</tr>
<tr>
<td>2002</td>
<td>8,650</td>
<td>11,623</td>
<td>-</td>
<td>22,573</td>
<td>2,879</td>
</tr>
<tr>
<td>2003</td>
<td>7,820</td>
<td>9,518</td>
<td>2,900</td>
<td>21,188</td>
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<tr>
<td>2004</td>
<td>4,450</td>
<td>3,475</td>
<td>6,750</td>
<td>16,985</td>
<td>824</td>
</tr>
<tr>
<td>2005</td>
<td>2,610</td>
<td>570</td>
<td>13,210</td>
<td>16,840</td>
<td>150</td>
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<tr>
<td>2006</td>
<td>11,575</td>
<td>300</td>
<td>15,940</td>
<td>30,215</td>
<td>375</td>
</tr>
<tr>
<td>2007</td>
<td>10,511</td>
<td>0</td>
<td>33,555</td>
<td>44,066</td>
<td>420</td>
</tr>
<tr>
<td>2008</td>
<td>5,600</td>
<td>0</td>
<td>22,703</td>
<td>28,303</td>
<td>519</td>
</tr>
<tr>
<td>2009</td>
<td>5,460</td>
<td>0</td>
<td>29,938</td>
<td>35,398</td>
<td>328</td>
</tr>
<tr>
<td>2010</td>
<td>2,150</td>
<td>0</td>
<td>26,533</td>
<td>28,683</td>
<td>452</td>
</tr>
<tr>
<td>2011</td>
<td>3,400</td>
<td>0</td>
<td>35,851</td>
<td>39,251</td>
<td>800</td>
</tr>
<tr>
<td>2012</td>
<td>10,134</td>
<td>0</td>
<td>23,849</td>
<td>33,983</td>
<td>0</td>
</tr>
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</table>
The Sunday Times reported in March 2013 that the majority of salmon farmed in Scotland are actually imported as eggs from Norway:

**THE SUNDAY TIMES**

Scots fish are ‘Vikings with kilts on’

ENVIRONMENTALISTS have questioned the provenance of farmed Scottish salmon amid evidence that most of the fish are Norwegian.

In the past decade, the number of salmon imported from Norway as eggs and reared on Scottish fish farms rose 11-fold, from 3m in 2003 to almost 36m in 2011.

With about 40m salmon farmed every year in Scotland, opponents argue that virtually every fish that lands on consumers’ plates is of Norwegian origin.

The data, published as part of routine disclosures by the Scottish government, has prompted claims that Scottish salmon, the country’s largest food export, are “Viking fish with a kilt thrown on”.

There are concerns that importing fish eggs could unwittingly introduce parasites and disease.
"We may now need to recognize a new biological entity — *Salmo domesticus* — and treat it as an “exotic” when it escapes into the wild," wrote Dr. Mart Gross in a scientific paper - "One species with two biologies: Atlantic salmon(*Salmo salar*) in the wild and in aquaculture" - published in 1998.

**Evolution of *Salmo domesticus***

Genetically based evolutionary changes move the fish towards “domestication,” thereby adapting the Atlantic salmon to the aquaculture niche while simultaneously maladapting it to the wild niche. The complexity and power of selection within the aquaculture niche is seen, for example, in the rapid response across generations of tameness toward human handlers, while evolving increased aggression to each other. After a few generations in the high-density niche of aquaculture, farmed juveniles aggressively out-compete wild juveniles in competition experiments and hybrids show intermediate aggression levels (Eimun and Fleming 1996). Fleming et al. (1994, 1996) show other remarkable morphological and behavioral differences between first and fifth generation Norwegian farmed salmon.

Salmon breeders commonly use artificial selection to improve performance traits (Gjerde 1993). The economic benefits of selective breeding include reduced production costs, more rapid turnover time, better quality product, and thus greater market acceptance. The Norwegian program, which has successfully increased growth rate, decreased early maturity, and increased disease resistance, now provides egg stock to many countries of the world. Future production of Atlantic salmon may include more substantial genetic changes, such as the current availability of triploid and transgenic Atlantic salmon (Donaldson 1997).

The inevitable outcome of the natural and artificial selection forces within the aquaculture niche is the increasing divergence within the Atlantic salmon species into distinct biologies reflecting the distinct niches of wild and aquaculture (Fig. 2). Both intentionally and unintentionally, a new life form of Atlantic salmon is emerging from the aquaculture niche. Farmed salmon may eventually become
oblige parasites, entirely dependent upon humans for survival; already humans shoot their predators, apply medicines to fight their diseases and parasites, provide special foods, and flush the niche with clean water to remove wastes, etc. The process and result are similar to the historic domestication of chickens, cows, pigs, sheep, and other animals and plants that has occurred over the past thousands of years but through technology it has become more rapid. While this paper considers two extremes in Atlantic salmon biology, wild and farmed, there are of course gradations between these two that must also be recognized (Fig. 3). In time the fisheries community may want to give new labels to these new life forms. To begin, we should recognize the existence of farmed Atlantic salmon as *Salmo domesticus*. Such a distinction will help us realize that in spite of the large biomass of *Salmo* in aquaculture, the wild species *Salmo salar* is endangered. Moreover, the domestic Atlantic salmon is an “exotic” when it leaves its aquaculture niche and enters either the native range of wild *Salmo salar* or into new areas of the globe.

Fig. 1. The behavioral ecology and life history of Atlantic salmon in its two niches: wild and aquaculture.
Fig. 2. Developmental and evolutionary forces affecting the Atlantic salmon gene pool in the wild and aquaculture will eventually result in a wild and a domestic organism, with distinct evolutionary lineages.

Table 1. Some genetic and developmental differences between cultured (farmed) and wild Atlantic salmon.

<table>
<thead>
<tr>
<th>Genetic</th>
<th>Suspected*</th>
<th>Developmental</th>
<th>Suspected*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased growth rate</td>
<td>No ejaculation</td>
<td>Lower stamina</td>
<td>Gut length</td>
</tr>
<tr>
<td>Increased age of maturity</td>
<td>Reduced male courtship</td>
<td>Smaller eggs</td>
<td>Diet preference</td>
</tr>
<tr>
<td>Increased weight</td>
<td>Higher hatchery survival</td>
<td>More eggs</td>
<td>Stream knowledge</td>
</tr>
<tr>
<td>Increased disease resistance</td>
<td>Higher temperature tolerance</td>
<td>More fat</td>
<td>Body odor</td>
</tr>
<tr>
<td>Decreased stress response</td>
<td>Shallower depth preference</td>
<td>Smaller rayed fins (parr and adult)</td>
<td></td>
</tr>
<tr>
<td>Lower genetic diversity</td>
<td>Larger tests</td>
<td>Smaller heads on parr</td>
<td></td>
</tr>
<tr>
<td>Allele frequency change</td>
<td>Juvenile color</td>
<td>Narrower caudal peduncle on parr</td>
<td></td>
</tr>
<tr>
<td>Malic enzyme allele change</td>
<td>Adult color</td>
<td>Bulkier body on adult</td>
<td></td>
</tr>
<tr>
<td>Reduced predator response</td>
<td></td>
<td>Distorted jaw on adult</td>
<td></td>
</tr>
<tr>
<td>Increased juvenile aggression</td>
<td></td>
<td>Longer head on adult</td>
<td></td>
</tr>
<tr>
<td>Increased tameness</td>
<td></td>
<td>Longer adipose fin on adult</td>
<td></td>
</tr>
<tr>
<td>Lower survival in wild</td>
<td></td>
<td>Smaller hearts in females</td>
<td></td>
</tr>
</tbody>
</table>


*Author's observations.
As a chapter in the book "The Atlantic Salmon: Genetics, Conservation and Management" (2007) explains:

12.3.2 Differences due to domestication

Artificial selection experiments were initiated in Norway by Harald Skjervold at the Agricultural University of Norway, and by Gunnar Nævdal of the Institute of Marine Research, Bergen (Nævdal et al., 1975; Gjedrem et al., 1991). Two main breeding programmes were established for Atlantic salmon in Norway (Box 12.1). The first was the Mowi strain established in the late 1960s. For the second, broodstock were sampled from one Swedish and 40 Norwegian rivers, between 1971 and 1974, and used to set up four separate strains, initially at Sunndalsora and later duplicated at, and replaced by, Kyrkjetjora (Gjøen and Bentsen, 1997).

Much of salmon farming elsewhere in Europe makes use of these Norwegian strains, although further differentiation has occurred as a result of directional and inadvertent changes subsequent to import. Strains of local origin have also been established in Iceland and Scotland. In Eastern Canada the principal aquaculture strain is based on salmon from the

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Box 12.1 Origin of farm salmon strains

Sunndalsora and Kyrkjetjora, Norway

Although rivers from most of the Norwegian coast were included in establishing these farm strains, there was a dominance in the material by stocks from the More and Romsdal and the Trondelag region; the middle part of the Norwegian coast. The intention was to obtain 12 females and 4 males from each river stock, but for practical reasons, the number of sires and dams from many rivers were lower than the requested numbers. This effective population size (N_e) of 12 or less would have resulted in a substantial inbreeding bottleneck. Selection was carried out at two stages. Before individual marking and communal rearing, families with low survival and low body weight were culled. Selection was then carried out after two years in the sea based on body weight and lower fitness component from the 1980 year class onwards. Each strain was stripped every four years, and in 1985 at generation 4, the remaining contribution from the various river stocks was evaluated. Somewhat surprisingly, it was shown that a low number of river stocks dominated the gene pool. In strain 1, River Nansen and River Sarna constituted 70% and 12% of the material respectively, while in strain 2 an unknown mixture of farm fish constituted 70% and River Elva about 22% of the material. In strains 3 and 4, mixtures of farm strains constituted close to 100%. Thus, the contribution of the majority of the initial 40 wild stocks was strongly reduced already after four generations. This has been explained by genetic differences among river stocks in traits such as growth rate and body weight at spawning, and by high representation of some stocks among the founders (Gjøen and Bentsen 1997; Gjedrem et al., 1991).
12.3.4 Phenotypic differences between wild and farm salmon

Most phenotypic traits are controlled by multiple gene loci and are a product of both genes and environment (Box 12.2). Given the several orders of magnitude higher fecundity of salmon compared to traditional farm livestock, much higher levels of selection can be applied. Domestication has thus been prevalent in cultured salmonids as a result of such breeding programmes, which have selected directly for a variety of traits sought by farmers, including growth rate, body size, survival, delayed maturity, stress tolerance, temperature tolerance, disease resistance, flesh quality and egg production (reviewed in Fleming 1995) (Table 12.3).

Due to the moderate heritability for growth, and the active selection for growth in breeding programmes (e.g. Gjedrem et al. 1991; Glebe 1998), it is not surprising that farm salmon outgrow wild salmon in artificial culture (Einum and Fleming 1997; Thodeen et al. 1999; Fleming et al. 2002) and this also carries over in the wild (Einum and Fleming 1997; McGinnity et al. 1997, 2003; Fleming et al. 2000). However, until recently surprisingly little was known about the mechanisms underlying growth and the impact of selection on these mechanisms. A recent study has shown that there is a direct link between domestication selection for growth and its endocrine regulation, where individuals with more active endocrine regulatory components (e.g. growth hormone production) will be targeted in breeding programmes (Fleming et al. 2002). Thus there can be unincidental changes associated with such directed selection.

Such changes caused by domestication are common in cultured salmon and frequently include alterations of fitness-related traits such as survival, deformity, feed conversion rate, spawning time, morphology, aggression, egg viability and production, risk-taking behaviour and growth hormone production (reviewed in Fleming 1995; Fleming et al. 2002). For instance, not only may selection for growth rate alter growth hormone regulatory components, but it may also affect fish behaviour. Growth hormone treatment has been shown to increase appetite (Johnsson and Björnsson 1994; Jönsson et al. 1996), aggression and activity (Jönsson et al. 1998), the tendency to forage under risk of predation (Johnsson et al. 1996; Jönsson et al. 1996) and dominance (Martín-Smith et al. 2004).

Not surprisingly then, farm salmon show behavioural and physiological differences (genetically based) related to differences in growth rate, including differences in activity, aggression, dominance, risk taking and cardiac responses to a perceived threat (Einum and Fleming 1997; Fleming and Einum 1997; Johnson et al. 2001; Fleming et al. 2002) (Figs 12.4, 12.5 and 12.6). Farming thus generates rapid genetic change, resulting in distinct differences relative to wild fish, so much so, that Atlantic salmon can be considered one species with two biologies (Gross 1998). These changes in fitness-related traits, as a result of domestication, have important implications for the survival of farm salmon in nature, and for their interactions with wild salmon.
Scotland's largest salmon farming company, Marine Harvest, stated in a press release in 2013: "Marine Harvest has carried out breeding of Atlantic salmon based on Mowi strain for more than 40 years". Watch a video from Marine Harvest on the 'Mowi Strain', sourced originally from the Vosso River in Norway, online here.

"This is a salmon like no other," claims the video which ends with the tag-line "Superior salmon since 1964" (the year before Unilever/Marine Harvest 'invented' salmon farming in Scotland in Lochailort). "Developed by natural selection we have continued to challenge the Mowi strain making it stronger generation after generation."

The Tyee reported in 2013:

"In just 14 years, Greenberg says, the Norwegians created "Salmo domestics," a fish with double the growth rate of wild salmon. These creatures have been exported to Nova Scotia, Chile, and of course B.C."

<table>
<thead>
<tr>
<th>Trait</th>
<th>Observation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate</td>
<td>Domesticated salmon parrouigrow with salmon</td>
<td>Linna &amp; Fleming (1997)</td>
</tr>
<tr>
<td>Growth rate</td>
<td>Domesticated salmon parrouigrow with salmon in natural habitat</td>
<td>McGinnity et al. (1997)</td>
</tr>
<tr>
<td>Aggression</td>
<td>Domesticated salmon parrouigrow with salmon more aggressive than wild salmon</td>
<td>Linna &amp; Fleming (1997)</td>
</tr>
<tr>
<td>Dominance</td>
<td>Domesticated salmon parrouigrow with salmon dominate wild salmon</td>
<td>Linna &amp; Fleming (1997)</td>
</tr>
<tr>
<td>Predator response</td>
<td>Time elapsed after reapearence after exposure to predator model shorter in domesticated salmon than in wild</td>
<td>Linna &amp; Fleming (1997)</td>
</tr>
<tr>
<td>Predator response</td>
<td>Domesticated salmon parrouigrow with salmon had lower heart rate and less pronounced flight and heart responses to a model predator at attack</td>
<td>Johnson et al. (2001)</td>
</tr>
<tr>
<td>Growth hormone</td>
<td>Individuals with high levels of growth hormone are targeted during domestication. Higher levels of growth hormone in domesticated than in wild salmon</td>
<td>Fleming et al. (2002)</td>
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</tbody>
</table>
undocumented selection, with cattle and sheep. The end result was the breeding of a fish that while still technically the same species as its forebears was markedly different in its internal metabolism. Some scientists refer to this separate line of salmon as *Salmo domesticus*. By the standard of sheer numbers, *Salmo domesticus* is now the most successful salmon in the world. For it was *domesticus* that the Norwegians were to use when they turned salmon farming from a domestic endeavor to an international juggernaut.

The emergence of *Salmo domesticus* helped Norwegians increase production of farmed salmon to a world-dominating half million tons in just thirty years.

Moreover:

But there is also a risk. The tamed-salmon genome is now markedly different from the wild-salmon genome. When tamed salmon escape into the wild (as they do in the millions every year) they risk displacing a self-sustaining wild fish population with a domesticated race that is not capable of surviving without human support. *Salmo domesticus* has been bred to eat a lot and grow fast in a controlled environment, but it has lost many of the fierce, determined traits that make a wild salmon able to swim against powerful currents, withstand fluctuations in temperature, and spawn in a river besieged by predators. Critics argue that escaped farmed salmon may outcompete wild salmon in some phases in their life cycle only to be unable to reproduce later on down the line. Some maintain that this could have a fatal impact on the long-term viability of wild salmon everywhere.

In fact, scientific evidence shows that *Salmo domesticus* is killing *Salmo salar* - wild salmon are being driven towards an "extinction vortex" by escapes of farmed salmon. A paper published in March 2014 in *Evolutionary Applications* by scientists
at the University of East Anglia identified "a clear threat of farm salmon reproduction with wild fish" (read more via The Scotsman, The Guardian, The Independent, ITV News, The Press & Journal and The Sunday Times).

In 2013, the Sunday Times newspaper reported that “as many as one in four wild Atlantic salmon from Scotland has been genetically “tainted” by Norwegian fish” following a genetic analysis by the Rivers & Fisheries Trusts of Scotland.

The Rivers & Fisheries Trusts of Scotland "Report on Genetic Tool Development for Distinguishing Farmed Vs. Wild Fish in Scotland" (February 2013) is available online here. Read more via the Wester Ross Fisheries Trust: "Norwegian genes found in wild salmon populations in Wester Ross".

"Farm fish are known to escape from pens in all salmon aquaculture areas," reported a paper - "Fugitive Salmon: Assessing the Risks of Escaped Fish from Net-Pen Aquaculture" - published in BioScience in 2005. "Their escape into the wild can result in interbreeding and competition with wild salmon and can facilitate the spread of pathogens, thereby placing more pressure on already dwindling wild populations."

"The high level of escapes from Atlantic salmon farms, up to two million fishes per year in the North Atlantic, has raised concern about the potential impact on wild populations," reported a paper - "Fitness reduction and potential extinction of wild
populations of Atlantic salmon, Salmo salar, as a result of interactions with escaped farm salmon" - published by the Royal Society of London in 2003. "We thus demonstrate 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."

"Pampered farmed salmon are driving their wild brethren into an "extinction vortex" in rivers along the west coast of Scotland, according to new research," reported New Scientist in 2002. "Farmed fish are bred to grow fast," says James Butler, director of the Spey Fishery Board. "Their voracious feeding ensures that they out compete native salmon." For more information read "Scottish salmon in 'extinction vortex'."

In addition to the impacts on humans, these escaped farmed fish are therefore also threatening the continued existence of Scottish wild salmon by diluting the gene pool and competing with native salmon. Read more via "Scottish Salmon's Great Escape" and "Environmental Damage from Escaped Farmed Salmon".

Protected Geographic Indication for 'Scottish Farmed Salmon' and 'Scottish Wild Salmon':

The distinction between Scottish wild salmon and Scottish farmed salmon is well established via the European Union's Protected Geographic Indication scheme.

The Scottish salmon farming trade association - the Scottish Salmon Producers Organisation (SSPO) - secured 'Protected Geographical Indication' for "Scottish Farmed Salmon" in 2004.
The **DEFRA registration document** (2006) included:

### 4.1 Name: ‘Scottish Farmed Salmon’

### 4.2 Description:

**Conventional Scottish Farmed Salmon**

Conventional Scottish farmed salmon must be typical of the species, *Salmosalar* (Atlantic salmon). Conventional Scottish farmed salmon have a consistent shape. The fish must have a rounded ventral body surface when viewed laterally and the body wall musculature should show no significant tendency to collapse when carcass is eviscerated. Scottish farmed salmon have an iridescent appearance and are silver in colour. The flesh colour must have a minimum intensity of 26 on the Roche Scale. Conventional Scottish farmed salmon are firm with a fibrous to smooth to even texture. Conventional Scottish farmed salmon have a consistent flavour due to the rapid chilling post harvest.

**Organic Scottish Farmed Salmon**

Organic Scottish farmed salmon have a similar description, with the exception that there is no minimum intensity for the flesh colour with reference to the Roche Scale.

The **European Commission document** (2008) contains very similar information.

The 'Roche Scale' cited above refers to the Swiss pharmaceutical company Hoffman-La Roche and their 'SalmoFan' or 'SalmoLineal' colour scale to measure the intensity of the artificial colourings Canthaxanthin (E161g) and Astaxanthin in the flesh of farmed salmon (read more via DSM's web-site):

"When purchasing salmon, color is one of the first things a consumer will consider," reported Hoffman-La Roche in a paper - "Salmon Color and the Consumer" - published in 2000. "When the focus groups were shown pictures representing different levels of coloration, a 33 (on the Salmo Fan™) was preferred by a 2:1 margin. This research suggest a gap in the market place, as most retailers feel they receive salmon of a score of 27 on the Salmo Fan™ and consumers indicate they prefer a color of 33."
"When asked about pricing, consumers felt that a salmon with a color of 22-24 should be less expensive and a well colored salmon, 33-34, would be the most expensive," continued the report. "Consumer research has suggested that consumers will pay more for redder salmon, acknowledging that a redder salmon commands a premium price. Yet, there is an over-riding need to present salmon in the most appealing fashion. Color is key to consumer purchasing decisions."

Read more background on the health impacts of Canthaxanthin via "Silent Spring of the Sea" and "Ugly in Pink: Cosmetically Challenged Farmed Salmon"

The DEFRA registration document (2006) also included:

In order to avoid discrimination against Scottish Wild Salmon interests, the applicants declare that the continued use of the terms “Scottish Smoked Wild Salmon” and/or any other combination of the terms “Scottish” and “Salmon” in connection with wild salmon shall in no way be affected, provided that these wild salmons are fished in Scotland and that the use of these terms in the labelling are made in such a way as to avoid misleading consumers in relation to the Protected Geographical Indication.

A 'Briefing Note on Fish Labelling and Protected Geographical Indication' from the SSPO includes:

Scottish Farmed Salmon PGI

There is also a European system of Protected Designations of Origin (PDOs) and Protected Geographical Indications (PGIs). These two forms of designation are both food protections linked to a specific name but they are essentially different in their scope. PDOs cover agricultural products and foodstuffs which are produced, processed and prepared in a given geographical area using recognised know-how. PGIs cover agricultural products and foodstuffs where one or more elements of production, processing or preparation is distinctive and where the product possesses a specific quality, reputation or other characteristics attributable to a geographical origin.

The designation 'Scottish Farmed Salmon' was granted PGI status in 2004. This followed a formal application process involving Scottish Government, Department for the Environment, Food and Rural Affairs (DEFRA), as the UK competent authority, and the European Commission. The standards governing the production of PGI 'Scottish Farmed Salmon' as first registered are set out in a 'Product Specification' published in the Official Journal of the European Union (Regulation (EC) No 2081/92 on the protection of geographical indications and designations of origin (2003/C 246/03). Approval of PGI status was recorded by Commission Regulation (EC) No 1473/2004.

The key features of the PGI designation were: the geographic area linkage to 'The western coast of mainland Scotland, Western Isles, Orkney and Shetland Isles'; and the distinctive resulting quality and characteristics of the salmon that were produced in that area under the husbandry conditions
If the PGI 'Scottish Farmed Salmon' really does maintain the Scottish salmon farming industry's "distinctive quality reputation and premium position in the market" then why do companies avoid the word "farmed" in their advertising and marketing to consumers?
In 2010, an application to register the name 'Scottish Wild Salmon' as a Protected geographical Indication (PGI) under the EU Protected Food Name Scheme was publicised by the Scottish Government. In 2012, the Scottish Wild Salmon Company announced on their web-site:

**Scottish Wild Salmon Netters Persue Quality and Gain Prestigious Award**

The Salmon Net Fishing Association of Scotland (SNFAS) industry body and representative for the majority of Scottish Salmon Netters, today announced it has been successful in having Scottish Wild Salmon awarded Protected Geographical Indication (PGI) status being recognised as an EU Protected Food Name.

The application process, which has been underway for over 2 years, has now been completed with the appropriate regulation coming into force within 3 weeks. Chairman of SNFAS, James Mackay said: "We are delighted that the finest of indigenous Scottish produce, Scottish Wild Salmon, has been awarded this distinguished accreditation. We are keen for the distinctive nature and quality of the salmon to be preserved for consumers and that is the reason why we have pursued this renowned benchmark."

The salmon and indeed our long established Scottish industry, with its traditional skills and crafts, should be safeguarded for future generations to enjoy as part of Scotland's proud heritage. The award of PGI status provides long overdue recognition for both the salmon and the few remaining Scottish salmon netters.

"The Scottish Wild Salmon continues to be one of the most sought after food sources worldwide, a fact borne out by the strength of both our domestic and world markets."

"We wish to thank the Scottish Government, EU and DEFRA for their support during the application process."

George Puller, a Director of Scottish Wild Salmon Company Ltd said: "It is excellent news that Scottish Wild Salmon has been recognised in this way and we are thrilled with this worthy achievement. PGI accreditation is fitting for a product of such unequalled quality and uniqueness. Using the logo, in conjunction with our distinctive branded security carrees tags, customers around the world will be further protected from cheap poor quality imitations, offering further assurance that they are buying the very finest Scottish produce."

A DEFRA document includes reference to the differences between wild and farmed salmon - the former being "free from artificial colouring or chemicals" and the latter having "distortion to its tail, fins or head":

### 4.1 Name:

"Scottish Wild Salmon"

### 4.2 Description:

Scottish Wild Salmon is the name given to the pelagic fish of the species *Salmo Salar* which are caught at in-river fisheries and coastal fisheries throughout Scotland and up to 1,500 metres off the Scottish Coast.

Fresh Scottish Wild Salmon are bright silver, with a dark blue back and firm, with scales intact. The flesh is firm and deep pink. They have a very fresh fish smell and are in excellent condition throughout the season when they are moist and full of taste. Scottish Wild Salmon is distinguishable from other Salmon types as it has perfect markings, no distortion to its tail, fins or head and has good muscle tone and is firm in texture as a result of the distance travelled by the fish. Scottish Wild Salmon is free from artificial colouring or chemicals.
The BBC reported in December 2012:

If PGI status is "a good promotional tool and helps to protect against imitation" then surely the Scottish salmon farming industry should use the protected PGI term 'Scottish Farmed Salmon'?

Celebrating the 10th anniversary of securing PGI status for Scottish farmed salmon, the Scottish Fisheries Secretary Richard Lochhead referred in news release (7 May 2014) to 'Scottish salmon' not 'Scottish Farmed Salmon':

"Scottish salmon is already our largest food export and earlier this year I launched a new food export plan designed to allow all the sector to realise its huge potential."

Why does the Scottish Government not distinguish between Scottish farmed salmon and Scottish wild salmon?
Product Piracy/Plagiarism:

Foreign-owned corporations are exploiting the world renowned and prized image of Scottish salmon - an iconic image of Scotland - to obtain a price premium. The hijacking of the name 'Scottish salmon' by the predominantly foreign-owned Scottish salmon farming industry is product piracy. For example, Scottish Sea Farms (owned by the Norwegian corporations SalMar and Leroy) abuse the name 'King of Fish' and mislead customers via their web-site promotional material.

"The King of Fish" was coined by Izaak Walton in his 17th century classic “The Compleat Angler” and is synonymous with wild not farmed salmon:

Read more via "Atlantic Salmon: An Natural History"
Michael Wigan details the traits of the Atlantic salmon in "The Salmon" (2014) - here's a book review in the Wall Street Journal:

Book Review: 'The Salmon' by Michael Wigan
Salmon sometimes spawn in tributary streams so shallow their backs are out of water.

By JOHN GIERACI
May 23, 2014 6:24 p.m. ET

An Atlantic salmon lives a complicated life. Born in the headwaters of a river, it spends its first months nestled in gravel, relying on its egg sac for sustenance. Eventually it grows into a smolt, swims downstream to the ocean and migrates to the North Atlantic, thousands of miles from its birthplace, navigating by means that still aren't completely understood. The fish stays at sea, feeding and growing, for anywhere from one to five years, and then retraces the long route back to its home river to spawn. Against the current it swims, squirming up cascades and vaulting waterfalls, sometimes to tributary streams so shallow that its back is dry. Mortality is high at every stage, everything in water and air with a taste for fish preys on salmon, from trout and kingfishers to seals and minko whales.

This is a precarious existence under the best of conditions, but as Michael Wigan points out in sometimes excruciating detail in "The Salmon: The Extraordinary Story of the King of Fish," conditions are now anything but the best. After introducing the life cycle of "the fish that connects land and sea," Mr. Wigan inventories the many man-made threats to the species and, just when things look hopeless, offers some possible solutions.

Salmon farming really gets Mr. Wigan's back up. The overcrowding in salmon pens breeds "swarms" of sea lice, a natural predator that in unnaturally large numbers can literally suck wild salmon dry as they pass the pens on their way to sea. The chemicals used to treat for sea lice are intended to dissolve the shells of the parasites, but when the chemicals wash out of the pens with the tides, they end up dissolving the shells of crabs and lobsters as well.

And there are the inevitable escapees from fish farms as storms swamp the pens and seals tear them open. Those fish interbreed with wild stocks and dilute the finely tuned genetics that allow them to find their natal streams in the first place and weather natural hazards.

For an in-depth analysis of what truly makes salmon tick read 'The Salmon' - available online here
If wild salmon is truly the 'King of Fish' then farmed salmon has an illegitimate claim to the throne. Farmed salmon have an unnatural not natural history. The life cycle of the Atlantic salmon is a natural wonder in the wild:

Yet on the factory farm, the life cycle of the farmed salmon is a world removed:
The First Minister of Scotland, Alex Salmond, is also guilty of misappropriating the name 'Scottish salmon' by referring to Norwegian-tainted farmed salmon as "the essence of Scotland" and "a signature Scottish product".

"When we get a signature Scottish product like salmon which is its own was as important to Scotland as whisky in terms of the reputation of Scotland and salmon is one of the identifying signature products of our country.......it's part of the essence of Scotland," said the First Minister during a video filmed in Norway when he met salmon farming giant Marine Harvest (Scotland's largest salmon farming company) in 2012. The First Minister also referred to the "premium" that Scottish salmon enjoys worldwide. Watch the video (notice the Norwegian flag flying from the top of the Norwegian Parliament building in the background) online here

"Scottish salmon now accounts for more than a third of the value of our national food exports - reflecting the premium that discerning consumers place on Scottish salmon, including in expanding markets such as China, where we were able to secure agreement with the Government in Beijing to enable direct exports to the country last year," said the First Minister in a press release issued in collaboration with Marine Harvest in 2012 (notice the phrase 'Scottish salmon' not 'Scottish farmed salmon').

Wild salmon is surely the true signature of Scotland and salmon farmed in Scotland by Norwegian corporations using Norwegian genetic material is a case of product plagiarism?
Fake not Real Salmon:

The phrase 'Scottish Salmon' is a misnomer - and misleading to consumers. The Oxford English Dictionary defines 'salmon' as:

Definition of salmon in English:

**salmon**

Line breaks: salmon

Pronunciation: /ˈsæmən/ /

NOUN (plural same)

1 A large edible fish that is a popular sporting fish, much prized for its pink flesh. Salmon mature in the sea but migrate to freshwater streams to spawn.
   Family Salmonidae (the salmon family): the Atlantic salmon (Salmo salar), which sometimes returns to spawn two or three times, and five species of Pacific salmon (genus Oncorhynchus), which always die after spawning. The salmon family also includes trout, char, whitefish, and their relatives.

However, farmed salmon do not migrate and are crammed at high stocking densities in cages. For more background read "Closed Waters: the welfare of farmed Atlantic salmon" (2007) and "In Too Deep" (2001) published by Compassion in World Farming.

Moreover, without the addition of artificial pink colourings would be an unappetising grey colour. Salmon farmers use a 'SalmoFan' to pick the finished colour of the farmed salmon product:

The DSM SalmoFan™

The DSM SalmoFan™ launched first in 1989 by Hoffman-La Roche as "Colour Card for Salmonids" is our days the Industry's color reference standard for the visual judging and comparison of degrees of pigmentation in salmon flesh perceived by the human eye.
Farmed salmon may also be fed on chicken feathers, blood meal, meat meal, peas, genetically modified soybean and maize and other unnatural ingredients - here's an illustration from fish feed company [EWOS](#) who operate in Bathgate, West Lothian:

Not to mention the addition of other chemicals such as pesticides, insecticides and antibiotics:
Here’s the cocktail of man-made chemicals and contaminants found in farmed salmon - as reported in the Norwegian newspaper VG in June 2013:

Farmed salmon is a completely different product than wild salmon. Scottish farmed salmon, for example, has been found to be contaminated with various toxic chemicals such as malachite green, DDT, DDE, dieldrin, deltamethrin and cypermethrin.

Farmed salmon are also injected with vaccines. According to the Scottish Government's latest fish farm production survey for 2012 - published in September 2013, 48.1 million farmed salmon in Scotland were vaccinated in 2012:

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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of sites</td>
<td>98</td>
<td>84</td>
<td>79</td>
<td>73</td>
<td>80</td>
<td>68</td>
<td>70</td>
<td>67</td>
<td>63</td>
</tr>
<tr>
<td>No. of fish (millions) vaccinated</td>
<td>39.4</td>
<td>33.8</td>
<td>43.5</td>
<td>41.0</td>
<td>36.7</td>
<td>39.6</td>
<td>42.6</td>
<td>49.2</td>
<td>48.1</td>
</tr>
</tbody>
</table>

Vaccines were used to provide protection against furunculosis, a disease caused by the bacterium Aeromonas salmonicida, which was the cause of serious losses within the fish farming industry in the late 1960's and early 1970's. Vaccination is normally carried out at the pre-smolt stage by intra-peritoneal injection. In addition, some sites vaccinated fish against ERN, Infectious pancreatic necrosis (IPN), pancreas disease (PD) and Vibriosis. A total of 48.1 million fish were vaccinated across 63 sites.
Since only 41.1 million smolts were put to sea in 2012 it can safely be assumed that the vast majority of Scottish farmed salmon are injected with vaccines (unlike wild salmon). Given its artificial nature, it is little wonder that campaigners advocate that consumers boycott farmed salmon:

From 1 June 2013, salmon farmers in Scotland (and across Europe) were also permitted to use chicken and pork products in farmed salmon feed. The new rules prompted a backlash in France and amongst Muslims who choose to avoid pork.
Consumers such as Muslims who want to avoid pig products surely have a right to know if they are being served natural wild salmon or farmed salmon fed on pig products?

Europe Muslims Want Fatwa on 'Haram' Fish

CAIRO – A European Union’s decision to reapprove the use of reconstituted animal and pork protein in fish feed is alarming Muslim minorities across Europe, who turn their eyes to religious organizations for a fatwa on the issue.

"Muslim immigrants face a major dilemma," Emad Sharqawi, an Egyptian restaurant owner in Brussels, told Al-Masry Al-Youm.

"Large numbers eat fish to avoid eating unknown meat and avoid any suspicion of eating pork in restaurants or products in the markets."

Last month, the European Consumer Organization (BEUC) reapproved the use of reconstituted animal protein in fish feed from June 2013.

But the decision, which comes in the throes of a horsemeat scandal in Europe, has raised alarm among Muslim communities in the continent.

Muslims do not eat pork and consider pigs and their meat filthy and unhealthy to eat.
Tesco could be one of the first retailers selling a range of farmed salmon on chicken feathers and pork products. Undercurrent News reported (31 January 2013):

“It rests on consumer perception and concerns. If the end consumers’ acceptance could be assured, we would like to see a wide acceptability of alternative feeds in all markets,” said Nigel Edwards, technical director for Seachill, a major supplier of salmon to Tesco.

“Feather meal is perfectly legal, safe, and sustainable, it’s just not currently used in the EU due to customer preference,” he said.

Niels Alsted, executive vice president of food manufacturer Biomar, confirmed this, saying that whether an EU farmer uses feather meal or not is dictated by their customers, the retailers.

“I could see some retailers accepting it, since some have Chilean fish, but not all would accept it. My personal view would be that retailers decide very much on their own, based on the profile they want to have and segment of customers they are looking for.”

Edwards is keen to point out that the different feed diets available to salmon farmers in different regions are all as good as each other for growing healthy salmon.

“This is all about finding the best feed materials balancing sustainability, fish performance, cost, human nutrition, flesh quality and flavor, fish health and welfare, minimizing food waste, food safety (reducing residues), GM crop use, and consumer perceptions of what is natural and correct,” he said.

While some poultry products were banned from 2000 onwards due to the BSE scares, feather meal use has always been allowed, though tightly controlled.

The right to say 'no' to pig and chicken products in your farmed salmon meal hinges upon the proper labelling (read more via "French Say "Non" to Chicken & Pork in Farmed Salmon!").

"Farmed salmon is completely different to wild salmon and we would say that the feed doesn't really replicate the diet of wild salmon so if that's what you think you're eating when you're buying farmed salmon, it's something different to what they're claiming," said Sue Chetwin of Consumer magazine in New Zealand News in October 2013 when it was revealed that farmed salmon "are fed chicken waste parts and bloodmeal from cattle, pigs and sheep".
Writing in the October 2013 issue of Consumer magazine, Sue Chetwin said:

Farmed salmon fed livestock  
By: Jade Cooper | New Zealand News | Monday October 7 2013 16:13

A major investigation into farmed salmon’s discovered the fish are fed chicken waste parts and bloodmeal from cattle, pigs and sheep.

Consumer Magazine says that’s not what you’d expect from a product that claims the fish were on a natural diet.

King Salmon also adds a chemical to the fish food to make its flesh pink.

Consumer’s Sue Chetwin says the public needs to know that the farmed salmon is very different to wild salmon.

“Farmed salmon is completely different to wild salmon and we would say that the feed doesn’t really replicate the diet of wild salmon so if that’s what you think you’re eating when you’re buying farmed salmon, it’s something different to what they’re claiming.”

Writing in the October 2013 issue of Consumer magazine, Sue Chetwin said:

**Food for thought**

When I learned most of our farmed salmon was fed a diet containing abattoir by-products - off-cuts from poultry processing and bloodmeal from cattle, pigs and sheep - I blanched. When I further discovered the precious omega-3 we get from salmon is actually fed to farmed salmon via fish oil in pellets, I double blanched.
Nutritional tests on wild salmon and farmed salmon have also shown significant differences with wild salmon higher in calcium and iron whereas farmed salmon is higher in fat:

<table>
<thead>
<tr>
<th>3oz, serving size of raw fish</th>
<th>Protein (g)</th>
<th>Calcium (mg)</th>
<th>Iron (mg)</th>
<th>Fat (sat)</th>
<th>Fat (mono)</th>
<th>Fat (poly)</th>
<th>Cholesterol (mg)</th>
<th>Omega-3 (g)</th>
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<tbody>
<tr>
<td>Salmon, Atlantic, farmed</td>
<td>17.36</td>
<td>8</td>
<td>0.29</td>
<td>2.59</td>
<td>3.20</td>
<td>3.30</td>
<td>47</td>
<td>1.67</td>
</tr>
<tr>
<td>Salmon, Atlantic, wild</td>
<td>16.38</td>
<td>10</td>
<td>0.88</td>
<td>1.79</td>
<td>2.16</td>
<td>47</td>
<td>1.22</td>
<td></td>
</tr>
<tr>
<td>Salmon, coho, farmed</td>
<td>18.08</td>
<td>10</td>
<td>0.29</td>
<td>1.54</td>
<td>2.83</td>
<td>1.58</td>
<td>43</td>
<td>1.03</td>
</tr>
<tr>
<td>Salmon, coho, wild</td>
<td>18.38</td>
<td>31</td>
<td>0.48</td>
<td>1.07</td>
<td>1.81</td>
<td>1.69</td>
<td>38</td>
<td>0.92</td>
</tr>
</tbody>
</table>

Wild salmon and farmed salmon are different products - they look different and taste different:
Many people honestly believe, based upon the peer-reviewed scientific evidence detailing cancer-causing contaminants in farmed salmon, that wild salmon is simply better. Writing in her Taste Nutritious blog - "Why is wild caught salmon healthier than farmed salmon?" - in February 2014, Silvia Segerstrale outlines the differences:

You have heard it many times before: eating wild caught salmon is healthier than eating farmed salmon. But why is this and does it justify the big price difference? In my opinion, it does and here is why.

In 2004 there was a study published in the Science journal that looked at the contaminants in farmed salmon. They analyzed 2 metric tons farmed and wild salmon and concluded that farmed salmon had significantly higher contaminant levels than wild salmon. The farmed salmon contained higher amounts of chemicals such as PCBs, Dioxins, Toxaphene and Dieldrin.

- **PCBs** are industrial insulators and lubricants. They were banned in the US in 1976 because they can stay in the environment for decades and can accumulate in the food chain. PCBs have been linked to cancer and numerous reproductive, neurological and developmental diseases.
- **Dioxins** are byproducts of high-temperature industrial and waste treatment and disposal. Yummy. Like PCBs, they persist in the environment for decades. They are a known cause of cancer in humans and have been linked to other developmental and reproductive diseases. They can alter the immune function and are toxic to fetal endocrine system.
- **Toxaphene** is a banned pesticide. High exposure can cause damage to the lungs, nervous systems and kidneys and can cause death. Toxaphene is a probable carcinogen and even in low doses has been linked to liver, kidney, adrenal glands and immune system problems.
- **Dieldrin**, like toxaphene, is a banned pesticide and it can stay in the environment for decades. Studies have shown that it can cause cancer in mice and prolonged low exposure to the chemical affects the liver and the immune function. High exposure affects the nervous system.

<table>
<thead>
<tr>
<th>Toxin</th>
<th>Wild Salmon</th>
<th>Farmed Salmon</th>
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</thead>
<tbody>
<tr>
<td>PCBs</td>
<td>4.8</td>
<td>36.7</td>
</tr>
<tr>
<td>Dioxins</td>
<td>0.2</td>
<td>1.9</td>
</tr>
<tr>
<td>Toxaphene</td>
<td>16.0</td>
<td>88.6</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>0.5</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Source: What, When, Where by Dr. Clyde Wilson
Others list farmed salmon as one of the most toxic foods on sale in the marketplace and a "nutritional nightmare":

**What Not To Eat: 15 Unhealthiest Foods On The Planet**

*by Sarah Murphy on February 27th, 2014*

We all think we know which foods are healthy and which we should avoid, but do we really know why? Besides the high fat content and low nutritional value, the world’s unhealthiest foods have some pretty dark secrets. Once you get the low down on the real reasons they’re a lousy choice for your health, you’ll think twice before reaching for that afternoon snack.

Here’s a list of our top nutritional nightmares.

**13. Farmed salmon**

We’re not disputing the fact that responsibly caught fish is good for you, but when it comes to farmed produce, it most definitely pays to go organic. Studies found highly toxic contaminants in farmed salmon that if consumed regularly could pose a serious risk to health. These included banned pesticides like toxaphene and dieldrin, both of which are thought to be carcinogenic.

Prevention magazine identify farmed salmon as one of the "7 Food That Should Never Cross Your Lips":

**7 Foods That Should Never Cross Your Lips**

*Is your food loaded with toxins and chemicals? Here, simple swaps to protect yourself.*

*By Anne Underwood*

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**5. Farmed salmon**

David Carpenter, PhD, director of the Institute for Health and the Environment at the University at Albany and publisher of a major study in the journal Science on contamination in fish, gives us the scoop:

The problem: Nature didn’t intend for salmon to be cremated into pens and fed soy, poultry litter, and hydrolyzed chicken feathers. As a result, farmed salmon is lower in vitamin D and higher in contaminants, including carcinogens, PCBs, brominated flame retardants, and pesticides such as dioxin and DDT. According to Carpenter, the most contaminated fish come from Northern Europe, which can be found on American menus. “You could eat one of those salmon dinners every 4 months without increasing your risk of cancer,” says Carpenter, whose 2004 fish contamination study got broad media attention. “It’s just bad.” Preliminary science has also linked DDT to diabetes and obesity, but some nutritionists believe the benefits of omega-3s outweigh the risks. There is also concern about the high level of antibiotics and pesticides used to treat these fish. When you eat farmed salmon, you get dosed with the same drugs and chemicals.

The solution: Switch to wild-caught Alaska salmon. If the package says from Atlantic, it’s farmed. There are no commercial fisheries left for wild Atlantic salmon.

Budget tips: Canned salmon, almost exclusively from wild catch, can be found for as little as $3 a can.
The Sunday Herald reported in 2002 that "Farm salmon is now the most contaminated foodstuff on the supermarket shelf":

Farm salmon is now most contaminated food on shelf
from Sunday Herald, 20 October 2002

Farmed salmon is the most contaminated food sold by British supermarkets, according to a new analysis by government advisers.

Among 109 different worst-case examples of fruit, vegetables, meat and other foodstuffs polluted by pesticides over the past five years, salmon comes out bottom. Every sample of farmed salmon in the batch tested by scientists was found to contain at least three toxic chemicals.

The revelation comes as the Scottish salmon-farming industry faces its biggest, and potentially most damaging, nationwide protest to date. Millions of salmon, fed and reared in cages at the 350 fish farms around Scotland's coastline, are sold throughout the UK. Virtually all fresh salmon sold in British supermarkets is farmed.

On Saturday, protesters are planning to picket supermarkets in up to 100 towns and cities across the country, urging shoppers not to buy farmed salmon. The protests will cover all the big-name supermarkets such as Tesco, Sainsbury's, Asda and the Co-op.

The day of action is being led by Bruce Sandison, a well-known angler from Sutherland, who chairs the newly formed Salmon Farm Protest Group. Last week the group launched its website, encouraging people to join in the protest on October 26.

"I am greatly concerned by the failure of supermarkets to warn customers that some farmed salmon might contain life-threatening levels of dioxins, DDT residues and other harmful substances," Sandison said.

"A decade of deceit, obfuscation and deception on the part of successive Scottish administrations has led to this public protest. The only way to save Scotland's remaining West Highland wild salmon and sea-trout from extinction, caused by fish farm disease and pollution, is to explain to consumers why they shouldn't buy farmed fish in their supermarkets."

The new analysis of pesticide contamination was carried out by the government's Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment. The committee's 15 experts were asked to investigate the health implications of mixtures of different chemicals in food because of growing concerns over possible "cocktail effects."

Their report, published last week, listed all the "worst-case occurrences of pesticide residues" in all the food sampled by scientists between 1997 and 2001. Salmon was the only food in which every sample, from a batch tested in 1997, contained three pesticides: DDT, dieldrin and toxaphene/benzene.

The committee accepted that evidence was limited and that some chemical interactions may be unpredictable, but concluded that there was "only a very small risk to human health of the cocktail effect of pesticides." But this has been attacked as complacent by environmentalists.

"Farmed salmon is the worst of the worst of all foodstuffs tested for DDT, dieldrin and other cancer-causing chemicals. It is a contaminated product," said Don Stanford, the author of a major critique of the salmon farming industry.

The salmon-farming industry argued that DDT and dieldrin, which have long been banned in most of the world, are pollutants present in most food. Stanford pointed out, however, that farmed salmon are much more contaminated than wild salmon.

In view of the material differences between wild salmon and farmed salmon there is a clear need for labelling.

Protect your family, know the difference choose wild salmon

Ask for wild salmon in restaurants. If they don't know, chances are it is farmed. Farmed salmon has white stripes of fat through the meat, wild salmon does not. The toxins in farmed salmon bind to this fat.

Read more via "What's in farmed salmon?" and "A threat to your child's health"