

**Garver, Kyle**

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**From:** Polinski, Mark  
**Sent:** March-12-19 10:53 PM  
**To:** Garver, Kyle  
**Subject:** Last update to points for media communication  
**Attachments:** Points for media release (006).docx

Attached.

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**From:** Garver, Kyle  
**Sent:** Tuesday, March 12, 2019 3:41 PM  
**To:** Polinski, Mark  
**Subject:** RE: points for media communication

Sorry for the delay, I got distracted. Attached as we discussed.  
-Kyle

**From:** Polinski, Mark <Mark.Polinski@dfo-mpo.gc.ca>  
**Sent:** March-12-19 1:41 PM  
**To:** Garver, Kyle <Kyle.Garver@dfo-mpo.gc.ca>  
**Subject:** RE: points for media communication

Updated version attached.

**From:** Polinski, Mark <Mark.Polinski@dfo-mpo.gc.ca>  
**Sent:** Monday, March 11, 2019 8:52 PM  
**To:** Garver, Kyle <Kyle.Garver@dfo-mpo.gc.ca>  
**Subject:** points for media communication

What I've got so far is attached. haven't gotten to addressing potential questions yet, just a summary of our studies.

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**From:** Garver, Kyle  
**Sent:** Monday, March 11, 2019 4:04 PM  
**To:** Polinski, Mark  
**Subject:** positive material

Mark,  
I need to send some PRV positive material to the Okanagan. I think it would be best to send some RNA as well as a positive tissue specimen. Do you have some extra that can be shipped out tomorrow. I will likely just use ice blocks and ship overnight.

-Kyle

## Preface (why we care)

PRV is a virus that infects salmon (people and other mammals are not effected). In Norway, the virus has been demonstrated to cause severe heart and skeletal muscle inflammation in farmed Atlantic salmon – a disease known as HSMI that has a notable impact on Norwegian Atlantic salmon production. PRV is also commonly detected in farmed Atlantic salmon in BC and sometimes in wild Pacific salmon. This has led to speculation that PRV is causing disease such as HSMI in farmed and wild salmon of BC, and possible mortality in wild Pacific salmon stocks.

## Scientific Reports Article

### Summary:

From the beginning (as soon as PRV was identified in British Columbia in 2012), we were seeing regional differences for the impact that PRV was having on Atlantic salmon farms – specifically, notable disease (clinical cases of HSMI) was occurring on Norwegian farms attributed to PRV that we were not seeing on farms in BC. Nevertheless, at least one case of subclinical disease similar to HSMI had been diagnosed in BC from 2013 and we needed to know how PRV was fitting in.

In collaboration with veterinary pathologists at the BC Animal Health Centre, we were able to identify a second case of subclinical HSMI-like disease on an Atlantic salmon farm through one of our DFO auditing programs in 2016 and those fish were subsequently identified to be infected with PRV. So we did a classic experiment to demonstrate disease causation: we took PRV from the diseased fish and injected it into healthy naïve individuals to see if we could recreate the disease (just like what has successfully been done in Norway to demonstrate that PRV causes HSMI in that country).

We found that, the virus amplified well in the naïve fish and reached higher loads than originally came out of the donor fish, but it didn't cause significant disease – only mild heart inflammation that we also sometimes saw in our non-PRV infected control population. This fact, coupled with a few differences we identified between how PRV was replicating in Norwegian salmon versus what was going on in our study with BC salmon, demonstrated that PRV in BC has a lower capacity to cause disease in farmed Atlantic salmon than what occurs in Norway. We currently don't know how much of this reduced harm can be attributed to differences in the virus or differences in the fish; however, we have preliminary evidence from continuing research that genetic differences in both the virus and fish can be contributing factors.

### Main points:

- PRV has demonstrated a limited capacity for initiating disease in farmed Atlantic salmon in BC; notably less so than what has been observed in Norway.
- HSMI-like disease which occasionally occurs in farmed Atlantic salmon in BC was not transmissible to naïve fish, suggesting that the condition is not the same as HSMI diagnosed in Norway. Moreover, it likely requires additional or independent factors other than PRV to develop.

## Frontiers in Physiology Article

### Summary:

Even though we had demonstrated a limited capacity for PRV to cause disease in BC Atlantic salmon, we did see some minor heart inflammation occur in association with the virus. We also knew that PRV typically targets red blood cells - the cells responsible for transporting oxygen throughout the body of the fish. We therefore wanted to know if these blood infections and minor heart inflammation was affecting the fish's respiratory and cardiovascular performance.

We teamed up with fish physiology experts at UBC to comprehensively explore the respiratory performance of PRV infected salmon using a state of the art fish respirometry system (think of it as an equivalent to hooking a person up to a bunch of sensor and an oxygen mask and putting them on a treadmill for a 'VO2 max' test). We looked at the fish's maximum and minimum oxygen needs, their agitation level, their ability to recover from exhaustion, and their ability to cope with low oxygen conditions.

We found that fish with high load PRV blood infection and minor heart inflammation performed the same as fish without infections. Their blood could carry just as much oxygen, their hearts pumped just as effectively as their uninfected counterparts, and they could handle exhaustive and low-oxygen stress equally. This demonstrated that a high-load PRV infection does not equate to functionally harm in Atlantic salmon and that fish with either no or only minor heart damage (i.e., the vast majority of PRV infected Atlantic salmon in BC) are performing just as well as the non-infected fish. We have also recently finished doing the same experiments with Sockeye salmon and found a similar lack of harm and are currently in the process of writing up those findings. This information substantially reduces the uncertainty and speculation that PRV infections are harming farmed and wild salmon in the absence of a clinical disease condition – in other words, the vast majority of PRV infections.

### Main points:

- **Functional harm to Atlantic salmon was not inflicted by high-intensity PRV infections; this finding reduces uncertainty and speculation that PRV is causing harm in fish which do not develop clinical disease**

## Studies Together

- **PRV has a limited capacity for directly causing disease or functional harm in farmed Atlantic Salmon of British Columbia.**

## Common questions

### **Was the data considered in the recent risk assessment?**

Yes, both studies were fully considered in the PRV risk assessment process. Finalized reports and management recommendations generated by that risk assessment should be available in the next few months.

### **How does this fit in with the recent Namgis First Nations court decision?**

Managers have been made aware of the key findings from these studies. Preliminary data from this work was even brought up during the court proceedings. To my knowledge, the minister and other management officials have not made a finalized decision on how they will proceed with regard to this ruling.

### **What about studies that say PRV is causing harm to salmon in BC?**

There have been a few studies from British Columbia that have made associations between PRV and disease or PRV and compromised survival. And based on the cause-and-effect relationship between PRV and HSMI which has been demonstrated in Norway, these studies have hypothesized or assumed that the same cause-and-effect relationship was occurring here in BC. But association is not the same as causation. For example, there's an association between very good hockey players and wearing professional sports jerseys; but putting on a professional jersey isn't necessarily going to cause you to become a better hockey player. Our new studies have helped to define these previous associations between PRV and disease here in BC: PRV may be present and even contributing to disease in some circumstances, but our work clearly shows that having a lot of PRV on its own isn't enough to cause a fish significant harm; there must be other factors involved.

### **What about PRV's effect on Chinook salmon?**

A recent report identified that PRV was present in diseased tissues of farmed Chinook salmon with Jaundice syndrome – an anemic condition that results in fish turning yellow. However, a previous study published in 2016<sup>1</sup> could not demonstrate PRV to cause this yellow disease condition in naïve fish in a similar fashion to our current Scientific Reports paper where PRV failed to cause HSMI in Atlantic salmon). It's also unclear as to why only some farmed Chinook (~1-2%) develop jaundice when it appears that more than 90% of them become infected with PRV. We suspect that if PRV is causing or contributing to Jaundice and mortality in Chinook salmon, the process is complicated and requires alternative factors in addition to PRV. More research is currently underway by DFO scientists to try to fill in some of these knowledge gaps.

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<sup>1</sup> Garver, Kyle A., et al. "Piscine reovirus, but not Jaundice Syndrome, was transmissible to Chinook Salmon, *Oncorhynchus tshawytscha* (Walbaum), Sockeye Salmon, *Oncorhynchus nerka* (Walbaum), and Atlantic Salmon,

**Is there a danger that PRV will become more virulent in BC salmon?**

There is always a possibility that a virus can mutate and become more virulent (cause more damage to the host). But in BC we know that the PRV relationship with host salmon has been relatively stable for at least the last 30 years. Typically, something needs to change in the host-pathogen relationship to put pressure on the virus to mutate, and we have no indication as yet that anything in this relationship is currently changing that would likely promote increased virulence of this virus.

**Should PRV positive smolts be allowed into open seawater net-pens?**

This is a question that DFO is currently re-assessing and the results from our studies along with other investigations on PRV are being carefully considered to best address this question. In fact, DFO just concluded a risk assessment on PRV whereby experts from around the world were gathered to inform the assessment of the risk to Fraser river sockeye salmon due to piscine orthoreovirus (PRV) transfer from Atlantic salmon farms in the Discovery islands area, British Columbia. The findings from this Risk Assessment are currently being finalized and will contribute to DFO's decision towards the management of PRV in response to the Commission of Inquiry into the Decline of Sockeye Salmon in Fraser River.

**Should DFO be screening wild and Pacific salmon for the presence of PRV?**

Screening fish for PRV will certainly add to our understandings of the distribution of the virus. However, as our new studies have shown, determining the presence or absence of PRV alone is not going to tell us if the infected fish are (or are going to become) diseased or not. Currently DFO is trying to determine what level of risk PRV infections pose to the health of salmon in BC, and how best to balance the costs associated with possible surveillance and mitigation strategies relative to the risks associated with the presence of this virus. Our results add important information to assessing risks associated with PRV, but there are many other factors that managers and regulators need to consider. It's a complicated decision involving finite budgets and resources that hinges on answering the question of 'what is an acceptable level of risk?'. In Norway, the government currently does not regulate or mandate screening for PRV. This goes for European countries in general. We'll just have to see what happens here in Canada.

**Article in Scientific Reports:**

Full citation: *Polinski, M. P., Marty, G. D., Snyman, H. N., and Garver, K. A. (2019) Piscine orthoreovirus demonstrates high infectivity but low virulence in Atlantic salmon of Pacific Canada. Sci. Rep., 40025. doi: 10.1038/s41598-019-40025-7*

URL: [www.nature.com/articles/s41598-019-40025-7](https://www.nature.com/articles/s41598-019-40025-7)

**Article in Frontiers in Physiology:**

Full citation: *Zhang Y, Polinski MP, Morrison PR, Brauner CJ, Farrell AP and Garver KA (2019) High-Load Reovirus Infections Do Not Imply Physiological Impairment in Salmon. Front. Physiol. 10:114. doi: 10.3389/fphys.2019.00114*

URL: <https://www.frontiersin.org/articles/10.3389/fphys.2019.00114>

**Rainer, Michelle**

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**From:** Rainer, Michelle  
**Sent:** March-15-19 10:40 AM  
**To:** Polinski, Mark  
**Subject:** RE: Articles

s.19(1)

Thanks, Mark. I thought that was a good article— [REDACTED]

**From:** Polinski, Mark <Mark.Polinski@dfo-mpo.gc.ca>  
**Sent:** March-15-19 10:19 AM  
**To:** Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>  
**Subject:** RE: Articles

Yes, it turns out.

<https://www.campbellrivermirror.com/news/farmed-atlantic-salmon-in-b-c-unaaffected-by-virus-researchers-find/>

**From:** Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>  
**Sent:** Thursday, March 14, 2019 8:46 AM  
**To:** Polinski, Mark <Mark.Polinski@dfo-mpo.gc.ca>  
**Subject:** RE: Articles

Oh yeah forgot about that one! [REDACTED]

**From:** Polinski, Mark <Mark.Polinski@dfo-mpo.gc.ca>  
**Sent:** March-14-19 8:31 AM  
**To:** Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>  
**Subject:** RE: Articles

Hi Michelle,

You asked for a tab of who I spoke to, and as I'm sure you've deduced from the article below, I talked to [REDACTED] the Canadian Press. Nobody else yesterday, but I am supposed to talk with [REDACTED] somebody (didn't catch his last name) from the Campbell River Mirror today at 2:30.

Best,

Mark

**From:** Rainer, Michelle <Michelle.Rainer@dfo-mpo.gc.ca>  
**Sent:** Thursday, March 14, 2019 8:26 AM  
**To:** Polinski, Mark <Mark.Polinski@dfo-mpo.gc.ca>; Garver, Kyle <Kyle.Garver@dfo-mpo.gc.ca>  
**Cc:** Lowe, Carmel <Carmel.Lowe@dfo-mpo.gc.ca>; MacDougall, Lesley <Lesley.MacDougall@dfo-mpo.gc.ca>  
**Subject:** Articles

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RE: Mark and Kyle

Thanks for being on deck yesterday! Even though we didn't get a ton of calls, the one we did was from CP (a news wire service) so the article has been picked up by other outlets, including Global and CTV:

<https://nationalpost.com/canada/studies-shed-light-on-impact-of-virus-on-farmed-atlantic-salmon-in-b-c>

I also had a couple of reporters contact me to say they would run pieces based off the published studies so we may hear from them in coming days if they have questions. Haven't seen anything from [REDACTED] the Star yet.

This one concerns DFO research on freshwater farming but passing along as it's also really interesting:

<https://www.tvonews.com/article/current-affairs/why-you-may-not-need-to-worry-about-ontario-farmed-fish-after-all>

Regards,  
Michelle