

Final Report to the Pacific Salmon Forum

**Out-group Program of the Broughton
Ecosystem Project (Bella Bella Region)
2007-2008**



Prepared by Michael Price



C.3 - Out-group Program of the Broughton Ecosystem Project (Bella Bella Region)

This research summary is based on presentations given at Pacific Salmon Forum meetings on November 5-6 and represents the opinions of the researcher(s) named below and not necessarily those of the Forum or the Science Advisory Committee. The summary has not been peer reviewed and the data contained within are preliminary, are the property of the researchers involved, and may not be used in any manner without their express permission.

Michael Price - mike@raincoast.org

Raincoast Conservation Foundation
15232 Babine Lake Road
Smithers, BC
V0J-2N7
Ph: 250-846-5451

John Reynolds - reynolds@sfu.ca

Department of Biological Sciences
Simon Fraser University
Burnaby, BC, V5A 1S6
Ph: 778-782-5636
Fax: 778-782-3496

Key Points

- Juvenile salmon in the Bella Bella region, an area that lacks salmon farms, host low levels of sea lice (3.5%) that can be considered natural background levels.
- In regions where there are fish farms, significantly more juvenile salmon host sea lice in areas near to farms (< 1 km) than farther from farms (> 1 km): Klemtu 21.8% near, versus 3.6% further away; Discovery Islands 37% near, versus 26.8 % further away.
- Elevated levels of lice nearer to farms included significantly greater proportions of *Lepeophtheirus salmonis*, a salmon-specific species, than *Caligus clemensi*, which is more of a generalist (found on numerous fish species).
- Close proximity to active salmon farms (<1 km) predicts abundance of lice on juvenile pink and chum salmon better than salinity or temperature.

Project Report

The purpose of this project was to examine the intensity of sea lice infection on wild juvenile pink and chum salmon in the Bella Bella region of the BC central coast, an area without fish farms, for comparison with intensities of infection from other regions that contain fish farms.

The project collected two years of data on ambient sea lice infection levels in the Bella Bella region since 2007 (Figure 1a,b). We also compared data with active salmon farming regions and our data can also be compared with information from the Broughton Archipelago (presented elsewhere in this report). Juveniles were collected by beach seine, and 40 juveniles were haphazardly selected and live-sampled from each set. All juveniles hosting lice were frozen individually in whirl-pak bags and forwarded to the Skeena Fisheries Commission lab for detailed lice identification. A random sample of 3 juveniles per sampling day judged to be free of lice was examined with a dissecting microscope as a quality control measure to ensure that lice were not being overlooked (none were). Sea surface salinity and temperature were recorded at each sampling location (Figure 2).

The goal set out in the original proposal was to compare ambient lice levels in an area that lacks salmon farms (Bella Bella) with data collected by other researchers on lice levels in the Broughton Archipelago, where there are farms. Comparisons with escapement were also envisaged, though these will not be possible until the 2009 spawning season. However, louse levels in the Bella Bella region proved to be so low (see below), that there is no chance of being able to detect inter-annual correlations with subsequent returns of spawners. We were, however, able to strengthen the baseline comparisons with farmed regions by adding in preliminary results from studies of two more regions: Klemtu to the north of Bella Bella, and the Discovery Islands, south of the Broughton. The BC Pacific Salmon Forum did not fund the Klemtu or Discovery Islands research, which was carried out by Michael Price.

Juvenile pink and chum salmon of the Bella Bella region hosted lice levels averaging 3.5% during 2007-2008 (Figure 2; Table 1). This was based on weekly samples from 14 sites. Lice levels in the Klemtu region north of Bella Bella, where 5 farms were active, averaged 3.6% at control sites (n = 1,051 fish from 5 sites), and 21.8% near active farm sites (n = 1,113 fish from 5 sites; Figure 3); temperature and salinity ranged from 6.9-11.8 °C and 14.3-31.5 ppt, respectively. Among the Discovery Islands region south of Bella Bella where more than 23 farms operate, lice levels averaged 26.8% at control sites (n = 1,004 fish from 5 sites), and 37.8% near active salmon farms (n = 2,567 fish from 9 sites; Figure 3); temperature and salinity ranged from 7.4-17.0 °C and 16.0-33.0 ppt, respectively. Ratios of lice species favour *L. salmonis* near active salmon farms compared with *C. clemensi* away from farms ($\chi^2=6.814$, $df=1$, $p<0.001$). A series of general linear models and AIC tests show that exposure to active salmon farms is a better predictor of lice levels on juvenile salmon than are salinity or temperature.

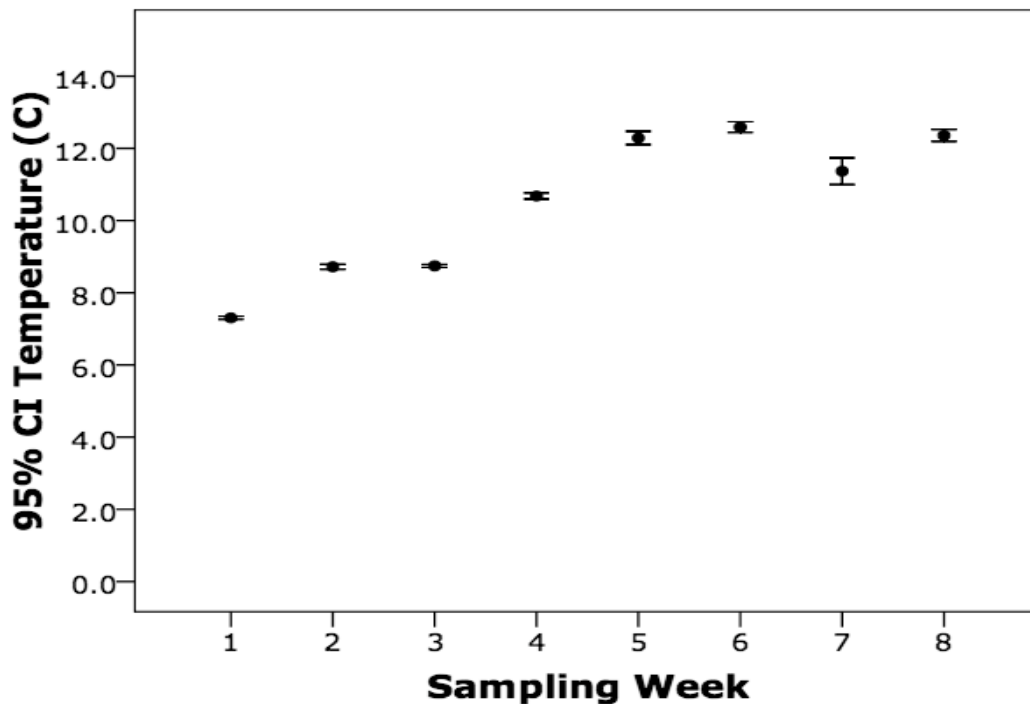


Figure 1a. Mean and 95% confidence intervals (± 2 SE) for surface water temperature among the Bella Bella region during April to June 2007-2008.

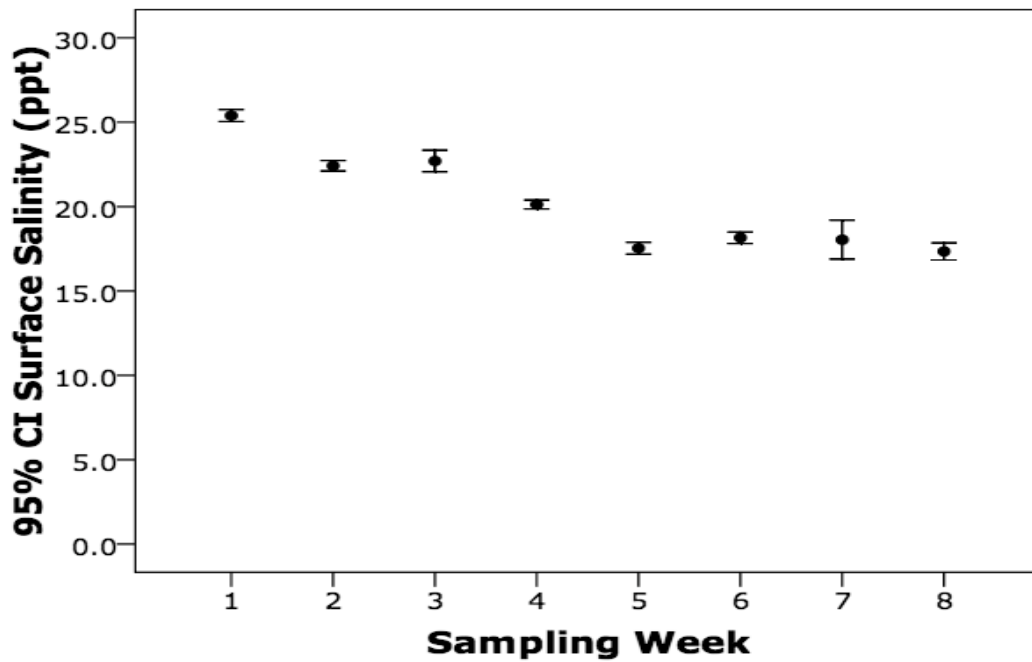


Figure 1b. Mean and 95% confidence intervals (± 2 SE) for surface water salinity among the Bella Bella region during April to June 2007-2008.

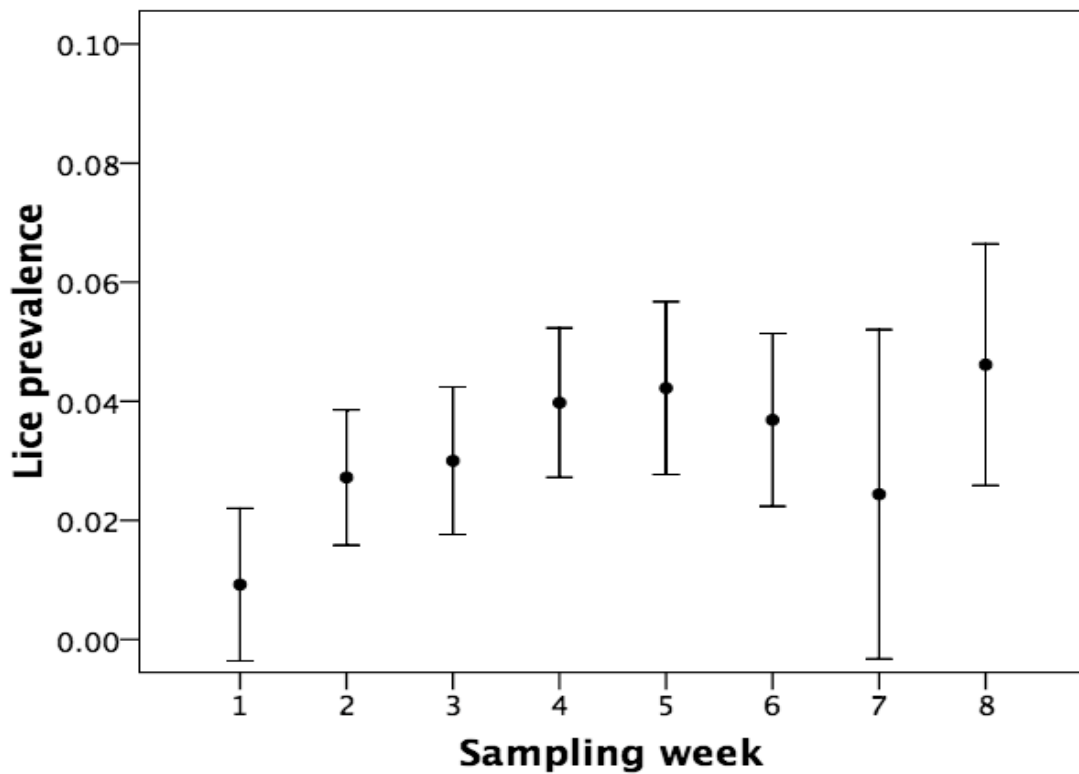


Figure 2. Mean and 95% confidence intervals (± 2 SE) for lice prevalence on juvenile salmon over the 8-week sampling period (April to June) in the Bella Bella region during 2007-2008.

Table 1. Comparisons of louse species identified on juvenile salmon among the Bella Bella region during 2007-2008.

2007					
Species	No. of fish sampled	<i>L. salmonis</i>		<i>C. clemensi</i>	
		#	prevalence (%)	#	prevalence (%)
Chum	1,504	32	2.1	35	2.2
Pink	479	6	1.3	12	2.3
Coho	86	0	0	0	0
Total	2,070	38	1.8	47	2.1

2008					
Species	No. of fish sampled	<i>L. salmonis</i>		<i>C. clemensi</i>	
		#	prevalence (%)	#	prevalence (%)
Chum	2	9	0.5	48	2.5
Pink	955	4	0.4	26	2.7
Coho	16	1	6.3	0	0
Total	2,888	14	0.5	74	2.5

2007-2008 Combined

Species	# Fish	Prevalence (%)	Abundance (%)	Intensity	Lice/gram
Chum	3,420	3.5	3.6	1.05	0.645
Pink	1,434	3.3	3.3	1.02	0.995
Coho	102	1.0	1.0	1.00	0.002
Sockeye	2	0	0	0	0

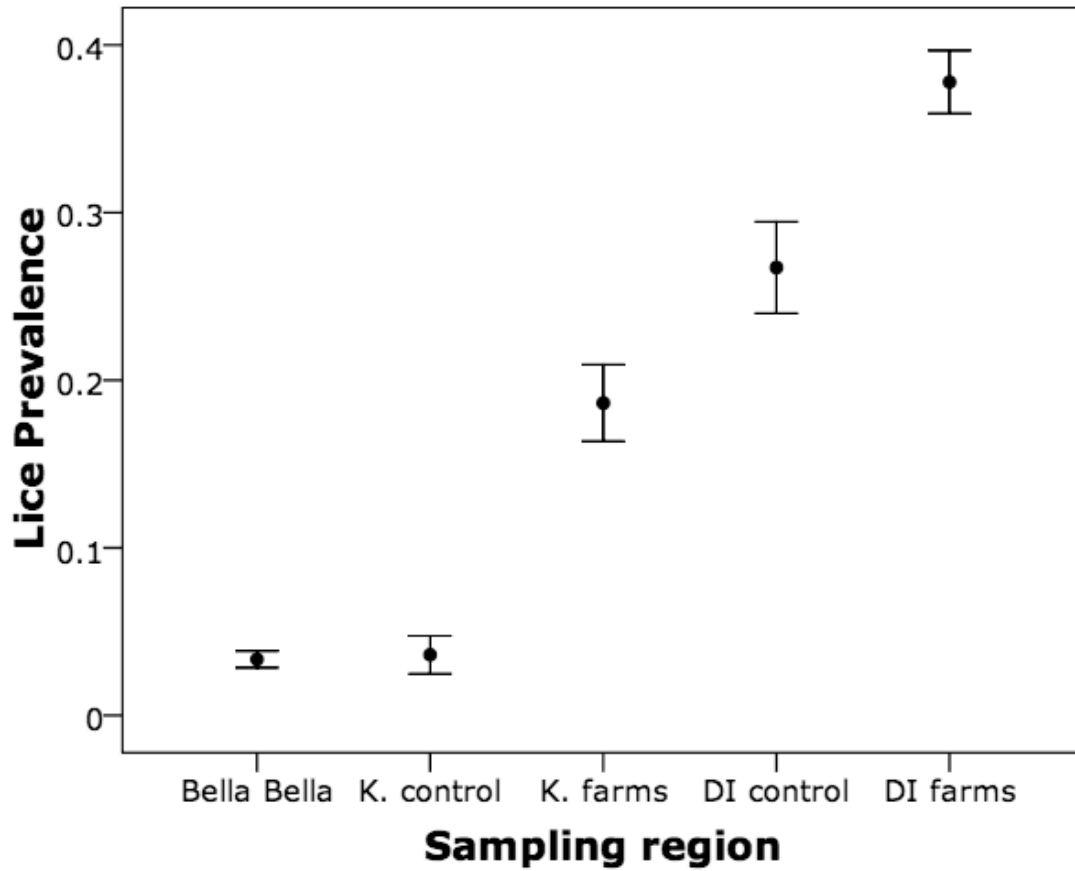


Figure 3. Mean and 95% confidence intervals (± 2 SE) for sea lice prevalence levels compared between Bella Bella, Klemtu control and farm sites, and Discovery Islands control and farm sites during 2007-2008 [Klemtu study only occurred in 2008]. Red bars represent significantly elevated lice infection values.