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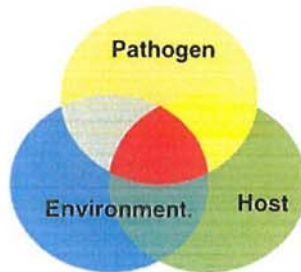
Introduction to Pathogens, Diseases and Host Pathogen Interactions of Sockeye Salmon



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- Pathogens are a natural component of all ecosystems
- Pathogens have co-evolved with their hosts *→ not*
- Presence of pathogen doesn't always mean disease will occur
- Disease determinants are multifactorial



- Features of the host, the pathogen, and the environment determine whether disease will develop and the severity of the disease.
- Disease severity may increase when conditions change (upset the normal balance)

■ Disease Occurrence

Suscept



Direct & Indirect Disease Impacts

- Mortality
- Performance Reduction
 - Growth
 - Physiological Performance (osmoregulation, stress resistance)
 - Swimming Performance
 - Reproduction (adult survival – offspring viability)
 - Immune Suppression (increased susceptibility to other pathogens)



Challenges to Quantifying Disease Impacts

- Limited information is available on the distribution and baseline levels of pathogens and infectious disease in Fraser River sockeye.
- Often little is known about the relationship between infection and disease and how environmental and other factors influence this relationship.
- Difficult to quantify indirect disease impacts on host populations.
- Fish mortality due to disease can go unnoticed or underestimated due to the difficulties in finding and recovering carcasses.
- Fish are often infected with a number of pathogens (concurrent infections). The types of pathogens and their intensity of infection will effect their hosts overall performance (e.g. stress resistance, swimming performance), how they respond to any particular pathogen and whether disease develops or not.





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PARR Research – Health Assessment of 2010 Juvenile Sockeye Salmon

April 2011



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PARR Goals:

To conduct a 3 year program to address the following questions for wild juvenile salmon of Fraser River origin:

- Which species of sea lice are found on juvenile salmonids and how abundant are they?
- When and where do juvenile salmon become infected with sea lice and how does the level of infection change over time?
- What role/s if any do farmed salmon play in the infection of juvenile wild salmon with sea lice?
- What role/s do wild hosts (salmonid and non-salmonid species) play in the infection of juvenile wild salmonids?



New Partners and Expanded Goals:

Collaboration with Marine Harvest Canada and the Pacific Salmon Foundation has allowed us to expand this program to:

- Increase the number of sites sampled, including in-river samples
- Determine sea lice numbers on pink and chum salmon
- Examine sockeye salmon for other disease-agents or conditions

Samples have been processed for histology, virology (IHNV, VHSV, ISAV) and bacteriology (BKD). Stock of origin has been determined for all fish sampled.





Field Surveys:

Three sets of samples obtained from Chilko Lake out migration.

Three marine-surveys completed: May 15- 23rd, June 7-2nd, August 3 -17th with samples collected throughout the Strait of Georgia and Johnstone Strait

Fish captured using a modified purse seine.

Sea lice sample collection and enumeration used the same methods used in the Broughton Archipelago sea lice surveys. (Simon Jones to discuss)



Location of Sampling Sites





Types of Samples Collected

Species	Stock ID	Otoliths	Genomics	Sea Lice	Histology	Microbiology
Coho	X	X	X		X	
Chinook	X	X	X		X	
Sockeye (River)		X	X		X	X
Sockeye (Marine)	X	X	X	X	X	X*
Pink				X		
Chum				X		
Non-salmonids				X		

* Samples for viral and bacterial culture and molecular diagnostics



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Sampling Trip	Number of Sockeye	Sample Sizes	
May 2010	216	157	Sea lice and Molecular Diagnostics
		20	Virus Isolation/ Bacteriology (culture)
		39	Histology
June 2010	520	316	Sea lice and Molecular Diagnostics
		37	Virus Isolation / Bacteriology (culture)
		167	Histology
August 2010	326	202	Sea lice and Molecular Diagnostics
		42	Virus Isolation / Bacteriology (culture)
		82	Histology



Virus Isolation and Bacteriology (culture)

- Samples of kidney and spleen were pooled from each individual
- Virus isolation was conducted following NAAHP protocols using EPC, CHSE, and SHK cell lines which are suitable for the culture of all salmonid viruses known to be present in Canada.
- Bacteriology samples were plated on TSA and TSA+salt. An ELISA for BKD was also conducted.
- All samples collected during our survey (river and marine samples) tested negative for the presence of virus and bacteria by culture. The BKD-ELISA did not identify any positive individuals.
- Although a few fish that were collected in the river and transferred to PBS via UBC were found to be carriers of IHNV. Carrier state in the marine environment?





Pathogen Survey (Molecular Diagnostics)

- Samples of brain and kidney were taken from all fish examined for sea lice.
- These samples will be tested for the presence of IHNV, VHSV, ISAV and *Renibacterium salmoninarum* (BKD) by molecular diagnostics (Real Time PCR).
- Nucleic acid (RNA and DNA) preps are presently being performed on these samples. Real Time PCR assays will be conducted prior to the start of the 2011 field season.

Histology

- For each individual, samples of gills, brain and other internal organs were taken and processed for histology.
- Examination of the slides was conducted by Dr. David Groman Atlantic Diagnostic Services UPEI who is a well-recognized fish pathologist.





Histology General Summary (ca. 300 fish examined)

Generally the fish were in good morphological condition, with no evidence of significant infectious disease problems or inflammation noted in any of the samples.

There was a low prevalence of intestinal trematode and intraperitoneal cestode infestations and a moderately high prevalence of intracerebral myxosporidian infections noted. None of these agents were causing significant pathologic changes.

Samples obtained at Chilko lake also showed a high prevalence of sessile protozoan infestations of the gills (32/40 fish).





Surveillance Activities in 2011-12

We plan to maintain the collaborations developed in 2010 and our broader focus on fish health.

We plan to modify the sampling program to:

1. obtain more samples of sockeye from the Fraser River, especially from the lower river.
2. to only conduct cruises in May and June and to expand the areas surveyed.

