

The Hidden Costs of Farmed Salmon

Facts & Footnotes

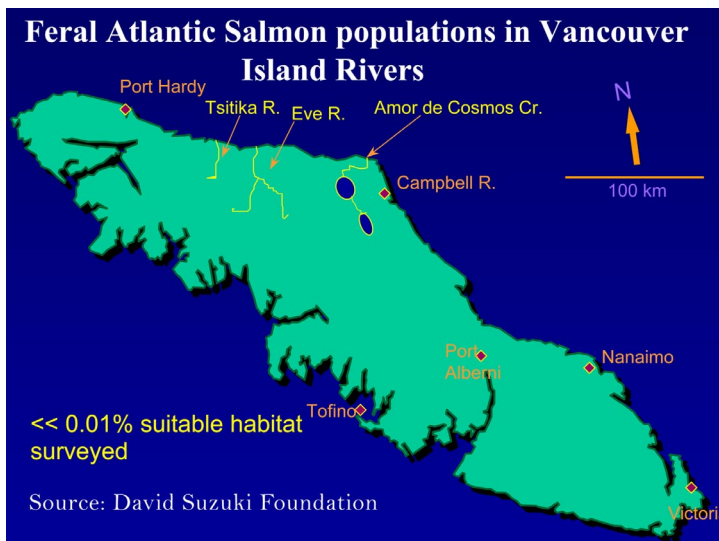
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Many people think that buying farmed salmon saves wild fish. Think again.

F In British Columbia, at least three rivers have now been populated by escaped Atlantic salmon, an invader to our Pacific waters that competes with wild fish.

"To date, conclusive evidence shows that three Pacific salmon-bearing systems currently support presumably wild-spawned juvenile Atlantic salmon. Juvenile Atlantic salmon have also been found in four additional rivers, but analyses suggest these fish escaped from fresh water hatcheries on the same river system in which they were found. While only seven rivers have been identified as holding juvenile Atlantic salmon, it must be noted that less than one percent of potential rearing habitat on Vancouver Island alone has been surveyed."

— Volpe, J. (2001). "Super-un-Natural: Atlantic Salmon in BC Waters." David Suzuki Foundation, p. 18.
http://www.davidsuzuki.org/Publications/Aquaculture_Reports/



F In Norway, the government has resorted to the deliberate poisoning of whole rivers to wipe out the spread of a parasite from a farming hatchery.

"In Norway the most serious disease effects to date have been the introductions to wild populations of lethal parasites and diseases from cultured fish. In recent years more than 30 (*now 41 - ed.*) of Norway's 500 salmon populations have become so infected by the parasite *Gyrodactylus salaricus* that they have had to be completely destroyed... Efforts by Norwegian authorities to prevent the further spread of the parasite to rivers and hatcheries have involved a rotenone treatment program (total poisoning of rivers to kill all fish, infected as well as uninfected)."

— David Ellis and Associates (1996). "Net Loss: The Salmon Netcage Industry in British Columbia." David Suzuki Foundation, p.179-181. http://www.davidsuzuki.org/Publications/Aquaculture_Reports/

"Infectious salmon anemia (ISA) is a contagious viral disease, first detected on Norway salmon farms in 1984... It was assumed that ISA was confined to Norway until it started appearing on New Brunswick (Canada) salmon farms in 1996. Since then, the virus has also been found on salmon farms in Scotland (May 1998) and in Chile (March 2000). By 1998 the disease had spread to so many farms in New Brunswick that 25% of the industry was temporarily shut down and over 1.2 million farmed salmon were slaughtered in an effort to control the disease... In October, 1999, biologists with the Atlantic Salmon Federation discovered wild Atlantic salmon infected with the ISA virus in New Brunswick's Megaguadavic River (ASF 1999). This was the first documentation of wild salmon containing the deadly virus. The biologists also discovered escaped farmed salmon with ISA in the river."

— Paone, S. (2000). "Industrial Disease: The Risk of Disease Transfer from farmed Salmon to Wild Salmon." *Friends of Clayoquot Sound*, p. 4. http://www.ancientrainforest.org/reports/ff_report_disease.pdf

F Salmon farming expanded from just 10% of global salmon production in 1986 to 58% in 2001...

"The most publicized challenge is competition from farmed salmon, which accounted for 58 percent of global salmon production last year, up from around 10 percent just 15 years ago. U.S. imports of farmed Atlantic salmon jumped from 289 million pounds in 2000 to 358 million pounds in 2001, and prices have plunged considerably over the last several months."

— Hedlund, S. (2002). "Atlantic salmon: Growth hinges on the farmed-salmon industry's ability to produce and market winning value-added products," *Seafood Business*, November. <http://www.seafoodbusiness.com/archives/02nov/11atlanticsalmon.htm>

Dye!

F Wild salmon get their beautiful hue from the prey they eat. But their farmed cousins rely on a dye to color their flesh pink. Without that added pigment, their meat would be a pale gray.

"Almost 100 percent of all farmed salmon is artificially colored with either canthaxanthin or astaxanthin, a process sometimes euphemistically called 'color finishing.' Responding to an ever-increasing demand for salmon—which must, however, be pink — several major chemical companies produce canthaxanthin and astaxanthin for color finishing. Swiss chemical giant Hoffman La Roche synthetically produces canthaxanthin and an astaxanthin called Carophyll Pink from petrochemicals and provides customers with its SalmoFan — much like an artist's color wheel but in various shades of pink—to help salmon farmers and buyers create and/or order a color that sells well."

— Forristal, L. (2000). "Is Something Fishy Going On?" *The World and I Online*. <http://www.worldandi.com/public/2000/may/fishy.html>

"Astaxanthin is the major carotenoid responsible for the pink-red pigmentation of fish and crustaceans. Aquatic animals (*meaning farm-raised aquatic animals -ed.*) cannot synthesize astaxanthin and therefore it must be supplemented in the diet... Consumer research has suggested that consumers will pay more for redder salmon, acknowledging that a redder salmon commands a premium price." (*from Hoffman-La Roche promotional materials -ed.*)

— Anderson, S. (2000). "Salmon Color and the Consumer." *Hoffman-La Roche Limited*. <http://www.salmonnation.com/tour/roche.pdf>

Selling authenticity short

F "To be perfectly honest, it [farmed salmon] is crap," says Executive Chef Daniel Long of Bon Appetit Management Company.

"At a panel discussion on 3 November, at the West Coast Seafood Show in Los Angeles, Executive Chef Daniel Long of Bon Appetit Management Company said: 'To be perfectly honest, it [farmed salmon] is crap. Wild salmon is much better. I think we need to push salmon back to being a seasonal thing.'"

— Cimarusti, M. (2002). *FishlinkSublegals* v.6, n.9, 8 November.

F A Wall Street Journal taste test scored farmed salmon at 4.83 out of 10, while wild salmon rated 9.7.

		Texture	Flavor	Overall	Comments
Wild	Salmon caught off the coast of Alaska	9.0	9.5	9.7	beautiful color; melts in your mouth; mellow
Farmed	Salmon born and raised in a cage in Washington	5.0	5.5	4.83	greasy; fishy but tender; watery

— Reifenberg, A. (2000). “Taste Test: Wild vs Farmed Salmon.” *The Wall Street Journal*, 5 January, NW3.

Poop!

F The fish pass their feces right into the waters around them, contaminating the water with as much raw sewage as a town of 65,000.

“Nutrient loading from aquaculture can be significant on a local scale. A salmon farm of 200,000 fish releases an amount of nitrogen, phosphorus, and fecal matter roughly equivalent to the nutrient waste in the untreated sewage from 20,000, 25,000, and 65,000 people, respectively (Hardy, 2000b).”

— Goldberg, R. et al. (2001). “Marine aquaculture in the United States: Environmental Impacts and Policy Options.” Pew Ocean Commission, p. 13. http://www.pewoceans.org/oceanfacts/2002/01/11/fact_22988.asp

Treating the ocean like a cesspool

F The result is a no-oxygen “dead zone” that can extend up to 500 feet.

“A wide body of literature documents raised levels of organic matter underneath cage operations (Beveridge, 1996), which change the chemical and biological structure of the sediment. Effects reported from salmon-farming include a dead zone under pens in severe cases, surrounded by a ring of decreased animal diversity. Impacts can extend roughly 500 feet (150 m) from the site (Beveridge, 1996), although 100 feet (30 m) is a more usual limit (EAO, 1998).”

— Goldberg, R. et al. (2001). “Marine aquaculture in the United States: Environmental Impacts and Policy Options.” Pew Ocean Commission, p. 13. http://www.pewoceans.org/oceanfacts/2002/01/11/fact_22988.asp

Epidemics!

F Fish farmers dose their fish to combat these outbreaks, using seven tons of antibiotics in British Columbia in 1998 alone.

“In 1998, salmon farmers in BC used a total of 6.4 metric tonnes of antibiotics for their salmon production (Sheppard, M.E., 2000).”

— Paone, S. (2000) “Farmed and Dangerous: Human Health Risks Associated with Salmon Farming.” Friends of Clayoquot Sound, p. 4. http://www.ancientrainforest.org/reports/salmon_farming_health_risks.pdf

F Still, epidemics can infect and decimate wild stocks. The 2002 collapse of the pink salmon run on the central B.C. coast is blamed on parasites known as sea lice, contracted from the area's numerous salmon farms.

“A near collapse of pink salmon runs in the Broughton Archipelago, where more than three million fish failed to return to spawning rivers this fall, is being blamed on fish farms in the area.

“Close to 30 farms, which raise Atlantic salmon in open sea pens, have clustered in the bays and inlets on the approaches to spawning streams in the region, on the mainland coast off northern Vancouver Island.

“Alexandra Morton, a biologist who has long been a critic of fish farms, said yesterday the farms have created a perfect winter breeding ground for sea lice, which flourish in the farms because of the concentration of fish and artificial lighting.

“She held a press conference yesterday with the Coastal Alliance for Aquaculture Reform, a coalition of 10 organizations opposed to open-ocean fish farms on the B.C. coast.

“In the spring, there are clouds of literally billions of lice larvae coming out of these farm pens,” Ms. Morton said.

“Sea lice are natural in the environment. They infect the farmed fish and then they explode in numbers over the winter because the conditions are just right. They moved back to the wild stocks last spring, just when the pinks were migrating through.

“This is not a theory. I’ve done the science on this.”

— Hume, M. (2002). “B.C. salmon runs near collapse, biologist says.” *National Post*, 25 September, A6.

See also “Salmon Farms, Sea Lice and Wild Salmon,” a report by the Watershed Watch Salmon Society, 2001, p. 10. http://www.farmedanddangerous.org/pdfs/WWSS_Sea_Lice_Report.pdf

A wild world in peril

F The pesticides used to control sea lice also poison creatures that turn the sea bottom and promote decomposition, just like earthworms do on land.

“In B.C., sealice are often treated using ivermectin. A high proportion of the administered chemical is excreted unchanged by the salmon, and accumulates in marine sediment beneath and in the vicinity of the fish farm... The lethal effect of ivermectin on the polychaetes is particularly interesting. This large class of marine worms is often a crucial part of many marine food chains. They also are key to the decomposition of accumulated organic matter, such as fish feces and uneaten feed that accumulates under salmon farms. The worms constantly turn over the marine sediment allowing oxygenated water to reach aerobic decomposing bacteria. Without these worms, the marine sediment can become depleted in oxygen and proper decomposition cannot occur.”

— Paone, S. (2001). “Drugs Used on B.C. Salmon Farms and Their Effects on the Marine Ecosystem.” *David Suzuki Foundation*, p. 2.

<http://www.watershed-watch.org/ww/publications/sf/DrugsEnvironmentalEffects.PDF>

F The antibiotics that fish farmers rely on to keep their livestock healthy kill not only germs that cause disease but also beneficial bacteria on the sea floor.

“Not surprisingly, investigators have shown that antibiotics can significantly alter the microbial community found in marine sediment. Not only can the total amount of bacteria be reduced, but also the relative abundance among the different species is altered. Sediment dwelling bacteria provide a number of key services, in particular the cycling of nutrients such as nitrogen, phosphorous and sulfur. Measurements reveal that antibiotics found in marine sediment near salmon farms lower the conversion rates for sulphates and nitrates.”

— Paone, S. (2001). “Drugs Used on B.C. Salmon Farms and Their Effects on the Marine Ecosystem.” *David Suzuki Foundation*, p. 1.

<http://www.watershed-watch.org/ww/publications/sf/DrugsEnvironmentalEffects.PDF>

F These antibiotics can also breed resistant strains of micro-organisms, reducing the effectiveness of medicines that are needed to save human lives.

"The use of antibiotics, however, is arguably a health risk for people and farmed fish, since it promotes the spread of antibiotic-resistance in both human and fish pathogens. At least a few types of bacteria associated with fish, such as *Streptococcus*, can be pathogenic to humans (Weinstein et al., 1997). If strains of these bacteria develop higher levels of resistance to antibiotics, infections by these bacteria may be difficult to treat. More generally, resistance can potentially spread to other types of bacteria, including human pathogens, through gene transfer mechanisms special to bacteria (Dixon, 2000)... A U.S. Center for Disease Control and Prevention (CDC) literature review indicates that certain antibiotic resistance genes in *Salmonella*—bacteria that can cause severe food poisoning in people—might have emerged following antibiotic use in Asian aquaculture (Angulo, 1999)."

— **Goldburg, R. et al. (2001). "Marine aquaculture in the United States: Environmental Impacts and Policy Options." Pew Ocean Commission, pp. 16-17.** http://www.pewoceans.org/oceanfacts/2002/01/11/fact_22988.asp

Toxins!

F The fishmeal and fish oil fed to farmed salmon are more contaminated with dioxins than any other livestock feeds, according to a study by the European Union.

"Fish meal and fish oil are the most heavily contaminated feed materials"

— **European Commission Health & Consumer Protection Directorate-General (2000). "Opinion of the Scientific Committee on Animal Nutrition on the Dioxin Contamination of Feedingstuffs and their Contribution to the Contamination of Food of Animal Origin." p. 7.**

http://europa.eu.int/comm/food/fs/sc/scan/out55_en.pdf

F As a result, an analysis of British Columbian salmon found that farmed salmon was nearly ten times higher in PCBs than the wild variety.

"This pilot study examined five commercial salmon feeds, four farmed salmon (one Atlantic, three chinooks) and four wild salmon (one chinook, one chum, two sockeyes) from the Pacific Coast for PCBs (112 congeners), polybrominated diphenylethers (PBDEs – 41 congeners), 25 organochlorine pesticides (OPs), 20 polycyclic aromatic hydrocarbons (PAHs), and methyl and inorganic mercury. The farmed salmon showed consistently higher levels of PCBs, PBDEs, OPs (except toxaphene) than the wild salmon. The mean concentrations in pg/g were 51,216 vs 5302 for total PCBs; 2668 vs 178 for total PBDEs; 41,796 vs 12,164 for total OPs (except toxaphene). The farmed salmon levels are likely a consequence of the elevated level of contamination found in the commercial salmon feed (mean concentrations in pg/g were 65,535 for total PCBs; 1889 for total BPDEs; 48,124 for total OPs except toxaphene)."

— **Easton, M D L, Luszniak, D and Von der Geest, E (2002) "Preliminary examination of contaminant loadings in farmed salmon, wild salmon and commercial salmon feed." *Chemosphere* 46, 1053-1074, at p. 1053.** http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V74-451NM0N-C&_user=10&_coverDate=02%2F28%2F2002&_rdoc=12&_fmt=summary&_orig=browse&_srch=%23toc%235832%232002%23999539992%232835101&_cdi=5832&_sort=d&_docanchor=&_acct=C000050221&_vers

"The health significance of human exposure to PCBs and dioxins has been subject of extensive discussions. The most recent assessment of the risks for human health from PCBs and dioxins has been performed in 1998 1, when a WHO consultation group agreed on a tolerable daily intake (TDI) of PCDDs/PCDFs ("dioxins") and dioxin-like PCBs in the range of 1 - 4 pg Toxic Equivalents (TEQ)/kg body weight, stressing that the upper range of the TDI of 4 pg TEQ/kg should be considered as a maximum tolerable intake on a provisional basis and that the ultimate goal is to reduce human intake levels below 1 pg TEQ/kg bw/day."

— **European Commission Health & Consumer Protection Directorate-General (2000). "Opinion of the Scientific Committee on Animal Nutrition on the Dioxin Contamination of Feedingstuffs and their Contribution to the Contamination of Food of Animal Origin."**

http://europa.eu.int/comm/food/fs/sc/scan/out55_en.pdf

Oligopoly?

F The salmon farming industry is controlled by a short list of global corporations – just four companies produce more than half of the farmed salmon sold in North America.

“With all the consolidation going on, it is now estimated that just four companies — Stolt, Marine Harvest, Pan Fish and Heritage — produce more than half of the farmed salmon sold annually in North America.”

— Redmayne, P. (2000). “Farmed salmon: As world harvests approach 1 million tons, the industry consolidates to keep up with spiraling demand.” *Seafood Business*, August.

<http://www.seafoodbusiness.com/archives/00aug/farmed.html>

Less Food!

F Net loss of protein in 1999: 2,126,000 tons of fish taken from the oceans to produce 871,200 tons of farmed salmon.

F It takes nearly two and a half pounds of smaller fish to raise one pound of farmed salmon...

“In 1999, global production of farmed salmon reached 871,200 tons.”

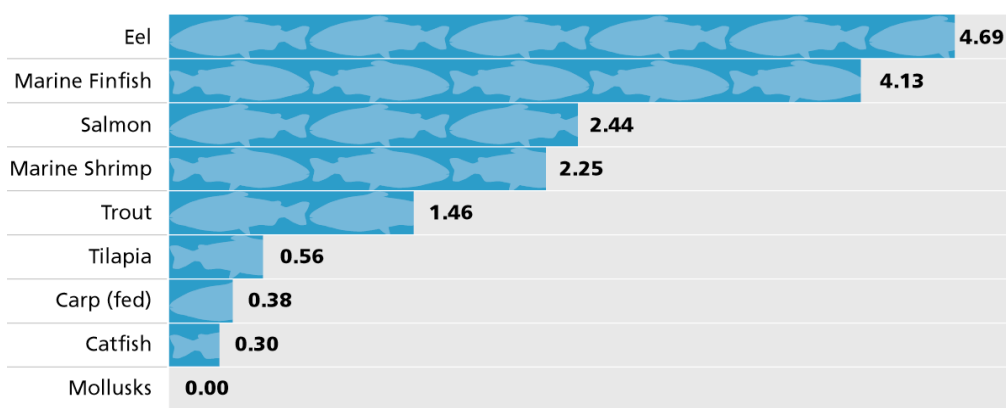
— Duchene, L. (2002). “Salmon farmers seek strategy for taking profits to next level.” *Seafood Business*, October. <http://www.seafoodbusiness.com/archives/01jun/issue.html>

“Although aquaculture is sometimes promoted as an alternative to capture fisheries, some types of aquaculture use huge quantities of wild-caught fish as feed in the form of fish-meal and fish oil, and thus indirectly affect marine ecosystems thousands of miles from fish farms (Naylor et al., 2000). Fish-meal and fish oil are produced primarily from processing small, oily fish such as anchovies, sardines, and menhaden, which are caught for this purpose. A huge quantity of these ‘forage’ fish— roughly a third of the global catch—is turned into fish-meal and fish oil each year (FAO, 2000b). Salmon, eels, striped bass, and many other marine and brackish water species are carnivores, and they rely on large amounts of fish meal and fish oil in their diets 2000).

“Many industry experts expect that within a decade, the global aquaculture industry will use two-thirds of world fish-meal production, and there may already be a serious fish oil shortage (Starkey, 2000).”

— Goldberg, R. et al. (2001). “Marine aquaculture in the United States: Environmental Impacts and Policy Options.” *Pew Ocean Commission*, p. 13-14. http://www.pewoceans.org/oceanfacts/2002/01/11/fact_22988.asp

Pounds of Wild Fish Consumed in Production of Each Pound of Farmed Fish



Based on Figure 5 of Goldberg et. al. (2001).

"It can be argued that if humans were to eat wild salmon, this too would represent a loss of wild fish, since they are after all carnivorous. This is true; given the high global human population, eating lower on the food chain will result in more food overall. But if the comparison is strictly between eating wild or eating farmed salmon, it is more sustainable to eat wild. When we fish for wild salmon we are taking part in a predator-prey relationship that is influenced by the many ecological factors that affect wild salmon supply. The complex checks and balances of nature are such that salmon represent a certain amount of the marine biomass. As the many factors that determine this biomass fluctuate, the amount of salmon also fluctuates in a very complex way. This puts a cap on how much salmon is available for our consumption. If we overfish, if there are global weather changes or if the organisms that wild salmon feed on are not as plentiful for some reason, there is less salmon for us to use, until the system can recover. But when we farm salmon, we are artificially setting a production level that is mainly determined by market rather than ecological forces. Rather than fluctuating with nature's checks and balances, the production level is relatively steady and can grow as demand grows. The salmon biomass, and that of the organisms that salmon use for food, is no longer ecosystem-based. The salmon farm becomes a sink for other ocean biomass and we determine how much of that biomass should be salmon."

— Paone, S. (2000) "Farmed and Dangerous: Human Health Risks Associated with Salmon Farming." Friends of Clayoquot Sound, p. 11-12. http://www.ancientrainforest.org/reports/salmon_farming_health_risks.pdf

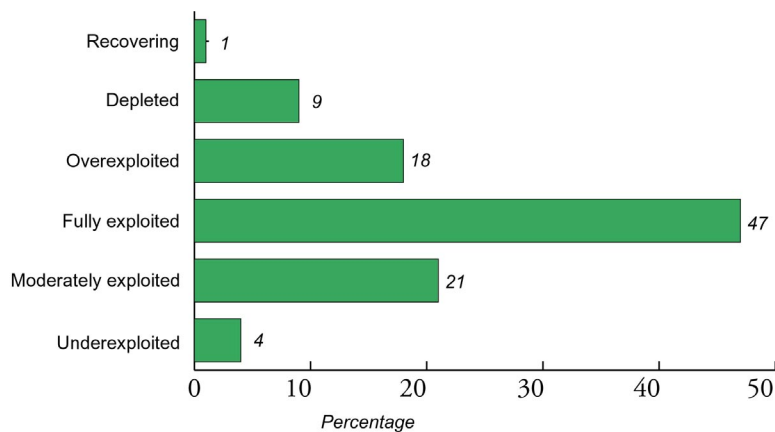
Emptying the oceans

F A quarter of the world's fisheries are already depleted or in the process of being overfished.

"Figure 37 shows that, in 1999, 4 percent of the stocks appeared to be underexploited, 21 percent were moderately exploited, 47 percent fully exploited, 18 percent overexploited, 9 percent depleted and 1 percent recovering."

— Food & Agriculture Organization of the U. N. (2000). "The state of world fisheries and aquaculture 2000." <http://www.fao.org/DOCREP/003/X8002E/x8002e00.htm>

The state of global stocks in 1999



Source: FAO

Where's Your Wild Salmon Come From?

F Average yearly harvests of chinook, coho, and sockeye: 1995-2001

Seven-year averages for landings of Pacific salmon are totaled from these sources:

— U.S National Marine Fisheries Service http://www.st.nmfs.gov/st1/commercial/landings/gc_runc.html

— Fisheries and Oceans Canada <http://www-sci.pac.dfo-mpo.gc.ca/sa/Commercial/AnnSumm.htm>

What's the Big Idea?

F “We assumed we could control the biological productivity of salmon and ‘improve’ upon natural processes that we didn’t even try to understand. We assumed we could have salmon without rivers.”

— Lichatowich, J. (1999). *Salmon Without Rivers*. Island Press: Washington D.C., p. 8.

F “Our manifest inability to centrally plan economies should inspire more humility among the planetary managers who would centrally plan the ecosystem.”

— Daly, H. (1996). *Beyond Growth*. Beacon Press: Boston, p. 59.