MVIHES
Mid Vancouver Island Habitat Enhancement Society

SHELLY CREEK COHO SMOLT TRAP REPORT - 2016

Prepared for Mid Vancouver Island Habitat Enhancement Society

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Abstract

A Coho smolt study was conducted during the spring of 2016 in Shelly Creek located in Parksville, BC. The objectives of the study were to monitor the number of Coho smolts migrating from Shelly Creek into the Englishman River, compare the 2016 migration with that of 2015, and assess mitigation of barriers to fish migration.

Coho smolts 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 smolts, before releasing them back into the creek. The smolt trap was in operation between April 7 and May 10. Minnow trapping was conducted on June 6 to determine if smolts were stranded in the creek upstream of the smolt trap.

A total of 5000 fish were captured by the smolt trap of which 4313 were Coho smolts and 69 were trout (Cutthroat and Rainbow). These numbers were significantly higher than the those in 2015 when only 1247 Coho smolts and no trout were captured.

The higher numbers in 2016 were attributed to anticipating an early migration of Coho and trout, as occurred in 2015, due to higher than normal air temperatures in January February, and March. The smolt trap was installed 11 days earlier than in 2015. Prior to installing the smolt trap, pipes were installed through two beaver dams that proved to be barriers to migrating Coho and trout smolts in 2015, due to low water levels caused by a dry spring. Fish were able to escape the beaver dams in 2016 through the pipes when water levels fell below the crests of the dams.

Minnow trapping conducted in Shelly Creek from January to April 2016, demonstrated that Coho smolt were in the creek as early as January 5. 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 2017 to monitor the health of the Coho smolt population.

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 km^2. 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 confluence, 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 obstructions which include: poorly installed culverts that restrict fish movement, low flows in summer months, and debris piles and sediment plugs created by erosion of the stream bed and banks. Coho juveniles also inhabit the creek in the lower 1 km of the creek. (D. Clough, 2011). It is believed they enter Shelly Creek when the high flows of the Englishman River back up into the creek 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). Dead and distressed Coho smolts were observed in the ponds in May 2015, when the water level fell below the crests of the dams (Riordan, 2015). Dissolved oxygen in the ponds had fallen below critical levels due to high water temperatures and lack of water flow. In early April of 2016, pipes were installed through the beaver dams to mitigate the effects of the barrier during low flow periods, by allowing fish to escape the beaver ponds and continue their migration to the river.

Coho smolt migration studies were conducted in Shelly Creek during the spring of 2011, 2012, 2013, and 2015 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 2016, another smolt trap study was conducted to compliment previous assessments. The study was also conducted to confirm that the low number of fish captured in 2015 was not due to a decrease in production, but to missing an early migration and fish being trapped behind the beaver dams. 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, M.V.I.H.E.S. (Mid Vancouver Island Habitat Enhancement Society), and the Castaways club.

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 2016 smolt migration to 2015 data to confirm the timing window and physical conditions that are critical to Coho smolt movement downstream.
- To assess the mitigation of barriers (beaver dams) to smolt migration during low flows.

The smolt trap study was supplemented by minnow trapping and water temperature monitoring that occurred between January and early April 2016. The objectives of these activities were:

- to determine when smolts enter Shelly Creek from the Englishman River
- to predict the timing of smolt migration for installation of the smolt trap

Minnow trapping was also conducted following the conclusion of the smolt trap study, after which the pipes in the beaver dams were capped to prevent dewatering of the ponds. The objectives of the minnow trapping were to determine:

- if Coho and trout smolts were trapped behind the beaver ponds
- if any Coho and trout smolts remained in the creek, indicating they reside longer in the creek than expected

Methods

On 7 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, 2013).

Figure 1. Shelly Creek Smolt Trap Location (2011, 2012, 2013, 2015, 2016)

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 was measured periodically to ensure levels were above the lethal concentration of 3.0 mg/L.

The smolt trap was decommissioned on May 11 to avoid stressing the fish from handling due to a lower than optimum oxygen level (4.1 mg/L, Appendix II). The pipes in the beaver dams were capped to prevent de-watering the ponds which support a variety of other aquatic life.

Daily rainfall data and average monthly air temperature was acquired from the Environment Canada Weather Station at the Qualicum Beach Airport and are presented in Figure 6.

During the months preceding the smolt trap installation, volunteers set baited minnow traps and measured water temperatures in Shelly Creek in the locations shown in Figure 4, on a weekly basis. Baited minnow traps were set in the same locations following the conclusion of the smolt trap study and capping of pipes in the beaver dams. During both

periods, the minnow traps were soaked overnight and checked for fish and removed the following day. Cat food and, when available, salmon roe was used as bait.

Figure 4: Locations of Minnow Traps and Water Temperature Monitoring - 2016

Results

Fish Sampling

The smolt trap was in operation between April 8 and May 10, 2016. Total fish counted during this period was 5000 (Appendix 1). Total count for Coho smolts was 4313, and 69 for trout (Cutthroat and Rainbow). Other fish species sampled included Stickleback and Sculpin. The highest daily count of Coho smolt was 430, on April 20th (Figure 5).

Figure 5. 2016 Daily Inventory at Shelly Creek (n=5000)

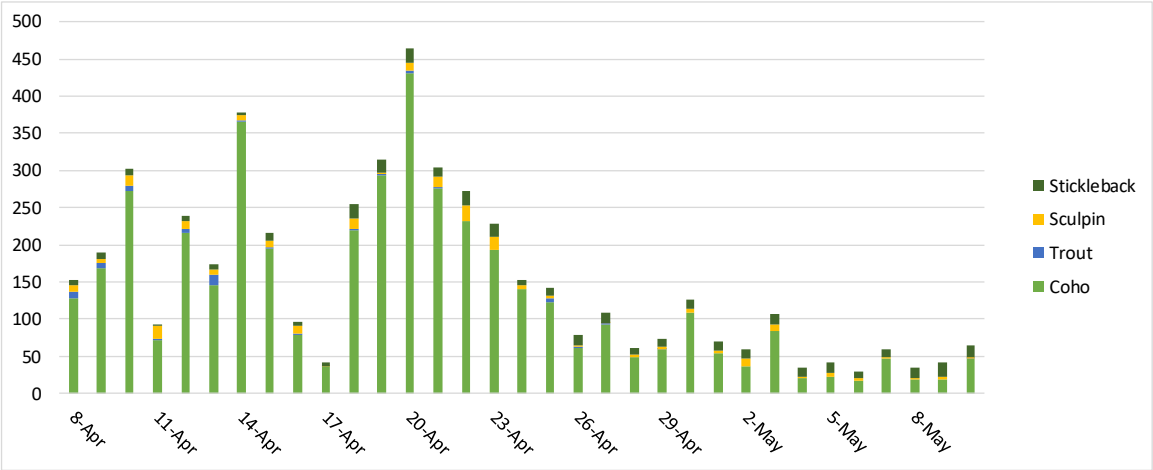
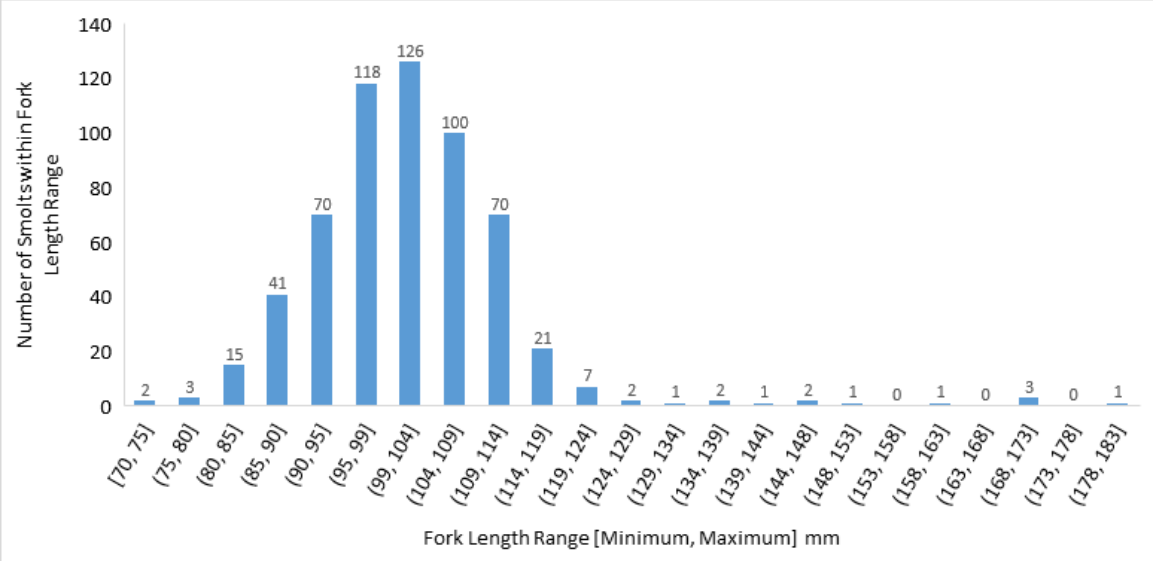


Figure 6. Fork Lengths of Coho Smolts in 2016



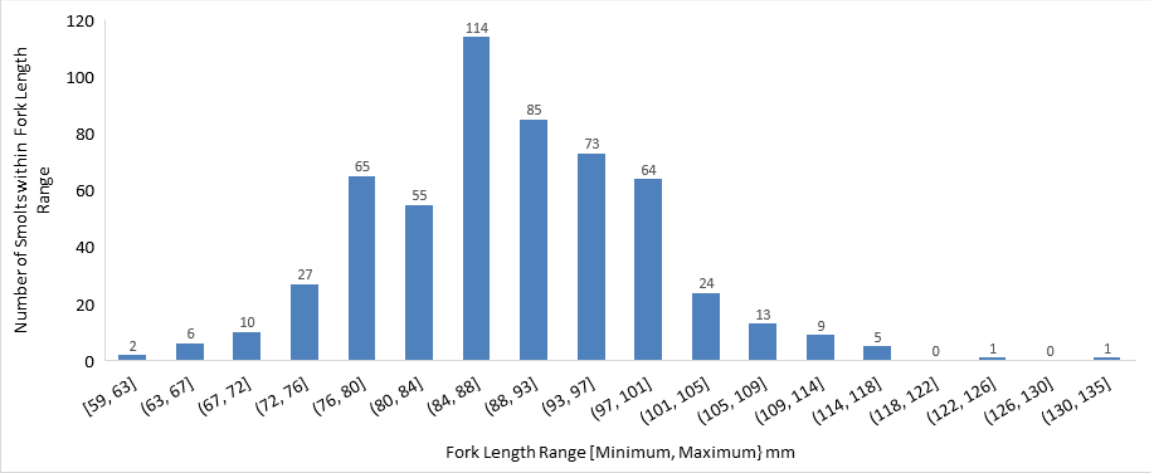
Fork lengths were measured on 587 Coho smolts and are grouped into fork length ranges in the histogram in Figure 6. Fork lengths range between 70 and 180 mm, with 98% being within a normal distribution of 70 to 129 mm. The range with the highest number of smolts (N=126) is 99 to 104 mm. The average fork length is 101 mm.

Eight smolts had fork lengths greater than 145 mm and may have been 2 year olds. Notes were made on the field data sheets when a 2 year old was measured and the smallest one was 145 mm in length. Two year olds were identified by silver colouring and a lack of parr marks.

A comparison of fork lengths measured in 2015 indicate that smolts were smaller than in 2016. In 2015, fork lengths were measured on 554 Coho smolts, and are grouped into fork length ranges in Figure 7. Fork lengths ranged between 59 and 131 mm, with 99.6%

being within a normal distribution of 59 to 118 mm. The range having the highest number of smolts (N=114) was 84 to 88 mm. The average fork length was only 89 mm.

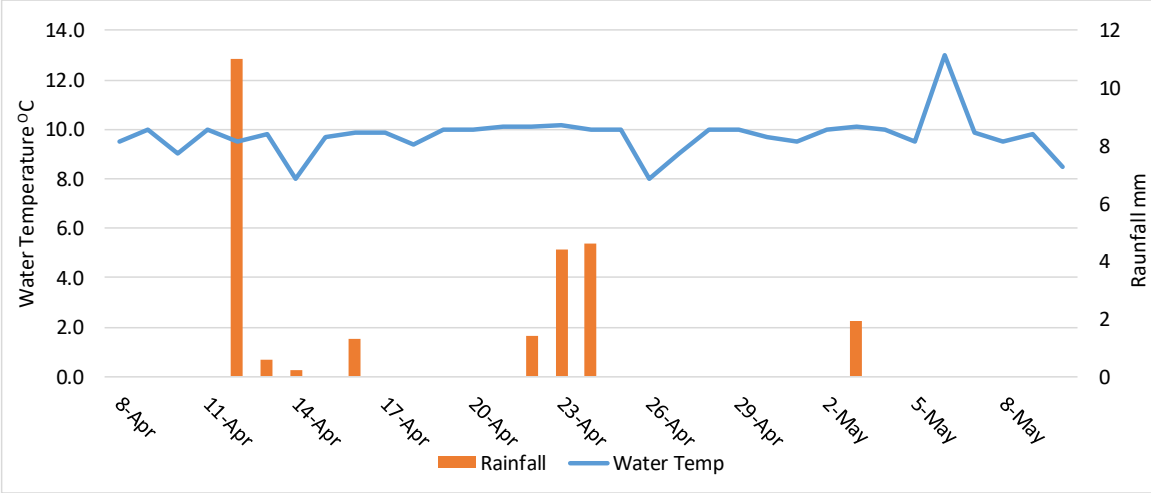
Figure 7. Fork Lengths of Coho Smolts in 2015



Stream Conditions during Downstream Trapping

Figure 8 shows daily water temperatures and rainfall for Shelly Creek during the trap operation in 2016. Dissolved oxygen levels in the creek water at the trap ranged between 4.1 and 5.9 mg/L (Appendix II).

Figure 8. Daily Water Temperatures and Rainfall in Shelly Creek



Water levels at the trap during operations ranged between 0.39 and 0.47 m (Appendix II) and increased by 0.01 to 0.05 m in the days following rainfall. Unlike the results for 2015, the water levels did not influence the daily number of smolts captured. The day with the highest number of fish caught (n= 430) was April 20. No rain had fallen in four days and water levels had remained constant. In 2015, however, over half of the smolts captured

(n= 749) were caught when there was an increase in water levels due to precipitation (Riordan, 2015).

Results of minnow trapping and water temperature monitoring are presented below in Table 1.

Table 1. Summary of Shelly Creek Minnow Trap and Water Temperature Data for 2016

Date	Water Temp ^{O}C	Coho	Trout	Stickleback	Sculpin
Jan 5	2.5	2	0	2	1
Jan 13	5.4	17	0	1	0
Jan 19	5.5	63	0	0	0
Jan 26	7.0	43	0	0	0
Feb 23	5.7	14	1	1	0
Mar 1	6.9	35	0	1	0
Mar 8	6.9	34	0	2	0
Mar 15	5.9	9	1	6	0
Mar 22	6.7	28	2	14	0
Mar 29	7.1	25	0	6	1
Apr 5	8.7	16	0	24	2
June 7	??	0	0	>100	0

In the months preceding the smolt trap study, water temperatures ranged between 2.5 and 8.7 deg C. A total of 285 Coho smolts and 4 trout were captured. Coho smolts were present in Shelly Creek as early as January 5. There does not appear to be a relationship between the daily catch of Coho and water temperature, although the numbers of stickleback increased with warmer temperatures.

No smolts were captured by minnow traps on June 7, and no smolts were observed behind the beaver dams or in the creek when the traps were raised.

Discussion

Comparison of Fish Migration Results

Coho smolt and trout numbers for 2016 and 2015 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
2015	1247	0	April 19 – May 26
2016	4313	69	April 8 – May 10

The numbers of Coho and trout smolts in 2016 are significantly higher than in 2015. In fact, numbers in 2015 were the lowest since the smolt trap studies began in 2011 (Riordan 2015). This had been attributed to higher than normal air temperatures in January, February and March 2015 which triggered an early migration of smolts out of Shelly Creek into the Englishman River. It was believed that the peak of the migration had been missed. A hot, dry spring resulted in low water levels in the creek, and high water temperatures caused low oxygen concentrations. Many dead and distressed smolts were observed trapped behind 2 beaver dams due to the low water levels, another reason the smolt count was so low.

In response to the poor results, recommendations were made in the 2015 Shelly Creek Smolt Trap Report that included installing the smolt trap before the water temperature reached 8.5 deg C. A comparison of data from previous smolt trap studies suggested that the Coho migration was triggered by a water temperature of 8.5 deg C (Riordan, 2015).

Recommendations also included installing pipes through the beaver dams to allow fish to escape the beaver ponds when water levels fell below the crests of the dams. This was completed in early April 2016.

Water temperatures monitored during minnow trapping in 2016 (Table 1) suggest that the smolt trap should have been installed between March 29 and April 5, since the water temperature exceeded 8.5 deg C on April 5. However, the water level in the creek was too high for the smolt trap. Instead, the smolt trap was installed on April 7 when water levels were more conducive for installation. On April 8, 128 Coho smolts were counted, indicating that the very beginning of the migration may have been missed, but since the migration did not peak until April 20, the number of fish that was missed was probably minor. The earlier installation of the smolt trap accounts partly for the higher numbers of fish captured in 2016.

The installation of pipes through the beaver dams is another reason for the increase in the number of fish counted in 2016. The fact that the numbers of fish in the daily counts

did not increase or decrease directly with water levels, as they did in 2015, demonstrates that the pipes in the beaver dams allowed fish to migrate to the smolt trap without interruption by low water levels at the beaver dams. No Coho or trout smolts were captured or observed during minnow trapping on June 7, suggesting there were no smolts trapped behind the beaver dams.

Comparison of Weather Conditions

Air temperature and precipitation data recorded by the weather station at the Qualicum Beach Airport are presented below.

Table 3. Average Monthly Air Temperatures (ºC) and Total Monthly Precipitation (mm) from Environment Canada Weather Station at Qualicum Beach Airport

	Average Daily Temperature ºC			Total Precipitation mm		
	2013	**2015**	**2016**	**2013**	**2015**	**2016**
January	2.6	5.0	3.7	27.2	94.8	160.2
February	4.9	7.3	5.6	42.3	125.0	98.9
March	6.4	7.4	7.6	56.5	50.4	155.7
April	8.7	8.5	10.9	37.2	16.4	20.1
May	12.5	14.9	14.0	63.7	5.3	17.2

A comparison between climate conditions for the last 3 years of smolt trap studies shows a trend towards warmer spring weather. There is also a trend towards more rainfall from January to March, but less rainfall in April and May.

The impact of these trends is seen in the earlier migration of Coho smolts and the early decline in habitat conditions consisting of higher water temperatures, lower oxygen concentrations, and low water levels. The study in 2016 was ended before the migration finished, to prevent stressing the fish from handling, because the oxygen concentration in the creek was very low.

In addition, the high rainfall in March 2016 caused the water level in the creek to be too high for the installation of the smolt trap at a time when the water temperature indicated it was the appropriate time for installation.

The pipes through the beaver dam did allow the Coho and trout smolt to leave the creek when habitat conditions began to decline in spring 2016. Perhaps this explains the reason for the Coho smolts being smaller in 2015 than in 2016, as shown in Table 4. The Coho smolts were trapped behind the beaver dams in 2015, in non-optimal conditions which affected their growth, until an increase in water levels from rainfall allowed them to escape.

Table 4. Comparison of Coho Smolt Fork Lengths in 2015 and 2016

	Minimum mm	Maximum mm	Mean mm	Range with most fish
2015	59	131	89	84 - 88
2016	70	180	101	99 -104

Another reason for the size difference could be that many of the smolts migrating to the ocean in 2015 became trapped in pools in the Englishman River due to the very low flows, and did not make it to the ocean. These fish would have spent another year in the Englishman River, giving them the opportunity to grow in size before they entered Shelly Creek in the winter.

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 pipes through the beaver dams should be maintained and managed to allow smolts to complete their migration during low water levels in the spring, and at the same time, prevent dewatering of the ponds.

3. Minnow traps should be installed periodically in Shelly Creek throughout summer and fall 2016 to confirm that smolt are not trapped behind the beaver dams, and determine when the smolts arrive from the Englishman River.

4. A smolt trap study should be conducted in 2017 to monitor the health of the Coho and trout smolt populations.

5. Water levels permitting, the smolt trap should be installed before the water temperature reaches 8.5 ^{o}C.

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Clough, D. 2011. Shelly Creek Smolt Trap 2011. A report sponsored by MVIHES

Law, Peter, 2015. Personal Communication

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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**		
2			**2**		**Trout**
3			**3**		
4			**4**		
5			**5**		
6			**6**		**Cutthroat Trout**
7			**7**		
8			**8**		
9			**9**		
0			**0**		**Sculpin**
1			**1**		
2			**2**		
3			**3**		
4			**4**		**Stickleback**
5			**5**		
6			**6**		
7			**7**		
8			**8**		
9			**9**		**Frogs**
0			**0**		
1			**1**		
2			**2**		
3			**3**		**Crayfish**
4			**4**		
5			**5**		
6			**6**		
7			**7**		
8			**8**		
9			**9**		
0			**0**		

Appendix II

2016 Shelly Creek Smolt Trap Data

Date	Coho Salmon	Rainbow Trout	Cutthroat Trout	Sculpin	Stickleback	Total Fish	Air Temp °C	Water Temp °C	Water Level m	O_2-D mg/L
8-Apr	128	9	0	9	6	152	13.0	9.5	0.42	5.9
9-Apr	168	5	2	5	9	189		10.0	0.42	
10-Apr	272	6	1	15	9	303		9.0	0.42	
11-Apr	71	3	0	16	3	93		10.0	0.42	
12-Apr	216	4	1	10	7	238	9.7	9.5	0.42	
13-Apr	145	14	0	7	7	173	9.8	9.8	0.45	
14-Apr	366	2	0	6	4	378		8.0	0.47	
15-Apr	194	2	0	10	9	215		9.7	0.47	
16-Apr	79	2		9	7	97	10.0	9.9	0.42	
17-Apr	36			1	4	41	10.0	9.9	0.42	
18-Apr	219	3		13	19	254	12.7	9.4	0.42	
19-Apr	293	1	1	2	18	315	14.2	10.0	0.42	
20-Apr	430	4		10	20	464	13.0	10.0	0.42	
21-Apr	276	1		14	13	304	14.0	10.1	0.43	
22-Apr	232			20	21	273	10.6	10.1	0.43	
23-Apr	193			18	18	229	10.4	10.2	0.45	
24-Apr	140			6	7	153	8.8	10.0	0.42	
25-Apr	123	2	2	4	11	142	9.0	10.0	0.42	
26-Apr	61	1		2	14	78	9.7	8.0	0.4	
27-Apr	93		1	1	13	108	8.8	9.0	0.4	
28-Apr	48			5	8	61	9.4	10.0	0.4	
29-Apr	59	1		2	11	73	11.0	10.0	0.4	4.1
30-Apr	108			6	12	126	10.0	9.7	0.4	
1-May	54			3	13	70	11.0	9.5	0.41	
2-May	37			9	13	59	12.0	10.0	0.41	
3-May	84			8	15	107	10.3	10.1	0.41	
4-May	20			2	12	34	9.5	10.0	0.415	
5-May	22			5	15	42	9.5	9.5	0.415	
6-May	17			4	8	29	9.5	13.0	0.415	
7-May	46			3	11	60	14.0	9.9	0.39	
8-May	19			1	15	35	13.0	9.5	0.39	
9-May	18			4	19	41	10.0	9.8	0.39	
10-May	46	1		1	16	64	10.0	8.5	0.39	
TOTAL	4313	61	8	231	387	5000				