LIVING OCEANS

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BRIEFING NOTE: PRV (*Piscine orthoreovirus*)

Salmon Aquaculture and PRV

PRV was introduced to BC waters by the salmon farming industry at some point between 1981 and 1997, according to genomic analysis performed in the DFO Nanaimo lab[1]. It probably arrived with imported eggs in the early days of salmon farming in BC.

One of the major concerns about viruses on salmon farms is that the farm environment provides the ideal conditions for a virus to mutate, becoming more infective. Different strains of PRV are known to exist in the world's salmon farming regions. In Norway, for example, PRV is responsible for killing up to 20 percent of farmed stock.[4]

These are the top findings about PRV:

1. DFO allows fish with the virus to be transferred from hatcheries to the open net pens in the ocean, despite knowing since at least 2011 that it can cause disease in wild salmon.

2. DFO refused to allow Dr. Kristi Miller to publish her ground-breaking paper describing the above findings. It took an order from the Information Commissioner to obtain the paper, which wasn't released until more than a decade after it was written.

3. PRV is now in circulation in the Pacific, being 'traded' by wild and farmed fish. The virus is so widespread that DFO claims all farms are infected within 100 days of being stocked.

4. PRV causes a disease in wild Chinook salmon known as jaundice/anaemia. It attacks the red blood cells, causing them to rupture and eventually kill the fish.

5. PRV causes different diseases in the various species of salmon. Penned Atlantic salmon will often recover from the disease. Wild Pacific salmon are more likely to die, whether from the disease itself or from reduced ability to feed and evade predators.[2,3]

In Canada, we have no way of knowing how much mortality is caused by PRV on salmon feedlots. This is because the Department of Fisheries and Oceans asked veterinarians—both their own and those employed in the industry—to vote on a definition of the disease caused by the virus in Atlantic salmon. The definition they chose is different from the diagnostic criteria used everywhere else in the world. It virtually guarantees that the disease will never be diagnosed on a Canadian feedlot.

Sick fish in a salmon feedlot will often recover, as they don't have to compete for their food or evade predators. While they recover, they shed virus particles into coastal ocean waters where it may be picked up by emerging juvenile salmon in the spring, or adults returning in the summer and fall.

To date, despite clear evidence to the contrary, DFO continues to claim that PRV is not a "disease agent" because (see above) the disease it in fact causes has been defined out of existence. Salmon farmers seeking to transfer smolts from their hatcheries to the ocean do not need to screen for the virus as a result.

Wild Chinook salmon have been shown to be far more likely to be infected with PRV the closer they are to salmon farms. This suggests strongly that transmission of the virus between wild and farmed stock is occurring. In the wild, PRV will be controlled by the death of diseased fish, while their caged counterparts live on, shedding infective particles of the virus into our coastal waters.

Endnotes:

1. GJ Mordecai, KM Miller, AL Bass, et al., "Aquaculture mediates global transmission of a viral pathogen to wild salmon," Sci. Adv. 7(2021) eabe2592 ("Mordecai et al. (2021)"), https://doi.org/10.1126/sciadv.abe2s92.

2. E Di Cicco, HW Ferguson, KH Kaukinen, AD Schulze, S Li, A Tabata, OP Gunther, G Mordecai, CA Suftle & KM Miller, "The same strain of Piscine orthoreovirus (PRV-1) is involved in the development of different, but related, diseases in Atlantic and Pacific Salmon in British Columbia," FACETS 3 (2018) 599-641 ("Di Cicco (2018)"), https://doi.org/10.1139/facets-2018-0008. T Takano, A Nawata, T Sakai, T

3. Matsuyama, T Ito, J Kurita, S Terashima, M Yasuike, Y Nakaumra, A Fujiwara, A Kumagai & C Nakayasu, "Full-genome sequencing and confirmation of the causative agent of Erythrocytic Inclusion Body Syndrome in coho salmon identifies a new type of Piscine orthoreovirus," PLOS One ("Takano (2016)"), https://doi.org/10.1371/journal.pone.0165424.

4. Laura Solarte-Murillo, Alex Romero, Juan Guillermo Cárcamo, Marcos Godoy, Francisco J. Morera, C.A. Loncoman, Piscine orthoreovirus 3a detected from farmed coho salmon with jaundice syndrome displays positive selection and polymorphisms in S1 and M2 viral segment, Aquaculture, Volume 574, 2023, 739709, ISSN 0044-8486, https://doi.org/10.1016/j.aquaculture.2023.739709. (https://www.sciencedirect.com/science/article/pii/S0044848623004830)