



## The Facts & Fallacies of the Salmon Farming Industry in BC

**The facts and science around salmon farming continue to be distorted by farm proponents intent on swaying public opinion and stirring up public doubt. This is an age-old tactic of distract and delay. Unfortunately, in this case, time passes without meaningful change in industry practices worldwide and we continue to lose our wild salmon and everything that depends on them. CAAR thus offers this fact sheet to correct inaccurate claims by industry and the government around salmon farming, including aspects of CAAR's Wild Salmon Narrows initiative.**

Industry/Government Claim: Scientific evidence gathered from a variety of independent sources over the past few years indicates the risk to juvenile wild fish from sea lice is low and manageable.

**FACT→** The current weight of scientific evidence heavily supports the conclusion that salmon farms pose significant threats to wild salmon. Internationally-recognized published studies from BC, Norway & Scotland have shown that sea lice kill juvenile salmon and cause population declines in salmon-farming regions.

Sadly, industry and government fail to accept the current scientific evidence, just as oil companies deny the overwhelming evidence of human-induced climate change. Collapse of wild salmon populations due to salmon farms is a real and substantiated risk that cannot be ignored.

Industry/Government Claim: Because sockeye salmon spend much of their first year of life in freshwater (where sea lice can't live for long) and have fully developed immune systems by the time they migrate out to saltwater, industry suggests they are resistant to damage from sea lice.

**FACT→** Sockeye salmon usually do have fully developed immune systems by the time they migrate to saltwater;

however, research has shown that despite having fully developed immune systems, wild juveniles in Europe (that are on average two times larger than juvenile sockeye) remain subject to sea louse-induced mortality. Infestation levels recorded near BC salmon farms, where some fish are infected with more than 20 lice, leave us to question whether any juvenile sockeye salmon could survive parasite infections from farms.

*"In Norway, we no longer discuss whether sea lice have an impact on wild fish. It is very clear that sea lice do have an impact. It is also very clear and understood that most of the sea lice originate in the fish farms."*

*-Proceedings from Speaking for the Salmon Summit, January 2007*

Industry/Government Claim: Pacific salmon are resistant to damage from sea lice except in their extreme infancy when first leaving their natal rivers.

**FACT→** The lab study supposedly supporting this claim was conducted by Fisheries and Oceans Canada (DFO) (Jones et al. 2008) to test salmon lice resistance. The study, however, exposed juvenile pink salmon to infective stages of lice for only a few hours, resulting in artificially low mortality rates. Migrating wild juvenile salmon, like those in the Broughton Archipelago, are exposed to lice for weeks or months. DFO's conclusions are based on unrealistic exposure times and conditions not comparable to the real world.

Hours vs. months makes a big difference (of two to three orders of magnitude). An independent scientific study

### COASTAL ALLIANCE FOR AQUACULTURE REFORM

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(Krkosek et al. 2009) examined the process of sea louse transfer to wild juvenile salmon in the field where salmon are exposed to sea lice over a longer period of time. This study highlights the importance of the exposure period when interpreting experimental field and lab results.

Industry/Government Claim: Sea lice are a naturally occurring parasite found on many fish (including all species of salmon) in the Pacific Ocean and therefore farms aren't the source of the sea lice problem. Sea lice are initially passed to farm-raised salmon from wild sources.

**FACT→** Sea lice are a naturally occurring parasite found on adult wild salmon, which, due to their size, can withstand sea lice infection. The problem is with juvenile wild salmon, and their inability to withstand infection due to their much smaller size. This is an example of how industry and government try to deflect criticism by misrepresenting the issue.

When adult wild salmon return to spawn they pass farms and can infect farmed salmon (lice transfer easily through net-pens where fish are raised). Farms then serve as sea lice reservoirs, providing numerous stationary hosts for lice to infect and this allows lice to proliferate.

Then in the spring, farmed fish transfer lice to juvenile wild salmon as they migrate to the open ocean. In a normal salmon life cycle, wild juvenile salmon don't encounter high levels of sea lice; salmon farms are the undeniable source of elevated lice levels on juvenile wild salmon during their vulnerable out-migration life-stage.

Salmon farms amplify sea lice to unnatural levels in salmon migration and rearing areas. Sea lice continue to be a problem everywhere in the world that salmon are raised in net-pens, despite all attempts to "minimize" impacts. Management measures are clearly not eliminating the transfer of sea lice from farmed to wild fish, nor are they eliminating the resulting mortality risk to wild salmon.

Watch the [Wild Salmon in Trouble](#)<sup>1</sup> animation to see how sea lice from salmon farms threaten wild salmon.

Industry/Government Claim: Sea lice on farmed salmon are monitored and managed to minimize possible transfer to wild populations. This work is audited by provincial authorities and is a condition of the farm license.

**FACT→** Government relies on industry to conduct sea lice monitoring. This is a clear conflict of interest lacking accountability. Salmon farming companies report their sea lice and disease information to a central database overseen by their industry association, the BC Salmon Farmers Association (BCSFA). This association provides monthly reports summarising sea lice abundance by region to the BC Ministry of Agriculture and Lands (BCMAL). The public only sees summarized data reported online by BCMAL.

This coarse information is of no value to researchers or concerned citizens.

Salmon farming companies are also not penalized or fined for allowing their sea lice levels to exceed treatment threshold, so they often fail to comply (see table below).

Every year scientists report elevated levels of lice on wild juvenile salmon near fully-stocked salmon farms. Clearly, monitoring, managing, and auditing are not effectively protecting wild salmon. The salmon farming industry's primary concern is the impact of sea lice on the health of farmed fish, and the reduction in the number of lesions caused by sea lice infection. Protection of wild fish, which requires a much more precautionary approach, is not the industry's concern or responsibility.

Industry/Government Claim: Sea lice numbers on fish farms are generally below the treatment threshold of three lice per fish and therefore are not a problem.

**FACT→** The government's treatment threshold of three lice per fish is not based on any science and is a purely arbitrary number. If sea lice at this threshold were safe, then we would not have continuous

reports of wild juvenile salmon being infected by sea lice. BC's arbitrary "treatment threshold" only suggests that action (treatment or harvest) should be taken if sea lice levels reach three motile lice per fish during juvenile wild salmon out-migration times (March to July). This regulation does not ensure sea lice numbers are safely reduced before juvenile salmon swim by the farms.

**TERMINOLOGY:**

**Motile Sea Lice:** Lice that have grown enough to crawl around on a host fish.

**Gravid Sea Lice:** Female lice bearing eggs.

**EXAMPLES OF SALMON FARMS EXCEEDING THE TREATMENT THRESHOLD IN THE GEORGIA STRAIT**

<i>Georgia Strait Farm</i>	<i>Motile sea louse levels above treatment threshold in 2008</i>			
Chancellor Channel	7.01 (Apr. 1)	9.73 (Apr. 25)	6.02 (May 18)	
Phillips Arm	5.22 (Mar. 26)	5.32 (Apr. 8)	8.27 (Apr. 22)	5.31 (May 6)
Frederick Arm	3.88 (Mar. 8)			
Lees Bay	10.2 (Apr. 23)			
Sonora Point	3.58 (Jun. 16)			
Hardwicke Island	4.4 (Mar. 11)			

These data were posted by Marine Harvest Canada (MHC), but have limited use to the public and scientists for analyses. Mainstream provides even less information on its website and Grieg Seafood provides almost no information.

The treatment threshold also doesn't take into account the number of fish per farm, which is critical if the goal is reducing the total number of sea lice. For example:

If Farm A has 100,000 fish and an average motile level of 2.5 lice per fish, it doesn't have to treat its fish even though it's infested with approximately 250,000 motile lice. If Farm B has 700,000 fish and the same average louse level (2.5 motiles) it is thus infested with 1.75 million lice. Even though Farm B contains many more fish, and produces a lot more lice, the treatment threshold is still not triggered and no protective action is taken to control lice levels. Considering that each female louse may lay an average of 250 eggs, that's an astronomical numbers of eggs produced at each farm.

Why isn't the industry more proactive about controlling its lice? Simple—because the treatment of sea lice with chemicals added to the fish feed is expensive and industry's primary concern is their own product. The onus to protect wild fish is on the government who is sadly failing in its duty to protect the public interest.

Industry/Government Claim: Canada is among the world leaders in aquaculture regulation and monitoring.

**FACT**→ Canada's aquaculture regulations and management practices are sub par. A 2007 report from the provincially-funded Pacific Salmon Forum compared BC's regulations with salmon farming regions around the world. British Columbia scored 5.1 out of 10, compared to Iceland and Norway with 9.6 and 9.0 respectively. Canada was especially weak on zoning, monitoring and enforcement of regulations. To view this report, [click here](#).<sup>2</sup> Fisheries and Oceans Canada (DFO) is the lead federal government agency responsible for aquaculture and fisheries management. DFO continues to allow the salmon farming industry in Canada to degrade and deplete marine ecosystem values and wild fisheries, despite its mandate to safeguard Canada's oceans.

The Office of the Auditor General of Canada, 2009 Spring Report states: "Fisheries and Oceans Canada and Environment Canada cannot demonstrate that fish habitat is being adequately protected as the Fisheries Act requires." And continues: "There has been little progress since 2001, when we last reported on this matter."

Major reform is required in Canada before it can count itself among the world leaders in aquaculture practices.

Industry/Government Claim: The main species of sea lice infecting juvenile sockeye is a different species than that found most commonly on farmed Atlantic salmon, so there is no problem.

**FACT**→ Two species of sea lice have recently been reported on sockeye: *Lepeophtheirus salmonis* which requires a salmonid host to reproduce, and *Caligus clemensi*, which can reproduce on many fish species. Juvenile sockeye tend to be found with more *Caligus clemensi*, and farmed fish tend to be found with more *Lepeophtheirus salmonis*. Both species of sea lice proliferate on fish farms and both can be detrimental to the health of wild juvenile salmon.

### Fallacies/Facts in Specific Geographical Areas:

Industry/Government Claim: There is no verifiable scientific research supporting the claim that migrating Fraser River salmon are at risk from salmon farms in the Wild Salmon Narrows.

**FACT**→ Morton et al. (2008) show that migrating wild juvenile salmon in the Wild Salmon Narrows are undeniably at risk from salmon farms. Though the research focused on migrating pink (1,708 sampled) and chum salmon (2,514 sampled), sockeye and herring were also analyzed (in 2005, 148 and 322 respectively). In 2005 and 2006, both pink and chum exposed to salmon farms



Photo: Alexandra Morton

were significantly more heavily infected with sea lice compared to peripheral areas. In 2005, the authors saw a similar pattern of elevated lice levels on sockeye and herring exposed to farms, but the small sample sizes precluded statistical comparison.

More recently, an ongoing sampling and DNA study has revealed that a significant number of juvenile sockeye from the Fraser River migrate through this area which suggests this highly valued fishery may be at risk from salmon farms. [See press release](#).<sup>3</sup>

Industry/Government Claim: Since the closest salmon farm to the Fraser River mouth is 110 kilometres away, there is no opportunity for out-migrating Fraser River salmon fry to come into contact with farmed salmon during the early stages of their life cycle.

**FACT**→ While the closest salmon farm is 110 km from the mouth of the Fraser River, the average seaward migration rate for juvenile sockeye is 5.1 to 7.8 km per day.

This means that juvenile salmon leaving the Fraser River may reach the first farm within 15 days.

Additionally, given the evidence that farms on average elevate the numbers of sea lice for 30 kms (Krkosek et al. 2006), juvenile Fraser sockeye could potentially reach farm-induced plumes of sea lice within 10 days. In both situations, this timeframe is well within what scientists consider the vulnerable early stages of sockeye's life cycle.

Industry/Government Claim: Juvenile salmon linger in the Fraser Delta for up to five months until they emerge from the Fraser River in late July. Since adult wild salmon populations are either collecting in the Delta or beginning their migration up the Fraser River during this time, these returning adults are a likely source of sea lice on juvenile salmon emerging from the river.

**FACT**→ Research shows that juvenile sockeye from the Fraser River migrate through the Wild Salmon Narrows in the northern Georgia Strait beginning the end of May, with the majority of fish migrating through in June. The juvenile sockeye migration through this area appears to generally be over by mid-July. The majority of adult fish residing in the Wild Salmon Narrows during the time of migration (and the primary source of lice) are farmed fish, not wild.

Industry/Government Claim: Salmon farms in the Georgia Strait have very low levels of sea lice.

**FACT**→ Industry claims that lice levels as low as 0.05 per fish on one farm are evidence of virtually no lice problems. They conveniently fail to mention that 0.05 can translate to 1.7 million infectious larval lice produced at this farm alone, twice a month. Here's how:

In April 2009, the Marine Harvest Canada farm, Cyrus Rock, in the Wild Salmon Narrows showed average louse levels of 0.93 motiles per fish and 0.05 gravid, egg bearing female lice per fish. Although 0.93 and 0.05 actually sound quite low, these figures become large numbers of lice when you consider the number of fish actually contained in a typical farm – over half a million.

For example, in April 2009 Cyrus Rock farm had over 516,000 fish. According to published science (Orr 2007), and using the average 0.05 gravid sea lice per fish value reported by industry, it is estimated this one farm would contain over 258,000 egg bearing female lice and approximately 6.45 million sea louse eggs based on a conservative estimate of 250 eggs per female in a two week period. Given an average egg survival rate of 26.8 % (Johnson and Albright 1991), approximately 1.7 million infectious larval lice would be produced at this single farm twice a month.

However companies normally wait until their stock reaches the government's treatment threshold of three lice per fish before consulting a veterinarian. By the time medicated feed is delivered, administered and takes effect, lice levels could be much higher. In BC, we continue to see farms with hundreds of thousands of fish reach levels of 10 lice per fish– that's upwards of millions of sea lice at just one farm!

Consider this number (keeping in mind these are only estimates based on the limited data industry provides) and multiply it by the 30 farms in the northern Georgia Strait, and the 50 additional sites along the BC coast. It is easy to understand why sea lice from salmon farms are such a problem, regardless of industry's claim of low lice levels.

Industry/Government Claim: Sea lice on salmon farms aren't a problem anymore, they are managed accordingly with a pesticide called SLICE®.

**FACT**→ In an attempt to control sea lice levels on salmon farms, emamectin benzoate (EB), marketed as SLICE, is added to the feed of farmed fish.

Upon digestion, the drug passes through the lining of the fish's gut and into its tissues where it is then absorbed by sea lice attached to the fish's body. But because most farms contain hundreds of thousands of fish, not every fish can be treated effectively and sea lice remain active in and around each farm. Every year scientists report elevated levels of lice on wild juvenile salmon near fully-stocked salmon farms. Clearly management of lice levels is not effectively addressing the problem.

Meanwhile, reports from Chile, Europe (Lees et al 2008) and Canada's east coast have indicated that sea lice are showing signs of resistance to treatments, including EB, likely due to frequent and heavy applications. Farmed fish in BC may already be showing signs of resistance, but appropriate studies are lacking.

SLICE is not a targeted treatment; it may affect the development of all crustaceans—including prawns, crab, and shrimp, as well as sea lice. EB in fish waste or uneaten food pellets in the open water has the potential to affect non-target organisms in the surrounding environment. This can jeopardize the livelihoods of coastal fishing communities reliant on wild species.

The use of SLICE is only a temporary band-aid solution, and an environmentally irresponsible one at that. Despite Health Canada's recent approval of the drug for use in the marine environment, the environmental effects of EB are still largely unknown and are still being studied by academics and the government.

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#### References

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#### Weblinks

- 1 <http://www.watershed-watch.org/sealice.html>
- 2 <http://www.pacificsalmonforum.ca/pdfs-all-docs/Regreviewprogress.pdf>
- 3 <http://www.farmedanddangerous.org/media-releases/2009/03/1263>