

**WDFW review of Wild Fish Conservancy's Feb. 15 news release  
on presence of virus in escaped Atlantic salmon**

**February 16, 2018**

**Summary of key points**

**The following points are fully elaborated in the material below, prepared by Dr. Kenneth Warheit, fish health and genetic specialist for the Washington Department of Fish and Wildlife:**

- The Wild Fish Conservancy's news release confuses the virus (PRV) with the disease (HSMI), misuses the scientific literature to exaggerate risks to native salmon, and fails to find a single study to support the claim that PRV from open-water pens will harm wild fish.
- The Conservancy asserts – without evidence – that HSMI will harm wild salmon. However, HSMI has never been detected in our native salmon or any other fish except farmed Atlantic salmon.
- PRV occurs naturally and was first confirmed in the Salish Sea from fish samples taken in 1987. The Conservancy provides no data or scientific research to support its claim that the PRV found in escaped fish originated in Norway.
- WDFW methodically and objectively investigates PRV and other fish health issues. We are increasing surveillance for the virus in both Atlantic salmon and in our hatcheries. At present, PRV is not recognized as a pathogen of concern by the World Organization for Animal Health.

**Review of Wild Fish Conservancy news release**

The press release is dated February 15, 2015. The following are general comments about the document (bullets), followed by specific responses to statements made in the press release. The numbered comments below correspond to annotations made in a copy of the press release included with this document.

- Wild Fish Conservancy (WFC) appears to be confused by the difference between the virus PRV (Piscine Orthoreovirus) and the associated disease HSMI. WFC exaggerates the risk associated with the presence of PRV, based on current scientific knowledge; and WFC fails to recognize that the presence of PRV does not equal the presence of disease, that most fish with PRV do not exhibit clinical or microscopic signs of disease, and that both farmed Atlantic salmon and free-swimming native Pacific salmon have PRV but only farmed Atlantic salmon get clinical signs of HSMI.
- WFC repeatedly makes statements that appear to be based on science by citing published scientific papers in defense of their statements; but in many, perhaps most cases the published papers do not support their statements. These published papers either do not address their

statements, or provide information that is counter to their statements. Where the published papers are consistent with WFC's statements, the statements generally overstate the conclusions in the published papers.

- Without evidence, WFC states that PRV itself originated in Norway, and they imply, also without evidence, that the strain of PRV detected in the 19 fish they tested was brought to Washington from Norway.
  - WFC misuses the scientific literature to exaggerate the risk that the August 2017 Cypress #2 accident will harm native salmon with a disease (HSMI) that has never been detected in our native Pacific salmon or any fish other than farmed Atlantic salmon.
1. WDFW never claimed that PRV was not present in escaped Atlantic salmon. In fact, in the State's report investigating the Cypress #2 accident, WDFW was the first to report the presence of PRV in the escaped Atlantic salmon. Ms. Amy Windrope's quote that appeared in WFC's press release was accurate and subsequent statements at the press briefing specifically dealt with the presence of PRV and stated that WDFW found PRV in the escaped Atlantic salmon. None of the escaped Atlantic salmon with PRV examined by WDFW had HSMI.
  2. PRV is a virus that is present in both captive Atlantic salmon and free-swimming native Pacific salmon. In most cases, fish with PRV are healthy, and show no signs of disease. The syndrome HSMI has been associated with PRV in Atlantic salmon aquaculture only. HSMI affects only a small subset of captive Atlantic salmon with PRV and in most cases HSMI is not fatal. See attached White Paper.
  3. WFC claims that PRV is "highly contagious and debilitating," and cites the scientific publication Wessel et al. as the source for their statement. But, the results from Wessel et al. do not support WFC's claim; however, Wessel et al. do state "PRV is ubiquitous in farmed Atlantic salmon and thus present also in apparently healthy individuals." The published paper indicates that in the laboratory, PRV produced microscopic signs that are consistent with HSMI, but in this study none of the fish developed a debilitating disease, and none of the fish died as a result of infection.
  4. Neither the Wessel et al. nor the DiCicco et al. papers state that there are "significant mortalities from HSMI," as WFC claims. Wessel et al. state that "[h]istopathological lesions in the heart can be found in most fish in an affected sea cage while the cumulative mortality [in Norway] ranges from insignificant to 20%." DiCicco et al. state "[t]he disease [HSMI] has been reported also in Scotland . . . and Chile." The data presented by DiCicco et al. for the BC farm indicates that about 0.2% of the affected fish died from HSMI.
  5. WFC states that the "spread of PRV from farmed Atlantic to wild salmon has been well documented," and cites Garver et al. as that documentation. Garver et al. describes a laboratory study where through injections and forced cohabitation the investigators demonstrate that PRV can be highly infectious. Therefore, this research does not state that PRV spreads from farmed Atlantic to wild salmon. However, it is likely that wild salmon can be

infected with PRV from farmed salmon, and likewise, farmed salmon can be infected by wild salmon. Furthermore, in addition to WFC's misuse of the Garver et al. research, they omitted another finding of Garver et al.: even with the high infectivity of PRV, none of the test fish showed any clinical or microscopic signs of disease.

6. This paragraph is entirely speculative and not based on any "peer-reviewed science," as claimed by WFC. WFC states that "the virus may reduce the amount of oxygen cells can transport to the fish's muscles," and cites another paper published by Wessel et al. However, the cited paper does not support WFC's statement: "[a]lthough the present study suggests salmon RBC [red blood cells] can tolerate high amounts of PRV, it is not known how it affects other important erythrocyte functions, such as oxygen transport."
7. The quote attributed to Amy Windrope was based on clinical examination, by a licensed veterinarian, of escaped Atlantic salmon re-captured soon after the spill. The veterinarian determined that these fish were indeed healthy, that is, free from disease. These fish were tested for regulated pathogens, not for PRV, which is not a regulated pathogen nor is it recognized by the World Organization for Animal Health (OIE) as a pathogen of concern. The quote attributed to Amy Windrope is accurate. WFC continues to inaccurately state the difference between a virus (PRV) and a disease (HSMI).
8. WFC is disingenuous when they label PRV as a "Norwegian virus" and WFC is implying that the PRV detected in the 19 fish they tested was brought here from Norway. PRV has been present in Salish Sea waters since at least 1987. There is a scientific debate in the peer-reviewed literature as to the origin of the PRV (eastern Pacific v Atlantic). This debate centers on viral genetics since there is little direct epidemiological evidence as to the origin of PRV. An objective evaluation, based on current information and analyses, would indicate that the origin of PRV is not known. Nevertheless and more importantly, it is unknown as to where the escaped Atlantic salmon contracted PRV. It is conceivable that the fish contracted the virus in Cooke Aquaculture's Rochester hatchery, which if true would suggest that all the Atlantic salmon in the net pens have PRV. This would be consistent with what is known about the prevalence of PRV in Atlantic salmon net pens in British Columbia, and not a surprising result here in Washington. Alternatively, it is also conceivable that the fish entered the net pens free of PRV and contracted the virus from wild fish—a scenario that is also common in British Columbia.
9. WFC provided no data or citations that support their claim that the PRV present in the escaped fish are of Norwegian origin. See comment #8 above. In addition, although PRV genetic sequences from eastern Pacific closely resemble that from Norway, there are differences between these sets of sequences, and it would have been more informative if WFC provided information about the sequences, rather than speculating about the origin of the PRV found in the escaped Atlantic salmon.
10. Despite WFC's claim that there is a "multitude of scientific studies," they failed to cite a single scientific study "that demonstrate[s] PRV from open-water pens will likely spread to and harm wild fish." WFC also failed to state that PRV is present in native Pacific salmonids from Alaska to at least Washington, and in all cases these native fish showed no clinical or microscopic signs of

HSMI or any other disease related to being infected with PRV. WDFW is methodical and objective in our evaluation of PRV, and we plan to increase surveillance for the virus in both Atlantic salmon and within our hatcheries. WDFW has been truthful with WFC and with anyone who asks us about PRV. The Pacific Northwest Fish Health Protection Committee made up of virologists, pathologists, geneticists, and veterinarians have produced a White Paper on PRV and HSMI. WDFW's current management associated with PRV is consistent with that White Paper.



# 1 Contrary to agency claims, escaped Atlantic salmon were infected with a highly contagious and harmful virus

Lab results show 100% of escaped Atlantic salmon tested were infected with virus of Norwegian origin.

February 15<sup>th</sup>, 2018  
For immediate release.

Wild Fish Conservancy (WFC) regrets to announce test findings that confirm long held fears about the nature of Atlantic salmon aquaculture in Puget Sound. This week, WFC received test results from an independent lab at the University of Prince Edward Island. WFC contracted the lab to test heart, gill, and kidney tissue samples obtained from 19 Atlantic salmon collected after the massive Cypress Island net pen escape last August. The 19 fish were donated to WFC by commercial, tribal, and recreational fishermen, and were caught in the Strait of Juan de Fuca, the site of the Cypress Island escape, and 50 miles up the Skagit River.

**Independent lab results demonstrate that 100% of escaped Atlantic salmon tested were highly infected with Piscine Orthoreovirus (PRV), and that the strain of the virus is of Norwegian origin.**



2 PRV is known to be a highly contagious and debilitating salmonid virus, and is proven to be the causal agent for heart and skeletal muscle inflammation (HSMI) disease.<sup>3</sup> HSMI causes a crippling onset of symptoms in salmonids, symptoms that would either kill or render a wild fish incapable of surviving in natural conditions. HSMI has caused up to 20% mortality in Atlantic salmon net pens in Norway.<sup>4</sup> Significant mortalities from HSMI have also been reported in farmed Atlantic salmon in Scotland and Chile.<sup>1,3</sup> Recently, HSMI has been reported in farmed Atlantic salmon in British Columbia.<sup>5</sup>

5 Peer-reviewed scientific literature demonstrates a high likelihood that Atlantic salmon net pens infected with PRV will amplify the virus and spread it to wild salmon. PRV survives well in sea water, and is known to spread out long distances from farms.<sup>4</sup> The spread of PRV from farmed Atlantic to wild salmon has been well documented,<sup>5</sup> and a 2017 BC study demonstrated that

<sup>1</sup> Wessel, O., Braaen, S., Alarcon, M. (2017). Infection with purified Piscine orthoreovirus demonstrates a causal relationship with heart and skeletal muscle inflammation in Atlantic salmon. *Plos One*, 12(8).

<sup>2</sup> Morton, A., Routledge, R., Hrushowy, S. (2017). The effect of exposure to farmed salmon on piscine orthoreovirus infection and fitness in wild Pacific salmon in British Columbia, Canada. *Plos One*, 12(12).

<sup>3</sup> DiCicco, E., H.W. Ferguson, A. D. Schultze. (2017). Heart and skeletal muscle inflammation (HSMI) disease diagnosed on a British Columbia salmon farm through a longitudinal farm study. *PlosOne* 12(2).

<sup>4</sup> Garseth, A. H., Ekrem, T., & Biering, E. (2013). Phylogenetic Evidence of Long Distance Dispersal and Transmission of Piscine Reovirus (PRV) between Farmed and Wild Atlantic Salmon. *Plos One*, 8(12).

<sup>5</sup> Garver, K. A., Johnson, S. C., Polinski, M. P (2016). Piscine Orthoreovirus from Western North America Is Transmissible to Atlantic Salmon and Sockeye Salmon but Fails to Cause Heart and Skeletal Muscle Inflammation. *Plos One*, 11(1).

significantly more wild salmon were infected with PRV if they had been exposed to salmon farms than if they were located far away.<sup>2</sup>

**6** Peer-reviewed science also shows us that even without the occurrence of HSMI, PRV can negatively impact a salmon's ability to compete and survive in the wild. As PRV builds up in a salmon's red blood cells, the virus may reduce the amount of oxygen cells can transport to the fish's muscles,<sup>6</sup> lowering the fish's performance. For a wild fish, reduced performance means a reduced ability to capture prey, evade predators, and swim upriver to spawn.

Statistical analysis conducted by WFC ecologist Dr. Nick Gayeski suggests the disease is highly prevalent in escaped farmed salmon from Cypress Island. "Based on the results of this sampling," Dr. Gayeski said, "I estimate that more than 99.9% of the 260,000+ fish that escaped from the Cypress Island net pen are infected with PRV. **For all practical purposes, all of the escaped fish are most likely infected with the PRV virus.**"

The independent lab results corroborate Washington State Department of Fish and Wildlife's (WDFW) recently released report detailing their own findings of PRV-positive Atlantic salmon originating from Cooke Aquaculture's Cypress Island net pen facility.<sup>7</sup> Yet during a January 30<sup>th</sup> press conference announcing a state agency investigative report into the Cypress Island spill, a spokeswoman for WDFW, who acted as incident commander and co-authored the report, contradicted the report's own findings, stating:

**7** "The released fish... were healthy at the time of release. Of the escaped fish, there was no disease. No endemic bacterial, viral, or parasitic (including sea lice) pathogens were detected at the time of release."<sup>8</sup>

- Amy Windrope, North Puget Sound Regional Director

"I'm outraged," said Kurt Beardslee, executive director of Wild Fish Conservancy. "The Atlantic salmon in Puget Sound net pens originate from Norway, and we now know they are highly infected with a harmful virus from Norway. **I'm outraged this disease is being amplified into our public waters, and I'm outraged our state agencies are willfully misleading the public. When the public finds out about this atrocity, they will be outraged as well.** Wild salmon are the environmental, social, economic, and cultural cornerstone of this region, we can't afford to put them at greater risk. We need to take corrective actions and remove this dangerous industry from Puget Sound before it's too late."

The lab work presents another stunning revelation, **finding the strain of PRV present in 100% of the tested samples to be of Norwegian origin.** This discovery raises immediate concerns as to whether Cooke Aquaculture is placing infected Atlantic salmon into open-water net pens in our public waters.

**9** In British Columbia, a recent lawsuit provided that many BC salmon farms are being stocked by salmon infected with PRV.<sup>9</sup> In one instance, British Columbia's predominant Atlantic salmon net pen company conceded that 5 out of 6 of their hatcheries were infected with PRV.

**10** Considering the multitude of scientific studies that demonstrate PRV from open-water pens will likely spread to and harm wild fish, **WFC is deeply disturbed by the disease's apparent ubiquity among escaped Atlantic salmon in Puget Sound, and incensed by WDFW's willingness to obfuscate the existence and harmful nature of the disease.** Even more troubling is the possibility of the virus being imported into public waters from an outside source, as lab results seem to suggest.

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<sup>6</sup> Wessel, O., Olsen, C., Rimstad, E. (2015). Piscine orthoreovirus (PRV) replicates in Atlantic salmon (*Salmo salar* L.) erythrocytes ex vivo. *Veterinary Research*, 46(1), 26.

<sup>7</sup> Lee, K., Windrope, A., & Murphy, K. (2018, January 30). WDFW, DoE, WDNR. Retrieved from [https://www.dnr.wa.gov/sites/default/files/publications/aqr\\_cypress\\_investigation\\_report.pdf?vdqi7rk&iqyk](https://www.dnr.wa.gov/sites/default/files/publications/aqr_cypress_investigation_report.pdf?vdqi7rk&iqyk)

<sup>8</sup> WDFW. (2018, January 30<sup>th</sup>) Retrieved from: <https://www.facebook.com/CommissionerHilaryFranz/videos/787631131444879/>

<sup>9</sup> Victory for wild salmon as Federal Court strikes down aquaculture license conditions. (2015). Retrieved from <https://www.ecojustice.ca/pressrelease/victory-for-wild-salmon-as-federal-court-strikes-down-aquaculture-licence-conditions/>

To remedy the harm that may be imparted to our wild fish, and to get to the bottom of the disease's source, WFC calls on WDFW, Washington Department of Natural Resources, and Washington Department of Ecology to:

1. Stop all restocking of Atlantic salmon net pens until thorough testing has proven the Atlantic salmon hatchery is not planting PRV infected fish.
2. Immediately test all Atlantic salmon net pens in Puget Sound for PRV.
3. Remove all PRV-infected Atlantic salmon from Puget Sound net pens.
4. Immediately disinfect facilities showing any trace of PRV.

These actions are essential to ensure that diseased, PRV-infected fish are not being planted into public waters and that Atlantic salmon raised in net pens are not amplifying the virus and spreading it in the public's waters where it places our native salmon at risk.

“Hopefully the Washington state legislature will successfully pass legislation to phase out Atlantic salmon net pens in Puget Sound, but in the interim, this alone is far from enough to protect our wild salmon from this industry,” said Kurt Beardslee. “It’s absolutely critical that our state agencies take immediate action to ensure we’re not planting or amplifying viruses into our public waters.”