



SHELLY CREEK COHO SMOLT TRAP REPORT
2018 and 2019



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Prepared by
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Abstract

Shelly Creek provides an important (over winter) sanctuary for juvenile Coho and Trout rearing in the Englishman River. In 2018 and 2019, a downstream smolt trap was installed into lower Shelly Creek, to monitor the health of the Coho smolt populations that overwinter there. This smolt trapping study has been ongoing for eight years and represents an important long-term biological dataset including factors that influence seasonal migrations, such as creek flows, weather and water temperatures. The results from these two trapping seasons, reveal the variability (in Coho counts) between seasons, where the average smolt count per day varied from a near record high in 2018 to the second lowest on record in 2019.

Introduction

Coho smolt migration studies have been conducted in Shelly Creek every spring since 2011 (D. Clough, 2011, 2012, 2013 and B. Riordan, 2015, 2016, 2017). The exception was in 2014 when a beaver flooded the lower creek, making trap installation impossible. Using a fence to capture salmonids as they move downstream, members of the Mid Vancouver Island Habitat Enhancement Society, under the guidance of the Department of Fisheries and Oceans, have been working in cooperation with other volunteer groups (Qualicum Beach Streamkeepers, Friends of French Creek and Mid Island Castaways) to compile fish and biological data on salmonid use of lower Shelly Creek. The objectives of the trapping program are as follows:

1. To determine the extent of Coho and Trout utilization of the lower Shelly Creek and Martindale Pond, during the winter/spring months
2. Increase public awareness of the Shelly Creek watershed and how it supports salmon production in the Englishman River.

In the spring months of 2018 and again in 2019, the smolt trap was installed and operated to complement previous assessments. This report is a compilation of two seasons of trap operations.

Methods

The smolt trap location, as in previous years, is 200m upstream from the Shelly Creek confluence with the Englishman River (Figure 1). It is placed just downstream of the Martindale Road culvert, at the outflow of a large wetland (Martindale Pond).

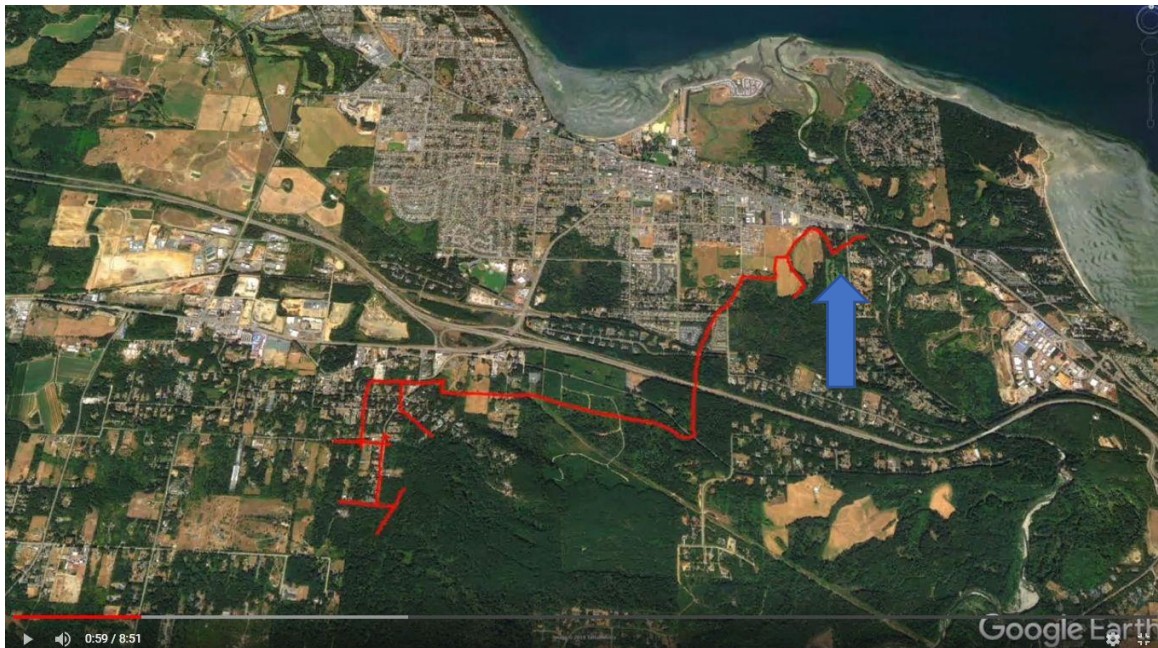


Figure 1. Location of the Smolt Counting Fence on Lower Shelly Creek.

A “V-weir” design is configured using two 4’x8’ long panels, composed of 2”x4” wooden frames covered with ¼” inch galvanized mesh, set onto the creek bed (Appendix IV-photo 3). A plastic apron is laid at the front of the fence panels to discourage fish migration around or through the fence. Sandbags are used to create wingwalls and assist in shoring up the fence during freshet flows. Fish are guided down the fence, into a “Big O” flexible pipe, where they are flushed into a trap box which is anchored into the stream bed with sandbags and wooden backstays.

During trap operations, the fence is checked daily for holes, undermining and cleaned of debris. The fence is installed in the same location and operated each year in a similar manner, as in previous years, allowing a year by year comparison of the results.

There is an assumption that the fish counts do not represent 100% of the smolt run. To achieve a higher level of accuracy would require “testing” of the fence’s efficiency for capturing smolts through a mark and recapture. The reason this is not done here, is that the fence is operated by volunteers, who do not wish to stress the fish unduly.

Sampling methods and data collection procedures were the same as in previous years. The trap box was checked daily by at least three volunteers. A wooden baffle (installed to provide quiet holding water for fish) was removed from the box, to allow for easy netting of fish. Fish are scooped up using a broom-handled knotless net, and visually inspected to determine species. Fish are poured from the net into a sampling tub (40cm x 40cm). Fish are then counted and removed using a small dipnet. A random selection of 10 Coho are measured to fork length (mm) for every 100 Coho smolts counted. Fork lengths are recorded for Coho and Trout on a Juvenile Salmonid Data Sheet (Appendix I). These daily records of Coho measurements are submitted to DFO as per Scientific License requirements. Copies are located on the MVIHES Google Drive.

Daily fish counts are recorded for Rainbow and Cutthroat Trout, Sculpin and Stickleback. Water level and temperature data were also collected.

To identify Trout juveniles at the trap was difficult. Cutthroat smolts were identified only if a slash under the throat was clearly visible (usually fish > 130mm). Smolts >130mm without slash under the throat were identified as Rainbow. Trout <130mm were listed as “Trout”.

In 2018, and again in 2019, the smolt trap was installed in third week of March, to ensure trapping began prior to the peak in the downstream smolt movements. The smolt trap was removed in mid to late May each year. The decision to remove the trap is based on the following criteria:

- low daily fish counts,
- rising water temperatures and
- low stream flows

Daily rainfall data and average monthly air temperature was acquired from the Environment Canada Weather Station at the Qualicum Beach Airport.

Results

Downstream Fish Counts

2018 Counts

The total number of fish counted during the 59 days of trap operation was 7432 (Appendix II). Total count for Coho smolts was 6840, and 296 for Trout (Cutthroat and Rainbow). Other fish species counted from the trap included Stickleback and Sculpin and are show in the totals. The highest daily count of Coho smolts was on April 26th (Figure 2). Trapping efficiency was believed to have been effective for most of the season, however the trap was not operational on May 3rd and 4th due to an incident where a River Otter tore out a screen in the trap box, allowing smolts to escape.

2019 Counts

The total number of fish counted during the 55 days of trap operation was 1188 (Appendix III). The total count of Coho smolts was 993, and 126 for Trout (Cutthroat and Rainbow). Stickleback and Sculpin were also counted from the trap during the season and are shown in the totals. The highest daily count of Coho smolts was on April 29th (Figure 3). In this trapping season, there were no incidents where trapping efficiency was compromised (eg. high water flowing around the fence), however, fence installation was not completed as effectively as in previous years. This means that there could have been fish by-passing the fence through gaps in the panels.

Comparison of Fish Counts - 2018 and 2019

When comparing the trapping results between years, there are some obvious differences (Table 1). These include the following:

- 1) The trap was operated for four days longer in 2018 than 2019.
- 2) The trap operation began one week earlier in 2019 and finished eleven days earlier than 2018.
- 3) There was a significant drop in the count of all fish species in 2019 compared to 2018.

The daily counts appear to follow a similar pattern, with fish movement starting slowly through late March and early April but spiking around April 20th and falling back down to lower numbers in the 2nd week of May.

Table 1. Fish Count and Trapping Operational Summary for 2018 and 2019

	# of Coho Smolts	# of Trout Smolts*	Coho Fry	Sculpin	Stickle back	Total Fish	Trapping Operations Start / End	Number of Trapping Days
2018	7467	297	5	235	56	7432	March 24 – May 21*	59
2019	993	126	2	55	18	1188	March 17 – May 10	55

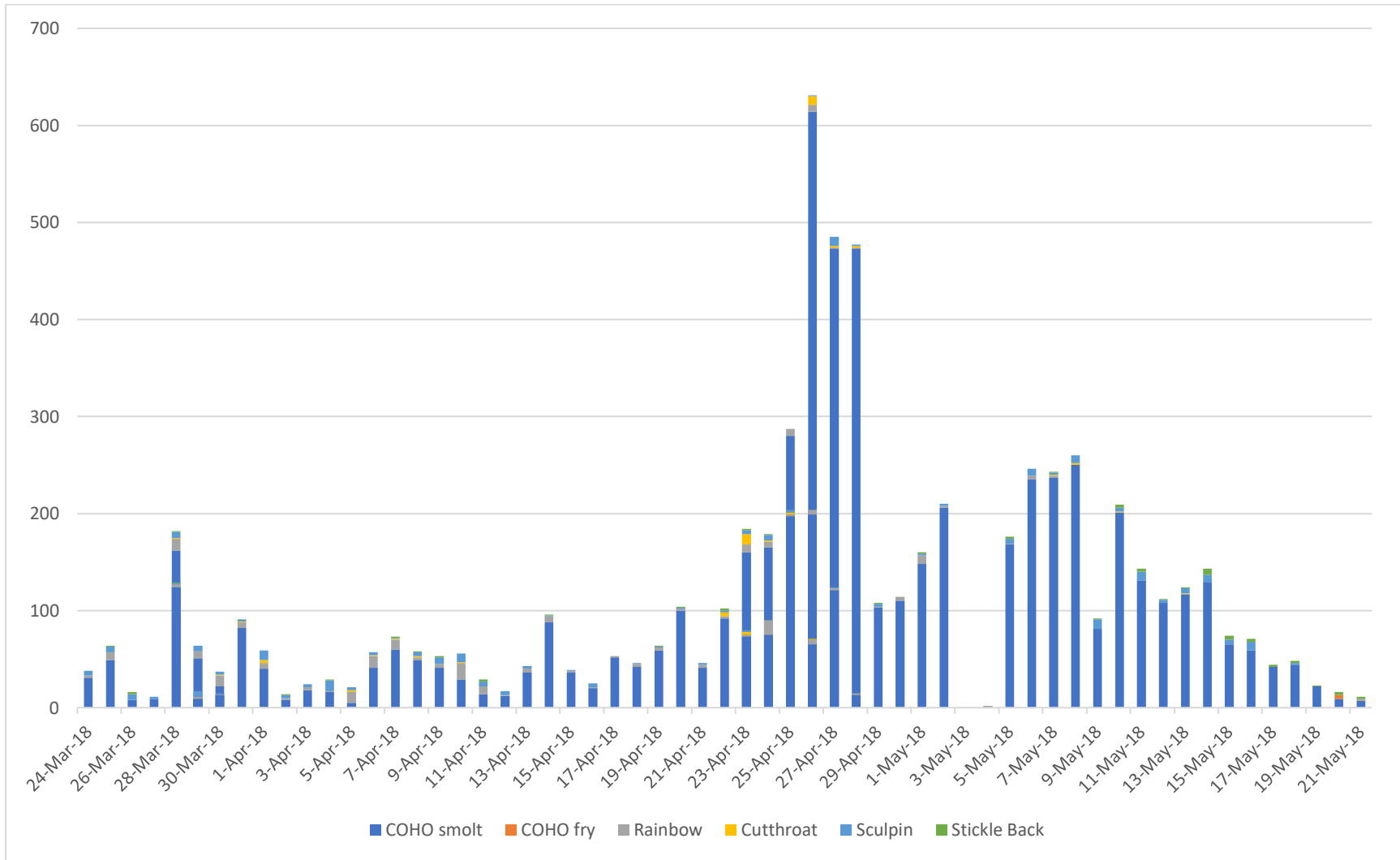


Figure 2. Shelly Creek Daily Trap Count by Species - 2018

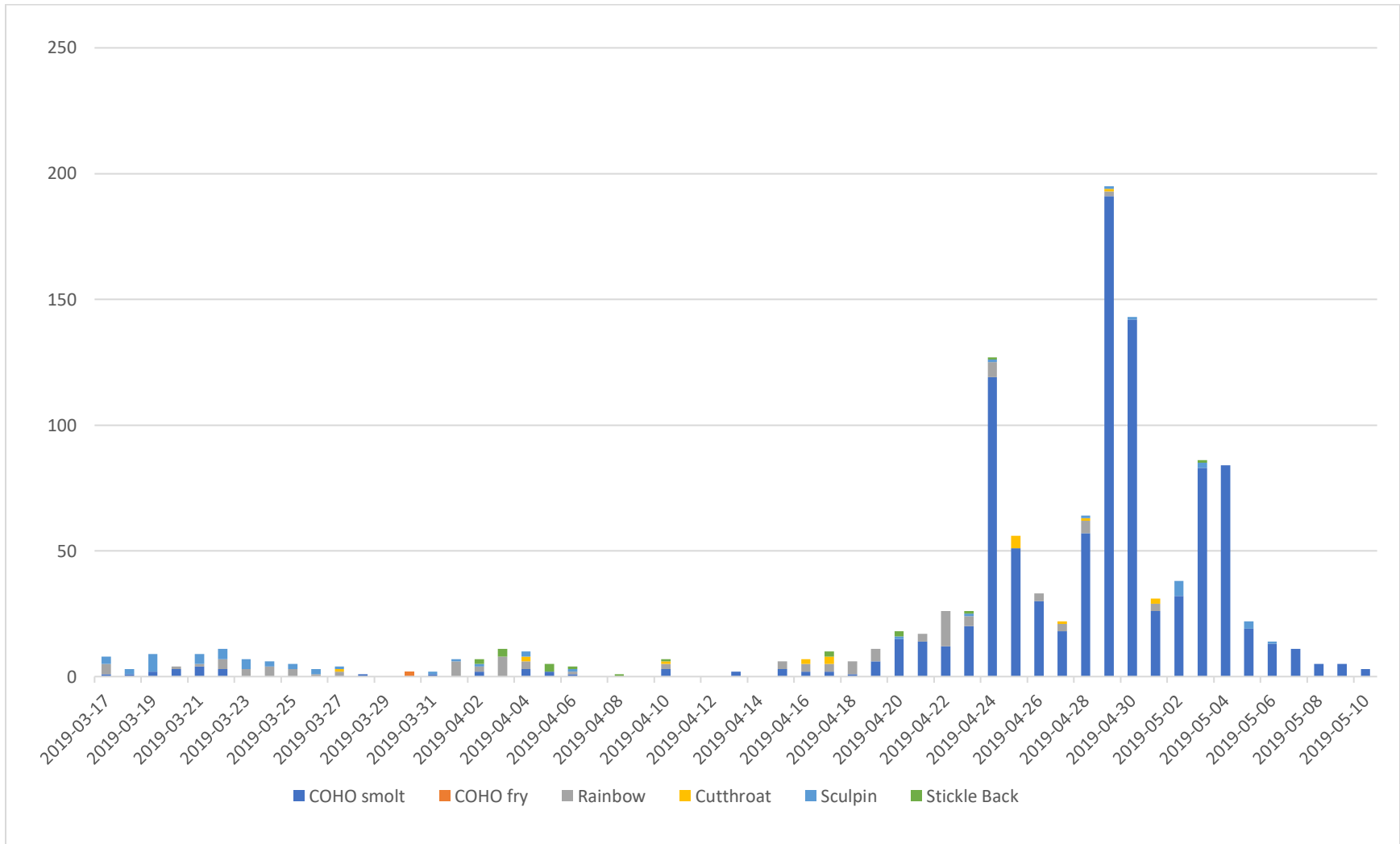


Figure 3. Shelly Creek Daily Trap Count by Species - 2019

Coho Smolt Sampling

2018 Sampling

In 2018, fork lengths were measured on 1032 Coho smolts and grouped into size ranges (Figure 4). The length frequencies were within a normal distribution of 71mm to 110 mm. The most common length frequency (n=175) was 84.4 to 88.2 mm. The average length for all Coho measured was 87 mm.

In the last week of trap counts, a total of five Coho fry (46mm to 50mm) were sampled.

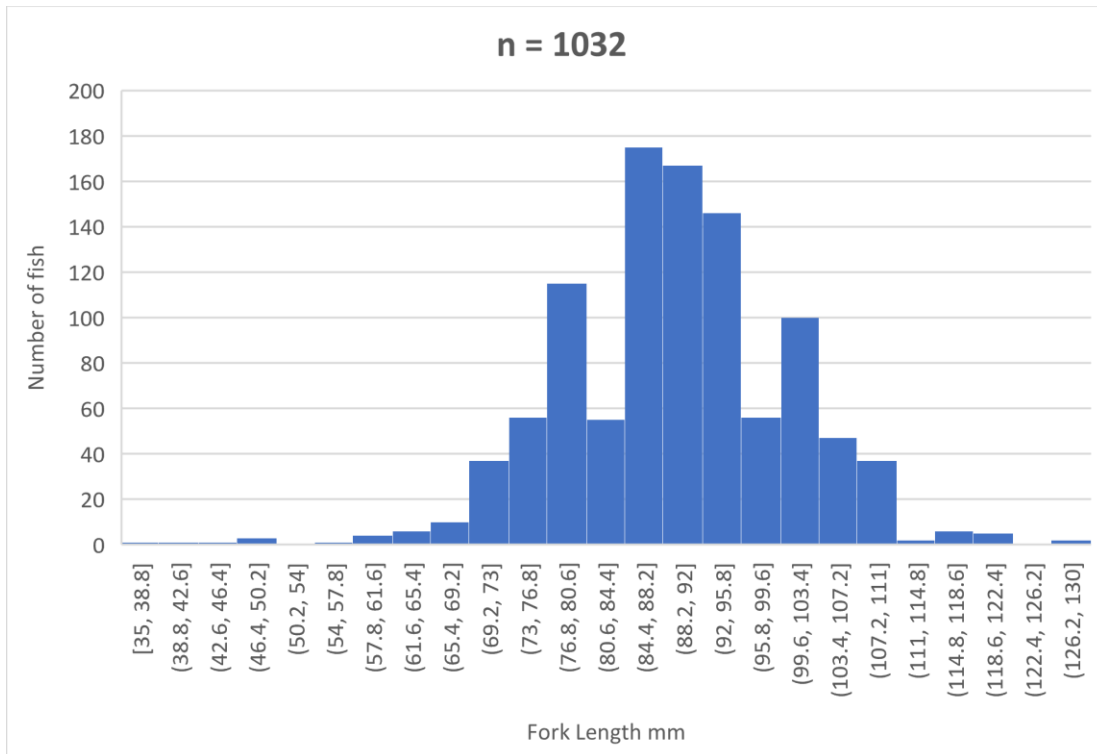


Figure 4. Length Frequency of Coho Smolts in 2018

2019 Sampling

In 2019, a total of 398 Coho were measured at the trap (Figure 5). Fish length frequencies show fork lengths within a normal distribution of between 70mm and 110mm. The most common length frequency (n = 67) was 90mm to 95mm. The average fork length for all Coho measured was 96mm. In 2019, two Coho fry were sampled at the trap.

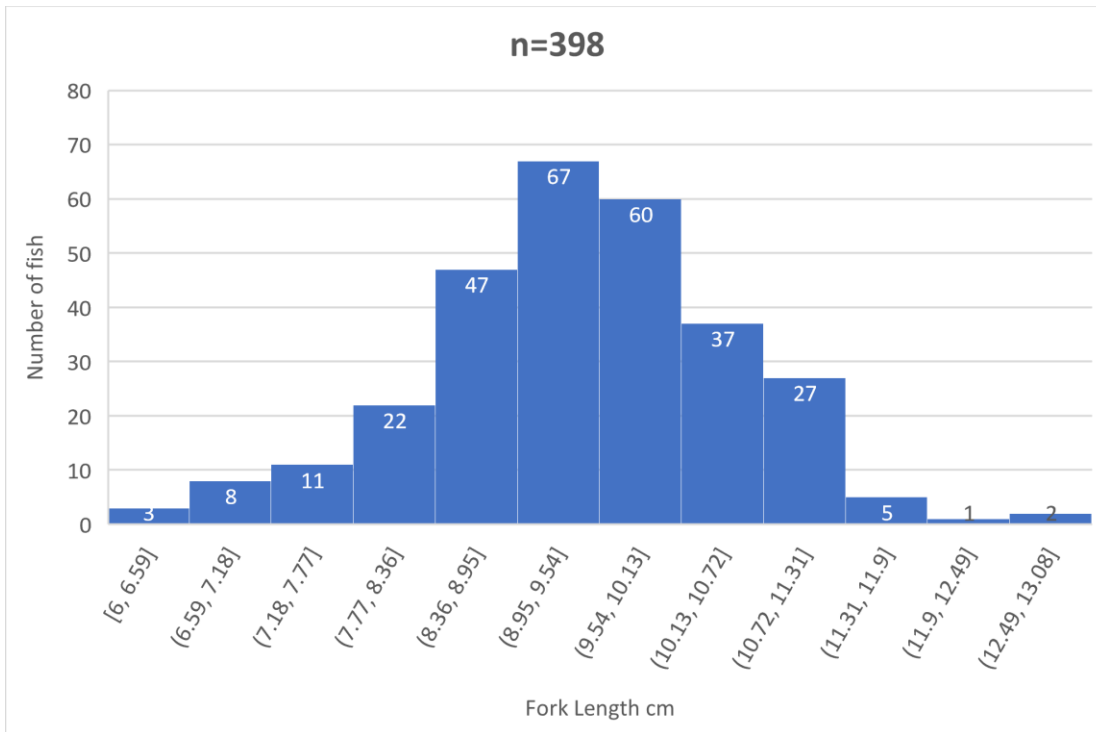


Figure 5. Length Frequency of Coho Smolts in 2019

Trout Smolt Sampling

In 2018, a total of 86 trout smolts were measured, with an average length of 123mm. One adult trout (28 cm) was captured (Appendix IV -photo 1.). In 2019, 108 trout smolts were sampled during the season, with an average length of 101mm. No adults were captured.

Trout Sampling Data Available on MVIHES Google Drive:
 /Project Data/Shelly Creek/Smolt Trap/2018 and 2019.

Stream Conditions during Trap Operations

2018 - (Trapping Period: March 24th to May 21st)

Rainfall records from the Qualicum airport show several small showers (<10 mm) in the month of April, however the influence these rain events had on stream temperatures appears to be minimal (Figure 6). Stream temperatures rose above 10°C twice during the trapping time period, once in early April and again in the last week of April, which stimulated smolt movement (see arrows) downstream through the trap.

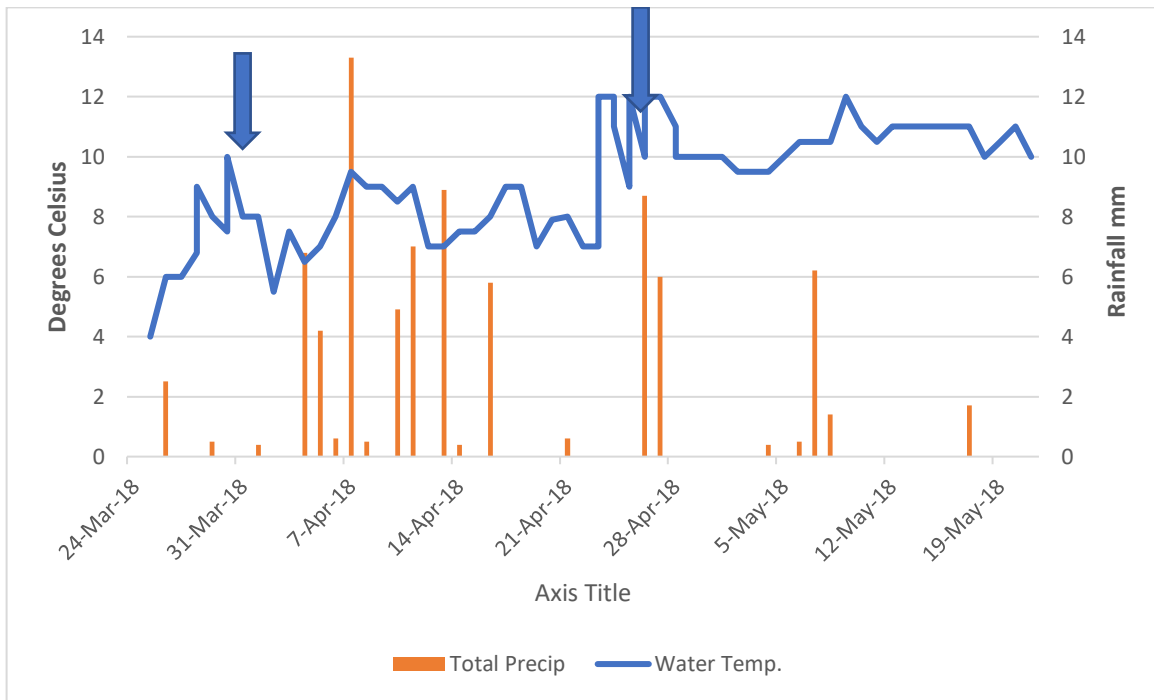


Figure 6. 2018 Daily Water Temperature Compared to Rainfall

2019 - (Trapping Period: March 17th to May 10th)

Rainfall records from Qualicum airport in the spring of 2019, showed rainfall occurring over a three day period in in early April, which influenced stream temperature (>10°C) for three days, but there was no corresponding movement of downstream smolts (Figure 7). Very little rainfall occurred from mid-April to early May, other than small showers. A moderate shower of 10mm occurred on April 7th, bumping the water temperature up, but no fish moved as a result (arrow). Smolt movement peaked in early May (arrow) as water temperatures climbed to 12°C.

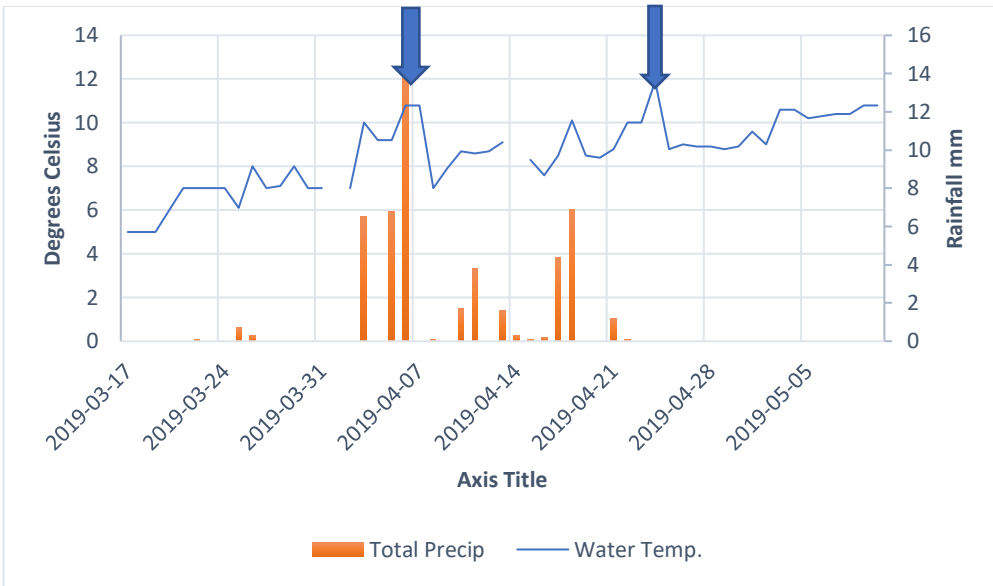


Figure 7. 2019 Daily Water Temperature Compared to Rainfall

Discussion

Comparison of Smolt Migration Counts (2011 to 2019)

The total number of Coho and Trout smolts counted in 2018 and 2019 are compared with previous years of trap operations in Table 2.

Table 2. Summary of Annual Coho and Trout Counts (2011-2019)

YEAR	Total Coho Smolts	Total Trout Smolts	Trapping Operations Start / End	Number of Trapping Days
2011	2368	37	April 22 – June 4	43
2012	8094	42	April 15 – May 23	38
2013	7265	21	April 1 – May 26	56
2014 No Trap Operation Due to Flooding by Beaver Dam				
2015	1247	0	April 19 – May 26	38
2016	4313	69	April 8 – May 10	33
2017	755	153	March 25 – May 25	62
2018	7467	297	March 24 – May 21*	59
2019	993	126	March 17 – May 10	55

*trap did not operate for a 48 hour period due to trap damage (May 3-4, 2018)

Reviewing the smolt counts, we can see a high amount of variability in the numbers of smolts counted between the years.

To provide a more robust comparison of Coho smolt counts between years, we can look at the mean number of smolts counted/day, on those common dates, in the years when the trap operated. By reviewing the trapping calendars over seven seasons, there were twenty-three days (April 19th to May 10th), that are common to all years. Generally, this window of smolt migration (from late April to mid-May) represents (+/-) seventy five percent of the total trap count for the season. By focusing on these dates, we see the mean number of smolts/day ranges from a high of 300 to a low of 21 (Table 3).

Table 3. Coho Smolt Counts/Day During Common Trapping Dates (2011-2019)

Year	2012	2013	2015	2016	2017	2018	2019
April 19th to May 10th	300	124	54	110	21	226	43

For the purpose of rating annual smolt counts compared to the peak smolt year of 2012, we propose to group the daily counts, during the peak migration time period (mid-April to mid-May), from low to high (Figure 8).

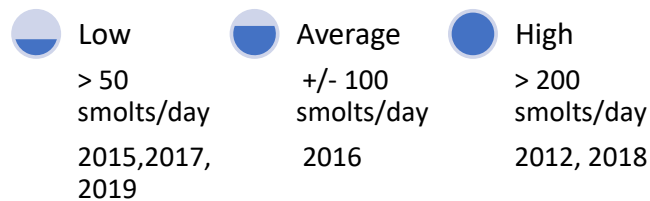


Figure 8. Rating the Peak Smolt Output Counts (2011-2019).

Factors that Influence Smolt Counts in Shelly Creek

If we assume that the annual trapping operations do not influence the “catchability” of smolts, then the following factors influence the number of smolts counted at the Shelly Creek trap in 2018 and 2019:

1. Coho Spawning Escapements

Each fall spawning season counts of migrating salmon are executed on the river to provide estimates of spawning salmon. This count is done by snorkel survey, beginning in early September and concluding when river conditions make fish observation difficult. DFO Stock Assessment gather these relative abundance “counts” and develop a total estimate of the number by species. The average number of adult Coho escaping into the river over the past twelve years is approximately 5500 fish. (DFO 2019). Coho spawn throughout the anadromous reaches of the watershed, including Shelly Creek in some years. The smolts enumerated at the fence are believed to be mostly progeny from Coho who spawned in the mainstem river above Shelly Creek, and get “washed” into Shelly Creek during high winter flood events the following year.

Judging from the records obtained from DFO, the wild Coho escapement estimates for brood years 2016 and 2017 remained close to the four-year average.

2. Winter High Flood Flows

In the 2017 trapping report, Riordan identified the importance of lower Shelly Creek as a refuge for Coho pre-smolt survival (Riordan, 2017). Juvenile fish rearing in the lower Englishman River can be subject to high winter flood flows. To survive, they escape the strong river currents and swim to backchannels

and adjacent wetlands. In 2018, the lower river experienced a flood event on January 29th, peaking at 290 m³/s, which resulted in the flooding of Parry's Trailer Park and Martindale Pond (Figure 9). This highwater event allowed Coho pre-smolts to "over winter" in the wetland, and move downstream in the spring. In 2019, a larger flood event (409 m³/s) took place on January 3rd. Once again, Parry's Trailer Park and Martindale Pond were flooded by the river.

Trap results, over these two seasons do not reflect a simple correlation of a flood event leading to enhanced smolt outputs, as seen in the low smolt count in 2019.

MVIHES members have observed some landowners in the Martindale Road neighbourhood constructing berms and ditches to protect their properties from flooding over the past few years. It is unknown if these activities could be preventing pre-smolts from accessing Martindale Pond.

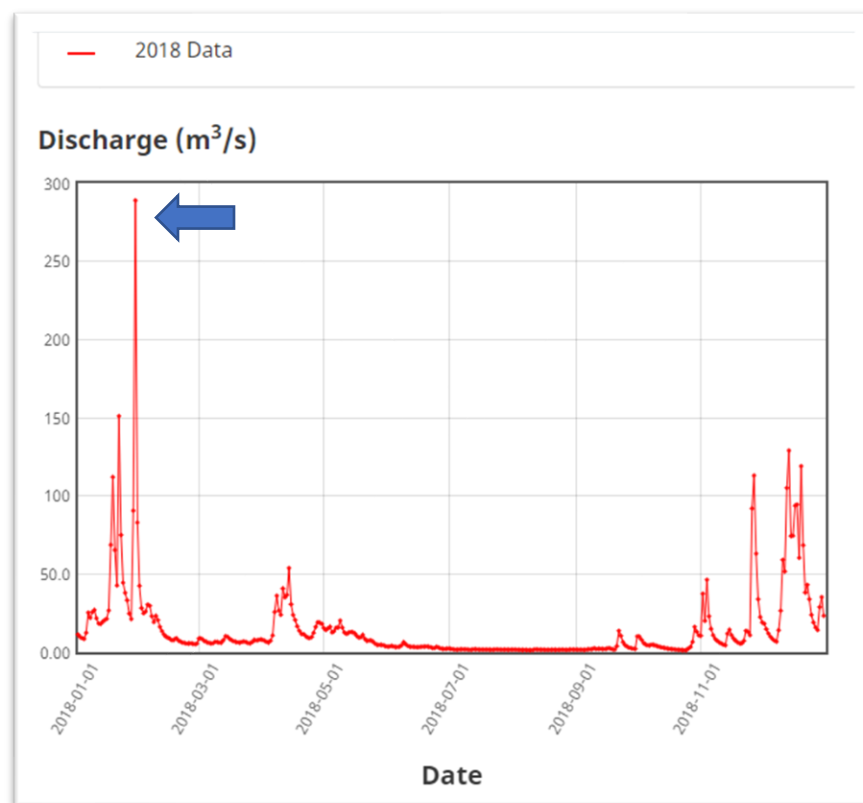


Figure 9. 2018 Hydrometric Data for the Englishman River (O8HB002), With Arrow Showing Peak Discharge on Jan. 29th.

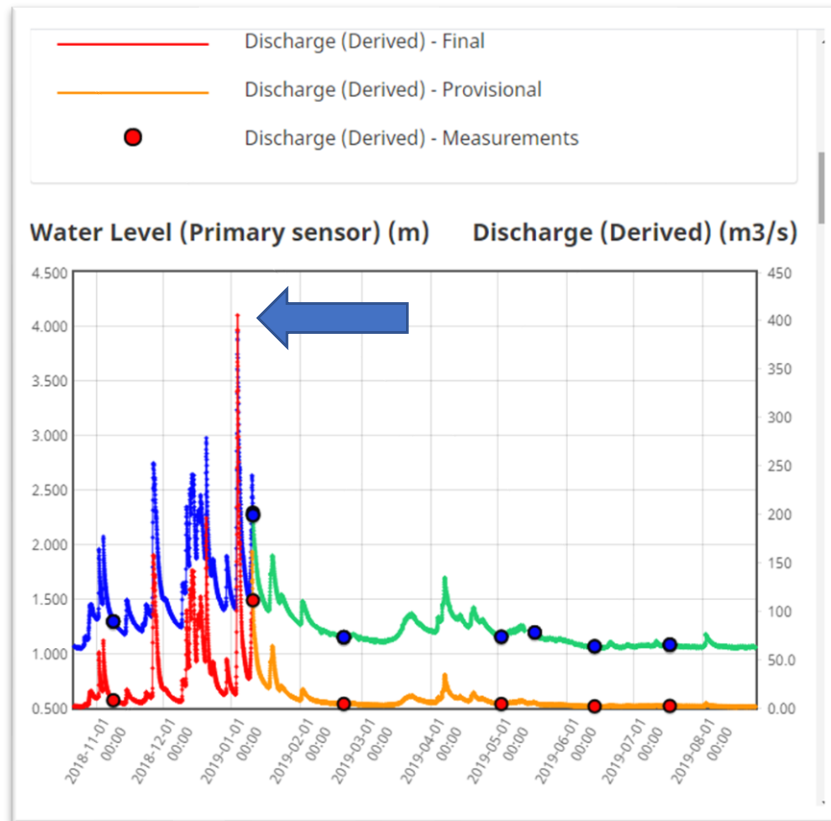


Figure 10. 2019 Hydrometric Data for the Englishman River (08HB002) With Arrow Showing Peak Discharge on Jan. 3rd

3. Weather and It's Influence on Water Temperatures and Flows

In 2016, Coho smolt movement was correlated to stream temperatures rising over 8.5°C and freshet stream flows caused by rain events (Riordan, 2016).

When comparing the air temperatures during the winter and spring months (Table 4), the month of February 2019 was colder than February 2018, contributing to lower water temperatures at the trap in the spring of 2019.

Flows in the creek were much lower in 2019, as a result of lower precipitation starting in January, with half the rain recorded in January 2018. Low rainfall, followed by a month of cold weather in February, followed by another dry month in March resulted in low stream flows in the spring trapping season.

Table 4. Mean Monthly Ambient Temperatures and Total Precipitation in Winter/Spring 2018 and 2019.

	Mean Air Temperature °C		Total Precipitation mm	
	2018	2019	2018	2019
January	4.5	4.6	228	125.4
February	3.0	-0.4	58.8	58.7
March	5.0	6.3	23.7	1.8

April	8.7	8.9	68.1	48.3
May	14.6	14.6	11.0	12.3

4. Physical Conditions of Martindale Pond/Lower Shelly Creek

The physical condition of the wetland complex in the lower reaches of Shelly Creek, have been the subject of concern for MVIHES (Appendix IV photo 4). There has been a noticeable “in-filling” of the wetland adjacent to Martindale Road, caused by siltation over the years from both Shelly Creek and the river. This has resulted in a reduction in the available fish habitat (D. Clough pers. comm.). This could account for the low trap numbers of fish in 2019. A project to rectify this loss of open water fish habitat will hopefully be implemented in the late summer of 2020.

5. The Condition Factor of Coho Smolts

In a review of the condition factor of Coho smolts, we can compare fork lengths of sampled fish over the past five years (Table 5). The data shows there can be variability between years, of up to 13 mm. Although we have not done an “age at length” analysis using scale samples, we assume the majority of smolts are 1+ years old when counted at the trap.

Table 5. Comparison of Mean Smolt Fork Lengths (2015-2019)

	Normal Distribution (mm)	Mean (mm)	90 Percent Range (mm)
2015	59 – 118	89	84 – 88
2016	70 – 129	101	99 -104
2017	71 – 131	101	101 – 107
2018	60 – 125	87	85 – 105
2019	70 – 120	96	77 – 115

It is interesting to see the “size at length” differences between 2018 and 2019 fish. In 2018, fish length was 10mm smaller than 2019, but smolt output was 7.5x greater.

Recommendations

1. Lower Shelly Creek should continue to be considered an important Coho salmon and trout producer and be protected from impacts of land development and urbanization in the Shelly Creek watershed. This must include ensuring that any future measures to mitigate flooding in the Martindale Road neighbourhood does not negatively impact this unique wetland.

2. A smolt trap study should be conducted in 2021 to continue to monitor the health of the Coho and trout smolt populations in the creek/wetland.
3. Water levels permitting, the smolt trap should be installed before the water temperature reaches 8.5 °C.
4. A restoration proposal to remove sediments from the Martindale Pond, in the summer of 2020, should be assessed in the spring of 2021 and 2022 to determine whether the project had a positive impact Coho smolt output.

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Environment Canada. Environment and Resources. Real Time Flow Data

https://wateroffice.ec.gc.ca/report/real_time_e.html?stn=08HB002

Appendix I

JUVENILE SALMONID DATA SHEET

Location	Shelly Creek/Martindale Rd	Date	
Observers		Page	of
Start Time	Stop Time	Water Level	
Water Temp.	Air Temp.		
Remarks and Observations			

Species	Coho			Other species
	Length Tally	Weight	Tally (unmeasured)	Tally (unmeasured)
1			1	Trout
2			2	
3			3	
4			4	Cutthroat Trout
5			5	
6			6	
7			7	Sculpin
8			8	
9			9	
0			0	Stickleback
1			1	
2			2	
3			3	Frogs
4			4	
5			5	
6			6	Crayfish
7			7	
8			8	
9			9	
0			0	

Appendix II

2018 Fence Count

Date	COHO smolt	COHO fry	Rainbow	Cutthroat	Sculpin	Stickle Back	Total Fish
24-Mar-18	31		2		5		38
25-Mar-18	49		8		6	1	64
26-Mar-18	8		0	0	6	2	16
27-Mar-18	9				2		11
28-Mar-18	162		12	1	6	1	182
28-Mar-18	124		3		1	1	129
29-Mar-18	51		7		6		64
29-Mar-18	9		2		6		17
30-Mar-18	22		11	1	3		37
30-Mar-18	13		1		1		15
31-Mar-18	82		6	1	2		91
1-Apr-18	40		6	3	10		59
2-Apr-18	8		2		3	1	14
3-Apr-18	18		3		3		24
4-Apr-18	16		1		11	1	29
5-Apr-18	5		11	2	3		21
6-Apr-18	41		12	1	3		57
7-Apr-18	60		10	1	1	1	73
8-Apr-18	49		3	1	4	1	58
9-Apr-18	41		4		7	1	53
10-Apr-18	29		17	1	9		56
11-Apr-18	14		8		5	2	29
12-Apr-18	12		1		4		17
13-Apr-18	36		4		3		43
14-Apr-18	88		6		1	1	96
15-Apr-18	36		2		1		39
16-Apr-18	20		1		4		25
17-Apr-18	52		1		0		53
18-Apr-18	42		3		1		46
19-Apr-18	59		3		1	1	64
20-Apr-18	100		2		1	1	104
21-Apr-18	41		3		2		46
22-Apr-18	92		2	4	2	2	102
23-Apr-18	160		8	11	4	1	184
23-Apr-18	73		2	3	2	0	80
24-Apr-18	165		6	1	6	1	179
24-Apr-18	75		15	0	0		90
25-Apr-18	197		2	2	3		204
25-Apr-18	280		7		0		287
26-Apr-18	614		7	9	1		631
26-Apr-18	65		5	1	0		71
26-Apr-18	199		5	0	0		204
27-Apr-18	473		1	2	9		485

27-Apr-18	121		2		1		124
28-Apr-18	473		1	2	1		477
28-Apr-18	13		2				15
29-Apr-18	103		1		3	1	108
30-Apr-18	110		4				114
1-May-18	148		9		2	1	160
2-May-18	206		2		2		210
3-May-18							
4-May-18	1		1				2
5-May-18	168		1		5	2	176
6-May-18	235		4		7		246
7-May-18	237		2	1	2	1	243
8-May-18	250			2	8		260
9-May-18	81				10	1	92
10-May-18	201			1	4	3	209
11-May-18	131				9	3	143
12-May-18	108				3	1	112
13-May-18	117			1	5	1	124
14-May-18	129				8	6	143
15-May-18	65				5	4	74
16-May-18	59				9	3	71
17-May-18	42					2	44
18-May-18	44				2	2	48
19-May-18	22					1	23
20-May-18	9	4				3	16
21-May-18	7	1			1	2	11
Totals	6840	5	244	52	235	56	7432

Appendix III

2019 Fence Count

Date	COHO smolt	COHO fry	Rainbow	Cutthroat	Sculpin	Stickle Back	Total Fish
3-17-2019	1	0	4	0	3	0	8
3-18-2019	1	0	0	0	2	0	3
3-19-2019	2	0	0	0	7	0	9
3-20-2019	3	0	1	0	0	0	4
3-21-2019	4	0	1	0	4	0	9
3-22-2019	3	0	4	0	4	0	11
3-23-2019	0	0	3	0	4	0	7
3-24-2019	0	0	4	0	2	0	0
3-25-2019	0	0	3	0	2	0	5
3-26-2019	0	0	1	0	2	0	3
3-27-2019	0	0	2	1	1	0	4
3-28-2019	1	0	0	0	0	0	1
3-29-2019	0	0	0	0	0	0	0
3-30-2019	0	2	0	0	0	0	2
3-31-2019	1	0	0	0	1	0	2
4-1-2019	0	0	6	0	1	0	7
4-2-2019	2	0	2	0	1	2	7
4-3-2019	0	0	8	0	0	3	11
4-4-2019	3	0	3	2	2	0	10
4-5-2019	2	0	0	0	0	3	5
4-6-2019	1	0	1	0	1	1	4
4-7-2019	0	0	0	0	0	0	0
4-8-2019	0	0	0	0	0	1	1
4-9-2019	0	0	0	0	0	0	0
4-10-2019	3	0	2	1	0	1	7
4-11-2019	0	0	0	0	0	0	0
4-12-2019	0	0	0	0	0	0	0
4-13-2019	2	0	0	0	0	0	2
4-14-2019	0	0	0	0	0	0	0
4-15-2019	3	0	3	0	0	0	6
4-16-2019	2	0	3	2	0	0	7
4-17-2019	2	0	3	3	0	2	10
4-18-2019	1	0	5	0	0	0	6
4-19-2019	6	0	5	0	0	0	11
4-20-2019	15	0	0	0	1	2	18
4-21-2019	14	0	3	0	0	0	17
4-22-2019	12	0	14	0	0	0	26
4-23-2019	20	0	4	0	1	1	26
4-24-2019	119	0	6	0	1	1	127
4-25-2019	51	0	0	5	0	0	56
4-26-2019	30	0	3	0	0	0	33
4-27-2019	18	0	3	1	0	0	22
4-28-2019	57	0	5	1	1	0	64
4-29-2019	191	0	2	1	1	0	195

4-30-2019	142	0	0	0	1	0	143
5-1-2019	26	0	3	2	0	0	31
5-2-2019	32	0	0	0	6	0	38
5-3-2019	83	0	0	0	2	1	86
5-4-2019	84	0	0	0	0	0	84
5-5-2019	19	0	0	0	3	0	22
5-6-2019	13	0	0	0	1	0	14
5-7-2019	11	0	0	0	0	0	11
5-8-2019	5	0	0	0	0	0	5
5-9-2019	5	0	0	0	0	0	5
5-10-2019	3	0	0	0	0	0	3
TOTAL	993	2	107	19	55	18	1188

Appendix IV

Photos



Photo 1. Sea Run Cutthroat Trout, 28cm Fork Length – Sampled on March 30, 2018.



Photo 2. Smolt Measurements – March 2019



Photo 3. Installation of Fence Panels – March 2019



Photo 4. Martindale Pond – Lower Shelly Creek (March 2019).