

Exposure to salmon farms increases virus infection in wild salmon

Piscine reovirus infection may lower wild salmon fitness



Embargoed until 11am Dec 13, 2017: The first scientific evidence that large numbers of wild salmon are becoming infected with piscine reovirus (PRV) through exposure to salmon farms was published this week in the scientific journal *Public Library of Science One*.

The effect of exposure to farmed salmon on piscine orthoreovirus [reovirus] infection and fitness in wild Pacific salmon in British Columbia, Canada” reports that the percentage of wild salmon infected with piscine reovirus was much higher in wild salmon exposed to salmon farms, than in wild salmon not exposed to salmon farms.

This is the first study to address this question in BC.

Unable to sample farm fish directly from the marine pens, the team purchased 262 fresh BC farmed salmon and 35 farmed steelhead from supermarkets. Polymerase chain reaction (RT-qPCR) tests detected piscine reovirus in 95% of the farm salmon and 69% of the farmed steelhead.

The highest percentages of wild salmon infected with PRV were found in high-density salmon farmed regions i.e. the Broughton Archipelago (45%) where First Nations are extremely concerned that salmon farms have contributed to the collapse of local wild stocks, Lois Lake (40%) where steelhead farms operate and the Discovery Islands (37%) where the Cohen Commission concluded farm salmon disease could have serious and irrevocable impact on Fraser River sockeye salmon returns. As well, 40% of returning wild adult salmon in the lower Fraser River and 76% of trout in Cultus Lake were infected.

In contrast, only 5% of wild fish on the north coast of BC and in the Skeena and Nass Rivers were infected, these regions were the furthest from salmon farms. PRV was detected in all species of Pacific salmon also and trout.

The most obvious explanation for this pattern of infection is that the highly infected farmed fish are passing the virus on to nearby migrating wild fish, and that some infected fish eventually make their way to the more remote parts of the coast. Previous research published by this team in [Virology Journal](#) reports the strain of PRV found in this study originated in Norway.

The most significant finding to British Columbians is that PRV prevalence in Fraser River salmon dropped an estimated 50% between the lower vs. the upper Fraser River.

“This suggests that salmon infected with PRV are less capable of swimming up through strong rapids in places like Hells Gate and therefore unable to reach their spawning grounds,” says co-author Dr. Rick Routledge, Simon Fraser University professor emeritus.

“When you consider that nearly 40 - 45% of salmon swimming past salmon farms are testing positive for PRV and that we found evidence that this virus could make it more difficult for salmon to swim upriver this adds up to enormous potential impact on wild salmon, whales, First Nations and British Columbians,” says lead author, Alexandra Morton.

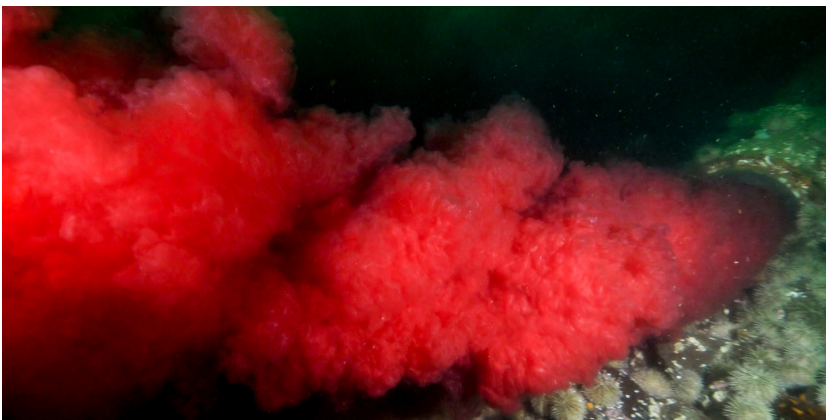
PRV is an emerging fish disease causing acute infection of salmon red blood cells. Scientists are concerned that large amounts of PRV in salmon blood may critically reduce oxygen uptake. If the infection progresses, the salmon’s heart and swimming muscles become damaged leaving fish very weak. Discovered in 2010, PRV was classified as harmless in BC until earlier this year when it was identified as causing disease in a salmon farm in the Discovery Islands. Whether DFO is required to test farm salmon for PRV prior to transfer into marine pens is a matter being heard in Federal court.

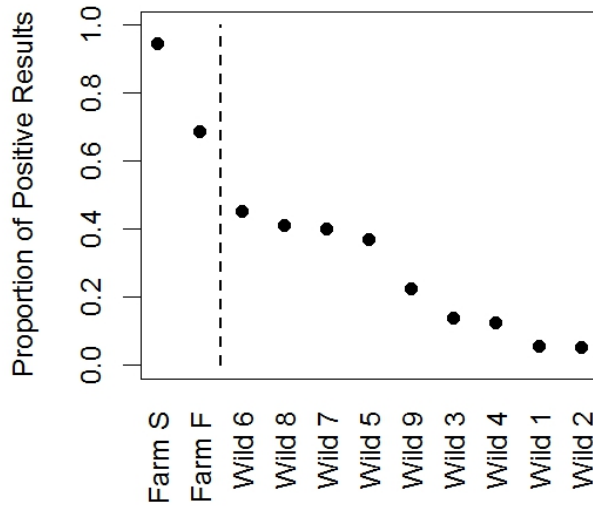
The source of the extraordinarily high proportion of trout infected with PRV (76%) in Cultus Lake (lower Fraser River) will have to be examined further as Cultus Lake sockeye were listed as *endangered* in December 2016.

This finding comes amid some of the lowest BC wild salmon returns on record and the recommendation by the Committee on the Status of Endangered Wildlife in Canada, that Fraser River sockeye salmon be listed. The video of effluent from a farm salmon processing plant shows blood infected with piscine reovirus pouring into the waters of Discovery Islands, which is likely contributing to the high PRV-infection rate measured by this research in wild salmon of that area.

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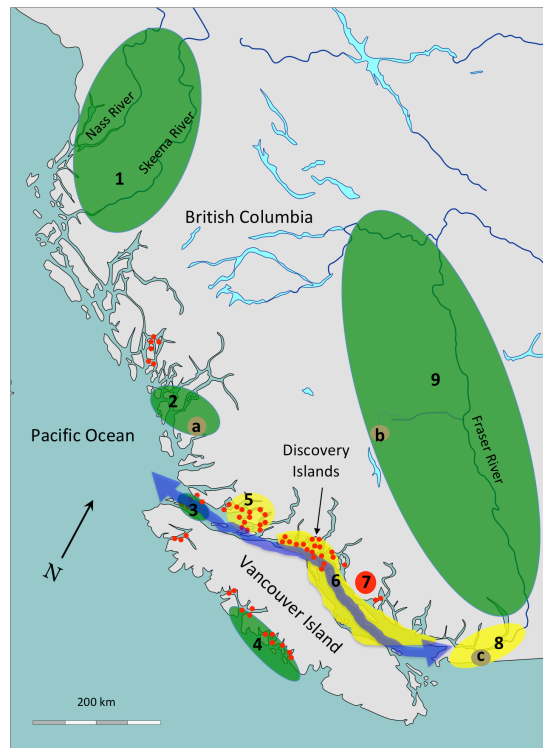
Footage <https://vimeo.com/244288704>





- Farm S** = farm salmon
- Farm F** = farmed steelhead
- Wild 1** = Skeena/Nass
- Wild 2** = Central coast
- Wild 3** = Queen Charlotte Strait
- Wild 4** = West Vancouver Island
- Wild 5** = Broughton Archipelago
- Wild 6** = Discovery Island
- Wild 7** = Lois Lake
- Wild 8** = Lower Fraser River
- Wild 9** = Upper Fraser River

The proportion of piscine reovirus infected fish was highest in farmed salmon and steelhead, and in wild fish exposed to the highest fish farm density on the BC coast.



The highest proportions of PRV infected wild salmon were in regions 5 (Broughton Archipelago) and region 6 (Discovery Islands) as well as region 8, the lower Fraser River and region 7 (Lois Lake). The red dots are salmon farms and the blue line is the Fraser River salmon migration route.



90% of farm salmon from markets tested positive for piscine reovirus.
Photo by Sabra Woodworth



Intensive industrial salmon farming allows pathogen populations to increase.
Photo by Ernest Alfred



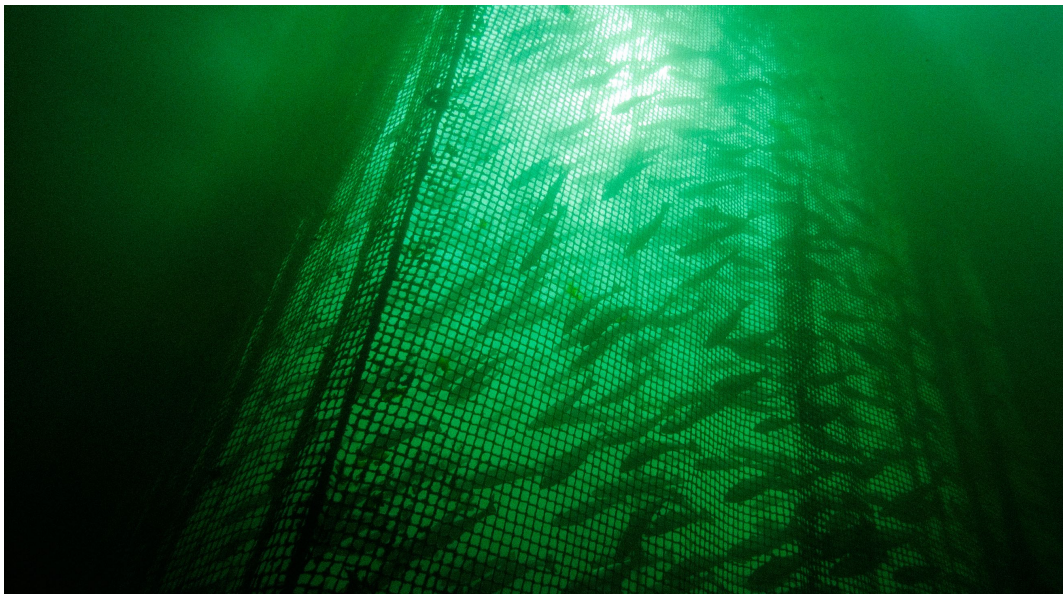
Hand-purse seine used to catch wild salmon near a salmon farm in the Discovery Islands. Photo by Tavish Campbell



Wild salmon exposed to salmon farms and are becoming infected with piscine reovirus. Photo by Tavish Campbell



Lead author, Alexandra Morton has been publishing on the impact of salmon farms on BC wild salmon and orca for the past 20 years. Her research into the spread of viruses from farm salmon began when she viewed provincial farm salmon health records as a participant of the Cohen Commission. This provincial lab is now under investigation Photo by Clio Nelson



Bacteria, parasites and viruses circulating among the over one million fish each farm flow freely through the nets into contact with wild salmon. Farm salmon effluent can introduce 65 billion infectious viruses per hour to the marine environment. Photo by Tavish Campbell