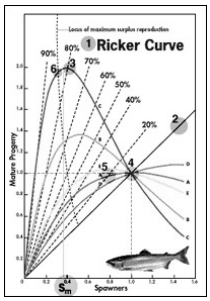
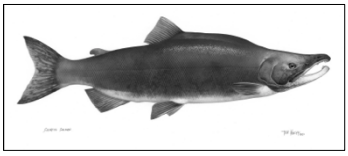
LEVY

RESEARCH SERVICES LTD.

March 27, 2013

Cohen Commission Science Workshop
Hosted by the Fraser River Aboriginal Fisheries Secretariat





Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River
Commission d'enquête sur le déclin des populations de saumon rouge du fleuve Fraser

COHEN COMMISSION
COMMISSION COHEN

FINAL AGENDA

09:00	**Start**	
	Prayer	
	Introductions	
	Dave Levy Levy Research Services Ltd.	*Purpose of Workshop; Review Agenda*
09:15	Dave Levy	*Role of Science in the Cohen Inquiry Process*
09:30	Randall Peterman Professor Emeritus, SFU	*Fraser Sockeye Production Dynamics*
09:55	Dave Marmorek, ESSA Technologies Ltd.	*Freshwater Ecology*
10:20	Villy Christensen Professor, UBC	*Marine and Freshwater Predators*
10:45	**Break**	
11:00	Larry Dill Professor Emeritus, SFU	*Salmon Farms*
11:25	Dave Levy	*Salmon Farms Part 2; Contaminants; Disease; Hatcheries; Climate Change*
12:00	**Lunch Break**	
12:45	Skip McKinnell North Pac Marine Science Org	*Marine Ecology*
1:15	Dave Marmorek	*Cumulative Impacts*
1:45	Dave Levy	*Causes for the Decline/Scientific Recommendations*
2:15	**Break**	
2:30	Panel	*Where do we go from here?*
4:00	**End**	

Panel
Howie Wright
Ernie Crey
Brenda Gaertner
Gordon Sterritt

What we've got here is a failure to communicate

Paul Newman - Cool Hand Luke

We're putting the band back together!

Role of Science in the Cohen Inquiry Process

Fraser Sockeye Salmon

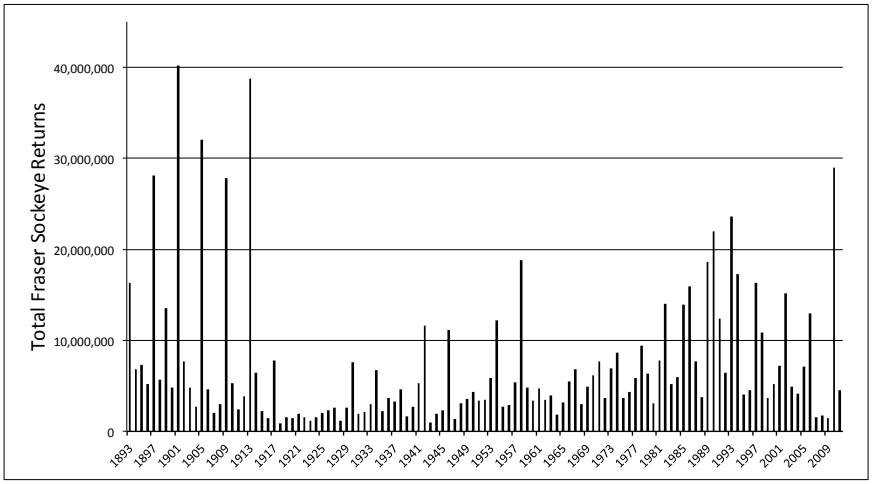
- One of the best protein sources on the planet
- Health food
- Cultural importance: “salmon people”
- Transport of marine resources onto your plate

sxwa7s

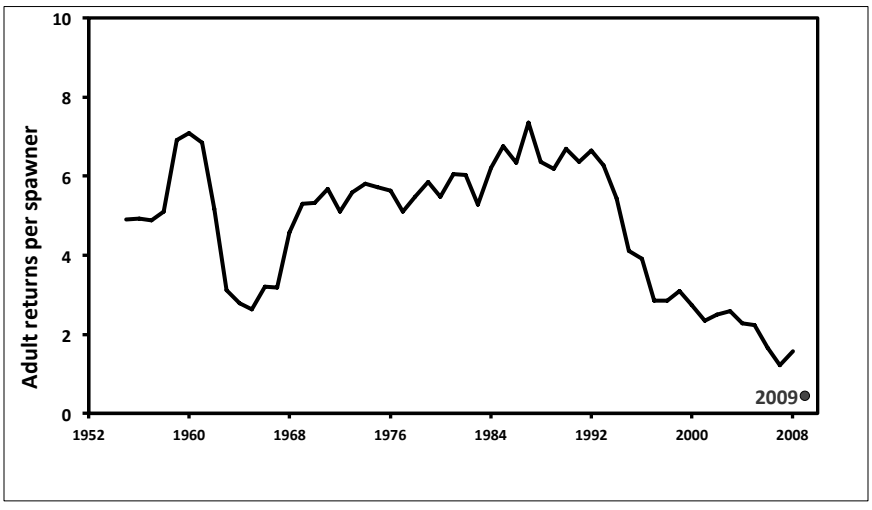
sts’wan

Sockeye salmon play a key role in aquatic and terrestrial ecosystems

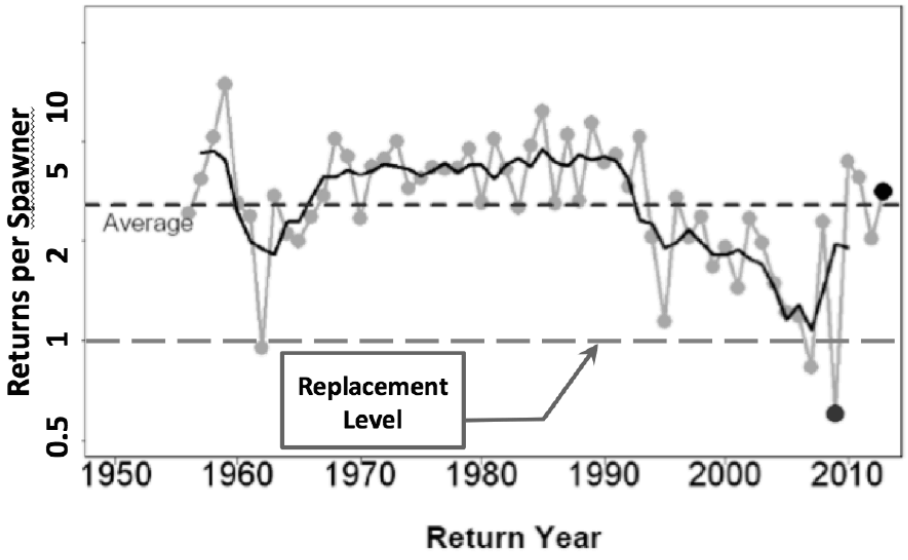
Total Fraser Sockeye Returns



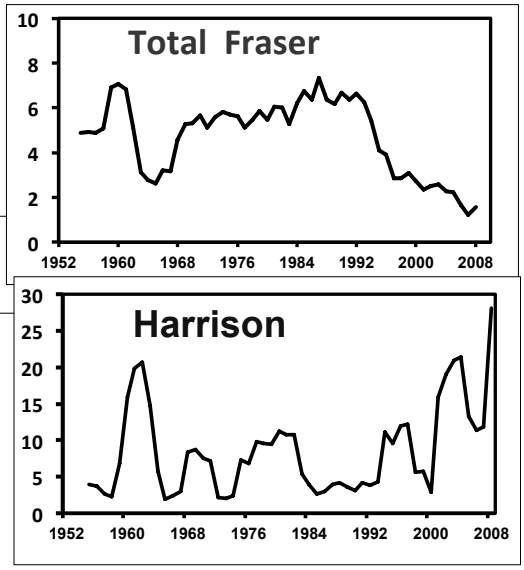
Fraser sockeye productivity - returns per spawner



Average Productivity Forecasted for 2013



Productivity (adult returns per spawner)



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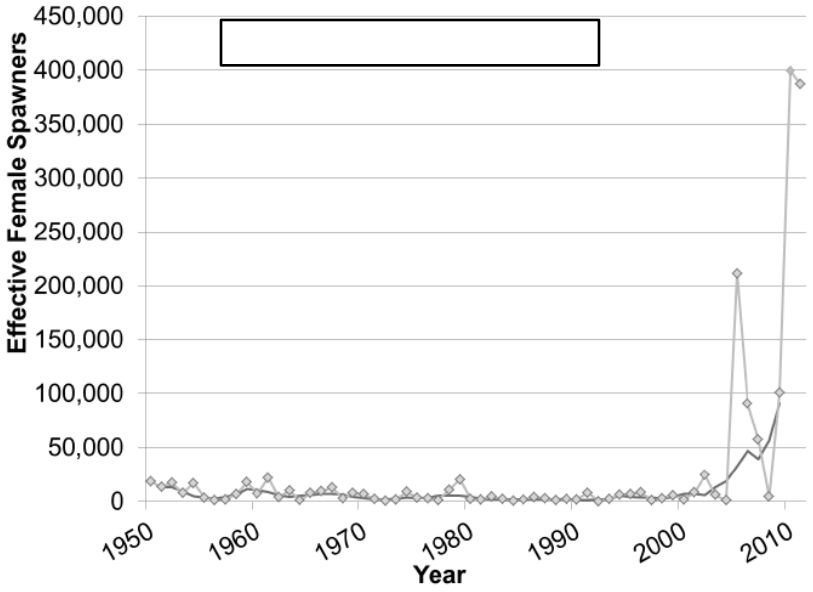
Harrison River Sockeye Escapement



2009 Sockeye return

- Pre-season forecast: **10.5 million**
- Post-season: **1.5 million**
- Total catch: 124,000

Lowest return since 1947

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Forecasting

Fraser sockeye abundance forecasts can be hit or miss

Forecasting models for sockeye

Peterman, R.E. 2007. Can we do pre-season forecasting effectively? If not, what can we do instead? Simon Fraser University.

- 11 forecasting models
- "Hybrid sibling forecasting model" was the best model for about half the 37 sockeye stocks analysed
- Average forecasting error of this model > 60%

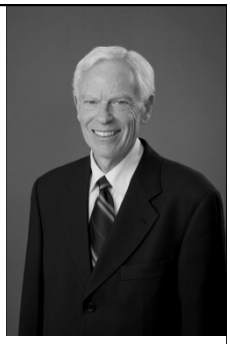
Is History Repeating Itself?

- Pearse 1992: 500,000 sockeye disappeared
- Fraser 1994: 1,000,000 sockeye disappeared
- Williams review (IHPC) 2004: "large numbers of unaccounted fish"

2009: a different kettle of fish

Drastic drop in sockeye numbers preceded adult entry into coastal areas

Cohen Commission TORs



- Investigate and make findings of fact without seeking to find fault
- 2 declines: long-term and 2009
- Recommendations: 1) the future sustainability of the Fraser sockeye fishery and, 2) DFO management practices
- 2 streams: science and management
- Final Report delivered to Parliament October 29, 2012

21 Participants with Standing the largest number in Canadian history

1. Government of Canada
2. Province of British Columbia
3. Pacific Salmon Commission
4. BC Public Service Alliance of Canada
   Union of Environment Workers BC
5. Rio Tinto Alcan Inc.
6. BC Salmon Farmers Association
7. Seafood Producers Association of BC
8. Aquaculture Coalition:
   Alexandra Morton
   Raincoast Research Society
   Pacific Coast Wild Salmon Society
9. Conservation Coalition:
   Coastal Alliance for Aquaculture Reform
   Fraser Riverkeeper Society
   Georgia Strait Alliance
   Raincoast Conservation Foundation
   Watershed Watch Salmon Society
   Mr. Otto Langer
   David Suzuki Foundation
10. Area D Salmon Gillnet Association
    Area B Harvest Committee (Seine)
11. Southern Area E Gillnetters Association
    BC Fisheries Survival Coalition
12. West Coast Trollers Area G Association
    United Fishermen and Allied Workers' Union
13. BC Wildlife Federation
    BC Federation of Drift Fishers
14. Maa-nulth Treaty Society
    Tsawwassen First Nation
    Musqueam First Nation
15. Western Central Coast Salish First Nations:
    Cowichan Tribes
    Chemainus First Nation
    Hwlitsum First Nation
    Penelakut Tribe
    Te'mexw Treatv Association
16. First Nations Coalition:
    First Nations Fisheries Council
    Aboriginal Caucus of the Fraser River Aboriginal Fisheries Secretariat
    Fraser Valley Aboriginal Fisheries Society
    Chehalis Indian Band
    Secwepemc Fisheries Commission of the Shuswap Nation Tribal Council
    Upper Fraser Fisheries Conservation Alliance
    Adams Lake Indian Band
    Carrier Sekani Tribal Council
    Council of Haida Nation
    Other Douglas Treaty First Nations who applied together (the Snuneymuxw, Tsartlip and Tsawout)
17. Métis Nation British Columbia
18. Sto:lo Tribal Council
    Cheam Indian Band
19. Laich-kwil-tach Treaty Society
    Chief Harold Sewid
    Aboriginal Aquaculture Association
20. Heiltsuk Tribal Council
21. Musgagmagw Tsawataineuk Tribal Council

Guiding Principles

(Walkerton Inquiry – Judge Dennis O'Connor

- Be open
- Provide opportunities for public participation
- Provide open and fair processes
- Be thorough but not exhaustive
- Be timely
- Be responsible

Evidence obtained from:

- 573,000 disclosed documents
- 128 days of hearings
- 182 witnesses
- 14,000 pages of transcripts
- 2147 exhibits
- 900 public submissions
- 10 community visits
- 15 technical reports

Researchers

PICES

MACDONALD ENVIRONMENTAL SCIENCES LTD.

LGL LIMITED environmental research associates

Golder Associates

ESSA

SFU SIMON FRASER UNIVERSITY

THOMPSON RIVERS UNIVERSITY

UBC

UNIVERSITY OF CALGARY

HOKKAIDO UNIVERSITY FOUNDED 1876

OSU Oregon State UNIVERSITY

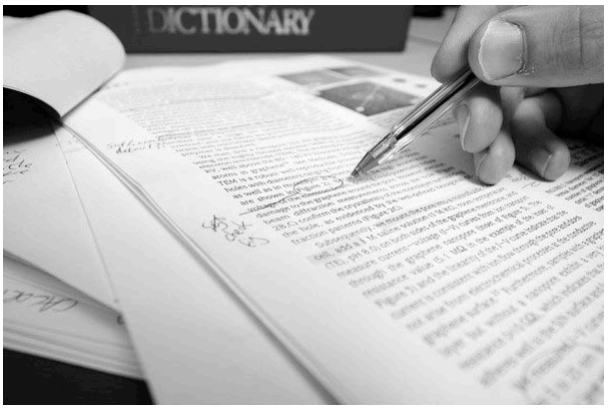
Primary Audience for Technical Reports

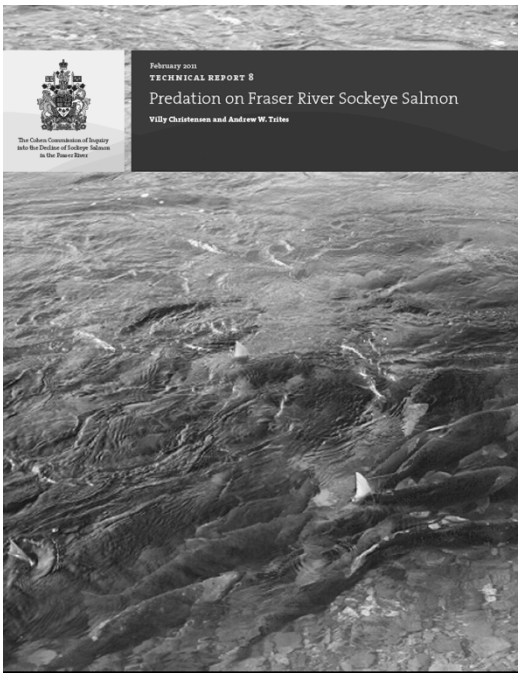
1. Commissioner Cohen
2. 21 Participants and their legal counsel
3. General public and other scientists

Methods and Evidence

- Literature Review
- Compilation of Data
- Quantitative Analysis
- Modeling
- GIS
- Evidence in a legal context

Peer Review





15 Technical Reports

1: Diseases and Parasites
1A: Hatchery Diseases
2: Contaminants
3: Freshwater Ecology
4: Marine Ecology
5A: Salmon Farms
5B: Salmon Farms
5C: Salmon Farms
5D: Salmon Farms
6: Cumulative Impacts
7: Fisheries Management
8: Predation
9: Climate Change
10: Production Dynamics
11: withdrawn
12: Habitat Use in the LFR and SOG

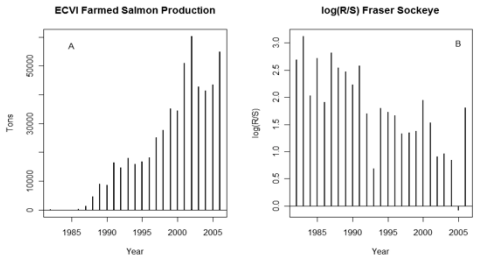
Salmon Farms: Part 2

- Technical Report 5A: Korman
- Technical Report 5B: Connors
- Technical Report 5C: Noakes
- Technical Report 5D: Dill

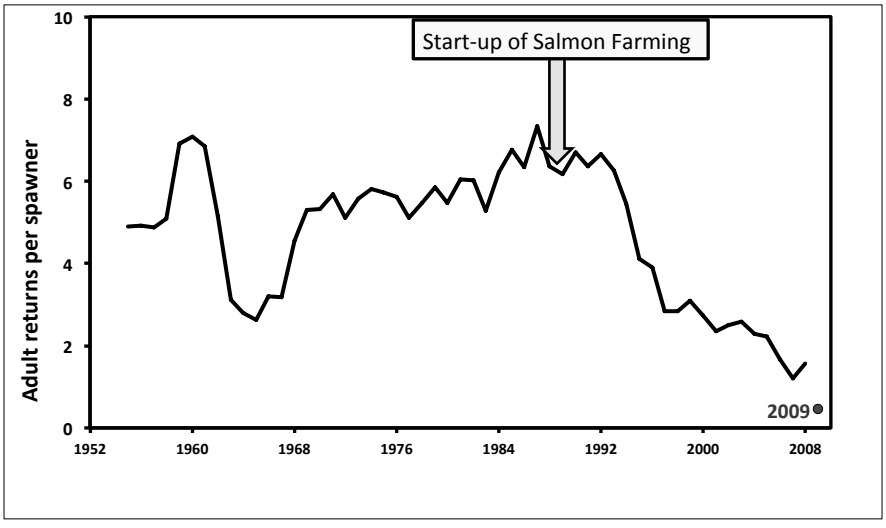
Technical Report 5C: Noakes

THOMPSON RIVERS UNIVERSITY

- No significant correlation between farmed salmon production and the returns of Fraser sockeye, problem with serial autocorrelation
- Disease originating from salmon farms has not contributed to the decline of Fraser sockeye.
- In any given year, a small number of farms (typically less than 5) along the main migration route for FRSS reported any of 4 'high risk' diseases.



Spurious Correlation



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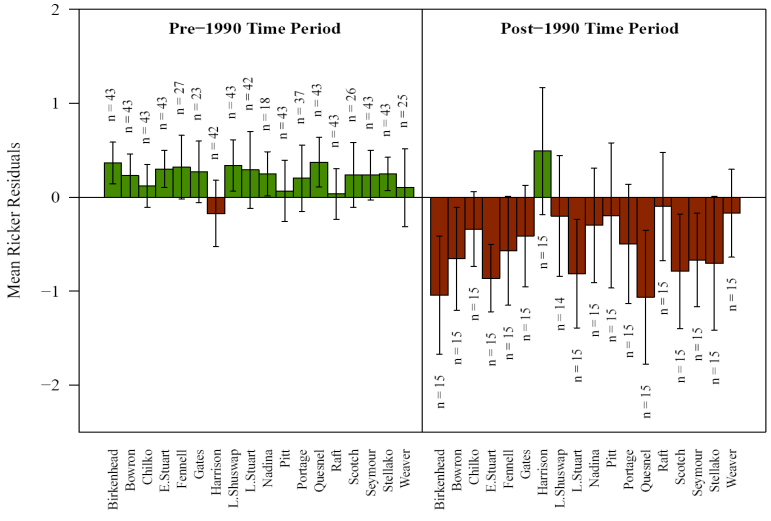
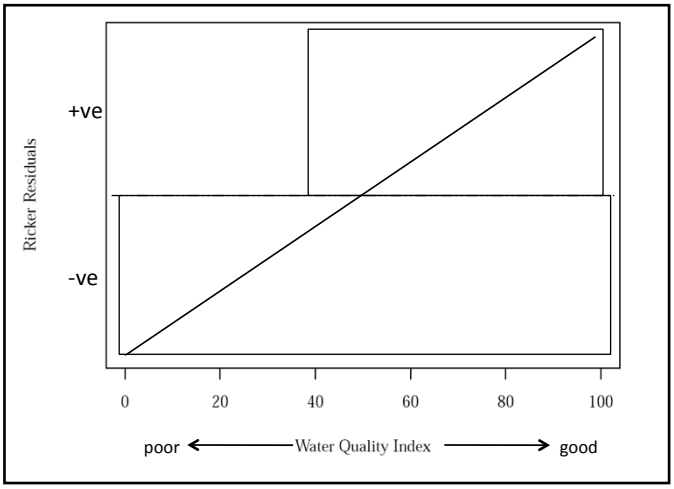
Technical Report 2: Contaminants

Mean Ricker Residuals for Fraser River Sockeye Salmon Stocks for 1948-1990 and 1991-2005



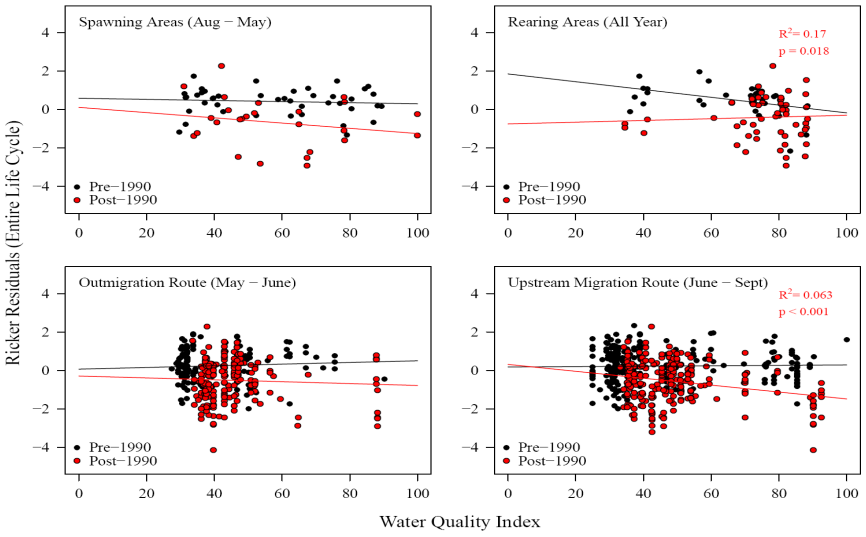
The 95% confidence interval of the mean and sample size are shown

Expected Relationship between Residuals and WQI



WQI is calculated by determining the proportion, frequency and magnitude of toxicity threshold exceedences

Fraser River Sockeye Salmon Productivity and Water Quality Index by Habitat Use



Each data point represents the water quality index during exposure for an individual stock

Conclusions: Contaminants

- Results do not implicate water quality conditions as a major factor in sockeye declines
- However endocrine disruptors (e.g PAHs) and contaminants of emerging concern (e.g. pharamaceuticals, personal care products) **<u>may have contributed</u> to sockeye declines since about 1990**
- Harrison River sockeye have highest exposure yet they show the highest (recent) productivity

Diseases and Parasites

OSU Oregon State University

Dr. Michael Kent
Director, Center for Fish Disease Research

Task: Determine the impacts of diseases and parasites and their relationship with Fraser sockeye declines

Out of 30 sockeye diseases, 6 were considered High Risk:

- IHN Virus
- 3 bacterial diseases
- Ich (Protozoan)
- Parvicapsula (Fungus)

Infectious Salmon Anemia (ISA)

- ISA discovery triggered 3 days of Commission hearings
- Testing methods
- ISA is a disease of Atlantic salmon that can be carried by Pacific salmon but no evidence that it is infectious