

Wild Juvenile Salmonid Monitoring Program 2023 Clio Channel and Chatham Channel, BC

Report Date: July 4, 2023

Prepared For:

*Grieg Seafood BC Ltd.
106 – 1180 Ironwood Street
Campbell River, BC
V9W 5P7*



MAINSTREAM
Biological Consulting
250-287-2462
www.mainstreambio.ca

Summary

Beach seine sampling was conducted on behalf of Grieg Seafood at ten sites in Clio Channel and Chatham Channel, BC in 2022. Sampling was completed to monitor sea lice abundance, prevalence, and intensity on juvenile wild salmon on behalf of Grieg Seafood Ltd. in support of the Aquaculture Stewardship Certification process for Grieg Seafood's finfish aquaculture sites in the area.

Sampling was conducted during four separate sampling events in, April and May 2023, selected to coincide with the peak outmigration period of juvenile salmonids. Sampling was completed at 10 sites within Clio Channel and Chatham Channel, BC. The sites were selected based on historical fish capture results and location relative to existing and potential aquaculture sites in the area. Three existing finfish aquaculture tenures are present in the sampling area near the east end of Clio Channel.

Thirty individuals from each target fish species or the total number of captured individuals from each target species (if less than 30 were captured) were collected from each of the ten sites during the sampling events. Total catch numbers of each species were recorded. Water quality measurements including surface, one meter, and five meter water depth temperature, salinity, and dissolved oxygen were recorded at each site during each sampling event.

Collected sample fish were frozen and analyzed in the lab for the presence of sea lice by Mainstream Biological Consulting. Sea lice observed on the individual fish specimens during laboratory analysis were initially 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 infestation 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 infestation rate on retained wild juvenile salmon collected in Clio Channel and Chatham Channel, BC in 2023. A total of 135 fish samples underwent lab analysis for sea lice infestation in 2023 including 127 pink, seven chum and one coho salmon. No chinook, sockeye or Atlantic salmon were captured during sampling completed in Clio Channel and Chatham Channel, BC in 2023. A total of 32 individuals were found to be infested with sea lice in the total sample population, resulting in a calculated sea lice prevalence of 23.7 % in 2023. A total of 37 sea lice were found during laboratory analysis resulting in an abundance of 0.27 and an average intensity of 1.2 for the sample population.

Pink salmon smolts were captured in significantly greater numbers than any other species. A total of 290 pink salmon were captured, representing 97.3 % of all captured salmonids. Of the 290 pink salmon captured, 127 were retained for lab analysis for sea lice infestation. A total of 31 pink smolts were found to be infested with a total of 35 sea lice resulting in a calculated prevalence of 24.4 %, abundance of 0.28 and an average intensity of 1.1 for the pink salmon sample population.

A total of seven chum salmon were captured, representing 2.3 % of all captured salmonids. All seven chum salmon were retained for lab analysis for sea lice infestation. One chum smolt was found to be infested with two sea lice, resulting in a calculated prevalence of 14.3 %, abundance of 0.29 and an average intensity of 2.0 for the chum salmon sample population.

One coho salmon was captured, representing 0.3 % of all captured salmonids. The single coho salmon was retained for lab analysis for sea lice infestation. No sea lice were observed on the coho salmon, resulting in a calculated prevalence, abundance, and average intensity of zero.

A total of 37 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 32 juvenile salmon. No *Caligus clemensi* sea lice were observed on the juvenile salmon population (Appendix III). A total of 35 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 31 juvenile pink salmon. Two *Lepeophtheirus salmonis* sea lice of copepodid life stage were identified on one chum salmon.

Table of Contents

Summary.....	i
Table of Contents.....	iii
List of Figures	iv
List of Tables.....	iv
1.0 Introduction.....	1
2.0 Methods.....	3
2.1 Site Locations	3
2.2 Field Procedures.....	5
2.3 Laboratory Procedures	6
2.4 Data Analysis.....	7
3.0 Results	9
3.1 Water Quality Parameters.....	9
3.2 Fish Sample Composition	14
3.3 Fish Sample Size Statistics.....	16
3.3.1 <i>Pink Salmon</i>	16
3.3.2 <i>Chum Salmon</i>	16
3.3.3 <i>Coho Salmon</i>	16
3.4 Sea Lice Infestation Rates	16
3.4.1 <i>Infestation Rates on Pink Salmon</i>	17
3.4.2 <i>Infestation Rates on Chum Salmon</i>	18
3.5 Infestation by Sea Lice Species	20
3.5.1 <i>Infestation by Life Stage on Pink Salmon</i>	20
3.5.2 <i>Infestation by Life Stage on Chum Salmon</i>	22
4.0 Conclusions	24
5.0 References	25
Appendix I – Field Data.....	I
Appendix II – Capture and Collection Sample Totals	II
Appendix III – Sea Lice Analysis	III

List of Figures

Figure 1:	An overview map showing the location of Clio Channel and Chatham Channel, BC on the east coast of Vancouver Island, BC.	2
Figure 2:	The locations of the 10 beach seine sites in Clio Channel and Chatham Channel, BC sampled in 2023.	4

List of Tables

Table 1:	The site number and locations of the ten beach seine sites where fish were collected for sea lice analysis in Clio Channel and Chatham Channel, BC in 2023.	3
Table 2:	Surface water quality parameters collected during 2023 beach seine sampling in Clio Channel and Chatham Channel, BC.	11
Table 3:	One meter water quality parameters collected during 2023 beach seine sampling in Clio Channel and Chatham Channel, BC.	12
Table 4:	Five meter water quality parameters collected during 2023 beach seine sampling in Clio Channel and Chatham Channel, BC.	13
Table 5:	The total of collected individuals of each fish species captured in Clio Channel and Chatham Channel, BC between April 10, 2023, and May 23, 2023, and the percentage of the total capture population that they represent.	14
Table 6:	The number of captured fish (Capture Total) and the number of individual fish collected (Sample Total) from each of the ten sample sites in Clio Channel and Chatham Channel, BC between April 10, 2023, and May 23, 2023.	15
Table 7:	Average lengths of pink, chum and coho salmon collected in Clio Channel and Chatham Channel, BC in 2023, summarized by sampling event.	16
Table 8:	Average weights of pink, chum and coho salmon collected in Clio Channel and Chatham Channel, BC in 2023, summarized by sampling event.	16
Table 9:	Results of analysis for sea lice infestation on fish collected by beach seine in Clio Channel and Chatham Channel, BC in 2023.	17
Table 10:	Total number, prevalence, abundance, and intensity of sea lice infestation on pink salmon collected in Clio Channel and Chatham Channel, BC in 2023, summarized by sampling site.	18
Table 11:	Total number, prevalence, abundance, and intensity of sea lice infestation on chum salmon collected in Clio Channel and Chatham Channel, BC in 2023 summarized by sampling site.	19

Table 12:	The number of <i>Lepeophtheirus salmonis</i> and <i>Caligus clemensi</i> in each life stage identified on the pink salmon sample population from Clio Channel and Chatham Channel, BC, in 2023. LEP = <i>Lepeophtheirus salmonis</i> CAL= <i>Caligus clemensi</i>	20
Table 13:	The number of sea lice found on pink salmon collected in Clio Channel and Chatham Channel, BC in 2023, summarized by sampling site. LEP = <i>Lepeophtheirus salmonis</i> CAL= <i>Caligus clemensi</i>	21
Table 14:	The number of <i>Lepeophtheirus salmonis</i> and <i>Caligus clemensi</i> in each life stage identified on the chum salmon sample population from Clio Channel and Chatham Channel, BC, in 2023. LEP = <i>Lepeophtheirus salmonis</i> CAL= <i>Caligus clemensi</i>	22
Table 15:	The number of sea lice found on chum salmon collected in Clio Channel and Chatham Channel, BC in 2023 summarized by sampling site. LEP = <i>Lepeophtheirus salmonis</i> CAL= <i>Caligus clemensi</i>	23

1.0 Introduction

Beach seine sampling was conducted at ten sites in Clio Channel and Chatham Channel, BC (Figure 1) to capture wild juvenile salmon on behalf of Grieg Seafood BC Ltd. Retained fish were analyzed in the lab for sea lice infestation. Four sampling events were completed between April 10, 2023, and May 23, 2023. Timing was selected to coincide with the estimated peak outmigration of juvenile salmonids in Clio Channel and Chatham, BC.

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 infesting fish in the Pacific Ocean, while only one species of *Caligus* (*Caligus clemensi*) has been identified (Margolis and Arthur 1979; McDonald and Margolis, 1995). *C. clemensi* infest 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. During this analysis, *Lepeophtheirus* spp. sea lice found on salmonid specimens were assumed to be *L. salmonis* due to the lack of documented infestations of Pacific salmon by other *Lepeophtheirus* lice species (Jones and Nemec, 2004).

Both Caligidae genera have similar life histories and developmental stages (Kabata, 1972; Johnson and Albright, 1991a). Sea lice hatch from eggs and go through two free-swimming naupilii stages before developing into an infectious free-swimming copepodid. The copepodids attach to their host and develop through several 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 known to 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 water temperature may 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).

Grieg Seafood BC Ltd. requested monitoring of sea lice abundance, prevalence, and intensity on juvenile wild salmon in Clio Channel and Chatham Channel, BC in support of Aquaculture Stewardship Certification for their aquaculture sites within the area. Existing finfish aquaculture sites within or near the sampling area included Noo-la, Wa-kwa and Tsa-ya aquaculture facilities near the eastern end of Clio Channel (Figure 2). This data summary report documents the observed sea lice infestation rates on juvenile salmonids collected in Clio Channel and Chatham Channel, BC in 2023. This is the fifth year that sampling was completed in Clio Channel and Chatham Channel, BC by Grieg Seafood BC Ltd.



Figure 1: An overview map showing the location of Clio Channel and Chatham Channel, BC on the east coast of Vancouver Island, BC.

2.0 Methods

Juvenile salmonids were collected from ten sites in Clio Channel and Chatham Channel, BC. These sites were chosen based on their locations relative to active and potential new Grieg Seafood finfish aquaculture tenures (Figure 2). The ten sites were each sampled four times in 2023 between April 10, and May 23.

2.1 Site Locations

Of the 10 sampling sites, six sites are located within Clio Channel, and four sites are located within Chatham Channel (Figure 2). Field GPS coordinates collected at the sampling sites are provided in Table 1.

Table 1: The site number and locations of the ten beach seine sites where fish were collected for sea lice analysis in Clio Channel and Chatham Channel, BC in 2023.

Site Number	Coordinates	
	Latitude North	Longitude West
1	50 35.379	126 27.112
2	50 34.360	126 26.034
3	50 35.318	126 21.544
4	50 36.535	126 22.120
5	50 36.121	126 20.625
6	50 36.791	126 19.558
7	50 37.448	126 17.589
8	50 36.628	126 16.282
9	50 33.791	126 12.572
10	50 33.535	126 11.234



Figure 2: The locations of the 10 beach seine sites in Clio Channel and Chatham Channel, BC sampled in 2023.

2.2 Field Procedures

Procedures used by Mainstream Biological Consulting during 2023 sampling were adapted from procedures for beach seining, fish collection and field data recording utilized by the Department of Fisheries and Oceans (DFO).

An 18 ft Boston Whaler powered by a 60 horsepower outboard motor was used to access sampling 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, with the centre bunt consisting of one-quarter inch diameter diamond mesh, and two side panels (wings) consisting of half-inch diameter diamond mesh. Floats were attached every 30 cm along the top-line and a lead line provided weight along the bottom of the net.

A three person crew conducted the beach seine sets. All beaches were approached slowly by boat and one crewmember was put ashore with one end of the net towline. The onshore crewmember held the towline at one side of the sample site, while the second crewmember ensured the net deployed smoothly off the bow or side of the boat as the third crewmember backed the boat in a wide semicircle towards the opposite side of the sample site. When the net was fully deployed, the second crewmember 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, surface, one meter and five meter depth water quality data was collected for temperature, salinity and dissolved oxygen using a YSI Pro Quatro Probe.

Crewmembers retrieved the net evenly from opposite ends, ensuring that the lead line remained as close to the bottom as possible. 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 any 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 contained the captured fish in the water so that they could be sampled.

The two shore crew members collected individual fish from the bunt to ensure that captured fish remained in the net for as short a period of time as possible. The net was manipulated as necessary in response to changing tides to ensure the captured fish remained in sufficient water to minimize contact with the net or with other fish.

Where possible, a total of 30 individuals from each target species were retained for sea lice infestation analysis. If less than 30 individuals of a target species were captured, all the captured fish were retained. Individual fish were randomly “swam” into an appropriately sized Whirlpac bag. Handling of fish was kept to a minimum.

Once all the fish for retention were collected, a total catch number was recorded for each species. Any fish remaining in the net were counted or estimated (if more than 300 individuals were present) and released. 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 standardized field form was used to record the following information for each beach seine set:

- Site name or number
- Date
- 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
- Water temperature (°C), salinity (ppt) and dissolved oxygen (mg/L) to one decimal place
- GPS coordinates
- The number of salmon mortalities.

Retained fish from each site were packaged separately in re-sealable bags and labelled with the site name or number, the date and sample numbers of each species. Sample bags were stored on ice in a cooler while on board the boat and transferred to a portable freezer on the support boat immediately following completion of the set.

Following each set the net was reloaded onto the bow of the boat. Crewmembers scanned the net for obvious holes, which were repaired immediately if found.

The above sampling procedures were repeated at each of the sample sites.

2.3 Laboratory Procedures

Laboratory procedures for sea lice analysis were adapted from procedures demonstrated by Sheila Dawe and Eliah Kim at the Pacific Biological Station in Nanaimo, BC, during sea lice identification training that was conducted on April 1, 2004. Additional sea lice identification training by Paul Callow was conducted at the Pacific Biological Station in September 2007.

Fish samples were thawed immediately prior to analysis. Individual fish were identified to species and counted. Results of the lab identification and count were compared to the reported data found on the field data sheets to identify any errors.

A standardized data sheet was used to record sea lice analysis results for each site. The site and week number, sample date and number of fish and specimen groups present were recorded. The date of the lab analysis was also noted.

Once thawed, individual fish were removed from their bag using a pair of forceps at the caudal peduncle and placed in a petri dish. Each bag was labelled with an individual fish identification number. Each fish was then scanned for the presence of sea lice under a stereoscopic dissection microscope. The microscope was set at a magnification of 20X for the preliminary survey of each fish sample, and magnification was increased to up to 40X during individual sea lice identification.

Microscopic analysis of each individual fish began at the anterior end of the right side of the specimen. The head was examined first, after which a scan was made along the dorsal half of the specimen working towards the posterior end and the tail. The dorsal fin and caudal fin were lifted and expanded with a pair of forceps to check for lice. From the posterior end a return scan was made along the ventral half of the specimen back to the head. The anal fin, pelvic fin and pectoral fin were lifted and expanded, and the operculum was lifted. The fish was then flipped using a pair of forceps at the caudal peduncle and the procedure was repeated on the opposite side of the specimen.

Additional scans were made longitudinally down the fish if the entire depth of the fish could not be seen in a single pass. Any sea lice observed on the fish were removed and placed in a petri dish of saline solution.

Each Whirlpac bag was visually inspected after the removal of the fish for the presence of pre-adult or adult sea lice that may have become dislodged during handling. Any sea lice found in the sample bags were identified under the microscope using the same characteristics outlined above. These “loose” sea lice were recorded on the data sheet with the data for the corresponding specimen and it was assumed that the lice had come from that individual.

Sea lice were identified using characteristics outlined by Kabata (1972) and Johnson and Albright (1991a). Sea lice observed on individual fish were identified as either non-motile chalimus (including copepodid), or motile pre-adults and adults. Non-motile sea lice were identified as one of two chalimus stages for *L. salmonis* (Hamre et al., 2013) or four chalimus stages for *C. clemensi*. Motile lice, either pre-adults or adults, were identified as either *L. salmonis* or *C. clemensi* and the sex of the louse was determined.

Chalimus were identified to species primarily by characteristics of the frontal filament. However, size, shape, genital development, and leg development were used as secondary identifying characteristics for speciation as well as primary indicators for life stage identification. Motile sea lice were identified to species by the presence or absence of lunules. If lunules were absent the louse was identified as *Lepeophtheirus* spp. The louse was identified as *Caligus* spp. if lunules were present.

Sea lice found on captured specimens have been assumed to be either *L. salmonis* or *C. clemensi* due to the lack of documented infestations of Pacific salmon by other species of sea lice (Jones and Nemec, 2004).

After microscopic analysis individual fish specimens were measured (fork length) in millimetres and weighed to the nearest tenth of a gram. Lengths and weights were recorded on the data sheet with the specimen’s corresponding sea lice analysis results. The fish were then returned to their respective individual bags and repackaged in the large re-sealable bags by site before being refrozen.

To allow for quality assurance of sea lice identification, all sea lice were placed in vials labelled with the corresponding fish identification number and preserved in 70% isopropyl alcohol. Ten percent of the deloused fish specimens were randomly selected by specimen number and retained. Both the preserved lice and retained deloused fish specimens will be kept at the office of Mainstream Biological Consulting in Campbell River for five years.

2.4 Data Analysis

Surface, one meter and five meter depth water quality data collected for temperature, salinity and dissolved oxygen was summarized to report the minimum and maximum values and averages for each sample week.

Beach seine fish sample composition was summarized by species and site for each sample period. The fork lengths and weights of the samples were summarized to present minimum and maximum values as well as averages. Sea lice infestation rates, including the overall number of infested fish and the number of sea lice identified, were determined for the sample population, and prevalence and abundance of sea lice were calculated. Prevalence was defined as the number of host fish found to have one or

more sea lice compared to the total number of host fish examined, while abundance was defined as the total number of sea lice observed compared to the total number of host fish examined. The intensity of sea lice infestation, as described by the average number of sea lice found on a single salmon infested was summarized. Average intensity was calculated by dividing the total number of sea lice identified by the number of infested fish.

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 inspection of juvenile salmonids collected from Clio Channel and Chatham Channel, BC in 2023. Water quality field data is presented in Appendix I, beach seine fish capture data is included in Appendix II and data on the fish sample population including sea lice lab analysis results are listed in Appendix III.

3.1 Water Quality Parameters

Surface, one meter and five meter depth measurements of water temperature salinity and dissolved oxygen taken during beach seining at each of the ten sites during the four sample periods are summarized in Table 2, Table 3 and Table 4 respectively and the complete dataset is included in Appendix I.

Recorded surface water temperatures ranged from a low of 7.2 °C recorded at Site 8 on April 11, 2023, to a high of 11.3 °C recorded at Site 3 on May 23, 2023 (Table 2; Appendix I). Calculated average surface water temperatures increased over the sampling period, from 7.8 °C on April 10 and April 11, 2023, to a maximum of 10.1 °C on May 23, 2023 (Table 2).

Recorded surface water salinity ranged from a low of 21.4 ppt recorded at Site 6 on April 11, 2023, to a high of 26.2 ppt recorded at Site 5 on April 24, 2023 (Table 2; Appendix I). Calculated average surface water salinity was relatively stable over the sampling period in 2023, ranging between 24.1 ppt on April 10 and April 11, 2023, and 25.9 ppt on May 8, 2023 (Table 2).

Recorded surface water dissolved oxygen ranged from a low of 6.6 mg/L recorded at Site 1 on May 8, 2023, to a high of 12.9 mg/L recorded at Site 5 on May 8, 2023 (Table 2; Appendix I). Calculated average surface dissolved oxygen was relatively stable during sampling in 2023 ranging between 9.3 mg/L on April 10, and April 11, 2023, and 10.6 mg/L on May 8, 2023 (Table 2).

Recorded one meter water temperatures ranged from a low of 7.3 °C recorded at Site 8 on April 11, 2023, to a high of 11.3 °C recorded at Site 3 on May 23, 2023 (Table 3; Appendix I). Calculated average one meter water temperatures increased over the sampling period, from 7.7 °C on April 10 and April 11, 2023, to a maximum of 10.0 °C on May 23, 2023 (Table 3).

Recorded one meter water salinity ranged from a low of 21.5 ppt recorded at Site 6 and Site 7 on April 11, 2023, to a high of 26.2 ppt recorded at Site 5 on April 24, 2023, Site 2 and 3 on April 25, 2023, and Site 2 on May 8, 2023 (Table 3; Appendix I). Calculated average one meter water salinity was relatively stable during sampling in 2023 ranging between 24.5 ppt on April 10 and April 11, 2023, and 26.1 ppt on April 24, and April 25, 2023 (Table 3).

Recorded one meter water dissolved oxygen ranged from a low of 6.9 mg/L recorded at Site 1 on May 8, 2023, to a high of 12.9 mg/L recorded at Site 5 on May 8, 2023 (Table 3; Appendix I). Calculated average surface dissolved oxygen was relatively stable during sampling in 2023 ranging between 9.3 mg/L on April 10, and April 11, 2023, and 10.9 mg/L on May 8, 2023 (Table 3).

Recorded five meter water temperatures ranged from a low of 7.3 °C recorded at Site 8 on April 11, 2023, to a high of 10.1 °C recorded at Site 6 on May 23, 2023 (Table 4; Appendix I). Calculated average five meter water temperatures increased over the sampling period, from 7.9 °C on April 10 and April 11, 2023, to a maximum of 9.5 °C on May 23, 2023 (Table 4).

Recorded five meter water salinity ranged from a low of 21.4 ppt recorded at Site 7 on April 11, 2023, to a high of 26.4 ppt recorded at Site 2 on April 25, 2023 (Table 4; Appendix I). Calculated average five meter water salinity was relatively stable during sampling in 2023 ranging between 24.4 ppt on April 10 and April 11, 2023, and 26.1 ppt on April 24/April 25, 2023 and May 28, 2023 (Table 4).

Recorded five meter water dissolved oxygen ranged from a low of 8.0 mg/L recorded at Site 7 on April 11, 2023 to a high of 14.0 mg/L recorded at Site 4 on May 8, 2023 (Table 4; Appendix I). Calculated average five meter dissolved oxygen slightly increased during over the sampling in 2023 ranging between 8.8 mg/L on April 10 and April 11, 2023, and 11.7 mg/L on May 8, 2023 (Table 4).

Table 2: Surface water quality parameters collected during 2023 beach seine sampling in Clio Channel and Chatham Channel, BC.

Site	10/11-Apr-23			24/25-Apr-23			8-May-23			23-May-23		
	Salinity (ppt)	Temp. (°C)	DO (mg/L)	Salinity (ppt)	Temp. (°C)	DO (mg/L)	Salinity (ppt)	Temp. (°C)	DO (mg/L)	Salinity (ppt)	Temp. (°C)	DO (mg/L)
1	25.8	7.5	9.7	23.3	8.7	9.5	25.3	9.0	6.6	24.4	10.0	6.9
2	25.4	7.5	9.6	26.0	8.1	9.7	26.1	9.1	11.0	25.4	9.6	9.3
3	25.8	7.6	9.7	25.8	9.1	9.8	25.8	10.8	12.3	23.0	11.3	8.5
4	23.1	7.8	9.0	26.1	9.5	10.2	26.1	10.4	9.3	25.3	10.1	10.4
5	24.3	8.8	9.4	26.2	9.1	9.4	26.0	10.5	12.9	24.6	11.2	10.6
6	21.4	7.8	8.1	25.9	10.0	9.4	25.9	10.1	11.3	24.5	10.7	10.4
7	21.6	7.7	8.2	26.1	8.7	9.6	25.9	9.4	10.6	25.1	9.8	10.0
8	25.6	7.2	8.9	26.1	8.3	9.9	25.8	10.2	10.6	25.2	10.0	10.2
9	25.4	7.7	10.1	25.4	8.1	11.9	25.9	8.8	10.2	25.6	9.2	9.8
10	22.7	8.0	10.4	25.3	8.4	9.5	25.8	11.1	11.4	25.5	9.5	9.8
Average	24.1	7.8	9.3	25.6	8.8	9.9	25.9	9.9	10.6	24.9	10.1	9.6

Table 3: One meter water quality parameters collected during 2023 beach seine sampling in Clio Channel and Chatham Channel, BC.

Site	10/11-Apr-23			24/25-Apr-23			8-May-23			23-May-23		
	Salinity (ppt)	Temp. (°C)	DO (mg/L)	Salinity (ppt)	Temp. (°C)	DO (mg/L)	Salinity (ppt)	Temp. (°C)	DO (mg/L)	Salinity (ppt)	Temp. (°C)	DO (mg/L)
1	25.7	7.5	10.1	26.1	8.6	9.4	26.0	8.9	6.9	25.5	9.5	7.5
2	25.9	7.5	9.4	26.2	8.2	9.1	26.2	9.0	10.3	25.4	9.6	9.3
3	25.9	7.4	8.9	26.2	8.8	9.7	25.8	10.1	12.9	23.0	11.3	8.6
4	23.9	7.9	9.6	26.1	8.6	10.5	26.1	9.6	9.9	25.3	9.9	10.7
5	24.3	8.8	9.5	26.2	9.0	9.3	26.0	10.5	13.3	24.7	11.0	10.9
6	21.5	7.7	8.0	25.8	8.7	9.4	26.0	10.0	11.5	24.6	10.6	10.8
7	21.5	7.7	8.1	26.1	8.6	9.6	25.9	9.4	10.7	25.1	9.8	10.5
8	25.6	7.3	9.0	26.1	8.2	9.6	25.9	9.5	11.2	25.3	10.0	10.4
9	25.4	7.6	9.9	25.8	8.0	10.5	26.0	8.6	10.6	25.5	9.2	9.7
10	25.2	7.9	10.1	25.9	8.1	9.6	25.9	10.0	11.7	25.5	9.5	10.0
Average	24.5	7.7	9.3	26.1	8.5	9.7	26.0	9.6	10.9	25.0	10.0	9.8

Table 4: Five meter water quality parameters collected during 2023 beach seine sampling in Clio Channel and Chatham Channel, BC.

Site	10/11-Apr-23			24/25-Apr-23			8-May-23			23-May-23		
	Salinity (ppt)	Temp. (°C)	DO (mg/L)	Salinity (ppt)	Temp. (°C)	DO (mg/L)	Salinity (ppt)	Temp. (°C)	DO (mg/L)	Salinity (ppt)	Temp. (°C)	DO (mg/L)
1	-	-	-	26.2	7.9	9.2	26.2	8.5	8.3	25.6	9.4	8.0
2	-	-	-	26.2	7.9	9.5	26.4	8.6	13.6	25.6	9.4	10.1
3	25.9	7.4	8.9	26.2	8.5	10.0	-	-	-	-	-	-
4	23.9	8.0	9.5	26.3	7.9	10.2	26.2	9.0	14.0	25.4	9.5	10.3
5	24.9	8.5	9.1	26.2	8.3	9.4	26.1	9.9	13.4	25.2	9.9	11.0
6	-	-	-	26.2	7.8	9.7	26.0	8.9	11.2	25.0	10.1	10.0
7	21.4	8.1	8.0	26.1	7.7	9.8	26.1	8.6	11.2	25.6	9.1	10.5
8	25.8	7.3	8.6	26.1	8.1	9.7	26.1	8.7	11.2	25.4	9.3	10.1
9	-	-	-	25.9	7.8	10.4	26.1	8.4	11.1	25.6	9.1	9.9
10	-	-	-	26.0	8.0	9.4	26.1	8.5	11.0	-	-	-
Average	24.4	7.9	8.8	26.1	8.0	9.7	26.1	8.8	11.7	25.4	9.5	10.0

3.2 Fish Sample Composition

A total of 298 fish were captured during beach seine sampling conducted in Clio Channel and Chatham Channel, BC in 2023 (Table 5). A summary of the total number of fish captured and collected as specimens at each site over the collection period is presented in Table 6, with a complete dataset provided in Appendix II. Of the 298 fish captured, 127 pink salmon, seven chum salmon and one coho salmon were retained for lab analysis (Table 5). No chinook, sockeye or Atlantic salmon were captured during sampling completed in Clio Channel and Chatham Channel, BC in 2023.

Pink salmon (*O. gorbuscha*) smolts were captured in significantly greater numbers than any other species. A total of 290 pink salmon were captured, representing 97.3 % of all captured fish.

Table 5: The total of collected individuals of each fish species captured in Clio Channel and Chatham Channel, BC between April 10, 2023, and May 23, 2023, and the percentage of the total capture population that they represent.

Common Name	Capture Total (% of total capture population)	Collection Totals	Collection %
pink salmon	290 (97.3 %)	127	43.8 %
chum salmon	7 (2.3 %)	7	100.0 %
coho salmon	1(0.3 %)	1	100.0 %
All Species	298	135	45.3 %

Table 6: The number of captured fish (Capture Total) and the number of individual fish collected (Sample Total) from each of the ten sample sites in Clio Channel and Chatham Channel, BC between April 10, 2023, and May 23, 2023.

Site	Pink		Chum		Coho		Capture Totals	Sample Totals
	Capture Total	Sample Total	Capture Total	Sample Total	Capture Total	Sample Total		
1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	1	1
3	0	0	0	0	1	1	1	1
4	82	48	3	3	0	0	85	51
5	0	0	0	0	0	0	0	0
6	145	43	4	4	0	0	149	47
7	3	3	0	0	0	0	3	3
8	57	30	0	0	0	0	57	30
9	0	0	0	0	0	0	0	0
10	2	2	0	0	0	0	2	2
Total	290	127	7	7	1	1	298	135

3.3 Fish Sample Size Statistics

Summary statistics for weight and fork length were calculated for the sample population of juvenile salmonids. Length (Table 7) and weight (Table 8) data were summarized by sampling event for each species.

3.3.1 Pink Salmon

Individual weight of the 127 pink smolts collected during the four sample events ranged from 0.2 g to 3.6 g and averaged 0.9 g (SD = 0.7). Fork length of the pink smolts ranged from 28 mm to 70 mm and averaged 40 mm (SD = 9).

3.3.2 Chum Salmon

Individual weight of the 7 chum smolts collected during the four sample events ranged from 0.4 g to 5.9 g and averaged 2.3 g (SD = 2.2). Fork length of the chum smolts ranged from 32 mm to 77 mm and averaged 52 mm (SD = 18).

3.3.3 Coho Salmon

The weight and fork length of the single coho collected during the four sample events was 19.8 g and 111 mm.

Table 7: Average lengths of pink, chum and coho salmon collected in Clio Channel and Chatham Channel, BC in 2023, summarized by sampling event.

Species	Length (mm)			
	10/11-Apr-23	24/25-Apr-23	8-May-23	23-May-23
pink	30	33	38	51
chum	32	34	48	76
coho	-	-	111	-

Table 8: Average weights of pink, chum and coho salmon collected in Clio Channel and Chatham Channel, BC in 2023, summarized by sampling event.

Species	Weight (g)			
	10/11-Apr-23	24/25-Apr-23	8-May-23	23-May-23
pink	0.3	0.4	0.7	1.9
chum	0.4	0.4	1.6	5.4
coho	-	-	19.8	-

3.4 Sea Lice Infestation Rates

The results of laboratory analysis for the presence of sea lice on the fish sample population collected in Clio Channel and Chatham Channel, BC in 2023 are presented in Table 9. A complete dataset is included in Appendix III. A total of 135 samples were collected at the ten sites in Clio Channel and Chatham Channel, BC in 2023 and inspected for sea lice infestation. A total of 32 fish in the sample population were found to be infested with 37 sea lice (Table 9).

The sea lice prevalence in the sample population collected in Clio Channel and Chatham Channel, BC in 2023 was 23.7 %, the abundance was 0.27 and the average intensity was 1.2 (Table 9).

No sea lice were observed on the single coho salmon smolt captured and retained at Site 3 on May 8, 2023, in Clio Channel, BC.

Table 9: Results of analysis for sea lice infestation on fish collected by beach seine in Clio Channel and Chatham Channel, BC in 2023.

Species	Sample size (n)	Total number of lice observed	Total number of fish infested	Prevalence (%)	Abundance	Average Intensity
pink	127	35	31	24.4	0.28	1.1
chum	7	2	1	14.3	0.29	2.0
coho	1	0	0	0.0	0.00	0.0
Total	135	37	32	23.7	0.27	1.2

3.4.1 Infestation Rates on Pink Salmon

The results of the laboratory analysis for sea lice infestation for pink salmon are presented by site in Table 10. A total of 31 pink salmon were found to be infested 35 sea lice. The largest number of pink salmon infested with sea lice (20 pink) and the largest number of total sea lice (23 lice) found on samples were at Site 6 (Table 10). Sea lice were found on pink salmon at Sites 4, 6 and 8. No pink salmon were collected at Sites 1, 3, 5 and 9 (Table 10).

A total of 31 pink salmon were found to be infested with at least one sea louse. The prevalence of sea lice on the pink salmon sample population (n= 127) collected in Clio Channel and Chatham Channel, BC in 2023 was 24.4 %. Sea lice prevalence calculated by site for pink salmon and is presented in Table 10. The highest sea lice prevalence (46.5 %) was at Site 6.

A total of 35 sea lice were identified during laboratory analysis of retained pink salmon. The abundance of sea lice on the pink salmon sample population (n= 127) collected in Clio Channel and Chatham Channel, BC in 2023 was 0.28. The 35 sea lice identified were observed on 31 individual pink salmon resulting in an average intensity of 1.1. Sea lice abundance and intensity were calculated by site and are presented in Table 10. The highest sea lice abundance (0.53) and average intensity (1.2) were both found at Site 6.

Table 10: Total number, prevalence, abundance, and intensity of sea lice infestation on pink salmon collected in Clio Channel and Chatham Channel, BC in 2023, summarized by sampling site.

Site	# of Pink Analyzed	# of Infested Pink	Average Weight of Infested Pink (g)	# of Lice	Prevalence (%)	Abundance	Average Intensity
1	0	0	-	0	0.0	0.00	0.0
2	1	0	-	0	0.0	0.00	0.0
3	0	0	-	0	0.0	0.00	0.0
4	48	3	2.4	3	6.3	0.06	1.0
5	0	0	-	0	0.0	0.00	0.0
6	43	20	0.6	23	46.5	0.53	1.2
7	3	0	-	0	0.0	0.00	0.0
8	30	8	0.9	9	26.7	0.30	1.1
9	0	0	-	0	0.0	0.00	0.0
10	2	0	-	0	0.0	0.00	0.0
TOTAL	127	31	0.9	35	24.4	0.28	1.1

3.4.2 Infestation Rates on Chum Salmon

The results of the laboratory analysis for sea lice infestation for chum salmon are presented by site in Table 11. Seven chum salmon were collected in Clio Channel and Chatham Channel, BC in 2023 at Sites 4 and 6. One chum collected at Site 6 was found to be infested with two sea lice (Table 11).

The prevalence of sea lice on the chum salmon sample population (n= 7) collected in 2023 was 14.3 % (Table 11). Site 6 had a calculated prevalence of 25.0 %.

The abundance of sea lice on the chum salmon sample population (n= 7) collected in 2023 was 0.29 (Table 11). Site 6 has a calculated abundance of 0.50. The two sea lice identified were observed on one chum salmon, resulting in an average intensity of 2.0 for the sample population.

Table 11: Total number, prevalence, abundance, and intensity of sea lice infestation on chum salmon collected in Clio Channel and Chatham Channel, BC in 2023 summarized by sampling site.

Site	# of Chum Analyzed	# of Infested Chum	Average Weight of Infested Chum (g)	# of Lice	Prevalence (%)	Abundance	Average Intensity
1	0	0	-	0	0.0	0.00	0.0
2	0	0	-	0	0.0	0.00	0.0
3	0	0	-	0	0.0	0.00	0.0
4	3	0	-	0	0.0	0.00	0.0
5	0	0	-	0	0.0	0.00	0.0
6	4	1	1.2	2	25.0	0.50	2.0
7	0	0	-	0	0.0	0.00	0.0
8	0	0	-	0	0.0	0.00	0.0
9	0	0	-	0	0.0	0.00	0.0
10	0	0	-	0	0.0	0.00	0.0
TOTAL	7	1	1.2	2	14.3	0.29	2.0

3.5 Infestation by Sea Lice Species

A total of 37 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 32 juvenile salmon. No *Caligus clemensi* sea lice were observed on the juvenile salmon sample population.

3.5.1 Infestation by Life Stage on Pink Salmon

An analysis of the species of sea lice identified on the 31 infested pink salmon is presented in Table 12 (Appendix III). A total of 35 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 31 juvenile pink salmon. No *Caligus clemensi* sea lice of were observed. The sea lice species identified on pink salmon by site are also presented by site in Table 13.

Table 12: The number of *Lepeophtheirus salmonis* and *Caligus clemensi* in each life stage identified on the pink salmon sample population from Clio Channel and Chatham Channel, BC, in 2023. LEP = *Lepeophtheirus salmonis* CAL= *Caligus clemensi*

Life Stage ¹	10/11-Apr-23	24/25-Apr-23	8-May-23	23-May-23
LEP Co	0	0	11	4
LEP C1	0	0	9	7
LEP C2	0	0	2	1
LEP NM No ID	0	0	0	0
LEP PAM	0	0	0	0
LEP PAF	0	0	1	0
LEP AM	0	0	0	0
LEP AF	0	0	0	0
TOTAL LEP	0	0	23	12
CAL Co	0	0	0	0
CAL C1	0	0	0	0
CAL C2	0	0	0	0
CAL C3	0	0	0	0
CAL C4	0	0	0	0
CAL NM No ID	0	0	0	0
CAL PAM	0	0	0	0
CAL PAF	0	0	0	0
CAL AM	0	0	0	0
CAL AF	0	0	0	0
TOTAL CAL	0	0	0	0

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 13: The number of sea lice found on pink salmon collected in Clio Channel and Chatham Channel, BC in 2023, summarized by sampling site. LEP = *Lepeophtheirus salmonis* CAL= *Caligus clemensi*

Site	Sample Period																TOTAL		
	10/11-Apr-23				24/25-Apr-23				8-May-23				23-May-23				# of Pink Analyzed	# of Infested Pink	# of Lice
	# of Pink Analyzed	# of Infested Pink	# of LEP	# of CAL	# of Pink Analyzed	# of Infested Pink	# of LEP	# of CAL	# of Pink Analyzed	# of Infested Pink	# of LEP	# of CAL	# of Pink Analyzed	# of Infested Pink	# of LEP	# of CAL			
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	30	0	0	0	0	0	0	0	18	3	3	0	48	3	3
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	30	12	14	0	13	8	9	0	43	20	23
7	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0
8	0	0	0	0	0	0	0	0	30	8	9	0	0	0	0	0	30	8	9
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0
TOTAL	3	0	0	0	31	0	0	0	62	20	23	0	31	0	0	0	127	31	35

3.5.2 Infestation by Life Stage on Chum Salmon

An analysis of species of sea lice identified on the one infested chum salmon is presented in Table 14 (Appendix III). Two *Lepeophtheirus salmonis* sea lice (copepodid life stage) were identified on one juvenile chum salmon and no *Caligus clemensi* sea lice were found on the chum salmon sample population. The sea lice species identified on the chum salmon by site are also presented by site in Table 15.

Table 14: The number of *Lepeophtheirus salmonis* and *Caligus clemensi* in each life stage identified on the chum salmon sample population from Clio Channel and Chatham Channel, BC, in 2023. LEP = *Lepeophtheirus salmonis* CAL= *Caligus clemensi*

Life Stage ¹	10/11-Apr-23	24/25-Apr-23	8-May-23	23-May-23
LEP Co	0	0	2	0
LEP C1	0	0	0	0
LEP C2	0	0	0	0
LEP NM No ID	0	0	0	0
LEP PAM	0	0	0	0
LEP PAF	0	0	0	0
LEP AM	0	0	0	0
LEP AF	0	0	0	0
TOTAL LEP	0	0	2	0
CAL Co	0	0	0	0
CAL C1	0	0	0	0
CAL C2	0	0	0	0
CAL C3	0	0	0	0
CAL C4	0	0	0	0
CAL NM No ID	0	0	0	0
CAL PAM	0	0	0	0
CAL PAF	0	0	0	0
CAL AM	0	0	0	0
CAL AF	0	0	0	0
TOTAL CAL	0	0	0	0

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 15: The number of sea lice found on chum salmon collected in Clio Channel and Chatham Channel, BC in 2023 summarized by sampling site. LEP = *Lepeophtheirus salmonis* CAL= *Caligus clemensi*

Site	Sample Period																TOTAL		
	10/11-Apr-23				24/25-Apr-23				8-May-23				23-May-23				# of Chum Analyzed	# of Infested Chum	# of Lice
	# of Chum Analyzed	# of Infested Chum	# of LEP	# of CAL	# of Chum Analyzed	# of Infested Chum	# of LEP	# of CAL	# of Chum Analyzed	# of Infested Chum	# of LEP	# of CAL	# of Chum Analyzed	# of Infested Chum	# of LEP	# of CAL			
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	3	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	0	0	0	0	0	0	0	3	1	2	0	0	0	0	0	4	1	2
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	0	0	0	1	0	0	0	3	1	2	0	2	0	0	0	7	1	2

4.0 Conclusions

This report presents the data from the fifth year of beach seining and sea lice analysis conducted for wild juvenile salmonid in Clio Channel and Chatham Channel, BC by Grieg Seafood BC Ltd. This report is limited to the summary and presentation of the 2023 collected data.

A total of 135 fish samples underwent lab analysis for sea lice infestation in 2023 including 127 pink, seven chum, one coho. No chinook, sockeye or Atlantic salmon were captured during sampling completed in Clio Channel and Chatham Channel, BC in 2023. A total of 32 individuals were found to be infested with sea lice in the total sample population, resulting in a calculated sea lice prevalence of 23.7 % in 2023. A total of 37 sea lice were found during laboratory analysis resulting in an abundance of 0.27 and an average intensity of 1.2 for the sample population.

Pink salmon smolts were captured in significantly greater numbers than any other species. A total of 290 pink salmon were captured, representing 97.3 % of all captured salmonids. Of the 290 pink captured, 127 were retained for lab analysis for sea lice infestation. A total of 31 pink smolts were found to be infested with a total of 35 sea lice resulting in a calculated prevalence of 24.4 %, abundance of 0.28 and an average intensity of 1.1 for the pink salmon sample population.

A total of seven chum salmon were captured, representing 2.3 % of all captured salmonids. All seven captured chum salmon were retained for lab analysis for sea lice infestation. One chum smolt was found to be infested with two sea lice, resulting in a calculated prevalence of 14.3 %, abundance of 0.29 and an average intensity of 2.0 for the chum salmon sample population.

One coho salmon was captured, representing 0.3 % of all captured salmonids. The single coho salmon was retained for lab analysis for sea lice infestation. No sea lice were observed on the coho salmon, resulting in a calculated prevalence, abundance, and average intensity of zero.

A total of 37 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 32 juvenile salmon. No *Caligus clemensi* sea lice were observed on the juvenile salmon population (Appendix III). A total of 35 *Lepeophtheirus salmonis* sea lice of various life stages were identified on 31 juvenile pink salmon. Two *Lepeophtheirus salmonis* sea lice of copepodid life stage were identified on one chum salmon.

5.0 References

- Hamre L.A., C Eichner, C.M.A. Caipang, S.T. Dalvin, J.E. Bron, F. Nilsen, G. Boxshall and R. Skern-Mauitzen. 2013. The Salmon Louse *Lepeophtheirus salmonis* (Copepoda: Caligidae) Life Cycle Has Only Two Chalimus Stages. PLoS ONE 8(9): e73539.
- Healey M.C. 1991. Life history of chinook salmon (*Oncorhynchus tshawytscha*). In: Pacific Salmon Life Histories. C Groot, L Margolis (eds). UBC Press, Vancouver. Pp 313-393.
- Jones S. and S. Johnson. 2015. Sea lice monitoring and non-chemical measures A: Biology of sea lice, *Lepeophtheirus salmonis* and *Caligus spp.*, in western and eastern Canada. DFO Canadian Science Advisory Secretariat. Research Document 2014/019 Pacific Region. Pacific Biological Station, Fisheries and Oceans Canada.
- Jones S. and A. Nemec. 2004. Pink Salmon Action Plan Research. Part II: Sea Lice on Juvenile Salmon and on Three-spine Sticklebacks in 2003. PSARC Working Paper H2004-01.
- Johnson S.C. and L.J. Albright. 1991a. The developmental stages of *Lepeophtheirus salmonis* (Kroyer, 1837) (Copepoda: Caligidae). Canadian Journal of Zoology 69: 929-950.
- Johnson S.C. and L.J. Albright. 1991b. Development, growth and survival of *Lepeophtheirus salmonis* (Copepoda: Caligidae) under laboratory conditions. Journal of the Marine Biological Association of the UK 71: 425-436.
- Kabata Z. 1972. Developmental stages of *Caligus clemensi* (Copepoda: Caligidae) from fishes of British Columbia. Journal of the Fisheries Research Board of Canada 29: 1571-1593.
- Kabata Z. 1974. The species of *Lepeophtheirus* (Copepoda: Caligidae), from fishes of British Columbia. Journal of the Fisheries Research Board of Canada 30: 729-759.
- Margolis L., J.R. Arthur. 1979. Synopsis of the parasites of fishes of Canada. Bulletin of the Fisheries Research Board of Canada, Number 199. Ottawa. 269 pages.
- McDonald T.E., and L. Margolis. 1995. Synopsis of the parasites of fishes of Canada (1978-1993). Canadian Special Publication of Fisheries and Aquatic Sciences No. 122. National Research Council of Canada, Ottawa. 265 pages.
- Pacific Aquaculture Regulations. Finfish Aquaculture Licence conditions under the Pacific Aquaculture Regulations. Section 7. Sea Lice Monitoring
- Parker R.R. and L. Margolis. 1964. A new species of parasitic copepod, *Caligus clemensi* sp. nov. (Clogoida: Caligidae), from pelagic fishes in the coastal waters of British Columbia. Journal of Fisheries Research Board of Canada 21: 873-889.
- Pollard W.R., G.F. Hartman, C. Groot, and P. Edgell. 1997. Field Identification of Coastal Juvenile Salmonids. Published by Harbour Publishing for the Federal Department of Fisheries and Oceans and MacMillan Bloedel Ltd. Madeira Park, BC Canada.

- Saksida, S., Constantine J., Karreman G.A. and Donald A. 2007a. Evaluation of sea lice abundance levels on farmed Atlantic salmon (*Salmo salar* L) located in the Broughton Archipelago of British Columbia from 2003 to 2005. *Aquacult. Res.* 38: 219-231.
- Saksida, S., Karreman G.A., Constantine J., and Donald A. 2007b. Differences in *Lepeophtheirus salmonis* abundance levels on Atlantic salmon farms in the Broughton Archipelago, British Columbia, Canada. *J. Fish Dis.* 30:357-366.
- Salo E.O. 1991. Life history of chum salmon (*Oncorhynchus keta*). In: Pacific Salmon Life Histories. C Grott, L Margolis (eds). UBC Press, Vancouver. Pp 233-309.
- Sandercock F.K. 1991. Life history of coho salmon (*Oncorhynchus kisutch*). In: Pacific Salmon Life Histories. C. Grott, L. Margolis (eds). UBC Press, Vancouver. Pp 397-445.
- Tully O. 1992. Predicting infestation parameters and impacts of caligid copepods in wild and captured fish populations. *Invert. Reprod. Develop.* 22: 91-102.

Appendix I – Field Data

Date	Time	Site Name	Salinity (ppt) 0.2m	Temperature (deg C.) 0.2m	Dissolved Oxygen (mg/L) 0.2m	Salinity (ppt) 1.0m	Temperature (deg C.) 1.0m	Dissolved Oxygen (mg/L) 1.0m	Salinity (ppt) 5.0m	Temperature (deg C.) 5.0m	Dissolved Oxygen (mg/L) 5.0m
10-Apr-23	10:30	1	25.8	7.5	9.7	25.7	7.5	10.1	-	-	-
10-Apr-23	10:53	2	25.4	7.5	9.6	25.9	7.5	9.4	-	-	-
10-Apr-23	11:22	3	25.8	7.6	9.7	25.9	7.4	8.9	25.9	7.4	8.9
11-Apr-23	09:05	4	23.1	7.8	9.0	23.9	7.9	9.6	23.9	8.0	9.5
11-Apr-23	08:46	5	24.3	8.8	9.4	24.3	8.8	9.5	24.9	8.5	9.1
11-Apr-23	08:29	6	21.4	7.8	8.1	21.5	7.7	8.0	-	-	-
11-Apr-23	08:01	7	21.6	7.7	8.2	21.5	7.7	8.1	21.4	8.1	8.0
11-Apr-23	07:42	8	25.6	7.2	8.9	25.6	7.3	9.0	25.8	7.3	8.6
10-Apr-23	12:20	9	25.4	7.7	10.1	25.4	7.6	9.9	-	-	-
10-Apr-23	16:25	10	22.7	8.0	10.4	25.2	7.9	10.1	-	-	-
25-Apr-23	07:29	1	23.3	8.7	9.5	26.1	8.6	9.4	26.2	7.9	9.2
25-Apr-23	07:12	2	26.0	8.1	9.7	26.2	8.2	9.1	26.2	7.9	9.5
25-Apr-23	06:55	3	25.8	9.1	9.8	26.2	8.8	9.7	26.2	8.5	10.0
24-Apr-23	16:18	4	26.1	9.5	10.2	26.1	8.6	10.5	26.3	7.9	10.2
24-Apr-23	16:10	5	26.2	9.1	9.4	26.2	9.0	9.3	26.2	8.3	9.4
24-Apr-23	15:53	6	25.9	10.0	9.4	25.8	8.7	9.4	26.2	7.8	9.7
24-Apr-23	15:33	7	26.1	8.7	9.6	26.1	8.6	9.6	26.1	7.7	9.8
24-Apr-23	15:16	8	26.1	8.3	9.9	26.1	8.2	9.6	26.1	8.1	9.7
24-Apr-23	11:35	9	25.4	8.1	11.9	25.8	8.0	10.5	25.9	7.8	10.4
24-Apr-23	14:11	10	25.3	8.4	9.5	25.9	8.1	9.6	26.0	8.0	9.4
08-May-23	09:55	1	25.3	9.0	6.6	26.0	8.9	6.9	26.2	8.5	8.3
08-May-23	10:10	2	26.1	9.1	11.0	26.2	9.0	10.3	26.4	8.6	13.6
08-May-23	10:33	3	25.8	10.8	12.3	25.8	10.1	12.9	-	-	-
08-May-23	16:32	4	26.1	10.4	9.3	26.1	9.6	9.9	26.2	9.0	14.0
08-May-23	16:20	5	26.0	10.5	12.9	26.0	10.5	13.3	26.1	9.9	13.4
08-May-23	15:52	6	25.9	10.1	11.3	26.0	10.0	11.5	26.0	8.9	11.2
08-May-23	15:35	7	25.9	9.4	10.6	25.9	9.4	10.7	26.1	8.6	11.2
08-May-23	15:10	8	25.8	10.2	10.6	25.9	9.5	11.2	26.1	8.7	11.2
08-May-23	11:16	9	25.9	8.8	10.2	26.0	8.6	10.6	26.1	8.4	11.1
08-May-23	15:03	10	25.8	11.1	11.4	25.9	10.0	11.7	26.1	8.5	11.0
23-May-23	10:01	1	24.4	10.0	6.9	25.5	9.5	7.5	25.6	9.4	8.0
23-May-23	10:20	2	25.4	9.6	9.3	25.4	9.6	9.3	25.6	9.4	10.1
23-May-23	10:42	3	23.0	11.3	8.5	23.0	11.3	8.6	-	-	-
23-May-23	16:39	4	25.3	10.1	10.4	25.3	9.9	10.7	25.4	9.5	10.3
23-May-23	16:26	5	24.6	11.2	10.6	24.7	11.0	10.9	25.2	9.9	11.0
23-May-23	11:10	6	24.5	10.7	10.4	24.6	10.6	10.8	25.0	10.1	10.0
23-May-23	16:06	7	25.1	9.8	10.0	25.1	9.8	10.5	25.6	9.1	10.5
23-May-23	15:52	8	25.2	10.0	10.2	25.3	10.0	10.4	25.4	9.3	10.1
23-May-23	11:46	9	25.6	9.2	9.8	25.5	9.2	9.7	25.6	9.1	9.9
23-May-23	14:53	10	25.5	9.5	9.8	25.5	9.5	10.0	-	-	-

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	Salmonid Mortalities	Comments
10-Apr-23	10:30	1	Calm and cloudy	Low	0	0	0	0	0	0	0	3 juvenile lings, 10 gunnels, 2 seastars
10-Apr-23	10:53	2	Calm and cloudy	Low	1	1	0	0	0	0	0	5 flounders, 1 cabezon, 6 sculpins, 5 pipefish
10-Apr-23	11:22	3	Calm, sunny and cloudy	Low	0	0	0	0	0	0	0	5 sculpins
11-Apr-23	09:05	4	Calm and cloudy	Mid	0	0	0	0	0	0	0	Shrimp
11-Apr-23	08:46	5	Calm and cloudy	Mid	0	0	0	0	0	0	0	No bycatch, good set
11-Apr-23	08:29	6	Rainy and calm	Mid	0	0	1	1	0	0	0	No bycatch
11-Apr-23	08:01	7	Rainy and calm	Mid	2	2	0	0	0	0	0	No bycatch
11-Apr-23	07:42	8	Rainy and calm	Mid	0	0	0	0	0	0	0	1 gunnel
10-Apr-23	12:20	9	Windy, sunny and cloudy	Low	0	0	0	0	0	0	0	Had to reset due to tide. 2 juvenile lings, 2 scuplins
10-Apr-23	16:25	10	Rainy and calm	Mid	0	0	0	0	0	0	0	No bycatch
25-Apr-23	07:29	1	Calm, overcast	Mid	0	0	0	0	0	0	0	No bycatch
25-Apr-23	07:12	2	Calm, overcast	High	0	0	0	0	0	0	0	11 juvenile lingcod
25-Apr-23	06:55	3	Calm, overcast	High	0	0	0	0	0	0	0	2 juvenile lingcod
24-Apr-23	16:18	4	Calm, sun, cloud	High	64	30	1	1	0	0	0	No bycatch
24-Apr-23	16:10	5	Calm, sun, cloud	High	0	0	0	0	0	0	0	No bycatch
24-Apr-23	15:53	6	Calm, sun, cloud	High	0	0	0	0	0	0	0	No bycatch
24-Apr-23	15:33	7	Slight chop, sun, cloud	Mid	1	1	0	0	0	0	0	No bycatch
24-Apr-23	15:16	8	Calm, sun, cloud	Mid	0	0	0	0	0	0	0	No bycatch
24-Apr-23	11:35	9	Calm, cloud	Low	0	0	0	0	0	0	0	1 gunnel, 7 juvenile lingcod, 2 pipefish, 3 kelp crabs, 4 flatfish
24-Apr-23	14:11	10	Calm, sun, cloud	Mid	0	0	0	0	0	0	0	No bycatch
08-May-23	09:55	1	Calm, sun	Low	0	0	0	0	0	0	0	1 Buffalo sculpin, 1 pile perch, 2 hooded nudibranchs, 1 red rock crab
08-May-23	10:10	2	Calm, overcast	Low	0	0	0	0	0	0	0	Abundant seaweed, no bycatch
08-May-23	10:33	3	Calm, sun	Low	0	0	0	0	1	1	0	1 dolly varden, 1 trout, 3 sculpins, 7 pipefish, 5 flatfish
08-May-23	16:32	4	Calm, sun, cloud	High	0	0	0	0	0	0	0	No bycatch
08-May-23	16:20	5	Chop, sun, cloud	High	0	0	0	0	0	0	0	No bycatch
08-May-23	15:52	6	Large chop, sun, cloud	High	132	30	3	3	0	0	0	Abundant juvenile lingcod
08-May-23	15:35	7	Chop, sun, cloud, wind	High	0	0	0	0	0	0	0	No bycatch
08-May-23	15:10	8	Slight chop, sun, cloud	High	57	30	0	0	0	0	0	20 pink salmon kept for fish health
08-May-23	11:16	9	Calm, sun	Low	0	0	0	0	0	0	0	6 shiner perch, 3 sculpins, abundant seaweed
08-May-23	15:03	10	Calm, sun, cloud	Mid	2	2	0	0	0	0	0	2 flatfish
23-May-23	10:01	1	Calm, overcast	Low	0	0	0	0	0	0	0	1 striped perch, sand lances, 4 kelp crabs, 1 dungeness crab
23-May-23	10:20	2	Calm, overcast	Low	0	0	0	0	0	0	0	4 sculpins, abundant sand lances, 1 kelp perch, 1 kelp crab
23-May-23	10:42	3	Choppy, wind, overcast	Low	0	0	0	0	0	0	0	50 sculpins, 20 gunnels, 15 flatfish, 2 crabs, 1 kelp greenling
23-May-23	16:39	4	Choppy, overcast	High	18	18	2	2	0	0	1	100 shiner perch
23-May-23	16:26	5	Calm, overcast	High	0	0	0	0	0	0	0	3 gunnels, 1 shiner perch, 1 sculpin
23-May-23	11:10	6	Light chop, overcast	Low	13	13	0	0	0	0	0	4 sculpins, 2 gunnels
23-May-23	16:06	7	Choppy, overcast	High	0	0	0	0	0	0	0	1 cutthroat
23-May-23	15:52	8	Calm, overcast	High	0	0	0	0	0	0	0	No bycatch
23-May-23	11:46	9	Calm, overcast	Low	0	0	0	0	0	0	0	6 gunnels, 5 flatfish, 1 shiner perch, 7 sculpins
23-May-23	14:53	10	Calm, overcast	Mid	0	0	0	0	0	0	0	1 sculpin

Appendix III – Sea Lice Analysis

SITE	WEEK	DATE COLLECTED	DATE EXAMINED	FISH SPECIES	FISH NUMBER	LENGTH IN MM	WEIGHT IN G	LEP Co	LEP C1	LEP C2	LEP NM NOT ID	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP MOT NOT ID	CAL Co	CAL C1	CAL C2	CAL C3	CAL C4	CAL NM NOT ID	CAL PAM	CAL_PAF	CAL AM	CAL AF	CAL MOT NOT ID	TOT LICE ID	TOT LEP	TOT CAL
Site 2	1	10-Apr-23	23-Jun-23	Pink	1	30	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 7	1	11-Apr-23	23-Jun-23	Pink	2	31	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 7	1	11-Apr-23	23-Jun-23	Pink	3	30	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	1	11-Apr-23	23-Jun-23	Chum	5	32	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 7	2	24-Apr-23	23-Jun-23	Pink	4	29	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Chum	73	34	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	74	33	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	75	35	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	76	32	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	77	34	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	78	35	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	79	38	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	80	36	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	81	32	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	82	34	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	83	34	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	84	34	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	85	29	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	86	33	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	87	30	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	88	32	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	89	33	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	90	35	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	91	33	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	92	31	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	93	34	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	94	34	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	95	37	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	96	33	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	97	34	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	98	32	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	99	36	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	100	29	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	101	35	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	102	33	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	2	24-Apr-23	23-Jun-23	Pink	103	33	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 3	3	08-May-23	23-Jun-23	Coho	19	111	19.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Chum	40	44	1.2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Chum	41	54	2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SITE	WEEK	DATE COLLECTED	DATE EXAMINED	FISH SPECIES	FISH NUMBER	LENGTH IN MM	WEIGHT IN G	LEP Co	LEP C1	LEP C2	LEP NM NOT ID	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP MOT NOT ID	CAL Co	CAL C1	CAL C2	CAL C3	CAL C4	CAL NM NOT ID	CAL PAM	CAL_PAF	CAL AM	CAL AF	CAL MOT NOT ID	TOT LICE ID	TOT LEP	TOT CAL
Site 6	3	08-May-23	23-Jun-23	Chum	42	46	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	43	34	0.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	44	37	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	45	31	0.3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	46	34	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	47	33	0.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	48	30	0.3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	49	39	0.8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	50	34	0.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	51	39	0.7	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	52	31	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	53	32	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	54	28	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	55	36	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	56	29	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	57	33	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	58	49	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	59	34	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	60	36	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	61	36	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	62	39	0.7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	63	33	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	64	42	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	65	35	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	66	32	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	67	33	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	68	36	0.6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	3	08-May-23	23-Jun-23	Pink	69	34	0.6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0
Site 6	3	08-May-23	23-Jun-23	Pink	70	35	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	71	29	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	3	08-May-23	23-Jun-23	Pink	72	33	0.4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0
Site 8	3	08-May-23	27-Jun-23	Pink	104	47	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	105	43	0.8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 8	3	08-May-23	27-Jun-23	Pink	106	34	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	107	47	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	108	32	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	109	48	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	110	50	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	111	42	0.8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 8	3	08-May-23	27-Jun-23	Pink	112	46	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	113	44	0.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 8	3	08-May-23	27-Jun-23	Pink	114	49	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SITE	WEEK	DATE COLLECTED	DATE EXAMINED	FISH SPECIES	FISH NUMBER	LENGTH IN MM	WEIGHT IN G	LEP Co	LEP C1	LEP C2	LEP NM NOT ID	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP MOT NOT ID	CAL Co	CAL C1	CAL C2	CAL C3	CAL C4	CAL NM NOT ID	CAL PAM	CAL_PAF	CAL AM	CAL AF	CAL MOT NOT ID	TOT LICE ID	TOT LEP	TOT CAL
Site 8	3	08-May-23	27-Jun-23	Pink	115	34	0.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 8	3	08-May-23	27-Jun-23	Pink	116	40	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	117	46	1.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 8	3	08-May-23	27-Jun-23	Pink	118	34	0.4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0
Site 8	3	08-May-23	27-Jun-23	Pink	119	36	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	120	45	1.2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 8	3	08-May-23	27-Jun-23	Pink	121	37	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	122	37	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	123	41	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	124	40	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	125	41	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	126	34	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	127	42	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	128	44	1.0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 8	3	08-May-23	27-Jun-23	Pink	129	44	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	130	40	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	131	41	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	132	40	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 8	3	08-May-23	27-Jun-23	Pink	133	41	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 10	3	08-May-23	27-Jun-23	Pink	134	42	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 10	3	08-May-23	27-Jun-23	Pink	135	38	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	4	23-May-23	23-Jun-23	Pink	6	36	0.6	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0
Site 6	4	23-May-23	23-Jun-23	Pink	7	34	0.5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	4	23-May-23	23-Jun-23	Pink	8	42	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	4	23-May-23	23-Jun-23	Pink	9	40	0.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	4	23-May-23	23-Jun-23	Pink	10	32	0.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	4	23-May-23	23-Jun-23	Pink	11	46	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	4	23-May-23	23-Jun-23	Pink	12	42	1.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	4	23-May-23	23-Jun-23	Pink	13	38	0.7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	4	23-May-23	23-Jun-23	Pink	14	39	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	4	23-May-23	23-Jun-23	Pink	15	44	1.2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	4	23-May-23	23-Jun-23	Pink	16	49	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 6	4	23-May-23	23-Jun-23	Pink	17	44	1.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 6	4	23-May-23	23-Jun-23	Pink	18	47	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Chum	20	75	4.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Chum	21	77	5.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	22	56	2.3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 4	4	23-May-23	23-Jun-23	Pink	23	60	2.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	24	57	2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	25	61	3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	26	70	3.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	27	63	3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SITE	WEEK	DATE COLLECTED	DATE EXAMINED	FISH SPECIES	FISH NUMBER	LENGTH IN MM	WEIGHT IN G	LEP Co	LEP C1	LEP C2	LEP NM NOT ID	LEP PAM	LEP PAF	LEP AM	LEP AF	LEP MOT NOT ID	CAL Co	CAL C1	CAL C2	CAL C3	CAL C4	CAL NM NOT ID	CAL PAM	CAL_PAF	CAL AM	CAL AF	CAL MOT NOT ID	TOT LICE ID	TOT LEP	TOT CAL
Site 4	4	23-May-23	23-Jun-23	Pink	28	56	2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	29	55	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	30	52	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	31	58	2.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 4	4	23-May-23	23-Jun-23	Pink	32	55	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	33	57	2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	34	55	2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	35	56	2.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	36	54	2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	37	56	2.3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Site 4	4	23-May-23	23-Jun-23	Pink	38	57	2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 4	4	23-May-23	23-Jun-23	Pink	39	66	3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0