

Piscine Reovirus Information Sheet

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Bullets:

- Heart and Skeletal Muscle Inflammation (HSMI) is a disease that affects farmed Atlantic salmon in Europe. Research is ongoing, but the cause of HSMI remains unknown.
- Some scientists think that piscine reovirus (PRV) might be the cause of HSMI, but this hypothesis has not been confirmed.
- In Europe, the virus PRV is common in wild and farmed Atlantic salmon that have no evidence of the disease HSMI.
- In BC, PRV is common in farmed Atlantic salmon and farmed Pacific salmon, but HSMI does not occur in BC.
- A PCR-positive test result for piscine reovirus does not mean that the fish have the disease HSMI; it only means that a segment of the virus (PRV) was detected in the fish.
- Diagnosing the disease HSMI requires histopathology.
- In 2010 the BC Ministry of Agriculture developed two PCR tests for PRV. Test validation revealed that piscine reovirus occurred in about 80% of farmed Atlantic salmon with and without unexplained heart disease. This is evidence that PRV is not the cause of unexplained heart disease.
- In all of our validation testing, the samples with the most abundant PRV were from live fish sampled and submitted as "No visible lesions; pre-move fish health check"; histopathology confirmed that these fish had no heart lesions of concern.
- When viruses do not cause disease, they are not a threat to wild salmon.
- Published scientific study of 200 wild juvenile pink salmon in BC (sampled in 2008) found no evidence of PRV or HSMI (Saksida et al. 2012).
- Published scientific study of wild Atlantic salmon in Norway found abundant PRV in some fish, but no HSMI by histopathology (Garseth et al. 2013).
- Published scientific study of BC salmonids did not report evidence of disease in any of the fish that tested positive for piscine reovirus; the study reported PRV sequences from 10 farmed Atlantic salmon, one farmed steelhead, two wild cutthroat trout, and one wild chum salmon smolt (Kibenge et al. 2013).

- PRV commonly infects farmed Chinook salmon in BC, including fish that have jaundice syndrome. When tissues from farmed Chinook salmon with jaundice syndrome were injected into fish that did not have PRV, the recipients did not develop jaundice syndrome (Garver et al. 2013). This is good evidence that PRV is not the cause of jaundice syndrome in Chinook salmon.
- Consistent farm fish production levels in BC for the past several years are good evidence that BC farmed salmon have no serious new diseases.

Background:

When piscine reovirus was first associated with HSMI in farmed Atlantic salmon in Norway (Palacios et al. 2010), I was intrigued but skeptical. Reoviruses got their name because many are "respiratory and enteric orphans". They are called "orphans" because many are viruses without a disease. For example, according to recently retired BC Animal Health Centre veterinary virologist, Dr. John Robinson, 80 - 100% of healthy Fraser Valley broilers (chickens) at the processing plant would be positive for intestinal reovirus (similar to but different from PRV): the reovirus is very common in chickens but it is not associated with disease.

In farmed salmon, scientists concluded that "PRV is almost ubiquitously present in Atlantic salmon marine farms, and **detection of PRV alone does not establish an HSMI diagnosis**" [emphasis mine] (Finstad et al. 2012). That means that without evidence of disease, the fact that fish have PRV cannot be used to prove anything about the risk to farmed or wild salmon.

The same thing seems to be occurring in farmed salmon in BC. The virus is common, but it is not associated with any disease.

The first piscine reovirus paper was published on July 9, 2010 (Palacios et al. 2010), and just 40 days later the BC Animal Health Centre had two qPCR tests for piscine reovirus ready for validation. By October 25, 2010, we had tested 146 pooled samples from 539 farmed Atlantic salmon. The samples were from 76 government audits of recently dead fish (n = 402) on the salmon farms and 137 fish that had been submitted directly from farm veterinarians, most of which were for health screening before transfer. The PRV prevalence was about 80% in all three groups of interest: audits with fish that died of unexplained heart disease (4 of 5 audits), audits with no fish that died of unexplained heart disease (56 of 71 audits), and direct submissions from salmon farms, none of which died of unexplained heart disease. We concluded that PRV is common among farmed Atlantic salmon in British Columbia, but PRV is not associated with any cause of mortality, including unexplained heart disease (Marty and Bidulka 2013).

As part of my work as the fish pathologist for the BC Ministry of Agriculture, I examine hundreds of salmon that die on the fish farms every year. I am very interested in finding new diseases (that's one reason I was hired), but so far we don't seem to have HSMI in BC.

Annual farm fish production in BC has been very consistent for the past several years. This is good evidence that we have no serious new disease in BC farmed salmon:
<http://www.env.gov.bc.ca/omfd/fishstats/graphs-tables/farmed-salmon.html>

Literature Cited:

- Finstad, O.W., Falk, K., Lovoll, M., Evensen, O., and E. Rimstad. 2012. Immunohistochemical detection of piscine reovirus (PRV) in hearts of Atlantic salmon coincide with the course of heart and skeletal muscle inflammation (HSMI). *Veterinary Research* 2012, 43:27.
- Garseth, Å. H., Fritsvold, C., Opheim, M., Skjerve, E., and E. Biering. 2013. Piscine reovirus (PRV) in wild Atlantic salmon, *Salmo salar* L., and sea-trout, *Salmo trutta* L., in Norway. *Journal of Fish Diseases* 36: 483–493.
- Garver, K.A., J. Richard, B. Bennett, L. Hawley, S. Cockburn, S. Saksida, G.D. Marty, and M.J. Higgins. 2013. Transmission studies with yellow jaundice syndrome fish and associated findings of piscine reovirus (PRV) in Chinook salmon from the west coast of British Columbia. Annual Meeting of the Fish Health Section of the American Fisheries Society. Port Townsend, Washington, USA. June 2013. Abstract.
- Kibenge, M.J.T., T. Iwamoto, Y. Wang, A. Morton, M.G. Godoy, and F.S.B. Kibenge. 2013. Whole-genome analysis of piscine reovirus (PRV) shows PRV represents a new genus in family Reoviridae and its genome segment S1 sequences group it into two separate sub-genotypes. *Virology Journal* 10:230.
- Marty, G.D., and J. Bidulka. 2013. Piscine reovirus (PRV) is common but unrelated to disease among farmed Atlantic salmon in British Columbia. Annual Meeting of the Fish Health Section of the American Fisheries Society. Port Townsend, Washington, USA. June 2013. Abstract.
- Palacios, G., Lovoll, M., Tengs, T., Hornig, M., Hutchison, S., Hui, J., Kongtorp, R.T., Savji, N., Bussetti, A.V., Solovyov, A., Kristoffersen, A.B., Celone, C., Street, C., Trifonov, V., Hirschberg, D.L., Rabadan, R., Egholm, M., Rimstad, E. and Lipkin, W.I. 2010. Heart and skeletal muscle inflammation of farmed salmon is associated with infection with a novel reovirus. *PLoS One* 5(7), e11487.
- Saksida, S.M., G.D. Marty, S. St-Hilaire, S.R.M. Jones, H.A. Manchester, C.L. Diamond, and J. Bidulka. 2012. Parasites and hepatic lesions among pink salmon, *Oncorhynchus gorbuscha* (Walbaum), during early seawater residence. *J. Fish Dis.* 35:137-151.