



BACKGROUND

Strategic Salmon Health Initiative

Genome British Columbia, the Pacific Salmon Foundation and Fisheries and Oceans Canada are embarking on a remarkable partnership to discover the microbes present in salmon in British Columbia that may be undermining the productivity of our Pacific salmon. The project will conduct epidemiological assessments to explore the transmission dynamics and historical presence of detected microbes, with key focus on microbes that are suspected globally to cause disease in salmon. Researchers will apply genomic technology to identify and verify which microbes are presently carried by BC's wild and cultured fish, and then assess their potential effect.

The Strategic Salmon Health Initiative (SSHI) was initiated in 2013 for a variety of reasons, the primary one being the variable survival of juvenile salmon during their early ocean migration. Infectious disease may contribute to salmon mortality patterns, but not enough is known about the distribution or impact of disease agents in wild Pacific salmon populations in their natural habitats. Most of the current knowledge about any potential for effect has been derived from observations of cultured fish (both in enhancement hatcheries and open-net pen aquaculture).

To address this issue the SSHI will use a four-phased program to discover the microbes present in Pacific salmon that may reduce the productivity of our Pacific salmon. In the initial phase of the work, the primary goal was to obtain collections of wild, hatchery and aquaculture salmonids from southern BC. This phase provided a tissue inventory for assessment of microbes carried both by wild and cultured salmon in BC. The first steps also included the development of a stakeholder consultation process (Public Interest Panel) that will provide input to the information needs, public engagement and communications, and ways to integrate research on microbes and disease on BC salmon.

The phases of the project are as follows:

Phase 1 (completed) established a large-scale sampling program, for wild, hatchery and aquaculture salmon. These samples were combined with similar samples collected from 2008 through 2012 to establish the broad scale overview of microbes in BC salmon. Phase 1 did not include analysis of samples. Phase 1 also established the Public Interest Panel.

Phase 2 (~2.5 years) of the Strategic Health Initiative involves rigorous analysis of the tissues samples collected in Phase 1 and in previous research. It has been divided into two sub-phases.

- Phase 2a (completed) focused on the development and evaluation of a new and innovative research platform. This technology, the Fluidigm BioMark™ HD System, offers an ability to analyze samples on a scale never done before in BC. The platform is able to analyze up to 96 individual fish simultaneously. With appropriate controls and running duplicate samples across 2-3 sample arrays, the load of 45 microbes in more than 200 salmon samples can be analyzed in a day. In total the analysis will look at over 90% of infectious agents known to cause disease in salmon- no other known study is doing quantitative analysis at this level. The results of this evaluation phase have now been reviewed by the Canadian

Science Advisory Secretariat (CSAS), which coordinates the peer review of scientific issues for the Department of Fisheries and Oceans. The CSAS review was positive and declared the technology as “fit for application”, which will allow the project to continue into Phase 2b.

- *Phase 2b* (~18-24 months, commencing spring 2015) will consist of the microbe analyses and epidemiology studies. In addition to novel research using the Fluidigm technology, a portion of the samples collected for molecular monitoring will also undergo histopathological analysis and gene expression profiling to identify microbes most likely to associate with disease. DFO Audit samples from dying farmed fish will also shed light on microbes associated with mortality of farmed salmon in BC. Epidemiology analyses will be performed to identify distributional patterns of microbes in wild, hatchery and aquaculture salmon. In its entirety, Phase 2 (a & b) is the discovery phase wherein points of focus and hypotheses are identified for testing in Phase 3.

Phase 3 (~2 years) will focus on the microbes identified in Phase 2, with an emphasis on microbes that have not been extensively researched and/or are associated with emerging diseases, and thought to be of pathological significance in salmon. The team will conduct laboratory studies of pathogenicity to provide further understanding of disease processes and dynamics in Pacific salmon. Moreover, laboratory transmission studies may be undertaken to elucidate potential routes of exchange (horizontal or vertical) within and between species. This Phase will begin towards the end of Phase 2 to expedite information needs on microbes that are newly discovered in BC salmon. Preparation of challenge facilities with appropriate controls for disease challenge work will be undertaken during Phase 2b.

Phase 4 (~1 year) will include reporting of research and presentations to management agencies on the potential utility of methods developed and the application of outcomes to future monitoring. The culmination of the project will likely be in 2017 when data have been compiled and research outcomes are documented.

Where are we today? The peer review of the Fluidigm BioMark™ HD System now allows analyses of the tissue bank collected to-date (approx. 30,000 samples, both historical and recently collected). The numbers of samples that can be processed in a day means that these samples can be processed within several months. However, if microbes of potential concern are observed, researchers will then examine other tissues from the fish for histopathology and/or genetic sequencing of the microbe to relate the observation with fish health conditions. These secondary examinations will provide critical information on the potential effect of a microbe but will also prolong final results in the study. Further, if reportable microbes are detected, they will be reported to CFIA for verification. The project leaders recognize the interest in these results and will make periodic reports on results to-date.

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About Genome British Columbia:

Genome British Columbia is a catalyst for the life sciences cluster on Canada’s West Coast, and manages a cumulative portfolio of over \$710M in 254 research projects and science and technology platforms. Working with governments, academia and industry across sectors such as forestry, fisheries, agriculture, environment, bioenergy, mining and human health, the goal of the organization is to generate social and economic benefits for British Columbia and Canada. Genome BC is supported by the Province of British Columbia, the Government of Canada through Genome Canada and Western Economic Diversification Canada and more than 300 international public and private co-funding partners. www.genomebc.ca

About the Pacific Salmon Foundation:

The Pacific Salmon Foundation was created in 1987 as an independent, non-government, charitable organization to protect, conserve and rebuild Pacific Salmon populations in British Columbia and the Yukon. The Foundation’s mission is to be the trusted voice for conservation and restoration of wild Pacific salmon and their ecosystems and works to bring salmon back stream by stream through the strategic use of resources and mobilization of local communities. www.psf.ca

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