Wild Juvenile Salmonid Monitoring Program Quatsino Sound, BC 2016

Prepared for

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Summary

Beach seine sampling was conducted on behalf of Marine Harvest Canada in Quatsino Sound, BC in 2016. Sampling was completed to monitor sea lice abundance, prevalence and intensity on juvenile wild salmon within Quatsino Sound in support of the Aquaculture Stewardship Certification process for Marine Harvest Canada finfish aquaculture sites in the area. This monitoring will also aid in evaluating the effectiveness of the current *Pacific Aquaculture Regulations* DFO notification threshold of an average abundance of motile *Lepeophtheirus spp*.equal or greater than three lice per cultivated Atlantic salmon.

Sampling was conducted during two separate sampling events in April and May 2016, selected to coincide with the peak outmigration period of juvenile salmonids. Sampling was completed at 10 sites within Quatsino Sound and Holberg Inlet, BC. The sites were selected based on their locations relative to existing aquaculture sites located in the area. Sampling was completed with the support of the Ḵusgimukw people of the Quatsino First Nation.

Thirty individuals from each target fish species (Pacific salmonids) or the total number of captured individuals from each target species (if less than 30 were captured) were collected from each of the 10 sites during the sampling events. Total catch numbers of each species were recorded. Water quality measurements including surface temperature and salinity were recorded at each site during each sampling event.

Collected sample fish were frozen and delivered to the Center for Aquatic Health Sciences (CAHS) for laboratory analysis. Sea lice infection data was tabulated by CAHS and provided to Mainstream Biological Consulting for reporting. Sea lice observed on the individual fish specimens during laboratory analysis were identified as either *Lepeophtheirus spp.* or *Caligus sp*. These lice are assumed to be *L. salmonis* and *C. clemensi* due to the lack of documented infections of Pacific salmon by other species. The lice were recorded by life stage and the sex of pre-adult or adult motile lice was determined.

This data summary report documents the observed sea lice infection rate on retained wild juvenile salmon collected in Quatsino Sound and Holberg Inlet in 2016. A total of

257 wild juvenile salmonids underwent lab analysis for sea lice infection including 235 chum salmon (*Oncorhynchus keta*), 19 chinook salmon (*Oncorhynchus tshawytscha*), one coho salmon (*Oncorhynchus kisutch)* and two pink salmon (*Oncorhynchus gorbuscha)*. From the total sample population 46 juvenile salmonids were infected with 69 sea lice. The calculated prevalence for the total sample population was 17.9 % and the sea lice abundance was 0.27 for the sample population collected in Quatsino Sound and Holberg Inlet in 2016.

Chum salmon smolts were captured in significantly greater numbers than any other species. A total of 938 chum salmon were captured, representing 97.7% of all captured salmonids. Of the 938 chum captured, 253 were kept for lab analysis for sea lice infection. A total of 36 chum smolts were found to be infected with a total of 54 lice resulting in a calculated prevalence of 15.3%, abundance of 0.23 and an average intensity of 1.5 for the chum salmon sample population.

A total of 31 *Lepeophtheirus salmonis* lice of various life stages were identified on 29 individual samples and 38 *Caligus clemensi* lice were identified on 27 fish. There were 10 sample fish that were infected by at least one louse of each species. For the chum salmon sample population, a total of 25 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 23 juvenile chum salmon and 29 *Caligus clemensi* sea lice were found on 22 of the juvenile chum salmon analyzed in the lab. There were nine juvenile chum salmon that were infected with both a *L. salmonis* and *a C. clemensi* sea louse.

A comparison of the prevalence, abundance and average intensity of sea lice species found on chum salmon was completed for sample data from 2015 and 2016 collected in Quatsino Sound and Holberg Inlet. This data is presented in the following summary table with additional yearly comparisons of juvenile wild salmon monitoring results presented in Appendix IV.

Year	*Caligus clemensi*			*Lepeophtheirus salmonis*		
	Prevalence	Abundance	Average Intensity	Prevalence	Abundance	Average Intensity
2015	13.6 %	0.24	1.75	12.4 %	0.21	1.72
2016	8.6 %	0.11	1.32	8.9 %	0.10	1.09

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1.0 Introduction

At the request of Marine Harvest Canada, beach seine sampling to capture wild juvenile salmon to be analyzed for sea lice infection took place at 10 sites located in Quatsino Sound and Holberg Inlet, BC (Figure 1). The sample collection occurred during two sample events in 2016 on April 5 and May 4. These weeks were selected to coincide with the estimated peak outmigration dates of juvenile salmonids. Sampling was completed with the support of the Gusgimukw people of the Quatsino First Nation.

Parasitic copepods from the family Caligidae (sea lice) found in the coastal waters of British Columbia are divided into two genera: *Lepeophtheirus* and *Caligus*. Eleven species of *Lepeophtheirus* have been identified infecting fish in the Pacific Ocean, while only one species of *Caligus* (*Caligus clemensi*) have been identified (Margolis and Arthur 1979; McDonald and Margolis, 1995). *Caligus clemensi* infect an extremely wide range of natural hosts in the marine environment including salmonids and non-salmonids; while *L. salmonis* natural hosts on the Pacific coast have been found to include Pacific salmon, threespine stickleback and Pacific herring. *Lepeophtheirus spp.* sea lice found on salmonid specimens were assumed to be *L. salmonis* due to the lack of documented infections of Pacific salmon by other *Lepeophtheirus* lice species (Jones and Nemec, 2004).

Both of these genera have similar life histories and developmental stages (Kabata, 1972; Johnson and Albright, 1991a). The sea lice hatch from eggs and develop through two free-swimming naupilii stages before developing into an infectious free-swimming copepodid. At this point, the sea lice attach to their host and develop through four chalimus stages. The chalimus are “non-motile” and are attached to their host by a frontal filament. The final chalimus stage terminates as the sea lice become “motile” and are no longer attached to their hosts by the frontal filament. The sea lice can now move freely on the fish as they develop through a pre-adult stage before becoming reproductively viable adults.

Water temperature and salinity are two environmental variables that influence sea lice development, growth, survival and reproductive rate. In British Columbia, surface seawater temperatures range from approximately 6 °C to 13 °C. Research on sea lice abundance conducted in the Broughton Archipelago and elsewhere on the coast of British Columbia indicates that surface water temperature during the winter months does

not appear to hinder the season abundance of *L. salmonis* (Saksida et al. 2007a, b). The rate of development and the generation times for *C. elongates* are strongly temperature dependent (Tully 1992) and although this research has not been conducted, similar relationships with temperature are to be expected for *C. clemensi* (Jones and Johnson, 2015). Survival and development of *L. salmonis* is optimal in high salinity seawater. Under laboratory conditions copepodid survival was limited to conditions where salinity was greater than 10 ppt (Johnson and Albright, 1991b).

Marine Harvest Canada requested monitoring of sea lice abundance, prevalence and intensity on juvenile wild salmon within Quatsino Sound and Holberg Inlet in support of Aquaculture Stewardship Certification for their aquaculture sites within the area. This monitoring will also aid in evaluating the effectiveness of the current *Pacific Aquaculture Regulations* DFO notification threshold of an average abundance of motile *Lepeophtheirus spp*.equal to or greater than three lice per cultivated Atlantic salmon (PAR Section 7.7). This data summary report documents the observed sea lice infection rates on retained juvenile salmonids collected in Quatsino Sound and Holberg Inlet in 2016. This represents the second year of wild juvenile salmonid monitoring in Quatsino Sound and Holberg Inlet conducted by Marine Harvest Canada.

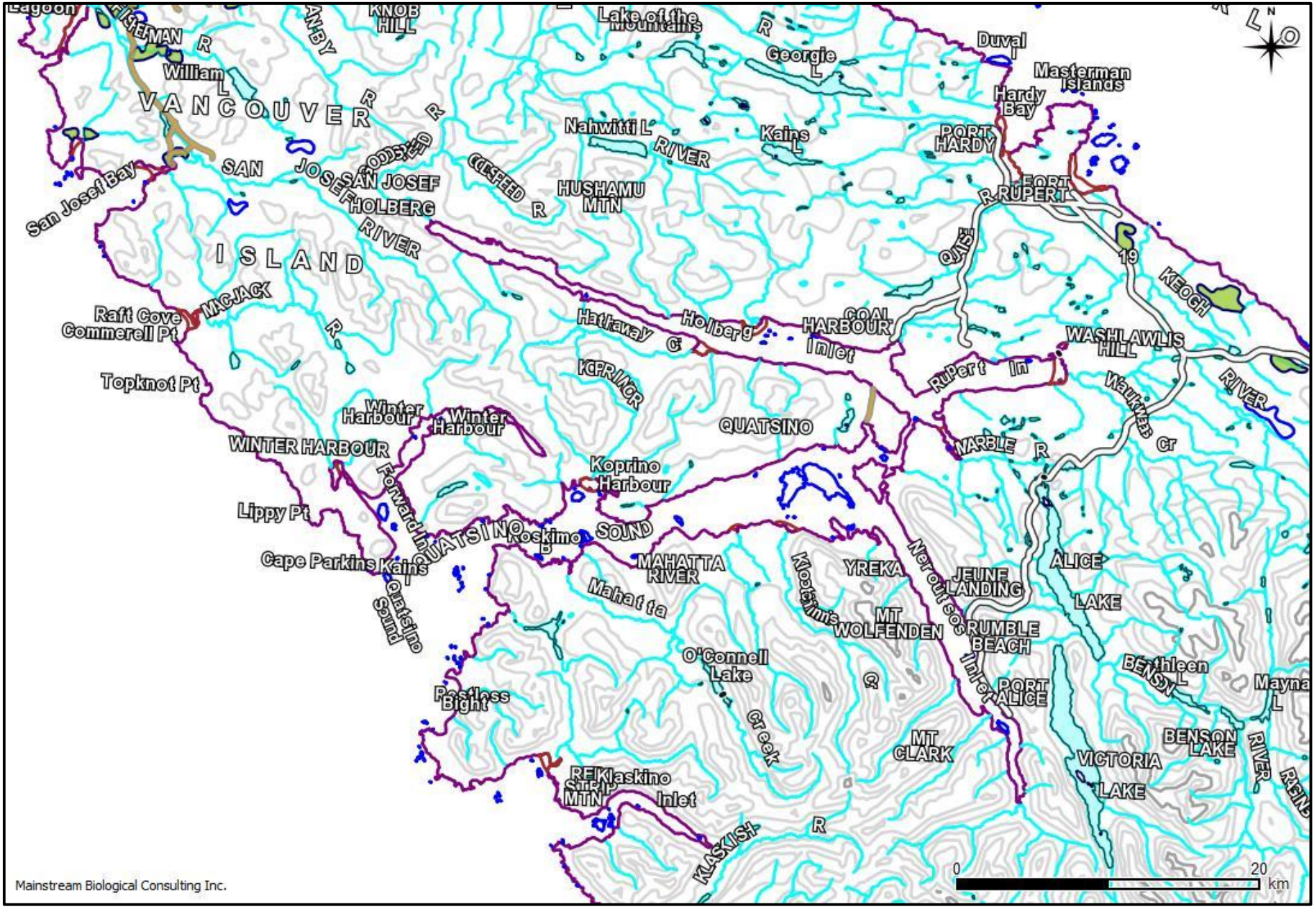

Figure 1: An overview map showing the location of Quatsino Sound and Holberg Inlet on the west coast of northern Vancouver Island, BC.

2.0 Methods

The fish inspected for sea lice infection were collected from 10 sites in Quatsino Sound and Holberg Inlet, BC. These sites were chosen based on their locations relative to existing Marine Harvest Canada aquaculture sites in the area (Figure 2). The sites were sampled twice in 2016 on April 5 and May 4.

2.1 Site Locations

The 10 sites at which beach seining was conducted to collect specimens for sea lice analysis consisted of three sites in Holberg Inlet (Sites 1, 2 and 3) and seven sites in Quatsino Sound. The approximate locations of the 10 beach seine sites are shown in Figure 2. GPS coordinates collected in the field for the sites are presented in Table 1.

Table 1: The site number and location of the 10 beach seine sites where fish were collected for sea lice analysis in Quatsino Sound and Holberg Inlet in 2016.

Site #	UTM Coordinates (NAD 83)		
	UTM Zone	Easting	Northing
1	9	594113	5604358
2	9	598764	5603542
3	9	599381	5603384
4	9	587297	5593031
5	9	585851	5591387
6	9	581818	5591805
7	9	580210	5590249
8	9	578392	5590120
9	9	578608	5592552
10	9	579737	5594278

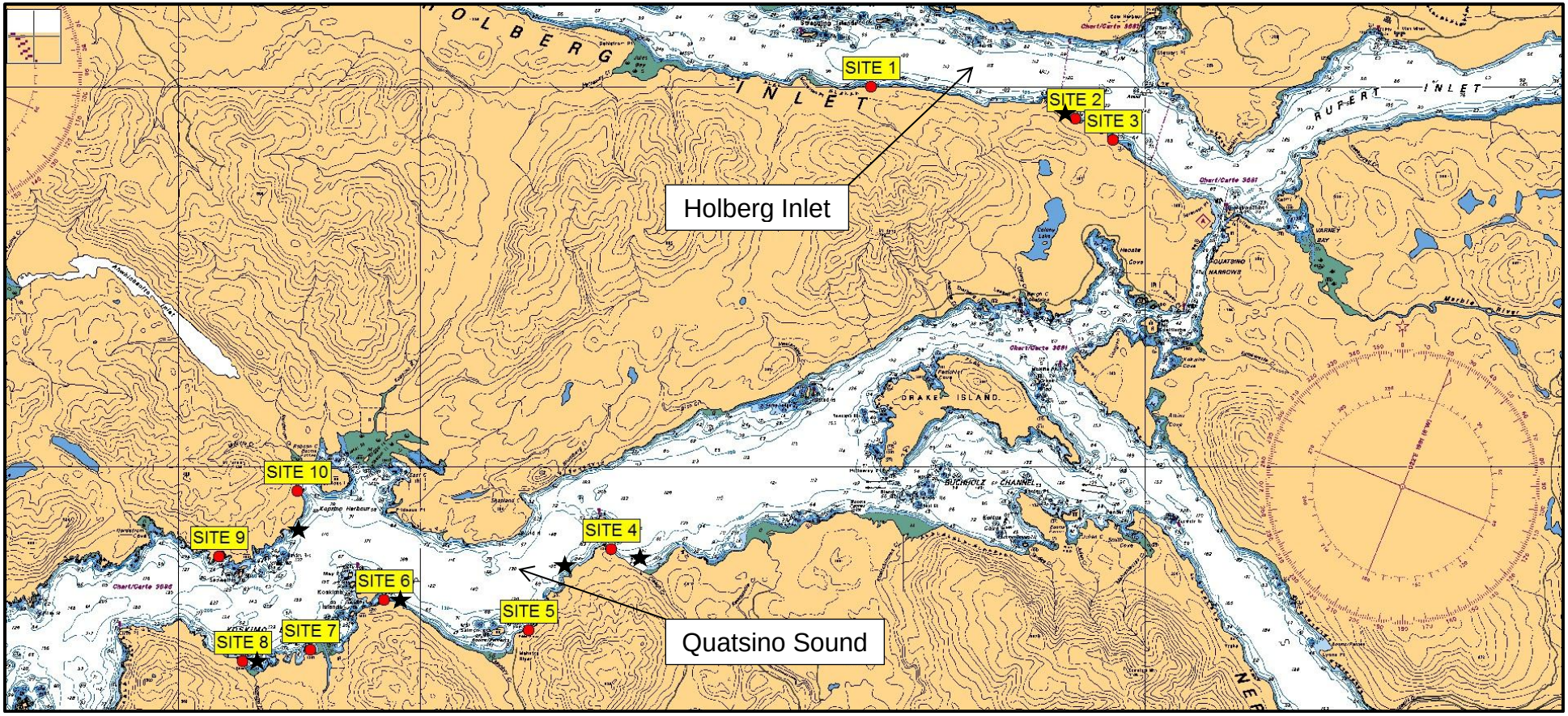

Figure 2: The locations of the 10 beach seine sites in Quatsino Sound and Holberg Inlet sampled in 2016. Marine Harvest Canada aquaculture site locations are indicated with a black star.

2.2 Field Procedures

Procedures for beach seining, fish collection and field data recording adapted from procedures utilized by the Department of Fisheries and Oceans (DFO) were used for juvenile salmon sampling by Mainstream Biological Consulting staff during sampling in Quatsino Sound and Holberg Inlet in 2016.

An 18ft Boston Whaler, powered by a 50 horsepower outboard motor, was used to access the beach seine sites. A 150 ft (45.7 m) long by 12 ft (3.7 m) deep beach seine net was used to capture specimens. The net was constructed in three 50 ft (15.2 m) sections. The centre bunt section consists of one-quarter inch diameter diamond mesh, while the two side panels (wings) consist of half-inch diameter diamond mesh. Floats were located every 30 cm along the top-line and a lead line weighted the bottom of the net.

A four person crew was utilized to conduct the beach seine sets and retrieve samples in a consistent manner at each of the 10 selected sites. All beaches were approached slowly by boat and one crewmember was put ashore with the towline from one end of the beach seine net. The onshore crewmember held the towline at one side of the sample site, while the second and third crewmembers ensured the net deployed smoothly off the bow or side of the boat. The fourth crewmember, the boat operator, backed the boat in a wide semicircle towards the opposite side of the sample site and remained on the boat. When the net was fully deployed, the second and third crewmembers stepped into the shallow water with the towline or tossed it to the awaiting crewmember on shore. A slow retrieval of the net began immediately.

As the net was slowly retrieved, the probe of a YSI85 water meter was placed just below the water surface at the stern end of the boat, to collect salinity and water temperature data. The YSI85 meter was calibrated weekly with de-ionized water while traveling to the sample sites.

The crewmembers retrieved the net evenly from opposite ends ensuring that the lead line remained as close to the bottom as possible. All retrieved netting was piled on the beach above the water level. As the retrieval reached the net bunt, the lead line was retrieved at a faster rate than the floats to allow the netting of the bunt to form a bag under the captured fish. The lead line was then pulled up onto the beach above the

water level. One crewmember worked their way around the outside of the net in the shallow water to ensure the floats stayed above the surface of the water. In this manner a small, shallow bag formed from the bunt of the net held the captured fish in the water.

The three shore crew members participated in the collection of individual fish to ensure that captured fish remained in the net for as short a period of time as possible. The net was manipulated, if necessary, in response to rising or falling tides in order to ensure the captured fish remained in the net and were held in sufficient water to minimize stress. The level of sufficient water was dependant on the size and numbers of captured fish, but was generally thought of as enough water to minimize fish contact with the net or with other fish.

A total of 30 individuals from each target species captured or all of the individuals present (if less than 30) were collected as samples for sea lice infection analysis. Individual fish were "swam" into an appropriately sized whirlpac bag. All handling of fish was kept to a minimum.

When all the fish for retention were collected, a total catch number for each species was recorded. The fish remaining in the net were counted out of the seine net, or an estimate of the remaining fish was made (estimates were used when it appeared that more than 500 individuals from any given species remained in the net). The total of fish remaining in the net was added to the number of retained individuals to calculate a total capture number for a given species.

A crewmember recorded all the information from each beach seine set in a standardized field form. The information recorded included the following:

- The site number (Site 1-10);
- The date;
- The time at the end of the individual fish collection;
- Comments on weather and oceanic conditions;
- Total capture and retained fish numbers for each specimen group; and
- Water temperature (°C) and salinity (ppt) to one decimal place.

The retained fish from each site were packaged separately in re-sealable bags and labelled with the site number (Site 1-10) and the week number (Week 1 or 2). Site

sample bags were placed in a portable freezer, which was plugged into the boat's battery. The specimens were transferred to a freezer immediately upon return from the field.

The beach seine net was reloaded onto the bow of the boat. Crewmembers scanned the net for obvious holes, which were repaired immediately if found. The YSI85 meter was shut off and stored, and all gear and coolers were reloaded into the boat.

The above procedures for beach seine net deployment and retrieval, as well as those described for fish collection, were repeated at all 10 sample sites.

2.3 Laboratory Procedures

Collected sample fish were frozen and delivered to the Center for Aquatic Health Sciences (CAHS) for laboratory analysis. Sea lice observed on the individual fish specimens during laboratory analysis were identified as either non-motile chalimus, or motile pre-adults and adults. Lice identified as being in any of the four chalimus stages were identified as *Lepeophtheirus salmonis* or *Caligus clemensi*. Motile lice, either pre-adults or adults, were identified as either *Lepeophtheirus salmonis* or *Caligus clemensi* and the sex of the louse was determined. Sea lice infection data was tabulated by CAHS and provided to Mainstream Biological Consulting for reporting.

Data provided by CAHS also included measured fork length in millimetres and weight (recorded to the nearest tenth of a gram). Lengths and weights were recorded with the specimen's corresponding sea lice analysis results.

2.4 Data Analysis

Surface water quality data collected for temperature and salinity was summarized to report the minimum and maximum values as well as the calculated averages for each sample week.

Beach seine fish sample composition was summarized by species and site for each week. The recorded fork lengths and weights of the juvenile salmon sample population were summarized to present minimum and maximum values as well as calculated averages. Sea lice infection rates, including the number of infected fish and the number of sea lice identified, were determined for the juvenile salmon sample population.

Prevalence, as defined as the number of host fish found to have one or more sea lice compared to the total number of host fish examined, was determined for the sample population and for chum salmon. Abundance, as defined as the total number of sea lice observed compared to the total number of host fish examined, was also determined for the sample population and chum salmon. The intensity of sea lice infection, as described by the number of sea lice found on a single salmon was summarized. Average intensity was calculated by dividing the total number of sea lice identified by the number of infected fish. Presentation of infection rates by site was limited to the chum salmon sample population only as these were the only species with sufficient numbers to warrant this analysis.

Statistical analysis of the spatial and temporal distribution of sea lice was not conducted. Spatial and temporal analysis has been limited to the simple presentation and discussion of the number of sea lice found on fish specimens collected from each site during each of the sampling events.

3.0 Results

The following sections outline the results of beach seine collection and subsequent sea lice inspection of juvenile salmonids collected from Quatsino Sound and Holberg Inlet, BC, in 2016. Water quality field data is presented in Appendix I, beach seine fish capture data is included in Appendix II and data on the juvenile salmon sample population including sea lice lab analysis results provided by CAHS are located in Appendix III.

3.1 Water Quality Parameters

Surface measurements of water temperature and salinity, taken during beach seining at each of the 10 sites during the two sample periods, are presented in Table 2. The field data recorded at each site is included in Appendix I.

Recorded surface water temperatures ranged from a low of 8.1 °C recorded at Site 10 on April 5, 2016, to a high of 11.6 °C recorded at Site 6 on May 4, 2016 (Table 2; Appendix I). Calculated weekly average surface water temperatures increased from 10.0 °C for April 5, 2016, to 11.1 °C for May 4, 2016.

Recorded surface water salinity ranged from a low of 9.2 ppt recorded at Site 10 on April 5, 2016, to a high of 29.6 ppt recorded at Site 6 on May 4, 2016 (Table 2; Appendix I). The low salinity observed at Sites 9 and 10 on April 5, 2016 was likely due to the location of these sites in close proximity to streams with therefore increased freshwater inputs in combination with the high precipitation that occurred in early April 2016 and on the sampling date. The calculated weekly average surface water salinity increased from 22.1 ppt for April 5, 2016 to 28.5 ppt for May 4, 2016.

Table 2: Water quality parameters collected at beach seine sites in Quatsino Sound and Holberg Inlet in 2016.

Site	April 5, 2016		May 4, 2016	
	Temp. (°C)	Salinity (ppt)	Temp. (°C)	Salinity (ppt)
1	11.1	22.3	10.8	27.9
2	11.2	21.0	11.1	27.8
3	11.0	21.0	11.2	27.7
4	9.8	26.6	11.0	29.5
5	10.0	27.7	11.2	29.3
6	9.9	27.8	11.6	29.6
7	9.9	27.5	11.0	29.0
8	9.6	24.2	11.1	29.4
9	9.3	13.8	11.2	29.5
10	8.1	9.2	11.1	25.5
Average	**10.0**	**22.1**	**11.1**	**28.5**

3.2 Fish Sample Composition

A total of 960 fish were captured during beach seine sampling conducted in Quatsino Sound and Holberg Inlet, BC in 2016 (Table 3). A summary of the total number of fish captured and collected as specimens at each site over the collection period can be found in Table 4. Totals of fish captured and collected specimens at each site over the entire collection period can be found in Appendix II. Of the 938 chum salmon captured, 235 individual chum salmon (25.1%) were retained and underwent lab analysis. All of the coho, chinook and pink salmon captured were retained and analyzed for sea lice infection (Table 3).

Chum salmon (*O. keta*) smolts were captured in significantly greater numbers than any other species. A total of 938 chum salmon were captured, representing 97.7% of all captured salmonids. Chinook salmon were the next most commonly caught species with a total capture of 19 individuals (Table 3).

Table 3: The total of collected individuals of each fish species captured in Quatsino Sound and Holberg Inlet, BC in April and May 2016, and the percentage of the total capture population that they represent.

Common Name	Capture Totals (% of total capture population)	Collection Totals	Collection %
chum salmon	938 (97.7%)	235	25.1
coho salmon	1 (0.1%)	1	100
chinook salmon	19 (2.0%)	19	100
pink salmon	2 (0.2%)	2	100
All species	**960**	**257**	**26.8**

Table 4: The number of captured fish (Capture Total) and the number of individual fish collected (Sample Total) from each of the 10 sample sites in Quatsino Sound and Holberg Inlet, BC in April and May 2016.

SITE	Chum		Coho		Pink		Chinook		Capture Total	Sample Total
	Capture Total	Sample Total	Capture Total	Sample Total	Capture Total	Sample Total	Capture Total	Sample Total		
1	64	44	0	0	0	0	8	8	72	52
2	243	33	0	0	1	1	6	6	250	40
3	61	30	0	0	0	0	4	4	65	34
4	0	0	0	0	0	0	0	0	0	0
5	8	8	0	0	0	0	0	0	8	8
6	0	0	0	0	0	0	0	0	0	0
7	33	30	1	1	0	0	0	0	34	31
8	0	0	0	0	0	0	0	0	0	0
9	457	60	0	0	1	1	1	1	459	62
10	72	30	0	0	0	0	0	0	72	30
Total	**938**	**235**	**1**	**1**	**2**	**2**	**19**	**19**	**960**	**257**

3.3 Fish Sample Size Statistics

Summary statistics for the sample population of juvenile salmonids were completed for weight and fork length. This was completed for chum and chinook salmon only as there were insufficient numbers of coho salmon (n=1) and pink salmon (n=2) captured to warrant this analysis.

3.3.1 Chum Salmon

Analysis of weight and fork length data was completed for the chum salmon sample population collected in Quatsino Sound and Holberg Inlet in 2016. The weight of 235 chum smolts collected during the two sample events ranged from 0.28 g to 3.74 g and averaged 0.75 g (SD = 0.6). The fork length of the chum smolts ranged from 33 mm to 68 mm and averaged 40.4 mm (SD = 6.6). Chum salmon weight and length data was summarized by month which shows the increase in both parameters in the sample population from April to May (Table 5).

3.3.2 Chinook Salmon

Analysis of weight and fork length data was completed for the chinook salmon sample population collected in Quatsino Sound and Holberg Inlet in 2016. The weight of 19 chinook smolts collected during the two sample events ranged from 0.59 g to 2.1 g and averaged 1.05 g (SD = 0.5). The fork length of the chinook smolts ranged from 37 mm to 55 mm and averaged 42.5 mm (SD = 5.1). Chinook salmon weight and length data was summarized by month which shows the increase in both parameters in the sample population from April to May (Table 5).

Table 5: Average weights and lengths summarized by month of chum and chinook salmon collected in Quatsino Sound and Holberg Inlet in 2016.

Species	Weight (g)		Length (mm)	
	April	May	April	May
Chum	0.52 (n=188)	1.52 (n=47)	37.9	48.3
Chinook	0.66 (n=2)	1.01 (n=17)	38.5	42.1

3.4 Sea Lice Infection Rates

The results of the laboratory analysis for the presence of sea lice on the wild juvenile salmonid sample population collected in Quatsino Sound and Holberg Inlet in 2016 are presented in Table 6. The data recorded for each fish in the sample population during

lab analysis is included in Appendix III. A total of 257 juvenile salmon were collected at 10 sites in Quatsino Sound and Holberg Inlet in 2016 and were inspected for sea lice infection. A total of 46 juvenile salmonids in the sample population were found to be infected with 69 sea lice (Table 6). A total of 36 chum smolts, nine chinook salmon and one pink salmon were found to be infected with sea lice (Table 6). No sea lice were found on the one coho salmon in the sample population. This data reflects the identification of sea lice of either species (*L. salmonis and C. clemensi*) on inspected juvenile salmon.

Prevalence was defined as the number of fish found to be infected with one or more sea louse compared to the total number of fish. Abundance was defined as the total number of sea lice observed compared to the total number of fish (Table 6). The sea lice prevalence in the juvenile salmonid sample population collected in Quatsino Sound and Holberg Inlet in 2016 was 17.9% and the abundance was 0.27. Sea lice counts of both species observed (*L. salmonis and C. clemensi*) were added together for the prevalence and abundance calculations.

The intensity of sea lice infection, as defined as the number of sea lice on a single salmon, ranged from one louse found on 24 individuals to a maximum of five lice found on one juvenile salmon. There were eight salmon infected with two lice, four chum infected by three lice, three chum infected by four lice and one chinook found to have five lice. The average intensity was calculated by dividing the total number of sea lice by the number of infected fish (Table 6).

Table 6: Results of analysis for sea lice infection on salmonid smolts collected by beach seine in Quatsino Sound and Holberg Inlet, BC in 2016.

Species	Sample size (n)	Total number of lice observed	Total number of fish infected	Prevalence (%)	Abundance	Average Intensity
chum	235	54	36	15.3	0.23	1.5
coho	1	0	0	0	0	0
pink	2	1	1	50.0	0.5	1.0
chinook	19	14	9	47.4	0.74	1.6
Total	**257**	**69**	**46**	**17.9**	**0.27**	**1.5**

3.4.1 Infection Rates on Chum Salmon

The results of the laboratory analysis for sea lice infection for chum salmon are presented by site in Table 7. A total of 36 chum salmon were found to be infected with 54 sea lice. For the chum salmon sample population (n=235) there were more infected individuals (23 chum) and more sea lice (35 lice) found on chum salmon collected on May 4, 2016 (Table 7). The largest number of chum salmon infected with sea lice (22 chum) and the greatest number of sea lice (34 lice) were found on samples collected at Site 9; the majority of these infected fish (19) were collected on May 4, 2016 (Table 7). Site 9 had the highest number of chum samples (n=59) collected over the two week sampling period.

Sea lice counts of both sea lice species observed (*L. salmonis and C. clemensi*) were added together for the presentation of sea lice infection, prevalence and abundance on the chum salmon sample population (Table 7).

The chum salmon sample population sea lice infection rates were summarized by site. No chum salmon were collected at Sites 4, 6 and 8. No sea lice were found on chum salmon samples collected at Sites 3 and 5 (Table 7).

A total of 36 chum salmon were found to be infected with at least one sea louse. The prevalence of sea lice on the chum salmon sample population (n=235) collected in Quatsino Sound in 2016 was 15.3 %. Sea lice prevalence calculated by site and week for chum salmon and is presented in Table 7. Sea lice prevalence was much higher in chum salmon collected in May (48.9 %) than in April (6.9 %). The highest sea lice prevalence (65.5 %) was at Site 9 on May 4, 2016. Sea lice prevalence calculated by site for the total chum sample population was highly variable ranging from 0 at Sites 3 and 5 to a high of 37.3 % at Site 9.

A total of 54 sea lice were identified during laboratory analysis of retained chum salmon. The abundance of sea lice on the chum salmon sample population (n=235) collected in Quatsino Sound and Holberg Inlet in 2016 was 0.23. Sea lice abundance was calculated by week and by site and is presented in Table 7. Sea lice abundance was much higher on chum salmon collected in May (0.74) than those collected in April (0.10). The highest sea lice abundance (1.00) was again at Site 9 on May 4, 2016. Sea

lice abundance calculated by site for the total chum sample population was also highly variable ranging from 0 at Sites 3 and 5 to a high of 0.58 at Site 9.

Site 9 had the highest sea lice prevalence and abundance of any of the sites in Quatsino Sound and Holberg Inlet where juvenile wild salmon monitoring was conducted in 2016.

Table 7: The number of sea lice found on chum salmon collected in Quatsino Sound and Holberg Inlet in 2016 summarized by the 10 sites where beach seining was conducted. Calculated sea lice prevalence, abundance and average intensity is also included by site.

Site	Sample Week													**Total Chum Sample Population**		
	April 5, 2016							May 4, 2016								
	# of Chum Analyzed	# of Infected Chum	Average Weight of Infected Chum (g)	# of Lice	Prevalence (%)	Abundance	Average Intensity	# of Chum Analyzed	# of Infected Chum	Average Weight of Infected Chum (g)	# of Lice	Prevalence (%)	Abundance	Average Intensity	**Prevalence (%)**	**Abundance**	**Average Intensity**
1	30	0	-	0	0	0	0	15	3	0.86	5	20.0	0.33	1.7	**6.7**	**0.11**	**1.7**
2	30	1	0.64	1	3.3	0.03	1.0	3	1	0.41	1	33.3	0.03	1.0	**6.1**	**0.06**	**1.0**
3	30	0	-	0	0	0	0	0	-	-	-	-	-	-	**0**	**0**	**0**
4	0	-	-	-	-	-	-	0	-	-	-	-	-	-	**-**	**-**	**-**
5	8	0	-	0	0	0	0	0	-	-	-	-	-	-	**0**	**0**	**0**
6	0	-	-	-	-	-	-	0	-	-	-	-	-	-	**-**	**-**	**-**
7	30	8	0.79	12	26.7	0.40	1.5	0	-	-	-	-	-	-	**26.7**	**0.40**	**1.5**
8	0	-	-	-	-	-	-	0	-	-	-	-	-	-	**-**	**-**	**-**
9	30	3	0.88	5	10.0	0.17	1.7	29	19	2.37	29	65.5	1.00	1.5	**37.3**	**0.58**	**1.5**
10	30	1	0.78	1	3.3	0.03	1	0	-	-	-	-	-	-	**3.3**	**0.03**	**1.0**
TOTAL	**188**	**13**	**0.80**	**19**	**6.9**	**0.10**	**1.5**	**47**	**23**	**2.09**	**35**	**48.9**	**0.74**	**1.5**	**15.3**	**0.23**	**1.5**

3.4.2 Infection Rates on Other Species

Chinook salmon were the second largest sample size collected during beach seine sampling in Quatsino Sound and Holberg Inlet in 2016 (n= 19). Nine chinook salmon were found to be infected with 14 sea lice resulting in a species prevalence of 47.4 % and an abundance of 0.74 (Table 5). The infected chinook salmon were collected from Sites 1, 2, 3 and 9 and eight of the infected individuals were collected on May 4, 2016.

There were two pink salmon captured on April 5, 2016, one at Site 9 and the other at Site 2. Of the two pink salmon captured, the fish collected at Site 2 was found to be infected with one sea louse resulting in a prevalence of 50 % for the pink salmon sample population and an abundance of 0.5 (Table 6).

There was only one coho captured on April 5, 2016 at Site 7 during beach seine sampling in 2016. This sample was not infected.

3.5 Infection Rates by Sea Lice Species

A total of 31 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 29 juvenile salmon and 38 *Caligus clemensi* sea lice were found on 27 of the juvenile salmon analyzed in the lab (Appendix III). There were 10 juvenile salmon that were infected with both a *L. salmonis* and *a C. clemensi* sea louse.

3.5.1 Infection Rates by Sea lice Species on Chum Salmon

An analysis of the species of sea lice identified on the 235 chum salmon collected in Quatsino Sound and Holberg Inlet was completed and is presented in Table 8. A total of 25 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 23 juvenile chum salmon and 29 *Caligus clemensi* sea lice were found on 22 of the juvenile chum salmon analyzed in the lab (Appendix III). There were nine juvenile chum salmon that were infected with both a *L. salmonis* and *a C. clemensi* sea louse. The sea lice species identified on chum salmon are also presented by site in Table 9.

Table 8: The number of sea lice in each life stage by species identified on the chum salmon sample population from Quatsino Sound and Holberg Inlet in 2016. LEP = *Lepeophtheirus salmonis* CAL = *Caligus clemensi*

Life Stage[1]	April 5, 2016	May 4, 2016
LEP Co	2	1
LEP C1	1	3
LEP C2	1	1
LEP C3	0	7
LEP C4	0	2
LEP PAM	1	5
LEP PAF	0	0
LEP AM	1	0
LEP AF	0	0
TOTAL LEP	**6**	**19**
CAL Co	1	2
CAL C1	9	9
CAL C2	3	1
CAL C3	0	2
CAL C4	0	2
CAL PAM	0	0
CAL PAF	0	0
CAL AM	0	0
CAL AF	0	0
TOTAL CAL	**13**	**16**

[1] Lice life stage codes: Co = copepodid, C1-4 = chalimus 1-4, PAM = pre-adult male, PAF = pre-adult female, AM = adult male, AF = adult female.

Table 9: The species of sea lice found on chum salmon collected in Quatsino Sound and Holberg Inlet in 2016 summarized by the 10 sites where beach seining was conducted. LEP = *Lepeophtheirus salmonis* CAL = *Caligus clemensi*

Site	Sample Week								**TOTAL**		
	April 5, 2016				May 4, 2016						
	# of Chum Analyzed	# of Infected Chum	# of LEP	# of CAL	# of Chum Analyzed	# of Infected Chum	# of LEP	# of CAL	**# of Chum Analyzed**	**# of Infected Chum**	**# of Lice**
1	30	0	0	0	15	3	3	2	**45**	**3**	**5**
2	30	1	1	0	3	1	0	1	**33**	**2**	**2**
3	30	0	0	0	0	-	-	-	**30**	**0**	**0**
4	0	-	-	-	0	-	-	-	**0**	**-**	**-**
5	8	0	0	0	0	-	-	-	**8**	**0**	**0**
6	0	-	-	-	0	-	-	-	**0**	**-**	**-**
7	30	8	2	10	0	-	-	-	**30**	**8**	**12**
8	0	-	-	-	0	-	-	-	**0**	**-**	**-**
9	30	3	2	3	29	19	16	13	**59**	**22**	**34**
10	30	1	1	0	0	-	-	-	**30**	**1**	**1**
TOTAL	**188**	**13**	**6**	**13**	**47**	**23**	**19**	**16**	**235**	**36**	**54**

3.5.2 Infection Rates by Sea lice Species on Other Species

The sea lice species found on the 19 chinook and two pink salmon are presented in Table 10. A total of six *Lepeophtheirus salmonis* sea lice of various life stages were identified on five juvenile chinook and one pink salmon and nine *Caligus clemensi* sea lice, all C1 chalimus, were found on five juvenile chinook salmon analyzed in the lab (Appendix III). One chinook salmon was infected with both a *L. salmonis* and *a C. clemensi* sea louse. The locations where the individual fish were collected are presented in Table 11.

Table 10: The number of sea lice in each life stage by species identified on chinook and pink salmon from Quatsino Sound and Holberg Inlet in 2016. LEP = *Lepeophtheirus salmonis* CAL = *Caligus clemensi*

Life Stage[1]	April 5, 2016	May 4, 2016
LEP Co	2	2
LEP C1	0	0
LEP C2	0	1
LEP C3	0	0
LEP C4	0	1
LEP PAM	0	0
LEP PAF	0	0
LEP AM	0	0
LEP AF	0	0
TOTAL LEP	**2**	**4**
CAL Co	0	0
CAL C1	0	9
CAL C2	0	0
CAL C3	0	0
CAL C4	0	0
CAL PAM	0	0
CAL PAF	0	0
CAL AM	0	0
CAL AF	0	0
TOTAL CAL	**0**	**9**

[1] Lice life stage codes: Co = copepodid, C1-4 = chalimus 1-4, PAM = pre-adult male, PAF = pre-adult female, AM = adult male, AF = adult female.

Table 11: The distribution of sea lice species identified on chinook and pink salmon collected in Quatsino Sound and Holberg Inlet in 2016 by site. LEP = *Lepeophtheirus salmonis* CAL = *Caligus clemensi*

Species	# of individuals	Date Collected	Site	# of LEP	# of CAL
Pink	1	April 5, 2016	2	1	0
Chinook	1	April 5, 2016	3	1	0
Chinook	4	May 4, 2016	1	2	2
Chinook	3	May 4, 2016	2	2	6
Chinook	1	May 4, 2016	9	0	1
TOTAL	**10**			**6**	**9**

4.0 Conclusions

This report presents the data from the second year of beach seining and sea lice analysis conducted for wild juvenile salmonid monitoring in Quatsino Sound and Holberg Inlet, BC by Marine Harvest Canada. This report is limited to the summary and presentation of the 2016 collected data. A tabular comparison of water quality data and chum sea lice infection data from 2015 and 2016 is presented in Appendix IV.

A total of 257 wild juvenile salmonids underwent lab analysis for sea lice infection in 2016 including 235 chum, 19 chinook, 2 pink and 1 coho. Sea lice were found on the chum, chinook and pink salmon samples but no sea lice were found on the one coho salmon collected. A total of 46 individuals were found to be infected with sea lice in the total sample population, resulting in a calculated sea lice prevalence of 17.9% in 2016. A total of 69 sea lice were found during laboratory analysis resulting in an abundance of 0.27 for the sample population.

Chum salmon smolts were captured in significantly greater numbers than any other species. A total of 938 chum salmon were captured, representing 97.7% of all captured salmonids. Of the 938 chum captured, 253 were kept for lab analysis for sea lice infection. A total of 36 chum smolts were found to be infected with a total of 54 lice resulting in a calculated prevalence of 15.3%, abundance of 0.23 and an average intensity of 1.5 for the chum salmon sample population.

A total of 31 *Lepeophtheirus salmonis* lice of various life stages were identified on 31 juvenile salmonids and 38 *Caligus clemensi* lice were identified on 27 juvenile salmonids. There were 10 salmonids that were infected by at least one louse of each species. For the chum salmon sample population, a total of 25 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 23 juvenile chum salmon and 29 *Caligus clemensi* sea lice were found on 22 of the juvenile chum salmon analyzed in the lab. There were nine juvenile chum salmon that were infected with both a *L. salmonis* and *a C. clemensi* sea louse.

A comparison of the prevalence, abundance and average intensity of sea lice species found on chum salmon was completed for sample data from 2015 and 2016 collected in Quatsino Sound and Holberg Inlet. This data is presented in the following summary

table with additional yearly comparisons of juvenile wild salmon monitoring results presented in Appendix IV.

Year	*Caligus clemensi*			*Lepeophtheirus salmonis*		
	Prevalence	Abundance	Average Intensity	Prevalence	Abundance	Average Intensity
2015	13.6 %	0.24	1.75	12.4 %	0.21	1.72
2016	8.6 %	0.11	1.32	8.9 %	0.10	1.09

5.0 References

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Appendix I – Field Data

Date	Time	Site Name	Salinity (ppt)	Temperature (°C)
			0.2m	0.2m
4/5/2016	8:00	Site 1	22.3	11.1
4/5/2016	8:27	Site 2	21.0	11.2
4/5/2016	9:00	Site 3	21.0	11.0
4/5/2016	9:45	Site 4	26.6	9.8
4/5/2016	10:00	Site 5	27.7	10.0
4/5/2016	10:20	Site 6	27.8	9.9
4/5/2016	10:35	Site 7	27.5	9.9
4/5/2016	11:00	Site 8	24.2	9.6
4/5/2016	11:20	Site 9	13.8	9.3
4/5/2016	11:45	Site 10	9.2	8.4
5/4/2016	8:10	Site 1	27.9	10.8
5/4/2016	8:31	Site 2	27.8	11.1
5/4/2016	8:43	Site 3	27.7	11.2
5/4/2016	9:30	Site 4	29.5	11.0
5/4/2016	9:43	Site 5	29.3	11.2
5/4/2016	10:02	Site 6	29.6	11.6
5/4/2016	10:15	Site 7	29.0	11.0
5/4/2016	10:30	Site 8	29.4	11.1
5/4/2016	11:00	Site 9	29.5	11.2
5/4/2016	11:20	Site 10	25.5	11.1

Appendix II – Capture and Collection Sample Totals

Date	Time	Site Name	Weather Comments	Tide Stage	Pink Captured	Pink Retained	Chum Captured	Chum Retained	Coho Captured	Coho Retained	Chinook Captured	Chinook Retained	Sockeye Captured	Sockeye Retained	TSB Captured	TSB Retained	Salmonid Mortalities	Comments
4/5/2016	8:00	Site 1	Pouring rain, calm	Low	0	0	50	30	0	0	1	1	0	0	0	0	0	20 chum for Fish Health
4/5/2016	8:27	Site 2	Pouring rain, calm	Low	1	1	240	30	0	0	0	0	0	0	0	0	0	2 flounder, pipefish, 3 sculpin 1 gunnel, 30 chum taken for Fish Health analysis
4/5/2016	9:00	Site 3	Pouring rain, calm	Low	0	0	61	30	0	0	1	1	0	0	0	0	0	6 pipefish, 3 clingfish, 30 chum taken for Fish Health analysis
4/5/2016	9:45	Site 4	Pouring rain, calm, 30cm chop at site	Mid	0	0	0	0	0	0	0	0	0	0	0	0	0	12 surf perch, 1 shiner perch, 1 striped perch
4/5/2016	10:00	Site 5	Pouring rain	Mid	0	0	8	8	0	0	0	0	0	0	0	0	0	3 sculpin, ground swell at site
4/5/2016	10:20	Site 6	Pouring rain	High	0	0	0	0	0	0	0	0	0	0	0	0	0	3 sculpin, 2 gunnel. 1 fry observed jumping at site
4/5/2016	10:35	Site 7	Pouring rain	High	0	0	33	30	1	1	0	0	0	0	0	0	0	6 flounder, 5 sculpin, 1 yoy coho, 3 chum for Fish Health analysis
4/5/2016	11:00	Site 8	Pouring rain	High	0	0	0	0	0	0	0	0	0	0	0	0	0	Good set no fish
4/5/2016	11:20	Site 9	Pouring rain	High	1	1	292	30	0	0	0	0	0	0	0	0	0	4 sculpin, 30 fish for Fish Health
4/5/2016	11:45	Site 10	Pouring rain, light chop	High	0	0	72	30	0	0	0	0	0	0	0	0	0	3 sculpin, 30 chum for Fish Health analysis
5/4/2016	8:10	Site 1	Foggy, small chop	Low	0	0	14	14	0	0	7	7	0	0	0	0	0	1 gunnel, 1 pipefish
5/4/2016	8:31	Site 2	Calm, clearing	Low	0	0	3	3	0	0	6	6	0	0	0	0	0	Abundant by catch
5/4/2016	8:43	Site 3	Calm, high overcast	Low	0	0	0	0	0	0	3	3	0	0	0	0	0	Abundant by catch
5/4/2016	9:30	Site 4	Calm, clearing	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	no fish seen in search, 1 surf perch
5/4/2016	9:43	Site 5	Clear, calm	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	Good set. Large school of fish observed approx. 100m off shore
5/4/2016	10:02	Site 6	Clear, calm	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	no fish seen in search, 1 sculpin, 1 rockfish
5/4/2016	10:15	Site 7	Clear, calm	Mid	0	0	0	0	0	0	0	0	0	0	0	0	0	no fish seen in search, 500 juvenile sandlance
5/4/2016	10:30	Site 8	Clear, calm	High	0	0	0	0	0	0	0	0	0	0	0	0	0	no fish seen in search
5/4/2016	11:00	Site 9	Clear, calm	High	0	0	165	30	0	0	0	0	0	0	0	0	0	Fish seen in bay second set completed after none caught in first set. 30 chum taken for Fish Health analysis
5/4/2016	11:20	Site 10	Clear, calm	High	0	0	0	0	0	0	0	0	0	0	0	0	0	Fish seen in the middle of the bay. Too far off shore.

Appendix III – Sea Lice Analysis Data

Sample Date	Site	Fish Species	Length (mm)	Weight (g)	LEP Co	LEP C1	LEP C2	LEP C3	LEP C4	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP Total	Cal Co	Cal C1	Cal c2	Cal c3	Cal C4	CAL PAM	CAL PAF	CAL AM	CAL AF	CAL Total
5-Apr-16	Site 1	CH	37	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	36	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	38	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	34	0.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	36	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	35	0.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	38	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	35	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	38	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	33	0.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	35	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	39	0.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	38	0.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	35	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	35	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	36	0.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	37	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	35	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	38	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	35	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 1	CM	34	0.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	PK	42	0.70	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	36	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	37	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	41	0.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	38	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	42	0.64	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	39	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	37	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	38	0.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Date	Site	Fish Species	Length (mm)	Weight (g)	LEP Co	LEP C1	LEP C2	LEP C3	LEP C4	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP Total	Cal Co	Cal C1	Cal c2	Cal c3	Cal C4	CAL PAM	CAL PAF	CAL AM	CAL AF	CAL Total
5-Apr-16	Site 2	CM	38	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	36	0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	37	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	35	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	37	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	36	0.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	35	0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	39	0.60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	36	0.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	38	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	36	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	37	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	38	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	38	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	39	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	37	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	40	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	38	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	37	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	38	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	39	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 2	CM	35	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CH	40	0.68	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	37	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	36	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	37	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	37	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	37	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	37	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	38	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	38	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	38	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	35	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	39	0.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	36	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	36	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	36	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	36	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	36	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	35	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	36	0.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	36	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	37	0.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Date	Site	Fish Species	Length (mm)	Weight (g)	LEP Co	LEP C1	LEP C2	LEP C3	LEP C4	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP Total	Cal Co	Cal C1	Cal c2	Cal c3	Cal C4	CAL PAM	CAL PAF	CAL AM	CAL AF	CAL Total
5-Apr-16	Site 3	CM	36	0.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	37	0.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	38	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	37	0.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	33	0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	38	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	35	0.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	38	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	37	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 3	CM	36	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 5	CM	38	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 5	CM	42	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 5	CM	38	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 5	CM	38	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 5	CM	39	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 5	CM	38	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 5	CM	39	0.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 5	CM	34	0.31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CO	32	0.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	37	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	40	0.70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	41	0.69	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1
5-Apr-16	Site 7	CM	38	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	40	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	34	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	38	0.66	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
5-Apr-16	Site 7	CM	43	0.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	40	0.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	36	0.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	40	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	46	1.24	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1
5-Apr-16	Site 7	CM	39	0.66	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
5-Apr-16	Site 7	CM	38	0.68	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
5-Apr-16	Site 7	CM	36	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	35	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	41	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	42	0.72	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
5-Apr-16	Site 7	CM	40	0.89	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
5-Apr-16	Site 7	CM	38	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	38	0.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	37	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	40	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	37	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Date	Site	Fish Species	Length (mm)	Weight (g)	LEP Co	LEP C1	LEP C2	LEP C3	LEP C4	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP Total	Cal Co	Cal C1	Cal c2	Cal c3	Cal C4	CAL PAM	CAL PAF	CAL AM	CAL AF	CAL Total
5-Apr-16	Site 7	CM	39	0.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	42	0.77	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
5-Apr-16	Site 7	CM	37	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	38	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	39	0.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 7	CM	40	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	38	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	39	0.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	40	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	34	0.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	42	0.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	44	0.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	37	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	36	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	38	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	40	0.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	38	0.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	38	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	41	0.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	45	0.88	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	45	0.92	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
5-Apr-16	Site 9	CM	38	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	34	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	34	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	37	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	38	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	37	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	37	0.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	38	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	38	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	37	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	36	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	44	0.81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	44	0.83	0	0	0	0	0	1	0	0	0	1	0	2	0	0	0	0	0	0	0	2
5-Apr-16	Site 9	CM	34	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	CM	34	0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 9	PK	31	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	37	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	39	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	40	0.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	42	0.73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	39	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Date	Site	Fish Species	Length (mm)	Weight (g)	LEP Co	LEP C1	LEP C2	LEP C3	LEP C4	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP Total	Cal Co	Cal C1	Cal c2	Cal c3	Cal C4	CAL PAM	CAL PAF	CAL AM	CAL AF	CAL Total
5-Apr-16	Site 10	CM	37	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	41	0.60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	42	0.78	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	37	0.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	37	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	40	0.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	41	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	40	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	46	0.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	39	0.62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	37	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	39	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	40	0.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	39	0.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	42	0.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	40	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	40	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	43	0.80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	37	0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	36	0.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	38	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	36	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	44	0.90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	40	0.63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Apr-16	Site 10	CM	38	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CH	50	1.66	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CH	52	1.94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CH	43	1.07	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 1	CH	37	0.59	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 1	CH	40	0.91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CH	38	0.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CH	45	1.39	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	49	1.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	42	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	40	0.84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	37	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	37	0.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	42	0.89	0	1	0	0	1	0	0	0	0	2	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 1	CM	47	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	34	0.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	36	0.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	37	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Date	Site	Fish Species	Length (mm)	Weight (g)	LEP Co	LEP C1	LEP C2	LEP C3	LEP C4	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP Total	Cal Co	Cal C1	Cal c2	Cal c3	Cal C4	CAL PAM	CAL PAF	CAL AM	CAL AF	CAL Total
4-May-16	Site 1	CM	42	0.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	42	0.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	43	0.92	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
4-May-16	Site 1	CM	44	0.96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 1	CM	43	0.78	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 2	CH	42	0.9	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 2	CH	40	0.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 2	CH	41	0.83	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5
4-May-16	Site 2	CH	40	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 2	CH	40	0.93	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 2	CH	48	1.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 2	CM	38	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 2	CM	38	0.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 2	CM	35	0.41	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 3	CH	40	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 3	CH	40	0.79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 3	CH	40	0.79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	53	1.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	56	2.13	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	58	2.8	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
4-May-16	Site 9	CM	54	2.03	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	51	1.53	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	59	2.55	0	0	0	1	0	1	0	0	0	2	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 9	CM	56	2.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	67	3.67	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 9	CM	48	1.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	50	1.62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	56	2.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	53	1.74	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 9	CM	57	2.32	0	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	2
4-May-16	Site 9	CM	54	1.99	0	0	0	0	0	1	0	0	0	1	0	2	0	1	0	0	0	0	0	3
4-May-16	Site 9	CM	58	2.38	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	55	2.18	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	62	2.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	56	2.16	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	56	2.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	68	3.74	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	50	1.75	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	58	2.42	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 9	CM	60	2.76	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1
4-May-16	Site 9	CM	55	2.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
4-May-16	Site 9	CM	55	1.94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	57	1.99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sample Date	Site	Fish Species	Length (mm)	Weight (g)	LEP Co	LEP C1	LEP C2	LEP C3	LEP C4	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP Total	Cal Co	Cal C1	Cal c2	Cal c3	Cal C4	CAL PAM	CAL PAF	CAL AM	CAL AF	CAL Total
4-May-16	Site 9	CM	55	1.99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	57	2.48	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CM	57	2.24	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
4-May-16	Site 9	CH	55	2.11	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1

Appendix IV – 2015/2016 Comparisons

Surface water temperature comparison between data collected in Quatsino Sound and Holberg Inlet in 2015 and 2016.

Site	April Temp. (°C)		May Temp. (°C)	
	2015	2016	2015	2016
1	8.7	11.1	11.6	10.8
2	8.0	11.2	11.9	11.1
3	8.4	11.0	12.5	11.2
4	9.7	9.8	11.6	11.0
5	9.6	10.0	11.2	11.2
6	10.5	9.9	12.1	11.6
7	10.1	9.9	12.3	11.0
8	10.0	9.6	12.7	11.1
9	10.0	9.3	11.9	11.2
10	10.4	8.1	13.5	11.1
Average	**9.5**	**10.0**	**12.1**	**11.1**

Surface water salinity comparison between data collected in Quatsino Sound and Holberg Inlet in 2015 and 2016.

Site	April Salinity (ppt)		May Salinity (ppt)	
	2015	2016	2015	2016
1	14.0	22.3	27.5	27.9
2	13.8	21.0	28.4	27.8
3	18.1	21.0	28.0	27.7
4	26.2	26.6	30.2	29.5
5	26.5	27.7	29.8	29.3
6	27.2	27.8	30.3	29.6
7	24.3	27.5	29.9	29.0
8	20.2	24.2	30.4	29.4
9	26.5	13.8	30.4	29.5
10	26.3	9.2	29.8	25.5
Average	**22.3**	**22.1**	**29.5**	**28.5**

A comparison of the results of analysis for sea lice infection on salmonid smolts collected by beach seine in Quatsino Sound and Holberg Inlet, BC in 2015 and 2016.

Species	Sample size (n) 2015	Sample size (n) 2016	Total # of fish infected 2015	Total # of fish infected 2016	Prevalence (%) 2015	Prevalence (%) 2016	Total # of lice observed 2015	Total # of lice observed 2016	Abundance 2015	Abundance 2016
chum	177	235	37	36	20.9	15.3	80	54	0.45	0.23
coho	21	1	7	0	33.3	0.0	12	0	0.57	0.00
pink	1	2	0	1	0.0	50.0	0	1	0.0	0.50
chinook	12	19	2	9	16.7	47.4	2	14	0.17	0.74
TSB	7	0	4	0	57.1	-	5	-	0.71	-
Total	**218**	**257**	**50**	**46**	**22.9**	**17.9**	**99**	**69**	**0.45**	**0.27**

A comparison of the calculated sea lice prevalence and abundance by site and by week as determined for chum salmon collected in Quatsino Sound and Holberg Inlet, BC in 2015 and 2016.

Site	Sample Month							
	April				May			
	Prevalence (%) 2015	Prevalence (%) 2016	Abundance 2015	Abundance 2016	Prevalence (%) 2015	Prevalence (%) 2016	Abundance 2015	Abundance 2016
1	6.6	0	0.07	0	31.3	20.0	0.50	0.33
2	0	3.3	0	0.03	0	33.3	0	0.03
3	3.3	0	0.03	0	17.2	-	0.17	-
4	40.0	-	0.80	-	-	-	-	-
5	-	0	-	0	-	-	-	-
6	-	-	-	-	-	-	-	-
7	0	26.7	0	0.40	-	-	-	-
8	41.9	-	1.10	-	50.0	-	2.50	-
9	-	10.0	-	0.17	60.0	65.5	2.60	1.00
10	-	3.3	-	0.03	-	-	-	-
TOTAL	**17.1**	**6.9**	**0.39**	**0.10**	**26.4**	**48.9**	**0.54**	**0.74**

The number of sea lice in each life stage by species identified on the chum salmon sample population from Quatsino Sound and Holberg Inlet in 2015 and 2016.
LEP = *Lepeophtheirus salmonis* CAL = *Caligus clemensi*

Life Stage[1]	Number of Lice 2015	Number of Lice 2016
LEP Co	2	3
LEP C1	3	4
LEP C2	9	2
LEP C3	16	7
LEP C4	5	2
LEP PAM	0	6
LEP PAF	2	0
LEP AM	1	1
LEP AF	0	0
TOTAL LEP	**38**	**25**
CAL Co	2	3
CAL C1	24	18
CAL C2	7	4
CAL C3	4	2
CAL C4	5	2
CAL PAM	0	0
CAL PAF	0	0
CAL AM	0	0
CAL AF	0	0
TOTAL CAL	**42**	**29**

[1] Lice life stage codes: Co = copepodid, C1-4 = chalimus 1-4, PAM = pre-adult male, PAF = pre-adult female, AM = adult male, AF = adult female.

The species of sea lice found on chum salmon collected in Quatsino Sound and Holberg Inlet in 2015 and 2016 summarized by the 10 sites where beach seining was conducted. LEP = *Lepeophtheirus salmonis* CAL = *Caligus clemensi*

Site	Sample Week							
	April				May			
	# of LEP 2015	# of LEP 2016	# of CAL 2015	# of CAL 2016	# of LEP 2015	# of LEP 2016	# of CAL 2015	# of CAL 2016
1	0	0	2	0	1	3	15	2
2	0	1	0	0	0	0	0	1
3	1	0	0	0	3	-	2	-
4	2	-	2	-	-	-	-	-
5	-	0	-	0	-	-	-	-
6	-	-	-	-	-	-	-	-
7	0	2	0	10	-	-	-	-
8	23	-	11	-	2	-	3	-
9	-	2	-	3	6	16	7	13
10	-	1	-	0	-	-	-	-
TOTAL	**26**	**6**	**15**	**13**	**12**	**19**	**27**	**16**

A comparison of sea lice infection rates on chum salmon collected in Quatsino Sound and Holberg Inlet between 2015 and 2016.

Year	*Caligus clemensi*			*Lepeophtheirus salmonis*		
	Prevalence	Abundance	Average Intensity	Prevalence	Abundance	Average Intensity
2015	13.6 %	0.24	1.75	12.4 %	0.21	1.72
2016	8.6 %	0.11	1.32	8.9 %	0.10	1.09