MVIHES
Mid Vancouver Island Habitat Enhancement Society

SHELLY CREEK COHO SMOLT TRAP REPORT - 2015

Prepared for Mid Vancouver Island Habitat Enhancement Society

Prepared by Barb Riordan

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Abstract

A coho smolt enumeration study was conducted during the spring of 2015 in Shelly Creek located in Parksville, BC. The objectives of the study were to monitor the number of coho smolt migrating from Shelly Creek into the Englishman River, compare the 2015 migration with that of 2013, 2012 and 2011, and assess the presence of barriers in the creek to fish migration.

Coho smolt were captured using a V-weir trap that directed fish into a trap box installed in the creek. Volunteers checked the box daily and inventoried all fish species, as well as recorded fork lengths of coho smolt, before releasing them back into the creek. The smolt trap was in operation between April 19 and May 26. Minnow trapping was conducted on May 26 and 27 to determine if smolt were stranded in the creek upstream of the smolt trap.

A total of 1708 fish were captured by the smolt trap of which 1247 were coho smolt. No trout (cutthroat or rainbow) were observed. These were the lowest numbers of smolt and trout captured since the studies began in 2011, and significantly lower than the counts in 2012 and 2013. The minnow traps only captured stickleback however, dead and distressed smolt were observed behind two beaver dams at the time of trap retrieval.

The low numbers were attributed to high air temperatures in January February, and March which triggered an early migration of coho and trout. The majority of fish probably migrated into the Englishman River before the smolt trap was installed. Low rainfall in April and May caused water levels behind two beaver dams to drop below the dam crests, stranding the fish that did not migrate earlier. This also contributed to the low numbers of fish captured. These fish would have perished due to high water temperatures and low oxygen levels caused by the hot, dry weather.

Shelly Creek remains an important waterbody for trout and coho salmon and should be protected from the impacts of development and urbanization. A smolt study should be conducted in 2016 to confirm the low numbers of coho and trout captured were due to an early migration and low water levels which trapped fish behind beaver dams, not a reduction in productivity.

Introduction

Shelly Creek drains from the base of Little Mountain in Parksville, BC and flows northeast into the Englishman River, approximately 2km from the Strait of Georgia. The confluence is located 200m upstream of the Island Highway 19A Bridge. This stream channel is approximately 6.5 km long, draining a watershed area of approximately 5 km². All of the reaches of Shelly Creek have been negatively impacted by agriculture and urbanization (P. Walshe, 1999).

Fish access ends 1000 m from the creek's confluence with the river, where there is a 5 m waterfall. Resident cutthroat trout are found in Shelly Creek throughout the length of the creek below the E&N rail crossing (Peter Law, pers. comm.). Currently, cutthroat migration is limited because of several man-made obstructions. Coho juveniles also inhabit the creek in the lower 1 km of the creek. (D. Clough, 2011). It is believed they enter Shelly Creek to escape the high flows of the Englishman River during the winter months and migrate back into the Englishman River during the spring months of March, April and May to avoid the high water temperatures and low oxygen levels that develop with warmer weather (D. Clough, 2013).

Two beaver ponds are present in Shelly Creek approximately 200 m upstream from Martindale Rd. These dams present a barrier to fish migration in spring during low flow years (D. Clough, 2013).

Coho smolt migration studies were conducted in Shelly Creek during the spring of 2011, 2012 and 2013, to learn the extent of the smolt and trout utilization of lower Shelly Creek, and increase public awareness and stewardship of the creek system.

In April 2015, another smolt enumeration study was conducted to compliment previous assessments. The project was funded through the D.F.O. public involvement program with support from D.F.O. community advisor, Dave Davies. Support was also provided by the Qualicum Beach Streamkeepers Society and M.V.I.H.E.S. (Mid Vancouver Island Habitat Enhancement Society).

The objectives of the study are to:

- To monitor the number of coho smolt migrating through the spring period from Shelly Creek to the Englishman River.
- To compare the 2015 smolt migration to previous years of trapping data to confirm the timing window and physical conditions that are critical to coho smolt movement downstream.
- To assess the presence of physical barriers to smolt migration during low flows.

Methods

On 18 April 2015, a smolt trap was installed in Shelly approximately 200 m upstream from its confluence with the Englishman River (Figure 1). It was placed downstream of the Martindale Road culverts, which drain an upstream pond.

The design of the trap was the same as that used in the previous years' studies (Figure 2). It includes a V-weir trap that directs fish into a 6 inch diameter plastic collection pipe located at the center of the trap. The pipe discharges into a 4 ft x 6 ft wooden trap box where fish are held until they can be inventoried and released (Clough, 2011, 2112, 2013).

Figure 1. Shelly Creek Smolt Trap Location (2011, 2012, 2013, 2015)

Figure 2. Shelly Creek Smolt Trap

Figure 3. Counting Fish Captured in Smolt Trap Box

The trap box was checked daily by teams of volunteers (Figure 3). Daily inventory and fork lengths were recorded for coho smolt on a Juvenile Salmonid Data Sheet (Appendix 1). Daily inventory was also recorded for rainbow and cutthroat trout, sculpin and stickleback. Water levels and temperature data were also collected. Dissolved oxygen levels were measured weekly to ensure levels were above the lethal concentration of 3.0 mg/L. The smolt trap was decommissioned on May 26 due to the low the number of smolt being captured.

Daily rainfall data was acquired from the Environment Canada Weather Station at the Qualicum Beach Airport and is presented in Figure 5.

A data logger that had been installed in Shelly Creek at the end of Blower Rd in February 2013, was downloaded on 24 May 2015. The logger provided hourly water temperature data.

Baited minnow traps were set on May 26 in front of the V-weir trap and in five upstream locations in Shelly Creek to determine if barriers were preventing downstream smolt movement due to:

- a plug in the pipe at the trap
- barriers in the creek,
- isolated pools

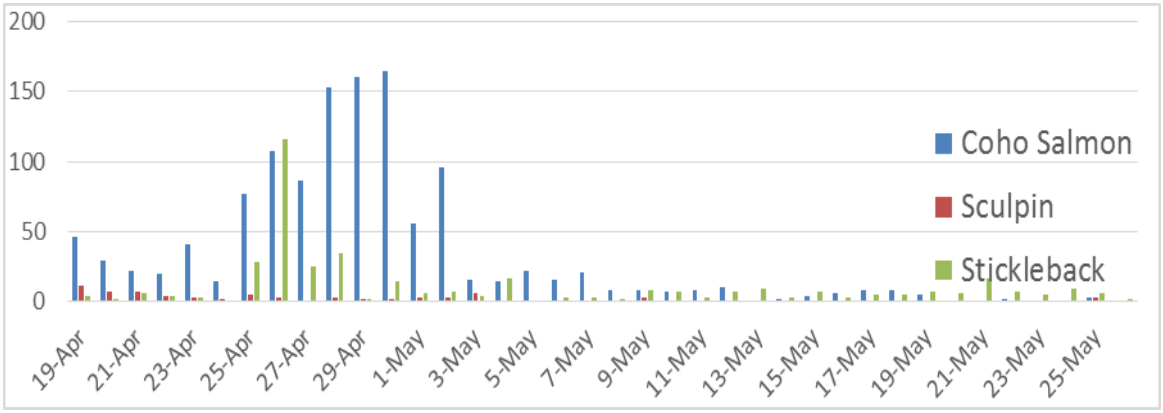
The minnow traps were soaked overnight, and checked for fish and removed the following day. Shrimp was used as bait.

Results

Fish Sampling

The smolt trap was in operation between April 19 and May 26, 2015. Total fish counted during this period was 1708 (Appendix 1). Total count for coho smolt was 1247. No trout (cutthroat or rainbow) were caught. Other fish species sampled included stickleback and sculpin. The highest daily count of coho smolt was 165 ,on April 30th (Figure 4).

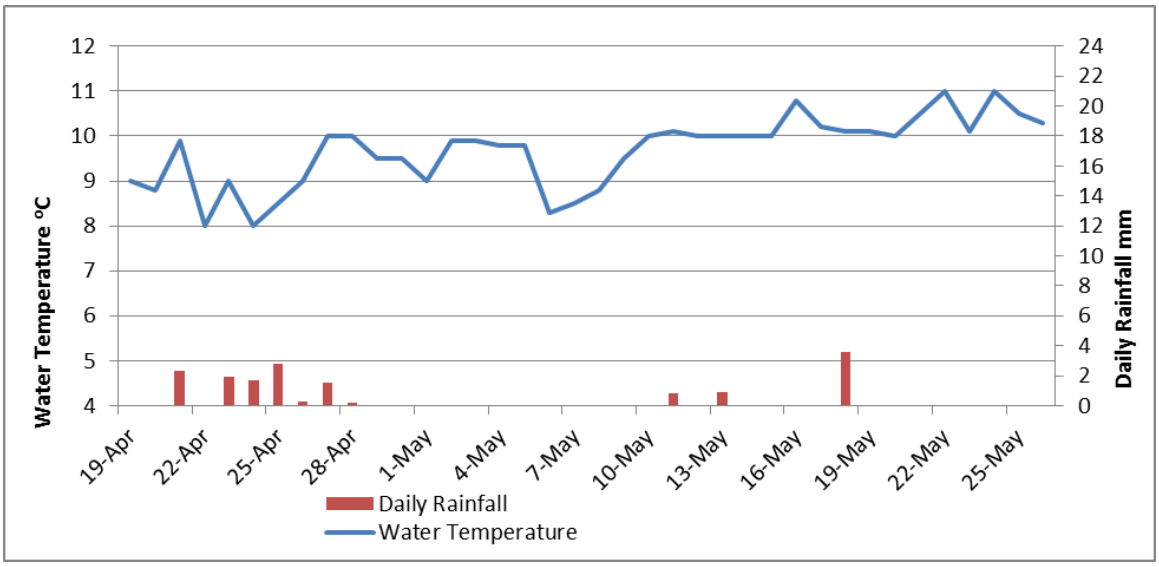
Figure 4. 2015 Daily Inventory at Shelly Creek (n=1708)



Stream Conditions during Downstream Trapping

Figure 5 shows daily water temperature and rainfall for Shelly Creek during the trap operation in 2015. Dissolved oxygen levels in the creek water at the trap ranged between 3.6 and 5.3 mg/L (Appendix 1).

Figure 5. Daily Water Temperatures and Rainfall in Shelly Creek



Water levels at the trap during operations ranged between 0.12 and 0.27 m. Over half the smolt captured in 2015 (n= 749) were caught when there was an increase in water levels, from 0.15 m to between 0.21 and 0.17 m (Appendix 1). This occurred between April 25 and April 30. Rainfall data in Figure 5 indicate that the increase in water levels was preceded by 6.4 mm of precipitation.

Assessment to Confirm Smolt Migration Barriers

After daily smolt counts dropped to < 5 for seven days, the upstream pools were assessed using minnow traps to determine if smolt were present (Table 1).

Table 1. Minnow Trap Data for May 26, 2015

Location	No. of fish	Other Species	Water Temp. (^{o}C)	Dissolved Oxygen (mg/L)
In front of smolt trap	45 stickleback	0	10.3	4.2
Upper beaver pond	1 stickle back	2 rough-skinned newt	15.7	2.2 – 3.6
Culvert at Blower Rd.	0	0		
Culvert at Hamilton Rd.	0	0		
Shelly Creek Park Footbridge	0	0		

When retrieving the minnow trap from the upper beaver pond, approximately 50 coho smolt were observed floating (dead) or gasping at the pond surface. Another 50 dead smolt were found in a small, shallow pool above the lower beaver dam. There was no surface flow of water passing over either dam as the water levels had dropped below the crest of the dams. The short creek bed between the dams was dry. Water temperature and dissolved oxygen were taken in the pond of the upper dam. The water was 15.7 ^{o}C compared to 10.5 ^{o}C at the smolt trap, and dissolved oxygen ranged between 2.2 and 3.6 mg/L compared to 4.2 mg/L at the smolt trap.

Discussion

Comparison of Fish Migration Results between Years

Coho smolt and trout numbers for each year of study are compared in the following table.

Table 2. Comparison of Coho Smolt and Trout Numbers by Year

YEAR	NUMBER OF SMOLT	NUMBER OF TROUT	TRAP DATES
2011	2638	37	April 22 – June 4
2012	8094	42	April 15 – May 23
2013	7265	21	April 1 – May 26
2015	1247	0	April 19 – May 26

The numbers of coho smolt were highest in 2012 and 2013, and are significantly greater than the numbers counted in 2011 and 2015. In fact, 2015 had the lowest number of all the years.

Although the dates of trap operations are variable, it is not clear if the dates of trap operations influenced the “total” number of smolt captured. The highest “daily” number of

smolt captured in 2012 was 864 on April 24th, with the majority of the "total" smolt captured after that date (D. Clough, 2012). This is within the dates of operation for 2011 and 2015, and yet those years had much lower "total" smolt counts. In 2013, the highest "daily" number of smolt captured was much earlier than in 2012 (767 smolt on April 6th).

The dates in common for the four smolt studies were April 22 to May 23. A comparison of the average number of fish captured per day for that time period is shown below:

- 2011 78 smolt/day
- 2012 278 smolt/day
- 2013 95 smolt/day
- 2015 36 smolt/day

These results complement those in Table 2, in that 2012 had the highest average catch per day, followed by 2013, then 2011, and finally 2015. This illustrates that the dates are not useful for predicting the "total" number of smolt, or when the peak migration will occur.

In-stream physical conditions are probable factors requiring investigation to determine the cause of the variable smolt counts.

Influence of Water Temperature and Flows on Smolt Enumeration Between Years

The water temperature data collected at the smolt trap during operations did not prove useful for determining the influence of temperature on the numbers of fish captured.

The hourly temperature data from the data logger was compared to the "daily" numbers of smolt captured in 2013 and 2015. April 6th is the date the coho migration peaked in 2013, at 747 fish. According to the data logger, the creek temperature on that day was 8.5 ^{o}C. The temperature data shows that the creek reached 8.5 ^{o}C at 6 pm on April 5th, and that water temperature did not reach 8.5 ^{o}C on the days prior to April 5th. In other words, April 5th was the first time in 2013 that water temperature reached 8.5 ^{o}C. This suggests that a temperature of 8.5 ^{o}C is a trigger for smolt migration.

The water temperature in 2015 reached 8.5 ^{o}C on March 27 th at 7 pm. Since the smolt trap was not installed until April 19, the peak migration was missed. This would account for the significantly lower "total" smolt number in 2015.

Since the data logger was installed in 2013, there are no water temperature data for 2011 and 2012. Average monthly air temperatures recorded by the Environment Canada Weather Station at the Qualicum Airport were used for comparison and are presented in Table 3.

Table 3. Average Monthly Air Temperatures (^{o}C) from Environment Canada Weather Station at Qualicum Beach Airport

	2011	2012	2013	2105
January	3.5	3.0	2.6	5.0
February	2.6	4.2	4.9	7.3
March	5.6	4.7	6.4	7.4
April	6.4	8.0	8.7	8.5
May	10.4	11.3	12.5	14.9

Air temperatures were higher in January, February and March 2015 than in the previous (trapping) years which caused the increase in water temperature that triggered an early smolt migration.

The high air temperatures in May 2015 caused water temperatures in the ponds behind the upper beaver dam to increase. Unlike the section of creek below Martindale Road (containing the smolt trap) where canopy closure is greater than 80%, the beaver pond above Martindale Road has very little shade (<50%) so is susceptible to heating from the sun's rays, causing higher temperatures. The smolt trapped behind the beaver dams probably perished due to low oxygen levels and high water temperatures.

Higher temperatures were not experienced in 2011 so it is doubtful that an early migration would explain the low numbers in that year. Further investigation is required to determine the cause of the low count for 2011.

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An increase in water levels at the smolt trap between April 25th and April 30th in 2015 was preceded by precipitation and resulted in a significant increase in the number of smolt captured on those days. An accurate measurement of precipitation, therefore, is another parameter that requires investigating.

Monthly precipitation from the weather station is presented in Table 4.

Table 4. Total Monthly Precipitation (mm) from Environment Canada Weather Station at Qualicum Beach Airport

	2011	2012	2013	2015
January	86.3	135.3	27.2	94.8
February	87.2	58.2	42.3	125.0
March	149.1	76.6	56.5	50.4
April	27.4	64.6	37.2	16.4
May	55.9	29.4	63.7	5.3

Significantly less precipitation fell in April and May 2015 than in previous years. The low precipitation in April and May 2015 resulted in lower water levels in Shelly Creek which prevented smolt from moving past the two beaver dams (located above the smolt trap), as observed during minnow trapping. This may have also contributed to the low "total" smolt count in 2015.

It can be concluded that the reduction in coho smolt and trout numbers in 2015 was most likely due to an early migration caused by high winter temperatures, and barriers to migration in late spring created by low rainfall, not a reduction in the productivity of Shelly Creek.

Recommendations

1. Shelly Creek should continue to be considered an important coho salmon and trout producer and be protected from impacts of development and urbanization.

2. The smolt trap should be installed before the creek water at Blower Rd. reaches 8.5 ^{o}C. Monitoring of water temperature should be conducted weekly beginning in March until the temperature reaches 7.5 ^{o}C, after which it should be monitored daily. When the water temperature remains at 7.5 ^{o}C or higher for three consecutive days, plans should be made to install the smolt trap as soon as possible.

3. Minnow traps should be installed periodically in Shelly Creek throughout fall and winter to determine when the smolt arrive from the Englishman River, and where in the creek they overwinter (Clough 2013).

4. Pipes should be installed in the beaver dams to ensure fish can migrate past the dams in spring, when water levels in the ponds fall below the crest of the dams (Clough 2013). The pipes could have a removable cap at their upstream end that would be removed when needed to allow fish passage. The cap would be replaced when needed to prevent dewatering of the ponds.

5. A smolt trap study should be conducted in 2016 following the above recommendations, to confirm that the low numbers of coho and trout in 2015 were caused by an early migration and low rainfall that resulted in fish being trapped behind beaver dams, not a reduction in productivity. The study should include a comparison of coho fork lengths and numbers of other species captured with those of other years to assess the health of the smolt population and creek system.

References:

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APPENDIX 1

Juvenile Salmonid Data Sheet

Location		Date
Observers		Page of
Water Temperature	Water Level	
Remarks		

Species			Species			Species		
	Length Tally	Weight		Length Tally	Weight		Length Tally	Weight
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
0			0			0		
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
0			0			0		
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
0			0			0		
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		

Appendix II

2015 Shelly Creek Smolt Trap Data

Date	Salmon	Rainbow	Cutthroat	Sculpin	Stickle Back	Total Fish	Air Temp.	Water Temp.	Water Level	O_2-D
	Coho						degrees C	degrees C	meters	mg/L
19-Apr	46	0	0	12	4	62	See	9.00	0.27	4.30
20-Apr	29	0	0	7	2	38	Table 1	8.80	0.15	
21-Apr	22	0	0	7	6	35		9.90	0.15	
22-Apr	20	0	0	4	4	9		8.00	0.15	
23-Apr	41	0	0	3	3	47		9.00	0.15	
24-Apr	15	0	0	2	1	18		8.00	0.15	
25-Apr	77	0	0	5	28	110		8.50	0.21	
26-Apr	108	0	0	3	116	227		9.00	0.19	5.30
27-Apr	86	0	0	1	25	112		10.00	0.18	
28-Apr	153	0	0	3	35	191		10.00	0.18	
29-Apr	160	0	0	2	2	164		9.50	0.17	
30-Apr	165	0	0	2	15	182		9.50	0.17	3.60
1-May	56	0	0	3	6	65		9.00	0.15	
2-May	96	0	0	3	7	106		9.90	0.15	
3-May	16	0	0	6	4	26		9.90	0.14	
4-May	15	0	0	1	17	33		9.80	0.14	
5-May	22	0	0	0	1	23		9.80	0.14	
6-May	16	0	0	0	3	19		8.30	0.13	
7-May	21	0	0	1	3	25		8.50	0.13	
8-May	8	0	0	1	2	11		8.80	0.12	
9-May	8	0	0	3	8	19		9.50	0.13	3.60
10-May	7	0	0	1	7	15		10.00	0.13	
11-May	8	0	0	1	3	12		10.10	0.14	
12-May	10	0	0	1	7	18		10.00	0.14	
13-May	1	0	0	1	9	11		10.00	0.15	
14-May	2	0	0	0	3	5		10.00	0.15	
15-May	4	0	0	1	7	12		10.00	0.17	
16-May	6	0	0	0	3	9		10.80	0.15	
17-May	8	0	0	0	5	13		10.20	0.15	3.90
18-May	8	0	0	0	5	13		10.10	0.15	
19-May	5	0	0	0	7	12		10.10	0.15	
20-May	0	0	0	0	6	6		10.00	0.15	
21-May	1	0	0	1	17	19		10.50	0.14	4.00
22-May	2	0	0	0	7	9		11.00	0.15	
23-May	1	0	0	0	5	6		10.10	0.13	
24-May	0	0	0	1	9	10		11.00	0.14	
25-May	3	0	0	3	6	12		10.50	0.14	
26-May	1	0	0	1	2	4		10.30	0.14	4.20
Totals	1247	0	0	80	400	1708		9.67		