

Centre for Science Advice Pacific

FPP non-CSAS Request for Rapid Science Response

REQUEST INFORMATION

Request Contact:	Kristi Miller Saunders	Project Type: Aquaculture-Emergency response
Date of request:	November 29, 2017	Project footprint:
Region of proposed impact:	Tofino and Browns Bay, British Columbia	Habitat Type: Coastal
Purpose of request:	Information for Ministry of Environment / Environment and Climate Change Canada investigation	
Potential affected species:	Pacific salmon	
Date required:	December 15, 2017	Request #:2017AQU01
Timeline rationale:	Required for ongoing inspection of fish processing facilities as conducted by Province of BC	

PROJECT OVERVIEW

In Canada, the regulation of processing of fish products is a shared Provincial – Federal responsibility. BC Ministry of Environment & Climate Change Strategies (ENV) supports marine fisheries and aquaculture and seafood industry development, issuing licenses to businesses involved in the aquaculture sector - including permits for seafood processing facilities - under the BC *Fisheries Act and Fish Inspection Act*. Thus, as a function of normally-operating fish processing plants, fish waste effluent is released back into the marine ecosystem subject to conditions of license.

Environment and Climate Change Canada (ECCC) administers section 36 of DFO's *Fisheries Act*, the key pollution prevention provision, prohibiting the deposit of deleterious substances into waters frequented by fish, unless authorized by regulations under the *Fisheries Act* or other federal legislation. A deleterious substance can be any substance that, if added to any water, would degrade or alter its quality such that it could be harmful to fish, fish habitat or the use of fish by people.

Following the public release of a video showing fish waste effluent being released into the marine environment, and subsequent related news articles and public interest, ENV initiated an inspection of two fish processing plants that were the subject of the videos. ENV has also initiated a compliance audit for fish processing plants.

The BC Ministry of Environment & Climate Change Strategies (ENV), Environmental Protection Regional Operations Branch requested assistance from DFO to support the collection of water samples at two fish processing facilities and to test collected effluent for the presence of the Piscine OrthoReovirus (PRV), as part of the ongoing inspection. Other labs contacted at the time did not have the capacity to perform the necessary diagnostics on water samples.

1ST QUESTION

Background:

Piscine OrthoReovirus (PRV) is known to be present in Norway, Japan, the United Kingdom, Ireland, Chile, the United States and Canada (Biering and Garseth 2012; Kibenge et al. 2013; Siah et al. 2015). Farmed and wild Atlantic Salmon (*Salmo salar*), Coho Salmon (*Oncorhynchus kisutch*), Chinook Salmon (*Oncorhynchus tshawytscha*), and Rainbow trout (*Oncorhynchus mykiss*), and wild Cutthroat Trout (*Oncorhynchus clarkii*), Steelhead Trout (*Oncorhynchus mykiss*),

Sockeye Salmon (*Oncorhynchus nerka*), Chum Salmon (*Oncorhynchus keta*) and Pink Salmon (*Oncorhynchus gorbuscha*) have all tested positive for PRV through molecular testing. However, around the world, PRV prevalence has been substantially higher in farmed populations, most showing 60-90+% prevalence, than in wild populations.

PRV is causative of Heart and Skeletal Muscle Inflammation (HSMI) disease in farmed Atlantic Salmon (Wessell et al. 2017) and EIBS disease in farmed Coho salmon in Japan (Takano et al. 2016). As well, it has been implicated in other diseases of farmed Rainbow Trout, Coho and Chinook Salmon in Chile (Godoy et al. 2016), Norway (Hauge et al. 2017) and Canada (Miller et al. 2017). HSMI disease occurs in farmed Atlantic salmon in Norway (Kongtorp et al. 2004), Scotland (Ferguson et al. 2005), Chile (Godoy et al. 2016), and Canada (Di Cicco et al. 2017).

Red blood cells (RBCs) are the primary infective tissue for PRV (Finstad et al. 2014). Not all salmon carrying the virus, even at high loads, are diseased. Given the high prevalence of PRV in farmed populations and presence of the virus in the blood, it is expected that blood effluent from processing plants would contain PRV.

Request:

As part of an inspection conducted at two fish processing facilities, ENV requested DFO expertise to:

- Accompany 1 ENV and 1 ECCC inspector to two fish processing facilities and support the collection of water samples;
- Analyze effluent samples collected from two fish processing plants on December 4 and 5, 2017; and
- Assess the PVR data results of presence/absence

Importance:

Essential

Important

Desirable

SCIENCE RESPONSE

Sample Collection:

Methods:

A DFO Molecular Genetics technician accompanied two inspectors (from ENV and ECCC) to each of the fish processing facilities to provide guidance for the appropriate collection of water samples to allow for viral analysis. Inspectors were the Senior Enforcement Officer - Enforcement Branch Environment and Climate Change Canada, and the Environmental Protection Officer - Compliance Section, Environmental Protection Division, BC Ministry of Environment and Climate Change Strategy.

At the Browns Bay Packing Co, Campbell River, BC, effluent was collected from one source – at the plant itself, after it had been passed over a roto-screen of 0.5 mm and 0.25 mm (as per the permit), and immediately prior to discharge out of the facility into the environment. This sample was the combination of discharge from the fish transport vessel (a mixture of saltwater, ice-water and blood from the fish being processed) and the liquid discharge from the plant used in the processing of the fish. The sample was red in colour, with very small particulates visible. This is MGL sample **2017-0017-J3205**.

At the Lions Gate Fish Co, Tofino, BC, effluent was collected from two sources;

1) Discharge from the fish harvest vessel (a mixture of saltwater, ice-water and blood from the fish being processed). The vessel discharge is un-treated and enters the fish plant discharge pipe after the plant discharge is screened, and so

was considered a separate sample by the accompanying inspectors. The sample was bright red in colour, and fairly clear with very little particulate matter visible. This is MGL sample **2017-0017-J3231**;

2) Discharge from the processing plant that was used in the processing and cleaning of fish. This sample was collected after it had passed over a fine-meshed screen (as per the permit) and prior to discharge out into the environment. This sample was had a cloudy, white appearance, with visible particulate matter. This is MGL sample **2017-0017-J3232**

Note – one additional discharge from this site was unable to be accessed for sampling. In this case the discharge was liquid from the processing plant floor which is passed over a 6mm screen, and then joins directly into the pipe for discharge.

Sample Analysis:

Laboratory Sample Handling

Samples were collected in new 2L sample bottles, and were transported to the DFO Molecular Genetics Lab on ice and in a locked truck. They arrived at the lab within 3-6 hours of collection.

Samples from the Fish Plant discharge inspections (MGL AQ# 2017-0017) were processed in the Molecular Genetics Forensics Lab at the Pacific Biological station, a laboratory space in the Molecular Genetics Section of DFO Science that is dedicated to highly sensitive and/or legal samples. This room is kept locked at all times, and has tightly-controlled access. All personnel accessing this lab are required to sign in/out. Samples processed in this lab are either of a legal nature, or are highly sensitive or degraded DNA (e.g. eDNA/Scat samples). Only one sample file/type can be processed at one time in this lab, and the laboratory processing stations are sterilized with bleach and UV between samples. Any processing steps requiring use of equipment outside of this laboratory are carried out with samples constrained to sealed containers (e.g. centrifugation, PCR amplification).

Details of sample processing methodologies are presented in Appendix 1.

Results:

PRV was detected in all samples tested. The number of viruses per mL of water was calculated to allow total viral burden to be assessed based on discharge estimates. Technical controls confirmed that equipment was performing appropriately and results were of high integrity.

Detailed results are presented in Appendix 2A (raw data containing results for all technical replicates) and 2B (synthesized data).

Context:

The high prevalence of PRV in farmed BC Salmon is well documented. The presence of the virus in facility effluent was therefore expected. Further Science studies would be required to determine and evaluate any associated marine environmental or public health risks associated with such effluent discharges.

References:

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REVIEW INFORMATION

This response does not constitute delivery of peer – reviewed Science advice; it is intended as a rapid response to an immediate requirement for Science input.

Reviewed by: Lesley MacDougall, Coordinator, Centre for Science Advice Pacific Region



Date: Dec 18, 2017

Comments:

Approved by:



Date:

Dec 18, 2017

Comments: