

**SEA LICE MONITORING STUDY IN
GOLETAS CHANNEL AND QUEEN
CHARLOTTE STRAIT, BC
YEAR 3**

Tlatlasikwala First Nation
Gwa'sala-Nakwaxda'xw First Nation
Marine Harvest Canada Inc
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YEAR 3

2014

Prepared for:

Tlatlasikwala First Nation
Box 339, Port Hardy, BC
V0N 2P0

Gwa'sala Nakwaxda'xw First Nation
PO Box 998, Port Hardy, BC
V0N 2P0

Marine Harvest Canada Inc.
124-1334 Island Highway
Campbell River, BC

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Written by:
Rachel Myers, BSc

Reviewed by:
Derek LeBoeuf, R.P.Bio.

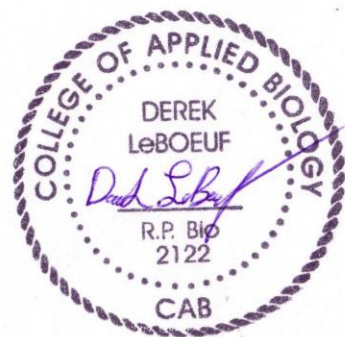


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Introduction

Pacificus Biological Services (Pacificus) supplemented the existing base-line studies (Pacificus 2011, 2013a and 2013b) of ambient sea lice levels present in Goletas Channel and Queen Charlotte Strait, British Columbia (Figure 1) by continuing the study during this years salmonid outmigration period (April and May, 2014). The study was conducted on behalf of Marine Harvest Canada, the Tlatlasikwala First Nation, and Gwa'sala Nakwaxda'xw First Nation.

A total of 20 beach seine sites were selected for the base line study. Six sites were located within the Shelter Bay Area, Queen Charlotte Strait in DFO's Management Areas 11-2¹ and 12-13². Three sites were repeated from the previous years' study and three were new sites. The remaining 14 sites were located in Goletas Channel in DFO's Management Areas 12-11, 12-12, 12-15, 12-16. Thirteen sites were repeated from previous years studies, with three sites being dropped and with the addition of one new site. Two species of sea louse commonly found on salmonids in BC waters, *Lepeophtheirus salmonis* and *Caligus clemensi*, were the focus of this study. All smolt samples were caught with a beach seine and processed for lab analysis at the BC Center for Aquatic Health in Campbell River, BC.

The target species for this study were pink salmon smolts (*Oncorhynchus gorbuscha*) although samples of chum (*O. keta*), coho (*O. kisutch*), Chinook (*O. tshawytscha*), and sockeye (*O. nerka*) salmon juveniles as well as cutthroat trout (*O. clarki*), Dolly Varden (*Salvelina malma*) and Pacific herring (*Clupea pallasii*) juveniles were also retained for analysis if encountered. Samples were analysed for sea lice prevalence (percentage of fish that are infected), intensity (average number of sea lice on infected fish) and abundance (average number of sea lice on all fish sampled).

A total of five fish farms were located within the study area (Figure 2). Two fish farms were located in the Shelter Bay Area (Zone 6), and a total of three fish farms were located within Goletas Channel, all in the southern-most section of the survey area in the Gordon Islands (Zone 5). Previous studies in the Broughton Archipelago have indicated that such farms may or may not be a source of sea lice infection in wild populations as reported by studies published by Beamish et al. (2006), Butterworth et al. (2008), Jones et al. (2007) and Saksida et al. (2007). However,

¹ <http://www.pac.dfo-mpo.gc.ca/fm-gp/maps-cartes/areas-secteurs/12-eng.html> (Accessed June 16, 2014)

² <http://www.pac.dfo-mpo.gc.ca/fm-gp/maps-cartes/areas-secteurs/11-eng.html> (Accessed June 16, 2014)

high natural levels of sea lice have also been observed in areas with no active fish farms nearby as observed by Beamish et al. in the 2009 paper *A large infection of sea lice on juvenile Pacific salmon in the Gulf Islands area of British Columbia, Canada*. Although a large amount of data exists regarding sea lice and salmon interactions on the BC coast, due to the highly charged and ongoing debate in the public realm, no scientific consensus regarding these interactions has been achieved as a result of the complex nature of the relationship and relatively short study period thus far.

As no historical data existed for these areas prior to 2011, the primary objective of this project was to create a baseline study. This is the third study year in Goletas channel (Pacificus 2011, 2013a) and the second study year in the Shelter Bay area (Pacificus 2013b). Secondary objectives included determining life history characteristics of sea lice in this area in terms of abundance, life stage, and distribution of the two species analysed. Additionally, observations regarding smolt outmigration timing, abundance and distribution patterns were to be determined.

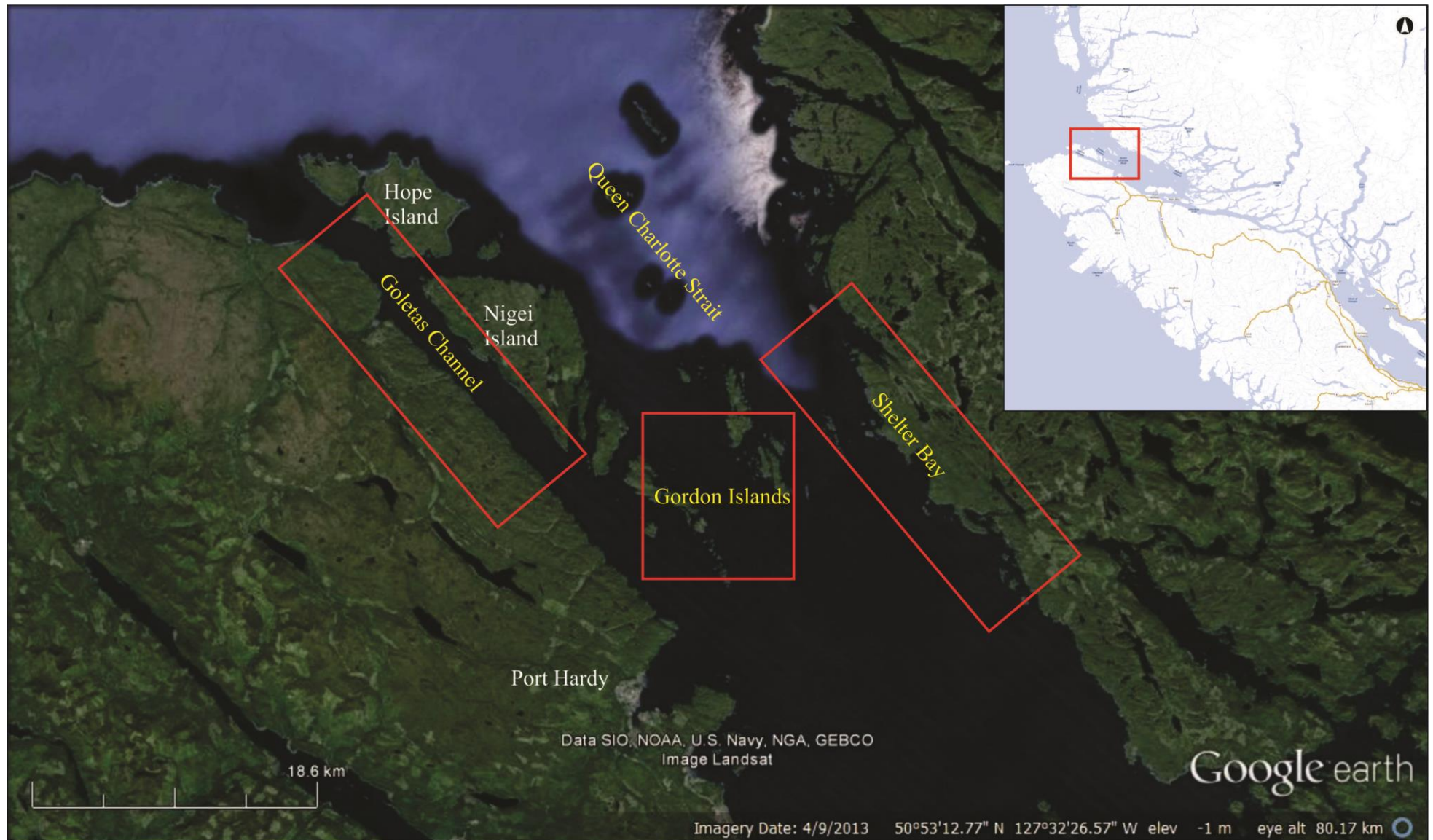


Figure 1: Overview map showing study locations (red boxes) in relation to Port Hardy, Vancouver Island, BC.

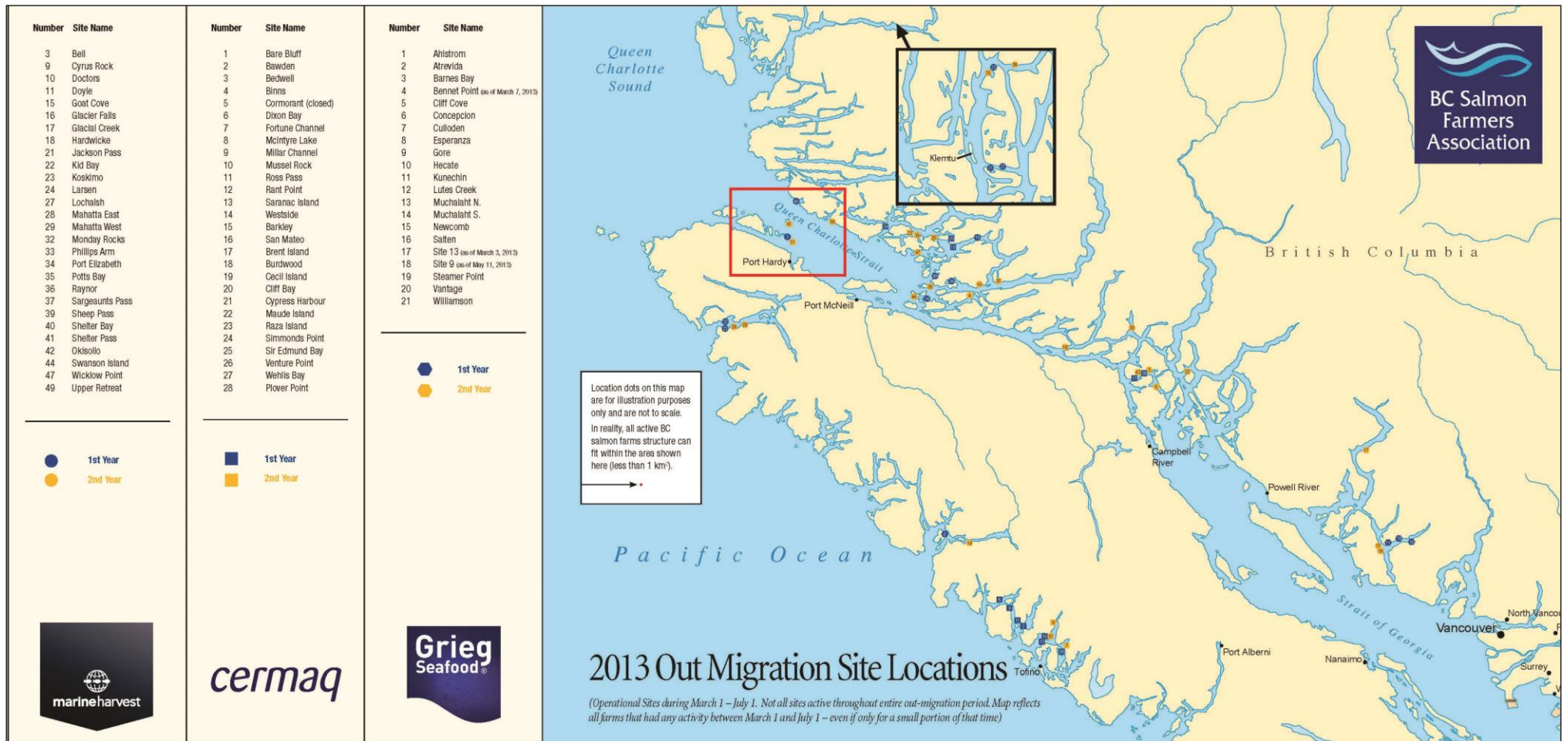


Figure 2: Location map of the fish farms located on the BC coast by company for 2013³ with area of study location outlined in red.

³ http://www.salmonfarmers.org/sites/default/files/all_companies_2013-07_out_migration_sites.pdf (Accessed June 16, 2014)

Methodology

The survey area consisted of 20 beach seine sampling locations within Queen Charlotte Strait. The 20 sites are separated into six zones based on relative geographic locations. Sample locations within Goletas Channel (Zones 1-5) were determined in the first year of the study (2011), and identified during the pre-sampling field reconnaissance (Pacificus 2011). Shelter Bay (Zone 6, Queen Charlotte Strait) sampling sites were determined in 2013 (Pacificus 2013b). Sample locations were chosen based on targeting areas with appropriate habitat characteristics and likelihood of juvenile salmonids holding in these locations during the project time frame. Efforts were made to evenly distribute sites throughout the survey.

Zones 1 - 5

This is the third year of sea lice monitoring in Zones 1 to 5, all located within Goletas Channel (previous years; 2011, 2013). These zones originally consisted of 3-4 sampling locations per zone (Pacificus 2011). Zones 1 and 2 were located on the west side of Goletas channel, on Vancouver Island (Figure 3 and 4) and consisted of two sampling sites per zone. Zones 3 and 4 consisted of three sampling sites per zone. Zone 3 was located on Hope Island (Figure 4), Zone 4 on Nigei Island (Figure 3) and Zone 5 around the Gordon and Deserter Group of Islands (Figure 5). Zone 5 consisted of four sampling sites. In 2014, Site 1 in Zone 1, Site 3 in Zone 2, Site 1 in Zone 4 were eliminated due to a combination of lack of fish being captured, redistributing effort, and allowing new sites to be added. Site 4, located within the Deserters Group was added to Zone 5 in 2014.

Zone 6

This is the second year of sea lice monitoring in Zone 6, located northeast of Port Hardy, in the Shelter Bay area, Queen Charlotte Strait (Figure 6). Five sampling locations were originally established by Marine Harvest Inc (Pacificus 2013b). A total of six sampling sites were established during this years sampling period. In 2014, Site 2 was eliminated and Site 4 and 5 were merged into one site in a new location (now known as Site 4) due to lack of suitable areas for beach seining. Two new sites were added in April of 2014. Site 6 was located near Marsh Bay, and Site 7, was located by Robinson Island. In May of 2014, an additional sampling location (Site 5) was added and located near Browning Island, in between Site 6 and 7.

Sampling for lice occurred on a monthly cycle in April and May in 2014. This differed from the 2013 study year where sampling occurred in April, May and June. In 2011, the sampling occurred from March until June. Successful sampling of all sites occurred in the 2014 study year.

Crew size was four people with one person operating the boat and collecting environmental data and three people hauling the net and processing fish samples. The sampling crew was composed of personnel from Pacificus. Cherise Wallace; a representative from the Tlaltlasikwala First Nation joined the crew on May 12th and 13th, 2014. A representative from the Gwa'sala-Nakwaxda'xw First Nations was unable to join the crew during sampling days.

Fish were sampled using a beach seine net deployed in a simple arc set pattern by boat and pulled into the beach area by the crew as outlined in the beach seining section of *The Salmonid Field Protocols Handbook* (2008). The seine net was built by Redden Nets in Campbell River with dimensions as follows: 150 ft length with ½" wings and ¼" bunt mesh, 2 fathom depth and #2 lead line.

Prior to setting the net a preliminary search of the shoreline at each location was performed for 5 minutes from the boat at a distance of 10-20m from the shore in order to ascertain salmonids presence. If fish were observed then a set encompassed this area, if no fish were observed during this search then the set was performed at the most likely area for fish presence as determined by the crew during the search.

If no salmonids were caught on the first set in a sample site, a subsequent set was made within the defined sample area to a maximum of two sets per sampling location (Pacificus 2013a). During the 2011 study, subsequent sets were made to a maximum of three sets per sampling location, however the results indicated that only on one occasion did a third set within a sampling location result in a captured salmonid (Pacificus 2011). Therefore, the maximum number of sets per sampling location was modified to two for the 2013 and 2014 study years.

If salmonids were caught, specimens were randomly selected for lab analysis and a count of the remaining numbers of fish to be released in the set was made based on field identification to the species level. A maximum of 30 fish/species for each target species were retained from each site for the lice analysis in each monthly cycle. Target species for the survey were pink (maximum 1440 specimens retained for entire project), chum, sockeye (maximum 1140 specimens per

species retained), coho, Chinook, Dolly Varden, cutthroat, stickleback and herring (maximum 1140 specimens per species retained).

Retained sample specimens were placed in sample bags and euthanized with a Tricaine methanesulfonate (TMS) overdose immediately. Samples in 2 ounce bags were given 1.0 ml of a 240 mg/L TMS solution while samples in 4 ounce bags were given 5 ml of the TMS solution. Each sample bag, having been pricked with a tack prior to usage, was then placed in a bucket where the solution was allowed to drain out and then poured to ground in the upland area. Sample bags for each site were placed in a larger bag together with relevant data for the set included on waterproof paper. Once samples were processed they were placed on ice in a cooler while in the field and frozen once they were transported back to Port Hardy. When the monthly cycle was complete the samples were transported in a frozen state to the BC Centre for Aquatic Health (CAHS) for laboratory analysis which included species identification and microscopic lice counts. Specimens were classified and analysed for wet weight, fork length and sea lice were identified to species and sexed with life stage determined and enumerated for each sample. For the purpose of analysis, louse prevalence was defined as the number of fish infected out of the total number sampled, abundance as the total average number of lice per fish and intensity as the total number of lice per infected fish.

In sets where large numbers of fish (over 100) were encountered in a single set or where sea conditions did not permit identification and/or processing of fish in the bunt of the net, caught fish were placed in a sea-water filled tote with airstones to maintain dissolved oxygen levels before being processed. Those fish that were not retained were released in a timely manner when identification and quantification had been completed.

Environmental data was collected at every seine location and consisted of temperature ($^{\circ}\text{C}$), dissolved oxygen (D_0) and salinity in parts per thousand (ppt) at the surface (0m), 1m depth and 4m depth. These measurements were taken using a 556 YSI meter at the same time and location as the set proximal to the mid-point of the net. Weather conditions at the time of each set were noted as well as any additional comments pertaining to the set. Locational data was collected from the sampling vessel's navigation system, a Ray-Marine multi-function GPS unit.

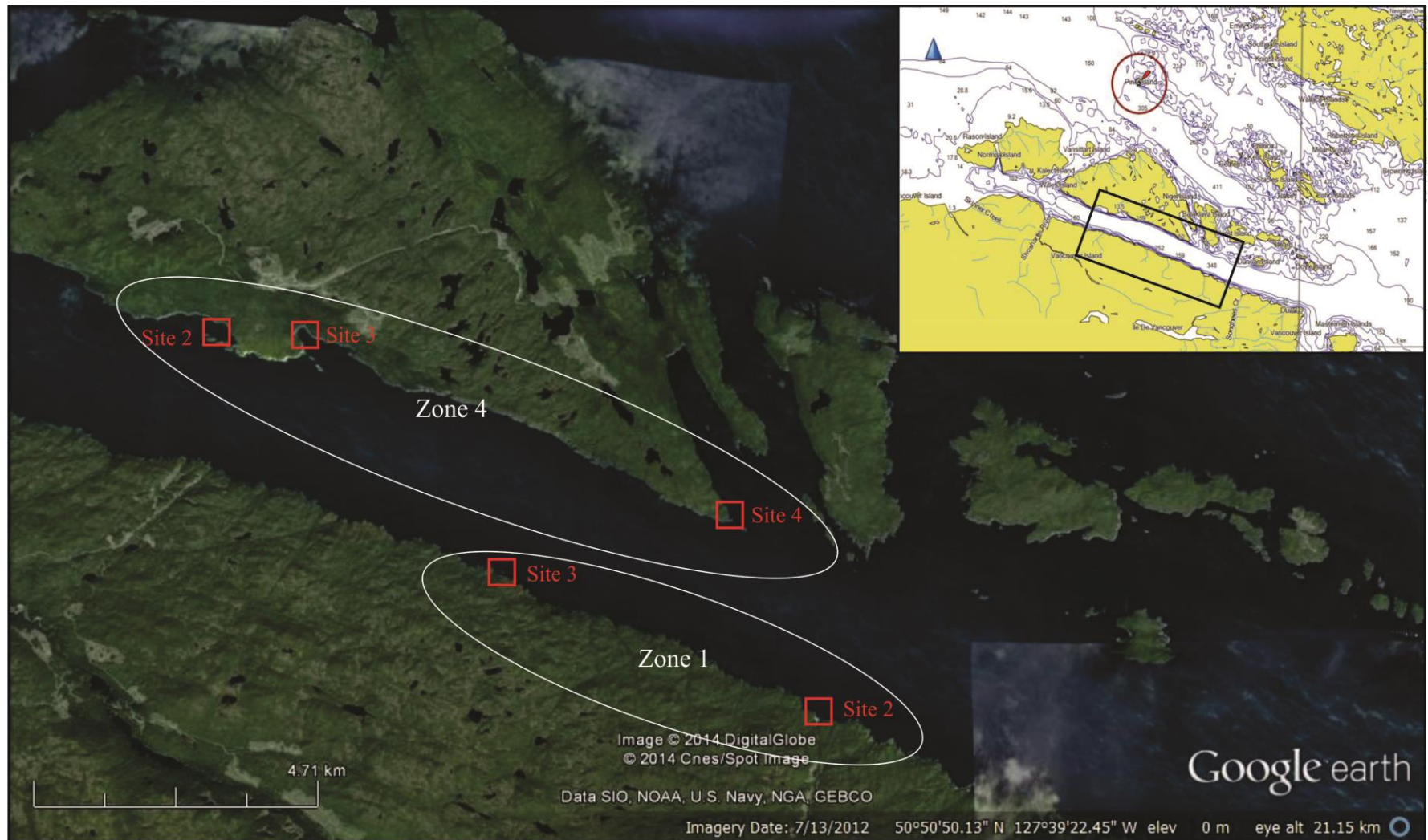


Figure 3: Location map of the sampling sites in Zone 1 (Vancouver Island) and 4 (Nigei Island) in Goletas Channel, British Columbia.

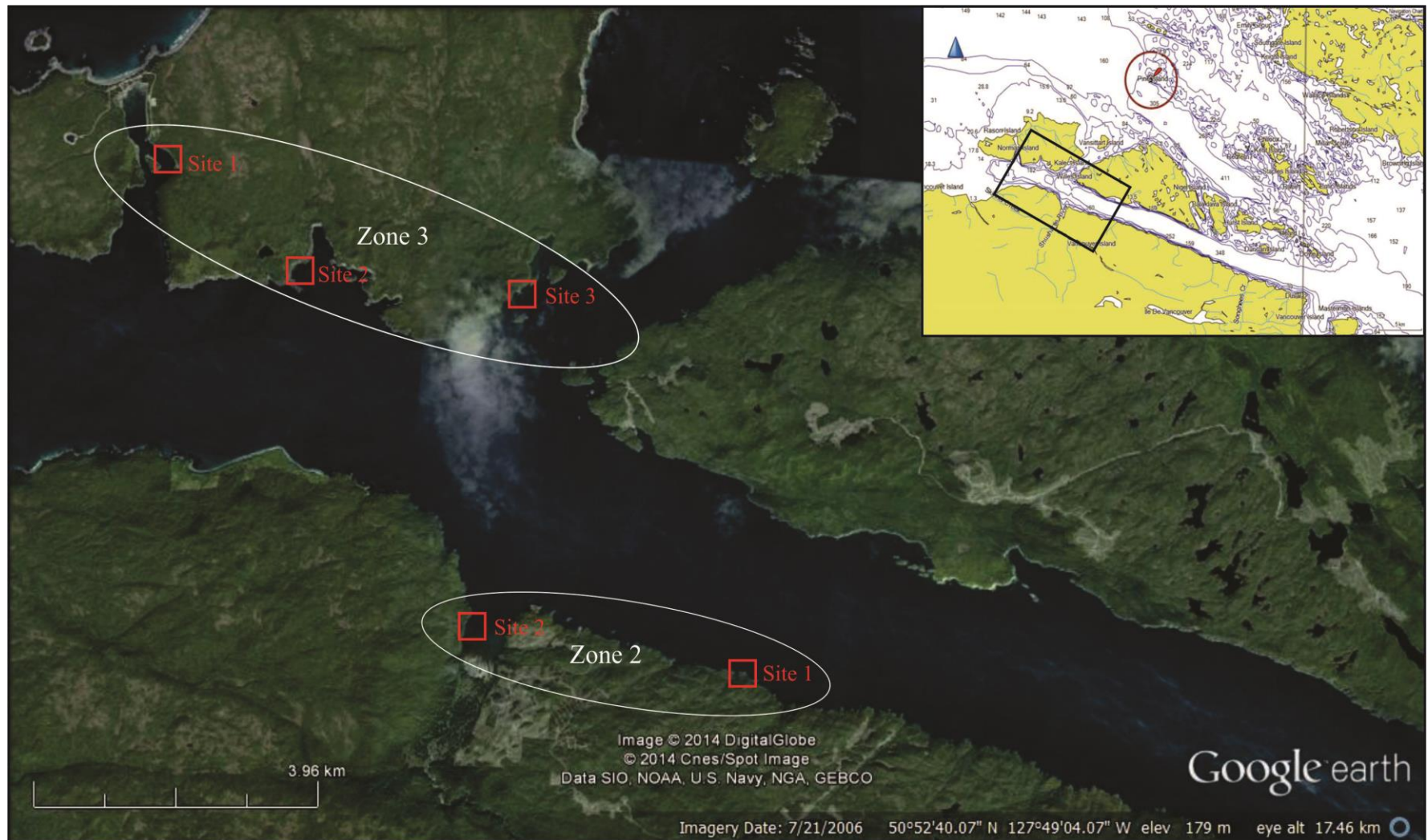


Figure 4: Location map of the sampling sites in Zone 2 (Vancouver Island) and Zone 3 (Hope Island) in Goletas Channel, British Columbia.

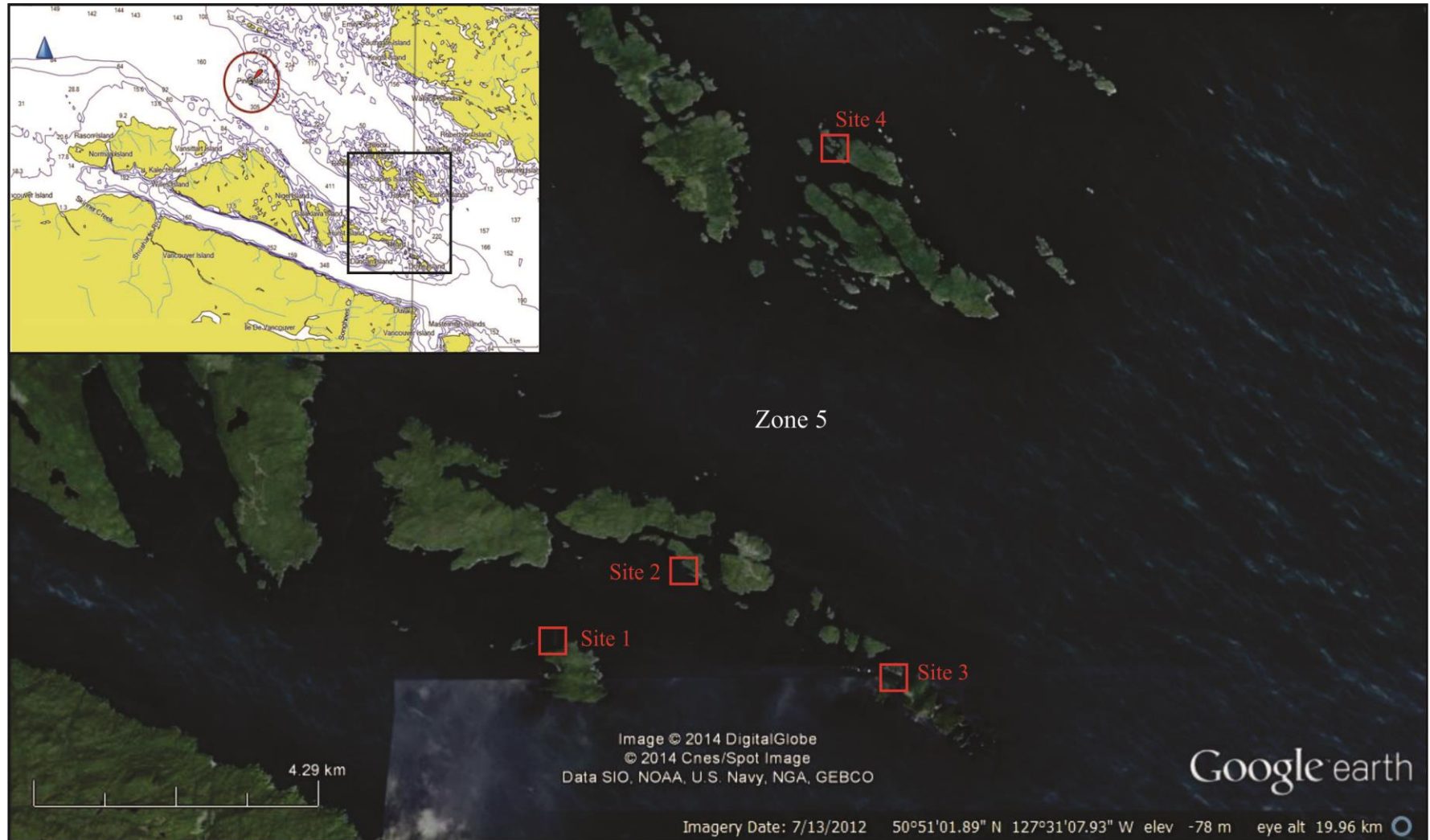


Figure 5: Location map of the sampling sites in Zone 5 (Gordon Group) in Goletas Channel, British Columbia. Site 4 (Deserter Group) was established in April of the 2014 study year.

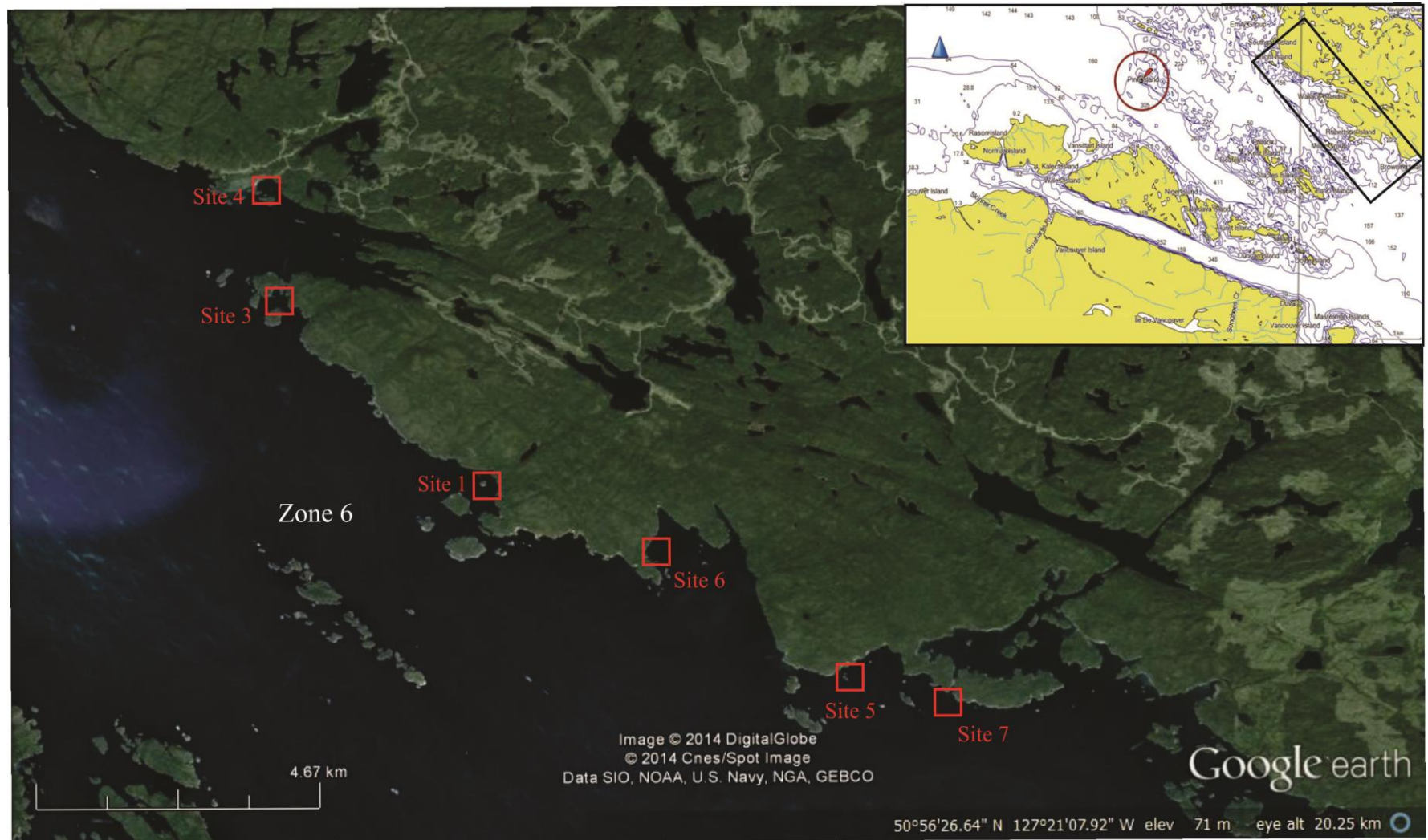


Figure 6: Location map of Zone 6 (Shelter Bay area) in Queen Charlotte Strait, British Columbia. Site 6 and 7 were established in April of the 2014 study year. Site 5 was established in May of the 2014 study year.

Results

Two cycles of beach seining were completed. The first cycle occurred from April 8th to April 11th 2014. The second cycle occurred from May 12th to May 15th 2014. Of the 20 total sample sites, 14 sites occurred in Goletas Channel. All sites within Goletas Channel were sampled during the April and May cycles. The remaining 6 sample sites occurred within the Shelter Bay area. Five sites were sampled during the April cycle, as Site 5 was not established until the May cycle occurred. All six sites in the Shelter Bay area were sampled during the May cycle.

A project total of 53 sets were completed during the 2014 season, 27 of which were successful at capturing target species. A total of 23 sets were completed during the April cycle, 16 of which were successful at capturing target species. A total of 30 sets were completed during the May cycle, 11 of which were successful at capturing target species.

During the April cycle, crew were unable to capture fish within the first seine attempt at four sites; only one of the subsequent sets resulted in the capture of target species (Site 1, Zone 6). During the May cycle, crew were unable to capture fish within the first seine attempt at ten sites; only one of the subsequent sets resulted in the capture of target species (Site 3, Zone 6).

The number of samples obtained in each of the 27 successful sets ranged from 1 to 39 target species and averaged 21.4 samples per successful set. A total of 579 samples were retained for laboratory analysis, 500 were pink salmon, 25 were chum, 21 were coho, 34 were sockeye, 1 was Chinook and 1 was unidentified. A summary of sample totals by zone and by month is provided in Table 1.

Table 1: Summary of sample totals for juvenile salmonids collected in Goletas Channel and Queen Charlotte Strait, BC during the spring of 2014.

Zone	Sample Period		Zone Totals	% of Total Catch by Zone
	April	May		
1	14	20	34	5.9%
2	40	35	75	13.0%
3	40	0	40	6.9%
4	18	33	51	8.8%
5	91	95	186	32.1%
6	92	101	193	33.3%
Monthly Total	295	284	579	
Monthly % of Total Catch	50.9%	49.1%		

Juvenile Salmonid Abundance, Distribution, Growth and Timing Patterns

The project total of target species captured was 579, all of which were salmonid species. 295 samples were collected from April 8th to April 11th (50.9% of the project total), and 284 samples were collected from May 12th to 15th 2014. (49.1% of the project total).

A summary of salmonid samples for the month of April, indicates that 4.7% of samples were collected in Zone 1, 13.6% in Zone 2, 13.6% in Zone 3, 6.1% in Zone 4, 30.8% in Zone 5, and 31.2% in Zone 6. In May, the summary of salmonid samples, indicated that 7.0% of samples were collected in Zone 1, 12.3% in Zone 2, 11.6% in Zone 4, 33.5% in Zone 5 and 35.6% in Zone 6.

In April, salmonid samples were collected in every Zone, however only 14 samples were collected in Zone 1, and 18 in Zone 4. In May, no samples were collected in Zone 3, however the remaining zones provided samples. The highest proportions of salmonids were collected in Zones 5 and 6 in April and May.

The average length and weight of the salmonid specimens increased throughout each sampling month for all species collected (Table 3). Pink, chum and sockeye salmon were captured during each sampling month. Only one Chinook was collected during April's sampling period. During May's sampling period, 21 coho salmon were collected.

Sea Lice Infection

Lice Species Distribution

Only 1 *L. salmonis* was present during April's sampling month, originating from Zone 5. During May's cycle, a total of nine *L. salmonis* were identified in four zones. Of those 9, 1 originated from Zone 2, 1 originated from Zone 4, 2 originated from Zone 5, and 5 originated from Zone 6 (Table 2).

A total of four *C. clemensi* were identified during April's sampling month, one originated from Zone 1 and Zone 3 and two originated from Zone 6. During May's cycle, a total of 28 *C. clemensi* were identified in four zones. Of those 28, 1 originated from Zone 1, 6 originated from Zone 4, 11 originated from Zone 5 and 10 originated from Zone 6 (Table 2).

No salmonids from Zone 3 were captured or sampled in May.

Table 2: Distribution of *L. salmonis* and *C. clemensi* by Zone in Goletas Channel and Queen Charlotte Strait during the spring of 2014.

Zone	<i>L. salmonis</i>		Zone Total	<i>C. clemensi</i>		Zone Total
	April	May		April	May	
1	0	0	0	1	1	2
2	0	1	1	0	0	0
3	0	0	0	1	0	1
4	0	1	1	0	6	6
5	1	2	3	0	11	11
6	0	5	5	2	10	12
Monthly Total	1	9	10	4	28	32

Lice Species Prevalence, Abundance and Intensity in Pink Salmon

A total of 500 pink salmon were retained for lab sampling, 262 of which were caught during the April cycle, and 238 during May's cycle.

The mean prevalence (percentage of fish that were infected) for all sea lice was 7.4% on pink salmon. *L. salmonis* prevalence was 0.38% in April, and 3.36% in May. *C. clemensi* prevalence on pinks increased from 1.15% in April, to 10.50% in May. Overall, *C. clemensi* showed a greater prevalence than *L. salmonis* on pink salmon.

The mean abundance (average number of sea lice on all fish sampled) for all sea lice was 0.039 on pink salmon. *L. salmonis* abundance on pink salmon was 0.004 in May and 0.034 in June. *C. clemensi* abundance on pinks was 0.011 in April, and 0.105 in May.

The mean intensity (average number of sea lice on infected fish) for all sea lice on pink salmon was 1.01. *L. salmonis* intensity on pink salmon was 1.00 in April and May. *C. clemensi* intensity on pink salmon was 1.00 in April and 1.04 in May.

Please see Table 3 for more information regarding species prevalence, abundance and intensity.

Lice Species Prevalence, Abundance and Intensity in Chum Salmon

A total of 25 chum salmon samples were retained for lab analysis, 20 were captured during April and 5 were captured during May's sampling cycle. Two *C. clemensi* were observed during the lab analysis.

Mean prevalence for all sea lice on chum salmon was 6.25%. *L. salmonis* was not prevalent on chum during the April or May sample cycle. *C. clemensi* prevalence on chum was 5.0% in April and 20.0% in May. In addition, *C. clemensi* abundance was lower in April compared to May (0.050 and 0.200 respectively). *C. clemensi* intensity remained the same for April and May (1.0)

Please see Table 3 for more information regarding species prevalence, abundance and intensity.

Lice Species Prevalence, Abundance and Intensity in Sockeye Salmon

A total of 31 sockeye salmon samples were retained for lab analysis, 11 of which were captured during April's sample cycle, and 20 of which were captured during May's sample cycle. One *L. salmonis* was observed during the lab analysis.

Mean prevalence for all sea lice on sockeye salmon was 1.25%. *L. salmonis* was not prevalent during April's cycle. In May, *L. salmonis* prevalence on sockeye was 5.0%, abundance was 0.050 and intensity was 1.00. There were no observations of *C. clemensi* on sockeye salmon during the April and May sampling cycle.

Please see Table 3 for more information regarding species prevalence, abundance and intensity.

Lice Species Prevalence, Abundance and Intensity in Chinook Salmon

In April, one Chinook was captured and retained for lab analysis. There were no observations of either *L. salmonis* or *C. clemensi* on this specimen. No Chinooks were retained during May's sample cycle.

Please see Table 3 for more information regarding species prevalence, abundance and intensity.

Lice Species Prevalence, Abundance and Intensity in Coho Salmon

No coho salmon were captured or retained during April's sample cycle. A total of 21 coho salmon were retained for lab analysis during May's sample cycle. There were no observations of *L. salmonis* on these specimens. A total of two *C. clemensi* were observed during the lab analysis. *C. clemensi* prevalence was 9.52%, abundance was 0.095, and intensity was 2.0 for the month of May.

Please see Table 3 for more information regarding species prevalence, abundance and intensity.

Table 3: Temporal changes in *L. salmonis* and *C. clemensi* presence on salmonids in Goletas Channel and Queen Charlotte Strait, BC (pink salmon values highlighted in blue).

Month	Species	Number sampled	Avg Weight (g)	Avg Length (mm)	<i>L. salmonis</i>					<i>C. clemensi</i>				
					Total # Lice	# Fish Infected	Prevalence	Abundunance	Intensity	Total # Lice	# Fish Infected	Prevalence	Abundunance	Intensity
April	Pink	262	0.37	34.06	1	1	0.38%	0.004	1.00	3	3	1.15%	0.011	1.00
	Chum	20	0.49	36.70	0	0	0.00%	0.000	0.00	1	1	5.00%	0.050	1.00
	Chinook	1	0.05	39.00	0	0	0.00%	0.000	0.00	0	0	0.00%	0.000	0.00
	Sockeye	11	3.78	72.00	0	0	0.00%	0.000	0.00	0	0	0.00%	0.000	0.00
	non salmonid	1	0.92	43.00	0	0	0.00%	0.000	0.00	0	0	0.00%	0.000	0.00
May	Pink	238	1.18	48.43	8	8	3.36%	0.034	1.00	25	24	10.50%	0.105	1.04
	Chum	5	1.21	45.40	0	0	0.00%	0.000	0.00	1	1	20.00%	0.200	1.00
	Coho	21	13.83	104.19	0	0	0.00%	0.000	0.00	2	1	9.52%	0.095	2.00
	Sockeye	20	8.20	91.10	1	1	5.00%	0.050	1.00	0	0	0.00%	0.000	0.00

Louse Life Stage on pink salmon

The most prevalent life stage of *L. salmonis* observed on pink salmon was the C3 stage (40%), followed by the copepodid and C4 stage (both 20%) and C2 and pre-adult phase (both 10%). No C1 or adult stages of *L. salmonis* were observed on pink salmon during lab analysis.

The most prevalent life stage of *C. clemensi* observed on pink salmon was the C1 stage (64.3%), followed by C3 (14.3%), copepodid stage (10.7%), C2 stage (7.1%) and adult stage (3.8%). No C4 stage or pre-adult *C. clemensi* were identified on pink salmon during the lab analysis.

See Figure 7 for *L. salmonis* and *C. clemensi* prevalence on pink salmon.

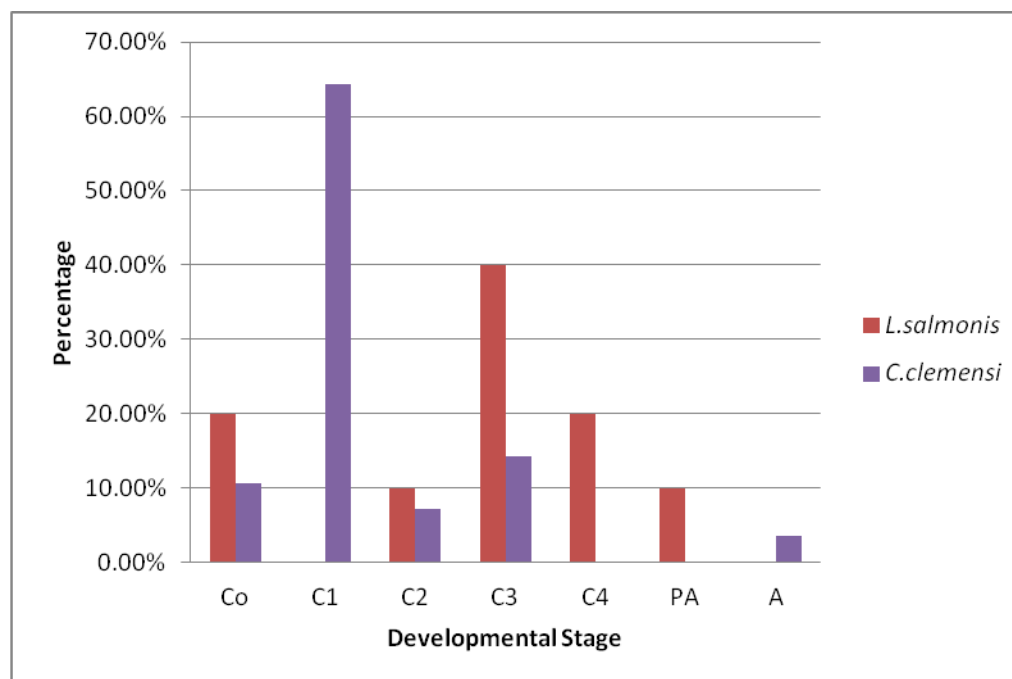


Figure 7: Developmental stages of *Lepeophtheirus salmonis* and *Caligus clemensi* present on juvenile pink salmon in Goletas Channel and Queen Charlotte Strait in the 2014 study period. The development stages are as follows: Co, copepodid; C1-C4, chalimus I to IV, PA, pre-adult (both sexes); A, adult (both sexes).

Louse Life Stage on chum salmon

A total of 25 chum salmon were retained for lab analysis during the April and May sampling event. Two sea lice, both *C. clemensi* were observed at the C1 life stage on the chum (100%), each occurring in April and May. *L. salmonis* was not observed on the chum salmon retained during the 2014 sampling event.

Please see Figure 8 for *C. clemensi* life stage and prevalence on chum salmon.

Louse Life Stage on sockeye salmon

A total of 31 sockeye salmon were retained for lab analysis during the April and May sampling event. Only one louse, *L. salmonis* was observed at the C3 stage (100%) of its life cycle during the month of May. There were no observations of *C. clemensi* on any sockeye salmon retained during the 2014 sampling event.

Please see Figure 8 for *L. salmonis* life stage and prevalence on sockeye salmon.

Louse Life Stage on coho salmon

A total of 21 coho salmon were retained for lab analysis during the May sampling event. Two lice, both *C. clemensi* were observed on a single coho salmon. The lice were at different life stages to one another, one was identified at the C1 life stage, and the other was an adult (both 50%). There were no observations of *L. salmonis* on any coho salmon retained during the 2014 sampling event.

Please see Figure 8 for *C. clemensi* life stage and prevalence on coho salmon.

Louse Life Stage on Chinook salmon

Only one Chinook was captured and retained for lab analysis during the 2014 sampling event in April. There were no observations of *C. clemensi* or *L. salmonis* on this sole specimen.

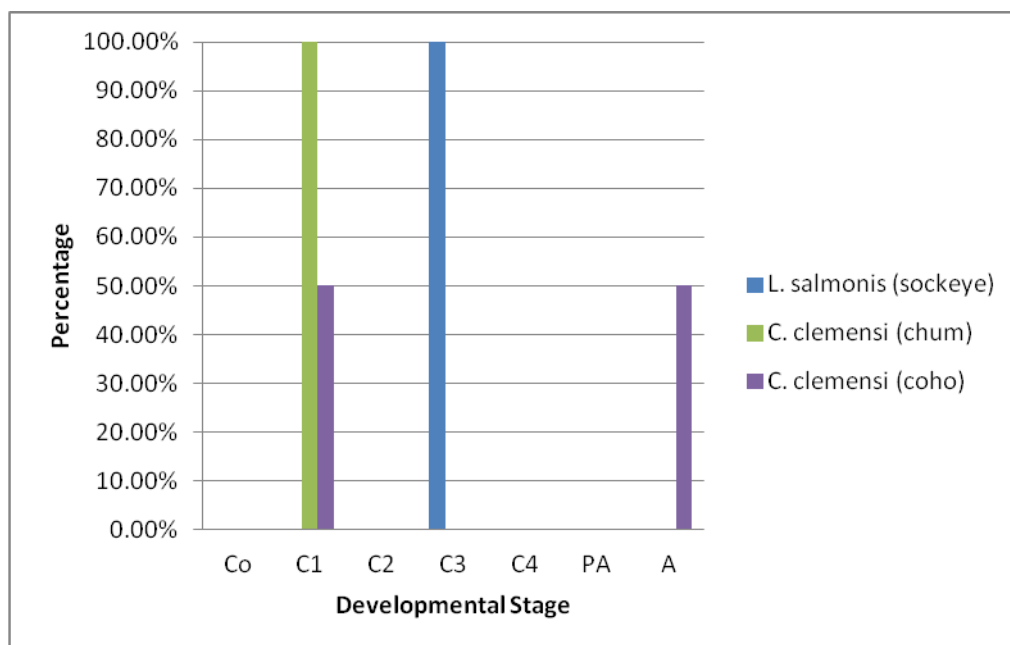


Figure 8: Developmental stages of *L. salmonis* and *C. clemensi* present on juvenile sockeye, chum and coho salmon in Goletas Channel and Queen Charlotte Strait in 2014 study period. Co, copepodid; C1-C4, chalimus I to IV, PA, pre-adult (both sexes); A, adult (both sexes).

Water Quality - Salinity and Temperature

Salinity and temperature were recorded at each site throughout the entire study period at the surface, 1m depth and 4m depth.

The average salinity remained the same from April to May, however salinity values increased with depth (Figure 9). At the surface, average salinity was recorded at 30.9ppt. At 1m depth, average salinity was 31.2 ppt and at 4m depth average salinity was 31.3ppt.

Average water temperature increased by 1.5 °C from April to May (Figure 10). Average water temperature at the surface was 8.4°C in April and 10.2 °C in May. At 1m water depth, average water temperature was 8.4°C in April and 9.8°C in May. At 4m water depth, average water temperature was 8.3 °C in April and 9.6°C in May.

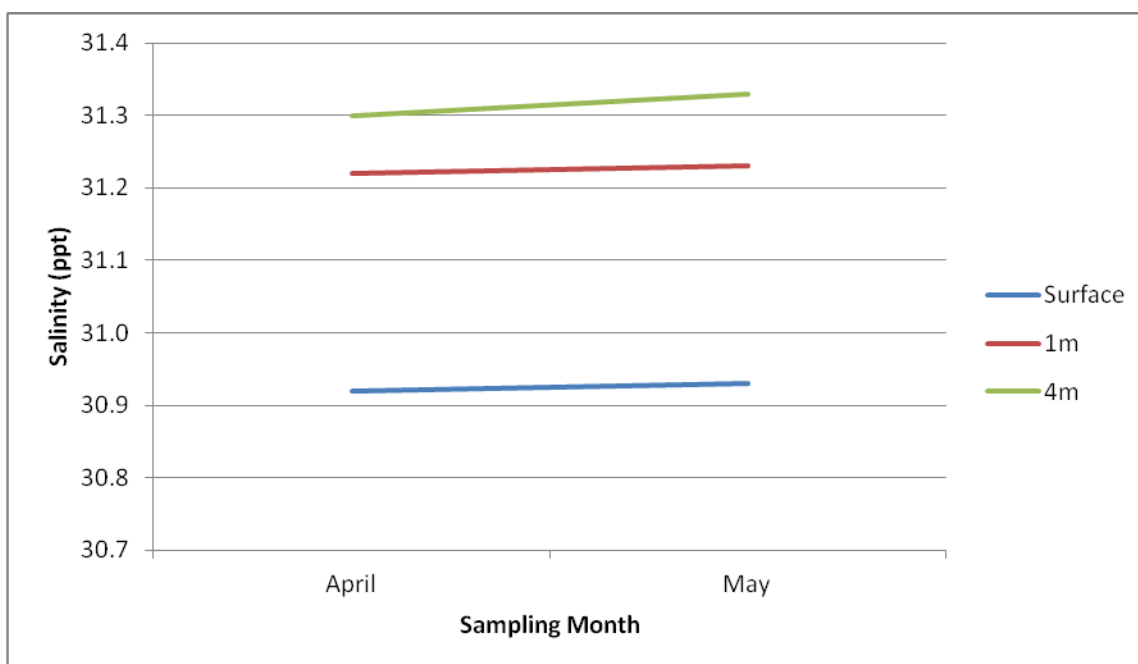


Figure 9: The average salinity recorded at the surface, 1m and 4m depth during the 2014 study period.

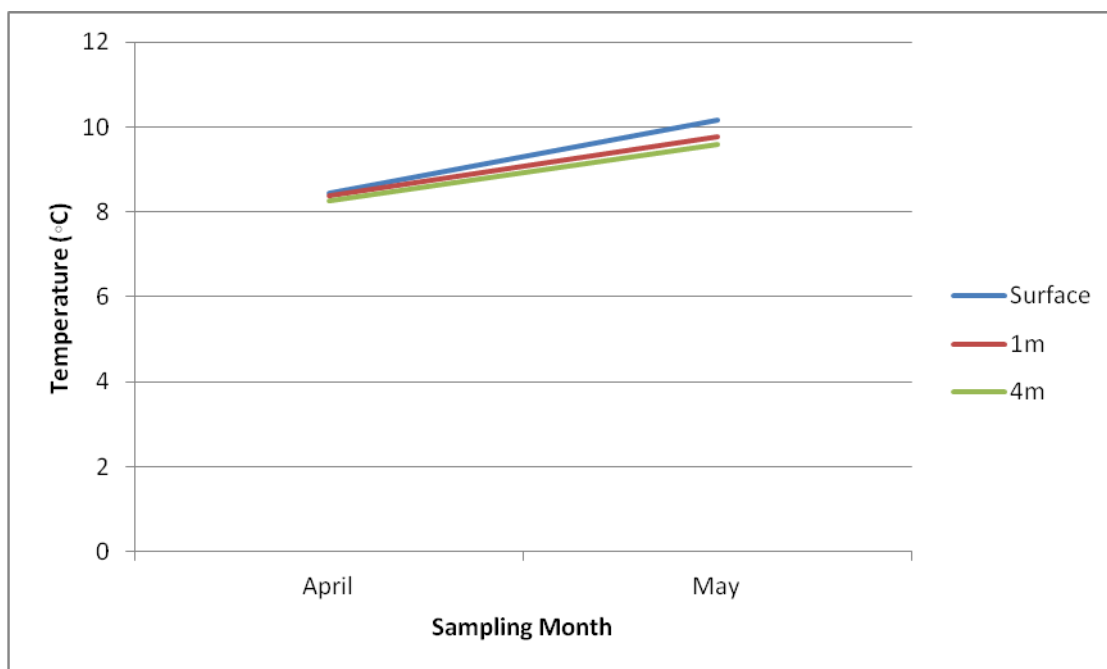


Figure 10: Average water temperature for April and May during the 2014 study period.

Discussion

Sample numbers

There were a total of 579 individual fish retained for sea lice analysis during the 2014 study year. In 2013, 869 individual fish (794 from Goletas and 75 from Shelter) were retained for analysis and in 2011, 809 individual fish were retained for lab analysis. Two sample cycles occurred in 2014 (April and May), in 2013, three sample cycles occurred (April, May and June) and in 2011, four sample cycles occurred (April, May, June and July). More fish were captured and retained in previous years, as more sample cycles took place compared to 2014.

Salmonids encountered were identified as pink, Chinook, chum, coho and sockeye salmon. The majority of fish caught and retained for lab analysis were pink salmonids (500 individuals). Small sample numbers of chum (25 individuals), Chinook (1 individual), sockeye (31 individuals) and coho (21 individuals) were also retained and analyzed in the lab.

Distribution

Based on the summary of sample percentages in Table 4, juvenile salmonids appeared to be more prevalent in Zones 5 and 6 for both April and May in 2014 (32.10% and 33.30% respectively). Zone 2 contributed 13.00% of samples, and less than 10% of samples were retained from Zone 1, 3 and 4 (5.90%, 6.90% and 8.80% respectively). Zone 5 continues to contribute the highest percentage of samples (36.80% - 2011, 23.40% - 2013, 32.10% - 2014).

No salmonids were captured in Zone 3 during the second cycle (May) of the 2014 study. In previous years, salmonids were caught in Zone 3 during May (Pacificus 2011, 2013a). One possible explanation for lack of success in capturing salmonids could be their behavioral response to tidal cycles. It was noted that salmonids may be moving closer to shore on a rising tide, hence increasing their vulnerability to beach seine capture (Pacificus 2013).

Table 4: A comparison of sample percentage by zone for the 2011, 2013 and 2014 study years. Zone 6 (Shelter Bay) was not sampled during the 2011 study year.

Year	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
2011	15.90%	14.80%	15.80%	16.70%	36.80%	n/a
2013	11.51%	28.08%	14.27%	16.11%	21.40%	8.63%
2014	5.90%	13.00%	6.90%	8.80%	32.10%	33.30%

Some sites consistently produced significantly more samples than other sites within the area. In 2011, the “hot-spots” were identified as Site 1 in Zone 2 (near the mouth of the Shushartie River on Vancouver Island), Site 2 in Zone 3 (Heath Bay on Hope Island), and Sites 1 and 3 in Zone 5 (Duncan and Doyle Islands). In 2013, the “hot-spots” were identified at Site 3 in Zone 1 (small cove on VI south shoreline with significant creek and eelgrass/kelp habitat), Site 3 in Zone 3 (Hope Island shoreline in the passage between Hope and Nigei Islands) and Site 3 in Zone 4 (Loquilla Bay on south Nigei Island).

In 2014, a number of these sites continued to be “hot-spots” for salmonids. Site 1 in Zone 2, Site 2 in Zone 3, Site 1 and 3 in Zone 5 were identified as “hot-spots” in 2011 and again in 2014. Site 3 in Zone 4 was identified as a “hot-spot” in 2013 and in 2014. A number of “hot-spots” were identified in Zone 6, at Site 1 (Stuart Point), 3 and 4 (Shelter Bay) and 7 (Blunden Harbour/Raynor Group).

Timing

A total of two cycles of beach seining took place in the 2014 study year. Beach seining occurred during the second week of April, and the third week of May. Results from 2011, indicated that the peak timing for pink salmon smolt migration occurred from April to June (Pacificus 2011).

A comparison of the number of juvenile pink salmon retained by cycle for 2011, 2013 and 2014 showed a similar trend in sample numbers between the study years (Figure 11). The highest proportion of pink salmon were retained in Cycle 2 (April) and 3 (May) in all three study years.

Insufficient catch data is available to accurately compare timing trends for other species. This is the third year for sea lice monitoring and data collection discerning juvenile salmon migration. Prior to 2011, no data existed for juvenile salmonid behaviour and migration in Goletas Channel and Queen Charlotte Straits.

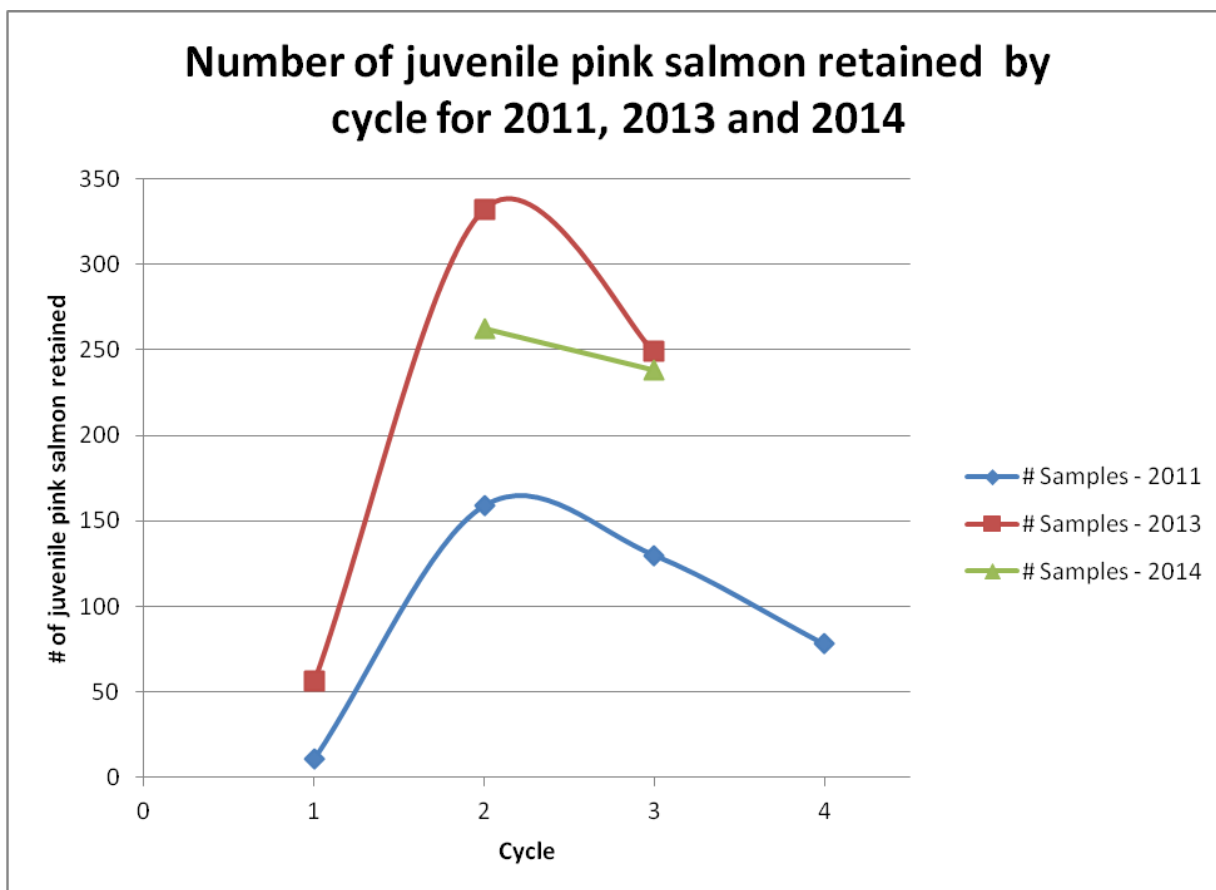


Figure 11: A comparison of the number of pink salmon juveniles retained during the 2011, 2013, and 2014 sea lice studies.

Water Quality

Water quality data showed a similar temporal trend in all study years (Figure 12). Water temperature increased from April to May, and water temperature was warmer in 2014 compared to 2013 and 2011 data. Salinity remained constant from April to May, with no real change between 2011, 2013 and 2014 data. It should be noted, that water quality data for 2011 is only available for Zones 1-5 (Goletas Channel) and not for Zone 6 (Shelter Bay, Queen Charlotte Strait).

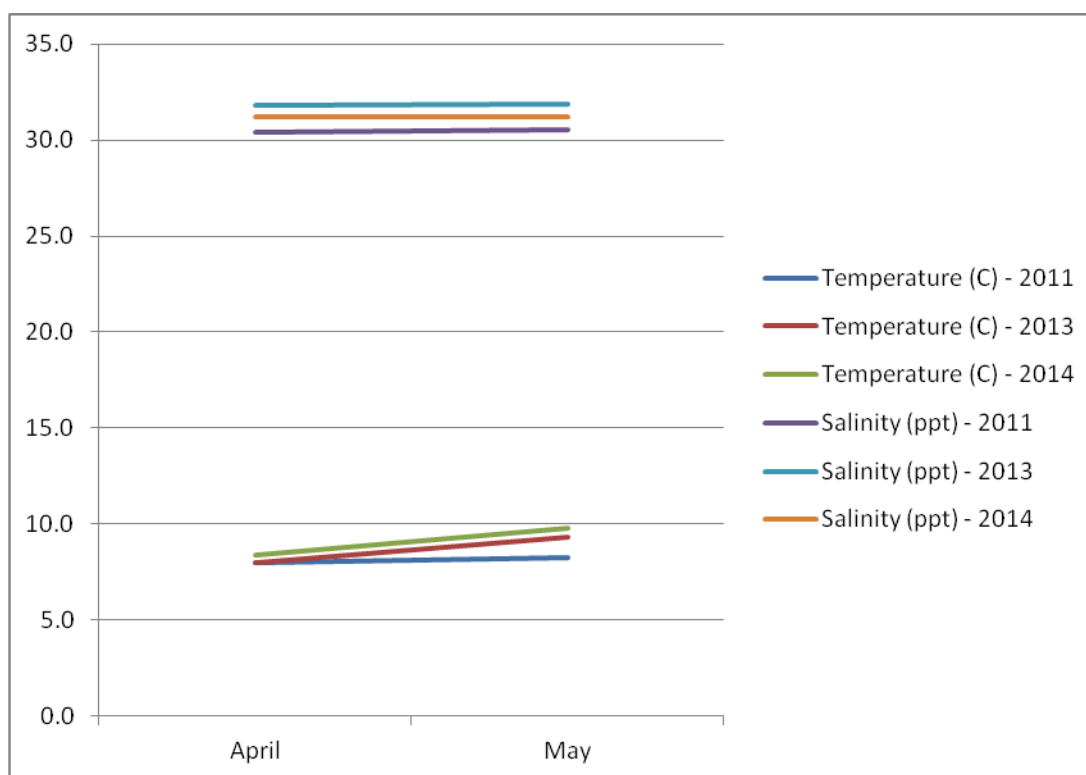


Figure 12: A comparison of temperature (°C) and salinity (ppt) for 1m depths at sampling locations in Goletas Channel and Queen Charlotte Strait during the 2011, 2013 and 2014 sampling period.

Sea lice

Sea lice intensity (average number of lice per infected fish) was 1.0 for *L. salmonis* during all sampling periods, while intensity for *C. clemensi* was 1.0 for April and 1.04 for May. The average weight of the pink salmon was 0.37g in April and 1.18g in May. These values were well below the threshold for lethal infection, estimated at 7.5 lice (*L. salmonis*) per fish averaging less than 0.7g in weight, as stated in Jones and Hargreaves, 2009. In Nendick et al (2011), swimming performance of juvenile pink salmon was negatively affected only when the individual was infected with a sea louse stage of 3 or greater at a body mass of 0.34g or less. A review of individual fish data indicated that none of the infected pink salmon weighing less than 0.34g were infected with a sea louse life stage of chalimus 3 or greater.

Based on the summary data in Table 2, *C. clemensi* was more prevalent than *L. salmonis* for the Goletas Channel and Queen Charlotte Strait study area in the 2014 study year. Of the 42 sea lice identified during the lab analysis, 76% were *C. clemensi*. This remains consistent with

the findings from the 2011 study year, where *C. clemensi* accounted for nearly 80% of the identified sea lice (Pacificus 2011), and the 2013 study year, where *C. clemensi* accounted for 76% of the sea lice (Pacificus 2013a).

Overall, sea lice prevalence, abundance and intensity values were at its highest in the 2011 study year. 2014 showed the lowest values for sea lice prevalence, abundance and intensity for both *L. salmonis* and *C. clemensi* (please see Appendix 2 for raw data from 2011, 2013 and 2014). Taking into consideration the sample size in all study years, a comparison of the total number of lice and the total number of infected salmonids identified in each year illustrates this difference (Table 5).

Table 5: A comparison of the total number of lice and the total number of infected salmonid identified in each study year.

Year	<i>L. Salmonis</i>		<i>C. clemensi</i>	
	Total # of Lice	Total # of infected fish	Total # Lice	Total # of infected fish
2011 (n = 809)	41	34	209	140
2013 (n = 870)	14	14	52	34
2014 (n = 578)	10	10	32	31

Pink salmon was the only species captured during all sampling cycles in all study years (2011, 2013 and 2014). Based on previous year's results for salmonid outmigration timing and the average weight and size of the salmonids, sampling effort was focused within April and May of 2014. As a result, sea lice prevalence and infectious rates on pink salmonids were only compared for the months of April and May between the three study years (Figure 13).

L. salmonis prevalence on pink salmon followed similar trends between study years, with prevalence ranging from 0-0.38% in April of all study years. In May 2014, *L. salmonis* prevalence increased to 3.36%, while in previous years *L. salmonis* prevalence did not increase.

C. clemensi, however, was observed in significantly greater numbers during April of the 2011 sampling year (18.2%). The prevalence of *C. clemensi* exhibited similar temporal trends during the 2013 and 2014 sampling cycles, where prevalence increased from April (1.8% and 1.2%) to May (5.2% and 10.5%). There is limited data to suggest what factors may affect sea lice prevalence and variation from year to year.

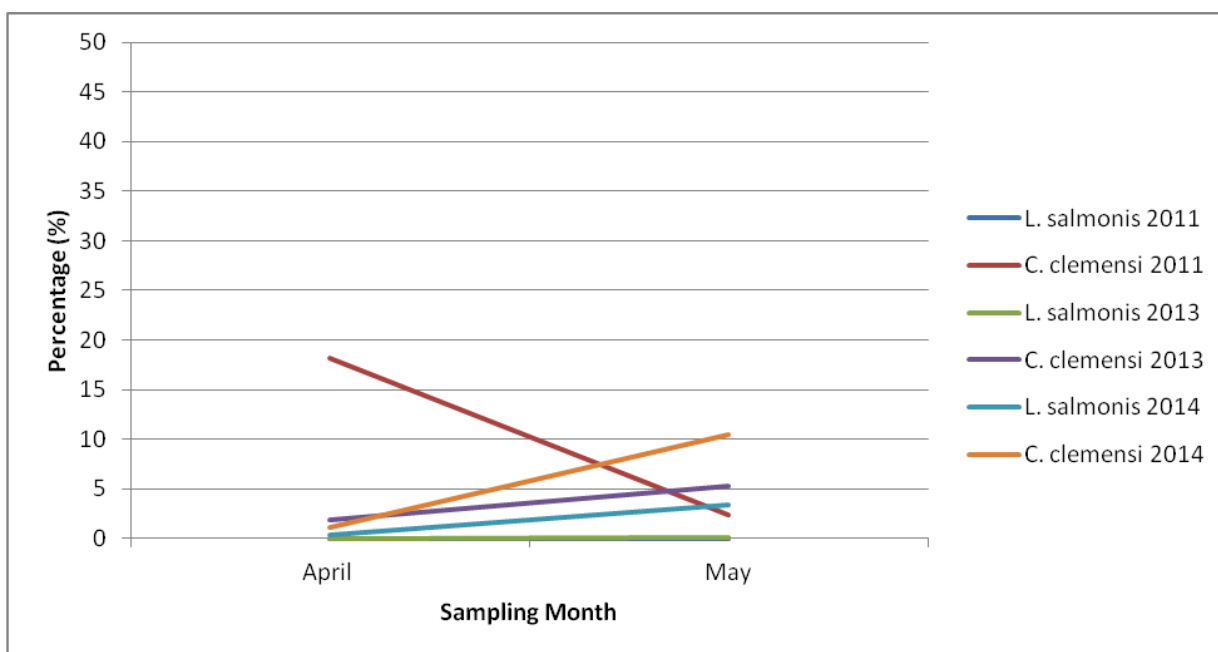


Figure 13: A comparison of the prevalence of *L. salmonis* and *C. clemensi* on pink salmon captured in Goletas Channel and Queen Charlotte Straits during the spring of 2011, 2013 and 2014.

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Appendix 1: Raw Field Data Summary

2014 Goletas Channel and Queen Charlotte Strait Beach Seine:

Beach Seine Summary		April 8-11 2014						May 12-15 2014				Site Total # Fish
Site #	Location	Pink	Chum	Coho	Sockeye	Chinook	Unidentified	Pink	Chum	Sockeye	Coho	
Zone 1 (VI south)												
Site 2	50°48.110 N	2	0	0	0	0	0	20	0	0	0	22
	127° 37.890 W	2	0	0	0	0	0	20	0	0	0	22
Site 3	50°49.487 N	11	1	0	0	0	0	0	0	0	0	12
	127° 42.564 W	11	1	0	0	0	0	0	0	0	0	12
Zone 2 (VI north)												
Site 1	50° 50.782 N	33	4	0	1	1	0	1	4	0	0	44
	127° 48.839 W	46	4	0	4	1	0	1	4	0	0	60
Site 2	50° 51.119 N	1	0	0	0	0	0	0	0	20	10	31
	127° 52.011 W	1	0	0	0	0	0	0	0	20	200	221
Zone 3 (Hope Isl)												
Site 1	50° 54.753 N	1	0	0	0	0	0	0	0	0	0	1
	127° 55.837 W	1	0	0	0	0	0	0	0	0	0	1
Site 2	50° 53.833 N	29	2	0	0	0	0	0	0	0	0	31
	127° 54.220 W	182	2	0	0	0	0	0	0	0	0	184
Site 3	50° 53.698 N	8	0	0	0	0	0	0	0	0	0	8
	127° 51.420 W	8	0	0	0	0	0	0	0	0	0	8
Zone 4 (Nigei Isl)												
Site 2	50° 51.667 N	2	3	0	0	0	0	0	0	0	0	5
	127° 46.712 W	2	3	0	0	0	0	0	0	0	0	5
Site 3	50° 51.692 N	2	0	0	10	0	1	31	1	0	1	46
	127° 45.477 W	2	1	20	10	0	1	32	1	0	1	68
Site 4	50° 49.980 N	0	0	0	0	0	0	0	0	0	0	0
	127° 39.147 W	0	0	0	0	0	0	0	0	0	0	0
Zone 5 (Gordon Isls)												
Site 1	50°49.095 N	31	0	0	0	0	0	0	0	0	0	31
	127° 33.311 W	300	0	0	0	0	0	0	0	0	0	300
Site 2	50°49.714 N	30	0	0	0	0	0	30	0	0	0	60
	127°31.560 W	650	0	0	0	0	0	6000	0	0	0	6650
Site 3	50°48.831 N	30	0	0	0	0	0	35	0	0	0	65
	127°28.678 W	500	0	0	0	0	0	10000	0	0	0	10500
Site 4	50°53.580 N	0	0	0	0	0	0	30	0	0	0	30
	127° 29.362 W	0	0	0	0	0	0	3000	0	0	0	3000
Zone 6 (Shelter Bay)												
Site 1	50° 55.920 N	30	0	0	0	0	0	1	0	0	0	31
	127° 24.324 W	49	0	0	0	0	0	1	0	0	0	50
Site 3	50° 57.580 N	31	2	0	0	0	0	30	0	0	10	73
	127° 27.254 W	78	3	0	0	0	0	400	0	0	10	491
Site 4	50° 58.577 N	1	0	0	0	0	0	30	0	0	0	31
	127° 27.477 W	1	0	0	0	0	0	37	0	0	0	38
Site 5	50° 54.241 N	n/a	n/a	n/a	n/a	n/a	n/a	0	0	0	0	0
	127°19.289 W	n/a	n/a	n/a	n/a	n/a	n/a	0	0	0	0	0
Site 6	50° 55.221 N	0	0	0	0	0	0	0	0	0	0	0
	127° 22.516 W	0	0	0	0	0	0	0	0	0	0	0
Site 7	50° 53.990N	20	8	0	0	0	0	30	0	0	0	58
	127° 17.859 W	20	8	0	0	0	0	37	0	0	0	65
		1853	22	30	14	1	1	19528	5	20	211	21685
TOTAL RETAINED		262	20	0	11	1	1	238	5	20	21	579

*** retained fish are first row for each site in bold, caught fish are second row for each site in regular print.

Appendix 1: Raw Field Data Summary (Cont)

2013 Goletas Channel Beach Seine

Beach Seine Dates		April 1-2, 2013			May 6-8, 2013				June 3-5, 2013					Site Total # Fish
Lab Analysis Dates		April 8, 2013			May 16-31, 2013				June 21-26 and July 4, 2013					Site Total # Fish
Site #	Location	Pink	Chum	Coho	Pink	Coho	Sockeye	Chum	Pink	Chum	Coho	Sockeye	Dolly Varden	
Zone 1 (VI south)														
Site 1	50° 47' 13.115" N	1	1	1	0	0	0	0	0	0	5	0	2	10
	127° 34' 36.832" W	1	1	1	0	0	0	0	0	0	5	0	2	10
Site 2	50° 48' 6.617" N	4	2	0	30	0	0	15	1	0	0	0	0	52
	127° 37' 55.582" W	4	2	0	3000	0	0	15	1	0	0	0	0	3022
Site 3	50° 49' 26.579" N	7	0	0	30	0	0	10	30	0	2	0	0	79
	127° 42' 36.213" W	7	0	0	350	0	0	10	150	0	2	0	0	519
Zone 2 (VI north)														
Site 1	50° 50' 32.792" N	30	5	0	30	16	0	25	30	5	0	0	0	141
	127° 48' 16.983" W	94	5	0	275	16	0	25	3500	5	0	0	0	3920
Site 2	50° 51' 1.563" N	2	0	0	0	14	3	0	0	0	16	0	1	36
	127° 51' 36.418" W	2	0	0	0	14	3	0	0	0	65	0	1	85
Site 3	50° 52' 24.844" N	0	0	0	2	0	0	0	15	0	1	1	0	19
	127° 54' 13.108" W	0	0	0	2	0	0	0	15	0	1	1	0	19
Zone 3 (Hope Isl)														
Site 1	50° 54' 40.388" N	0	0	0	0	1	0	0	0	0	0	0	0	1
	127° 55' 42.765" W	0	0	0	0	1	0	0	0	0	0	0	0	1
Site 2	50° 53' 48.141" N	3	0	0	30	0	0	5	30	0	0	0	0	68
	127° 53' 17.963" W	0	0	0	3500	0	0	5	92	0	0	0	0	3597
Site 3	50° 53' 40.083" N	1	2	0	30	0	0	11	11	0	0	0	0	55
	127° 51' 34.341" W	1	2	0	3800	0	0	11	11	0	0	0	0	3825
Zone 4 (Nigei Isl)														
Site 1	50° 52' 12.580" N	0	0	0	0	0	0	2	1	0	0	0	0	3
	127° 48' 40.430" W	0	0	0	0	0	0	2	1	0	0	0	0	3
Site 2	50° 51' 42.071" N	4	0	0	30	0	0	8	1	0	0	0	0	43
	127° 46' 33.619" W	4	0	0	1400	0	0	8	1	0	0	0	0	1413
Site 3	50° 51' 42.928" N	3	0	0	30	0	0	3	0	1	0	0	0	37
	127° 45' 30.676" W	3	0	0	126	0	0	3	0	1	0	0	0	133
Site 4	50° 49' 54.803" N	1	0	0	30	0	0	2	30	0	0	0	0	63
	127° 39' 12.223" W	1	0	0	150	0	0	2	30	0	0	0	0	183
Zone 5 (Gordon Isls)														
Site 1	50° 49' 3.788" N	0	0	0	30	0	0	6	30	0	16	0	0	82
	127° 33' 16.194" W	0	0	0	350	0	0	6	250	0	37	0	0	643
Site 2	50° 49' 52.875" N	0	0	0	30	0	0	13	0	0	0	0	0	43
	127° 30' 52.353" W	0	0	0	700	0	0	13	0	0	0	0	0	713
Site 3	50° 48' 49.921" N	0	0	0	30	0	0	4	30	4	0	0	0	68
	127° 28' 40.714" W	0	0	0	3500	0	0	4	10000	4	0	0	0	13508
TOTAL RETAINED		56	10	1	332	31	3	104	209	10	40	1	3	800

*** retained fish are first row for each site in bold, caught fish are second row for each site in regular print. Please note: This data represents the field data recorded during beach seines and does not reflect corrections made during lab analysis of samples. Therefore, discrepancies may be present between field and lab data.

Appendix 1: Raw Field Data Summary (Cont)

2013 Queen Charlotte Strait Beach Seine

Beach Seine Summary		06-Jun-13			03-Jul-13			Site Total # Fish
Site #	Location	Pink	Coho	Chum	Pink	Chinook	Herring	
Shelter Bay								
Site 1	50°55'58.90"N	30	0	0	9	0	31	70
	127°24'19.94"W	500	0	0	9	0	500	1009
Site 2	50°56'42.39"N	0	0	0	n/a	n/a	n/a	0
	127°26'02.88"W	0	0	0				0
Site 3	50°57'41.21"N	0	3	0	1	1	0	5
	127°27'16.18"W	0	3	0	1	1	0	5
Site 4	50°58'37.90"N	0	0	0	0	0	0	0
	127°27'25.39"W	0	0	0	0	0	0	0
Site 5	50°59'15.24"N	0	0	0	0	0	0	0
	127°30'21.21"W	0	0	0	0	0	0	0
TOTAL RETAINED		30	3	0	10	1	31	75
		500	3	0	10	1	500	1014

Appendix 1: Raw Field Data Summary (Cont)**2011 Goletas Channel Beach Seine**

Beach Seine Summary		March 30-April 1, 2011			April 27-29, 2011			May 30-June 3, 2011					June 28 30-July 4, 2011				Site Total # Fish
Site #	Location	Pink	Chum	Coho	Pink	Chum	Chinook	Pink	Chum	Coho	Herring	Dolly Varden	Pink	Chum	Coho	Herring	
Zone 1 (VI south)																	
Site 1	50° 47' 13.115" N	0	0	3	3	0	0	0	7	0	0	0	0	0	0	0	13
	127° 34' 36.832" W	0	0	3	3	0	0	0	7	0	0	0	0	0	0	0	13
Site 2	50° 48' 6.617" N	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0	4
	127° 37' 55.582" W	0	0	0	0	0	0	1	0	0	0	6	0	0	0	0	7
Site 3	50° 49' 26.579" N	2	0	0	31	7	0	31	30	0	0	0	0	0	0	0	101
	127° 42' 36.213" W	2	0	0	731	7	0	68	171	0	0	0	0	0	0	0	979
Zone 2 (VI north)																	
Site 1	50° 50' 32.792" N	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3
	127° 48' 16.983" W	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3
Site 2	50° 51' 1.563" N	0	0	0	1	0	0	0	3	45	0	0	0	0	0	0	49
	127° 51' 36.418" W	0	0	0	1	0	0	0	3	259	0	0	0	0	0	0	263
Site 3	50° 52' 24.844" N	0	0	0	18	0	0	0	0	0	0	5	0	0	0	0	23
	127° 54' 13.108" W	0	0	0	18	0	0	0	0	0	0	7	0	0	0	0	25
Zone 3 (Hope Isl)																	
Site 1	50° 54' 40.388" N	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
	127° 55' 42.765" W	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
Site 2	50° 53' 48.141" N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	127° 53' 17.963" W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 3	50° 53' 40.083" N	0	0	0	34	11	2	0	0	0	0	0	35	36	0	0	118
	127° 51' 34.341" W	0	0	0	1000	11	2	0	0	0	0	0	40	42	0	0	1095
Zone 4 (Nigei Isl)																	
Site 1	50° 52' 37.046" N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	127° 50' 2.288" W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 2	50° 51' 42.071" N	4	0	0	1	0	0	3	0	0	0	0	0	0	1	0	9
	127° 46' 33.619" W	4	0	0	1	0	0	3	0	0	0	0	0	0	1	0	9
Site 3	50° 51' 42.928" N	0	0	0	0	0	0	44	33	5	30	0	0	0	0	30	142
	127° 45' 30.676" W	0	0	0	0	0	0	60	140	5	500	0	0	0	0	45	750
Site 4	50° 49' 54.803" N	0	0	0	36	4	0	0	0	0	0	0	0	0	0	0	40
	127° 39' 12.223" W	0	0	0	380	4	0	0	0	0	0	0	0	0	0	0	384
Zone 5 (Gordon Isl)																	
Site 1	50° 49' 3.788" N	0	0	0	1	0	0	0	30	0	0	0	0	0	0	0	31
	127° 33' 16.194" W	0	0	0	1	0	0	0	160	0	0	0	0	0	0	0	161
Site 2	50° 49' 52.875" N	0	0	0	31	6	0	30	30	0	0	0	46	30	14	0	187
	127° 30' 52.353" W	0	0	0	411	6	0	685	1331	0	0	0	1251	80	14	0	3778
Site 3	50° 48' 49.921" N	3	2	0	2	0	0	30	30	4	0	0	18	8	0	0	97
	127° 28' 40.714" W	3	2	0	2	0	0	36	70	4	0	0	18	8	0	0	143
TOTAL RETAINED		11	2	3	159	30	2	139	163	54	30	8	99	74	15	30	819

*** retained fish are first row for each site in bold, caught fish are second row for each site in regular print.

Appendix 2: Raw Data from lab analysis

2014 Study Year

Month	Species	Number sampled	Avg Weight (g)	Avg Length (mm)	L. salmonis					C. clemensi				
					Total # Lice	# Fish Infected	Prevalence	Abundance	Intensity	Total # Lice	# Fish Infected	Prevalence	Abundance	Intensity
April	Pink	262	0.37	34.06	1	1	0.38%	0.004	1.00	3	3	1.15%	0.011	1.00
	Chum	20	0.49	36.70	0	0	0.00%	0.000	0.00	1	1	5.00%	0.050	1.00
	Chinook	1	0.05	39.00	0	0	0.00%	0.000	0.00	0	0	0.00%	0.000	0.00
	Sockeye	11	3.78	72.00	0	0	0.00%	0.000	0.00	0	0	0.00%	0.000	0.00
	non salmonid	1	0.92	43.00	0	0	0.00%	0.000	0.00	0	0	0.00%	0.000	0.00
May	Pink	238	1.18	48.43	8	8	3.36%	0.034	1.00	25	24	10.50%	0.105	1.04
	Chum	5	1.21	45.40	0	0	0.00%	0.000	0.00	1	1	20.00%	0.200	1.00
	Coho	21	13.83	104.19	0	0	0.00%	0.000	0.00	2	1	9.52%	0.095	2.00
	Sockeye	20	8.20	91.10	1	1	5.00%	0.050	1.00	0	0	0.00%	0.000	0.00

2013 Study Year: Goletas Channel

Month	Species	#	Avg wt (g)	Avg Ln(mm)	L. salmonis					C. clemensi				
					total # lice	# fish infected	Prevalence	Abundance	Intensity	total # lice	# fish infected	Prevalence	Abundance	Intensity
April	Pink	55	0.32	32.4	0	0	0.0%	0.00	0.0	1	1	1.8%	0.02	1.0
April	Chinook	11	0.39	35.6	0	0	0.0%	0.00	0.0	0	0	0.0%	0.00	0.0
April	non-salmonid	1	0.39	35	0	0	0.0%	0.00	0.0	0	0	0.0%	0.00	0.0
	Total	67												
May	Pink	344	0.82	42.1	2	2	0.6%	0.01	1.0	18	18	5.2%	0.05	1.0
May	Chum	95	1.19	46.7	2	2	2.1%	0.02	1.0	7	5	5.3%	0.07	1.4
May	Coho	15	9.19	92	0	0	0.0%	0.00	0.0	0	0	0.0%	0.00	0.0
May	Sockeye	19	6.23	82.58	2	2	10.5%	0.11	1.0	3	1	5.3%	0.16	3.0
	Total	473												
June	Pink	213	2.25	58.3	4	4	1.9%	0.02	1.0	7	7	3.3%	0.03	1.0
June	Chinook	6	5.12	76.8	0	0	0.0%	0.00	0.0	1	1	16.7%	0.17	1.0
June	Coho	30	23	121.6	2	2	6.7%	0.07	1.0	4	2	6.7%	0.13	2.0
June	Sockeye	2	3.6	68.5	0	0	0.0%	0.00	0.0	0	0	0.0%	0.00	0.0
June	Dolly Varden	4	26.7	136.2	1	1	25.0%	0.25	1.0	0	0	0.0%	0.00	0.0
	Total	255			13					41				

2013 Study Year: Queen Charlotte Strait

Month	Species	# Sampled	Avg wt (g)	Avg Ln(mm)	<i>L. salmonis</i>					<i>C. clemensi</i>				
					total # lice	# fish infected	Prevalance	Abundance	Intensity	total # lice	# fish infected	Prevalance	Abundance	Intensity
June	Pink	30	2.5	59.4	0	0	0.0%	0.00	0.0	1	1	3.3%	0.03	1.0
June	Coho	3	27.5	129.7	1	1	33.3%	0.33	1.0	0	0	0.0%	0.00	0.0
	Total	33												
July	Pink	9	1.86	59.1	0	0	0.0%	0.00	0.0	3	3	33.3%	0.33	1.0
July	Chinook	1	39.9	155	0	0	0.0%	0.00	0.0	0	0	0.0%	0.00	0.0
July	Herring	31	0.4	38.6	0	0	0.0%	0.00	0.0	7	6	19.4%	0.23	1.2
	Total	41												

2011 Study Year: Goletas Channel

Capture	Dates	Species	# of fish	Avg Lth (mm)	Avg wt (g)	<i>L. salmonis</i>					<i>C. clemensi</i>					Salinity ppm	Temperature °C
						total # lice	# fish infected	Prevalance	Abundance	Intensity	total # lice	# fish infected	Prevalance	Abundance	Intensity		
First Capture	March 30 - April 1, 2011	Pink	11	31.3	0.28	0	0	0%	0	0	2	1	9.1%	0.18	2.0	30.4	8.0
		Chum	2	36.0	0.46	0	0	0%	0	0	0	0	0.0%	0.00	0.0		
		Coho	3	80.0	4.93	0	0	0%	0	0	0	0	0.0%	0.00	0.0		
		Total	16														
Second Capture	April 27 - 29, 2011	Pink	164	36.8	0.55	0	0	0%	0	0	4	3	1.8%	0.02	1.3	30.5	8.2
		Chum	21	44.9	1.01	0	0	0%	0	0	5	4	19.0%	0.24	1.3		
		Non Salmonid	2	38.0	0.62	0	0	0%	0	0	0	0	0.0%	0.00	0.0		
		Total	187														
Third Capture	May 30 - June 3, 2011	Pink	298	53.8	2.20	12	12	4%	0.04	1	30	28	9.4%	0.10	1.1	31.0	10.3
		Chum	43	80.7	9.36	2	2	5%	0.05	1	18	13	30.2%	0.42	1.4		
		Coho	11	96.6	14.99	0	0	0%	0.00	0	1	1	9.1%	0.09	1.0		
		Herring	30	34.7	0.35	1	1	3%	0.03	1	8	7	23.3%	0.27	1.1		
		Dolly Varden	8	135.6	36.50	2	1	13%	0.25	2	3	2	25.0%	0.38	1.5		
		Total	391														
Fourth Capture	June 28 - July 4, 2011	Pink	138	85.8	9.20	12	10	7%	0.09	1.2	61	46	33.3%	0.44	1.3	31.1	9.9
		Chum	46	115.6	23.89	8	5	11%	0.17	1.6	16	11	23.9%	0.35	1.5		
		Coho	4	118.5	27.97	3	2	50%	0.75	1.5	1	1	25.0%	0.25	1.0		
		Herring	30	35.5	0.48	1	1	3%	0.03	1	60	23	76.7%	2.00	2.6		
		Total	218														