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ABUNDANCE AND RUN TIMING OF SMOLT AND ADULT SALMON IN THE SIXMILE CREEK DRAINAGE ON JOINT BASE ELMENDORF-RICHARDSON, ALASKA, 2015

FINAL

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Abundance and Run Timing of Smolt and Adult Salmon in the Sixmile Creek Drainage on Joint Base Elmendorf-Richardson, Alaska, 2015

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Symbols and Abbreviations

Alaska Department of Fish and Game	ADF&G
Celsius	°C
Civil Engineers Installation Environmental Conservation	CEIEC
Feet	‘ or ft
Inches	“ or in
Height	H
Joint Base Elmendorf-Richardson	JBER
Kilometers	km
Length	L
Meters	m
National Marine Fisheries Service	NMFS
Primary Constituent Elements	PCE
Width	W

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Abstract

In 2008, the National Marine Fisheries Service (NMFS) listed the Cook Inlet beluga whale (*Delphinapterus leucas*) as endangered (NMFS 2008). Beluga whales are predatory in nature and follow eulachon (*Thaleichtys pacificus*) into the Upper Cook Inlet during the spring then switch to consuming salmon (*Oncorhynchus* spp.) as the eulachon numbers decline (NMFS 2009). In 2011, critical habitat was established within Cook Inlet, including Knik Arm in front of the mouth of Sixmile Creek (76 FR 20180, April 11, 2011). The Sixmile drainage, located on Joint Base Elmendorf-Richardson (JBER), produces sockeye (*O. nerka*), coho (*O. kisutch*), chum (*O. keta*) and pink (*O. gorbuscha*) salmon. These salmon are food sources for the beluga whales and are part of a small sport fishery. Thus, monitoring these populations is a is a priority for JBER. A fyke weir was used to enumerate smolt, and a weir was used to enumerate adult salmon at the outlet of Lower Sixmile Lake using the same methodology that was used in 2014 (CEIEC 2014). The estimated smolt out-migration in 2015 was 10,276 for sockeye, and 540 for coho. The 95th percentile of sockeye smolt out-migrating in the previous years' cumulative average was reached on 18 June, while this year's 95th percentile of cumulative sockeye smolt was reached on 10 June. The 95th percentile of coho smolt out-migrating was reached on 9 June, which is one day earlier than the cumulative previous years' average. There were 4,768 adult sockeye and 527 adult coho enumerated using the weir in 2015. The 2015 adult sockeye counts were significantly higher than the previous 17-year cumulative average of 1,761 sockeye. The 2015 adult coho escapement was also significantly higher compared to the average for the last 12 years of 43 coho. Current management recommendations for this system are to: (1) continue to monitor the out-migrating smolt salmon and the returning adult salmon, (2) extend the adult salmon sampling period to ensure a more representative count of coho occurs, and (3) continue monitoring the water temperature.

Introduction

In 2008, the National Marine Fisheries Service (NMFS) listed the Cook Inlet beluga whale (CIBW) (*Delphinapterus leucas*) as endangered (NMFS 2008). Beluga whales are predatory in nature and follow eulachon (*Thaleichtys pacificus*) into the Upper Cook Inlet during the spring, then switch to consuming salmon (*Oncorhynchus* spp.) as the eulachon numbers decline (NMFS 2009). In 2011, critical habitat was established within Cook Inlet, including Knik Arm in front of the mouth of Sixmile Creek (76 FR 20180, April 11, 2011). Included in the designation was a list of factors that the NMFS deemed essential to the survival and recovery of the Cook Inlet beluga. These factors, or Primary Constituent Elements (PCEs), include all of the Pacific salmon species, with the exception of pink salmon (*O. grobuscha*). The Sixmile drainage, located on Joint Base Elmendorf-Richardson (JBER), produces sockeye (*O. nerka*), coho (*O. kisutch*), chum (*O. keta*) and pink salmon. Belugas are commonly seen milling at the mouth of Sixmile during the fall, and it is assumed that they are foraging for salmon returning to the creek. Monitoring productivity of this population is important in terms of the beluga recovery (i.e., PCE productivity) as well as for management of the small sport fishery at the mouth.

The Sixmile Creek drainage (Figure 1), located in south-central Alaska, consists of Upper and Lower Sixmile lakes and Sixmile Creek on JBER. The lakes were created in 1951 when Sixmile Creek was dammed in two locations (Abbott and Allgair n.d.) to create a floatplane base. The first records of sockeye salmon in Sixmile Creek drainage occurred in 1975 (Rothe et al. 1983). These sockeye have been genetically linked to stocks in Big Lake and Fish Creek (Habicht et al. 2007).

In 2003, Tracey Gotthardt with the Alaska Natural Heritage Program conducted a field study, “Limnological and Fishery Investigations Concerning Sockeye Salmon Production in Sixmile Lakes, Elmendorf Air Force Base, Alaska” (Gotthardt 2006). This was the first time that the out-migrating smolt had been enumerated from the Sixmile lakes. Since 2003, there has been nine years of enumerating the out-migrating smolt and the last four years there has been consistent enumeration.

Historically, smolts have been counted out-migrating from Lower Sixmile Lake from mid-May through June. Sixmile smolt out-migration includes sockeye and coho salmon, while pink salmon spawn below the lake, and chum salmon occasionally spawn in the creek[1]. Sockeye salmon smolts are the most abundant species, with annual counts ranging from 4,037–23,644, while counts of coho salmon smolt have ranged from 23–3,996 fish.

[1] Thus, the vast majority of juvenile pink and chum would not pass through the fyke weir to allow enumeration.

In 1988, the Conservation and Planning Element of the Environmental Flight, 3rd Civil Engineering Squadron began monitoring the returning adult salmon using a weir and continued to monitor them through 2008. In 2009 and 2010, the Alaska Department of Fish and Game (ADF&G) was contracted to conduct data collection and daily operations of the weir. In 2011, JBER Environmental Conservation Section (CEIEC) once again operated the weir and collected salmon escapement data.

The Sixmile Creek adult weir is was historically operated to monitor sockeye salmon. In the last five years the weir operation has been expanded to include enumeration of returning adult coho salmon. The weir is operable by mid-July, with biologists, technicians, and volunteers counting and releasing salmon until mid-September. Four out of the five North American Pacific salmon species can be found spawning in the Sixmile Creek drainage. Sockeye, coho, and a small fraction of the pink salmon can be enumerated at the weir. Sockeye salmon are the most abundant species with annual counts ranging from 317–4,768, while counts of coho salmon have ranged from 1–527 fish.

Objectives

The primary objective of this project was to enumerate the out-migrating sockeye smolt and the adult sockeye salmon returning to the Sixmile Creek drainage to spawn. The secondary objective was to maintain the historical database and evaluate long-term salmon population trends. The third objective was to extend the current fish ladder so that the lip sits underwater making it easier for fish to navigate the ladder. The final objective was to summarize all of the stream walks that have been conducted over the years.

Study Site

The Sixmile Creek drainage covers approximately 2,033 acres on JBER (Figure 1). The drainage includes Sixmile Creek, Lower Sixmile Lake, and Upper Sixmile Lake. The lakes and creek occupy a valley created by an old channel of Eagle River (U.S. Department of Defense 2012). The system is charged primarily by groundwater entering the south side of Upper Sixmile Lake. The lakes are approximately 3.4 kilometers (km) in length. Sixmile Creek flows approximately 1.5 km from Lower Sixmile Lake into the Knik Arm of the Cook Inlet.

During 1975, when sockeye were first recorded in Sixmile Creek drainage, a fish ladder was installed at the outflow of Lower Sixmile Lake (Gotthardt 2006). During the summer of 1996, a new fish-friendly culvert with a splash pool was placed between Upper and Lower

Sixmile lakes. The culvert was then revamped in 2004 to add a beaver baffler to prevent beavers from clogging the culvert and preventing fish passage.

From 1988 until 1997, the adult weir was located in a meadow halfway between Lower Sixmile Lake and Cook Inlet. Since 1998, the adult weir has been located at the outflow of Lower Sixmile Lake under the Fairchild Avenue bridge. This site is also where the smolt weir is located.

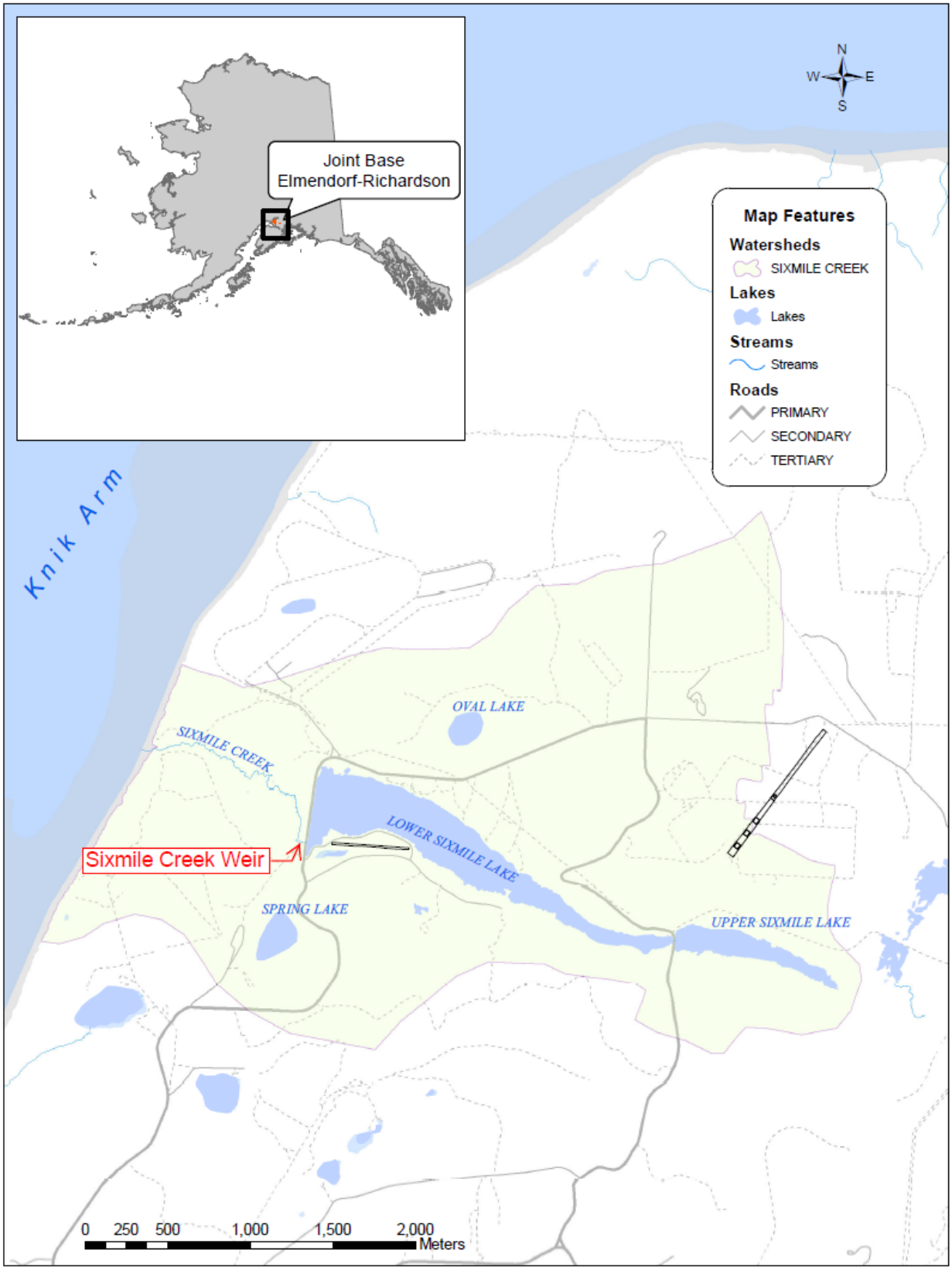

Figure 1. The Sixmile Creek drainage on JBER, AK (Gumpert 2011).

Methods

Smolt Weir Design and Operation

Sockeye and coho salmon smolt out-migrating from the Sixmile lakes are typically counted from mid-May through the end of June. In 2015, the smolts were enumerated from May 5 through June 30.

The smolts were captured by use of a fyke weir with a live box, which was checked at least twice daily. The weir consisted of four 4’ x 8’ panels that spanned from the bridge abutment; this ensured that the entire stream width was effectively fished. These panels were made out of aluminum frame covered in poly vinyl mesh netting. The panels narrowed to a cylindrical entrance into a rectangular aluminum box with 1.0 m x 0.85 m x 0.80 m (L x W x H) dimensions (figure 2). Also, chain link fence was used to exclude rainbow trout from entering the live box and consuming the smolt. The panels were inspected daily by the sampling crew for gaps that could allow smolt to pass through undetected. Water temperature, in Celsius (°C), was recorded on a daily basis.

Figure 2. Smolt weir setup.

Adult Weir Design and Operation

Adult sockeye, coho, and a few pink salmon were counted and released into Lower Sixmile Lake. The adult salmon counts typically occur between mid-July and mid-September. In 2015, adults were counted from July 13 until September 25. A custom mobile picket weir with a gate that can be lifted to allow controlled fish passage was used for the first time this year. The weir was cleaned of debris and visually inspected daily to ensure that there were no gaps that would allow salmon to pass through undetected. For the majority of the season, July 23 through August 31, the weir was checked twice a day. Later in the season, there were less fish so the weir was only checked once a day. Before the gate was opened to pass fish, the fish ladder was blocked so that fish were unable to escape downstream. A beach seine net was used to school the fish through the open gate where they were identified and counted. Water temperature, in °C, was recorded at the site on a daily basis.

Stream Surveys

Historically stream surveys had been conducted to better understand the number of salmon using the creek below the weir site. However, the 2014 field season was the last year that the stream surveys were conducted due to personnel constraints and data not being fully utilized. During the field season of 2011- 2014, stream surveys started at the mouth of Sixmile Creek, from Knik Arm tide lineup to the weir at the outfall of Lower Sixmile Lake. The total length of the stream survey was approximately 1.5 km. The first quarter of the survey, the crew was forced to walk in the creek due to the steep banks and thick vegetation. The second quarter of the survey required the crew to walk along the bank on either side of the creek. The third quarter of the survey took the crew through a meadow where the stream was too deep to walk in. Therefore, the crew was forced to walk along the bank. It should be noted that in the meadow, it was difficult to see the salmon because of bank overhangs and tall grasses along the bank. During the final quarter of the survey, the crew was able to walk along the bank in most of the areas, but there were a few areas where the crew was forced into the creek. The crew consisted of a minimum of three people. One person wearing polarized sunglasses continually counted fish in the creek and carcasses along the creek. The other two personnel were surveying the area for bears. Personnel looking for bears occasionally helped spot and count fish. The first survey is usually conducted in mid-August, at the peak of the pink salmon return, and the second is usually completed in mid-September. The second survey is done on the last day of the weir operation for the season.

It is presumed that previous stream surveys were conducted in a similar fashion. However, detailed notes were not taken in previous stream surveys. Therefore, the number of crew members, along with the number of surveys in a given year, may have changed.

Fish Ladder Extension

The original fish ladder design was the Alaskan Steeppass Fishway (Figure 3). It was 10' long by 22" across the outside and 28" tall. The baffling inside the fish ladder was 14" wide and 5 ¼" tall inside (Figure 4 inlay), with an approximate 12" drop from the lip of the ladder to the top of the water (Figure 5). This 12" drop from the lip made it difficult for adult salmon to enter the ladder, and, when salmon smolt were leaving the system, they could potentially incur injuries, leaving them vulnerable to predation.

JBER had discussed several different ways to make the fish passage easier for both the adults returning and the out-migrating smolt. Some of these included; removing the fish ladder and making the passage more of a meandering stream, replacing the fish ladder with a new and wider ladder and finally extending the current ladder. It was decided that simplest method was to extend the ladder. The ladder extension made passage for adult salmon into the lake easier. However, the extension is still considered a velocity passage for juvenile salmon.

Figure 3. Alaskan Steeppass Fishway prior to the extension.

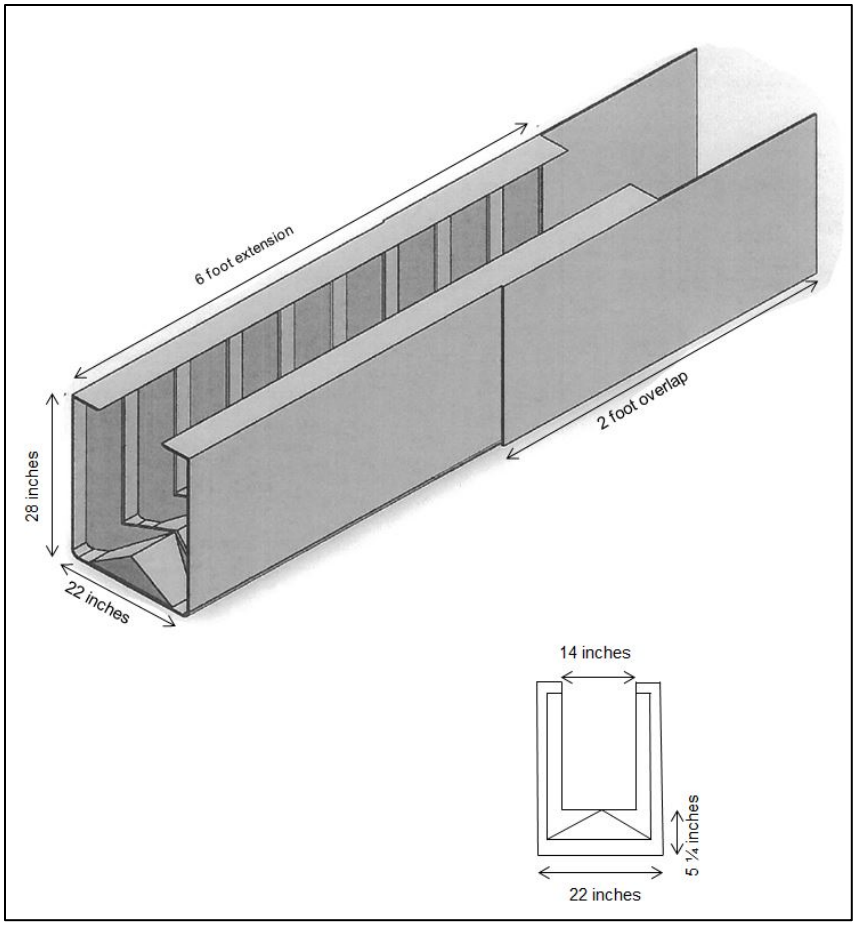

Figure 4. Dimensions of the fish ladder.

Figure 5. Terminus portion of the Alaskan Steeppass Fishway, prior to the extension.

Genetics Collection

As part of the ADF&G Fish Resource Permit, genetic samples were collected from a maximum of 100 adult coho before they were counted and released into the lake. Using dog nail clippers, the axillary process was clipped and placed into a labeled bottle of ethanol for preservation. Collected fin clips were enumerated, recorded, and given to ADF&G for analysis.

Data Analysis

CEIEC maintains two historical databases, one for the enumeration of the out-migrating smolt and the other for the enumeration of the returning adults. The total number of smolt and adult sockeye and coho were added to their representative database. Graphs depicting 2015 cumulative and daily counts for both the smolt and adults were compared to previous years' average counts. Water temperature was graphed alongside the daily smolt and adult counts for 2015 and the daily average smolt and adult counts from previous years, in order to illustrate whether correlations existed.

Results

Smolt Weir

The weir was fully operational at 1438 hours on May 5, 2015, with no fish counted. The first smolts counted for the season were 4 sockeye smolt and 4 coho smolt on May 10. The final sockeye smolt was counted on June 28, two days prior to the last day of operation, while the last coho was counted on June 17 (Table 1). A total of 10,276 sockeye and 540 coho were counted for the year. To maintain consistency with the historical data, the weir was removed on June 30, 2015 at 0922 hours. The average water temperature during the smolt out-migration was 17.1 °C, over one degree warmer than the 2014 season average. Anchorage experienced a rapidly warming summer in 2015, reaching record high temperatures, which attributed to a higher observed ambient temperature and therefore a higher observed water temperature. During the 2015 field season, 40 days out of the 57 sampled were above average ambient air temperatures (National Weather Service 2015).

Table 1. Daily and cumulative counts of sockeye and coho salmon smolt at the Sixmile Creek weir, JBER 2015.

		Sockeye		**Coho**	
Date	*Temp (°C)*	*Daily*	*Cumulative*	*Daily*	*Cumulative*
5-May	11	0	0	0	0
6-May	11.25	0	0	0	0
7-May	11.25	0	0	0	0
8-May	11	0	0	0	0
9-May	11	0	0	0	0
10-May	11.5	4	4	4	4
11-May	11.5	1	5	0	4
12-May	12	0	5	0	4
13-May	13.25	0	5	64	64
14-May	13.50	0	5	6	70
15-May	14.00	1	6	66	136
16-May	14.50	177	183	53	189
17-May	15.25	807	990	52	241
18-May	14.50	34	1024	3	244
19-May	15.00	25	1049	8	252
20-May	14.50	14	1063	4	256
21-May	15.25	39	1102	9	265
22-May	15.00	91	1193	12	277
24-May	15.50	38	1710	5	291
25-May	16.00	182	1892	26	317

		Sockeye		Coho	
Date	*Temp (°C)*	*Daily*	*Cumulative*	*Daily*	*Cumulative*
26-May	16.50	333	2225	36	353
27-May	16.50	1086	3311	25	378
28-May	16.75	1335	4636	25	403
29-May	17.00	243	4879	4	407
30-May	17.00	3	4882	2	409
31-May	18.25	74	4956	2	411
1-Jun	18.50	14	4970	0	411
2-Jun	18.25	81	5051	0	411
3-Jun	18.25	924	5975	9	420
4-Jun	17.50	562	6537	11	431
5-Jun	16.75	336	6873	2	433
6-Jun	17.00	1245	8118	13	446
7-Jun	17.25	596	8714	1	447
8-Jun	17.00	349	9063	64	511
9-Jun	16.50	567	9630	15	526
10-Jun	16.25	80	9710	2	528
11-Jun	16.00	364	10074	3	531
12-Jun	16.75	146	10220	8	539
13-Jun	17.75	0	10220	0	539
14-Jun	18.75	43	10263	0	539
15-Jun	19.25	0	10263	0	539
16-Jun	20.50	0	10263	0	539
17-Jun	21.00	0	10263	1	540
18-Jun	21.00	3	10266	0	540
19-Jun	22.00	1	10267	0	540
20-Jun	22.00	4	10268	0	540
21-Jun	21.50	1	10272	0	540
22-Jun	20.50	0	10273	0	540
23-Jun	20.75	4	10277	0	540
24-Jun	20.50	1	10278	0	540
25-Jun	21.00	0	10279	0	540
26-Jun	21.00	0	10279	0	540
27-Jun	20.00	0	10279	0	540
28-Jun	20.00	1	10280	0	540
29-Jun	19.50	0	10280	0	540
30-Jun	19.50	0	10280	0	540
TOTALS	**17.1 Average**		**10,280**		**540**

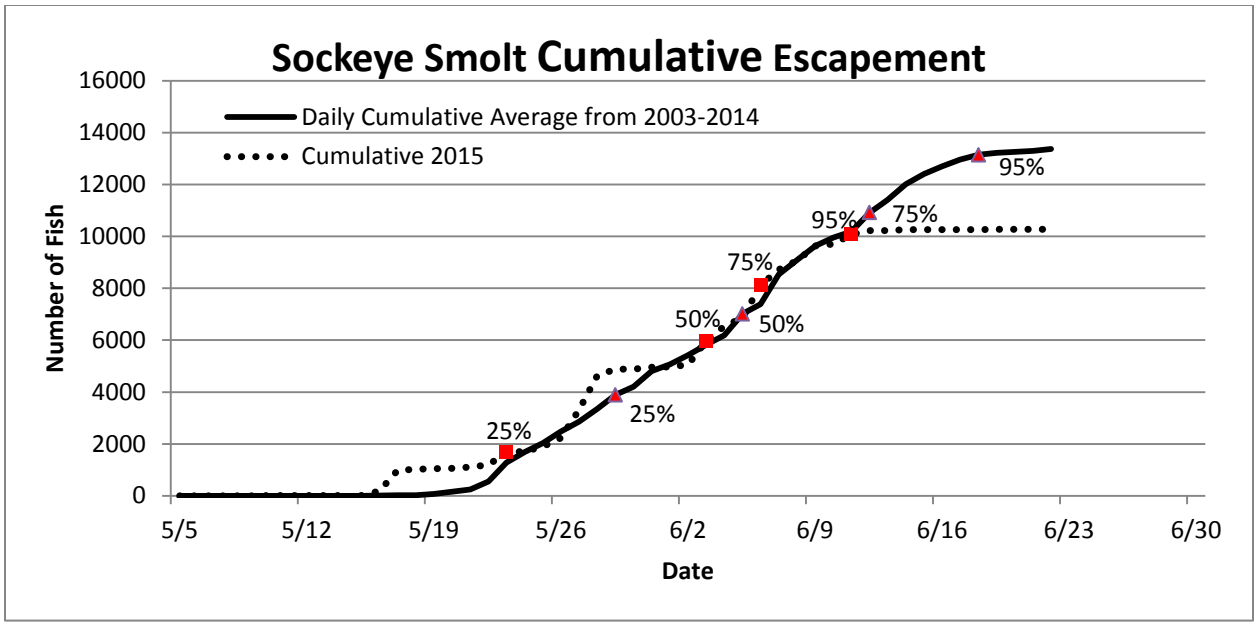

Figure 6. Daily cumulative comparison of 2015 sockeye smolt out-migration and the average from 2003-2014.

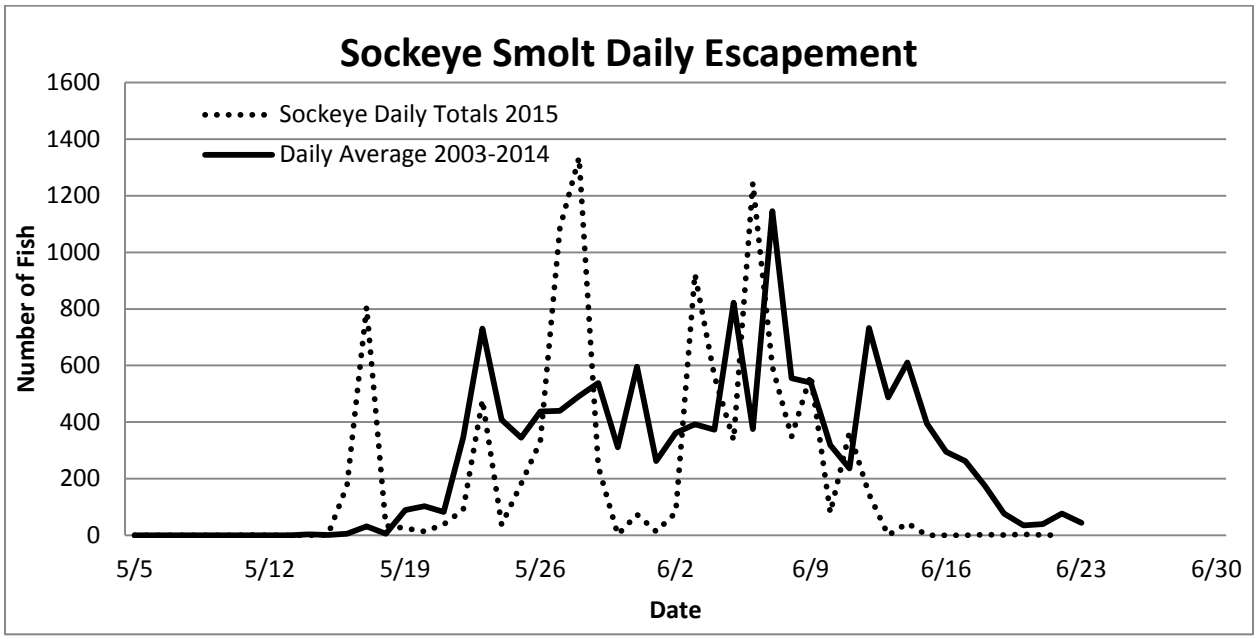

Figure 7. Daily comparison of 2015 sockeye smolt out-migration and the average from 2003-2014.

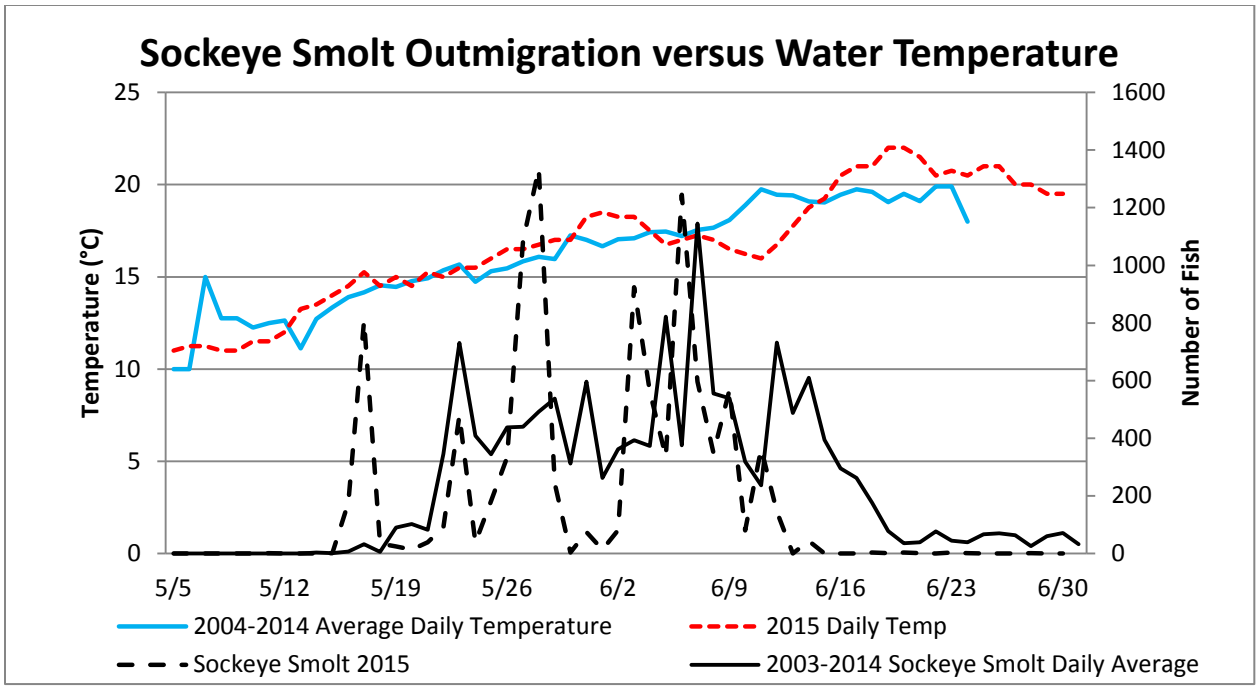

Figure 8. A comparison of 2015 and daily average 2003-2014 sockeye smolt counts to the water temperature for each relative timeframe.[2]

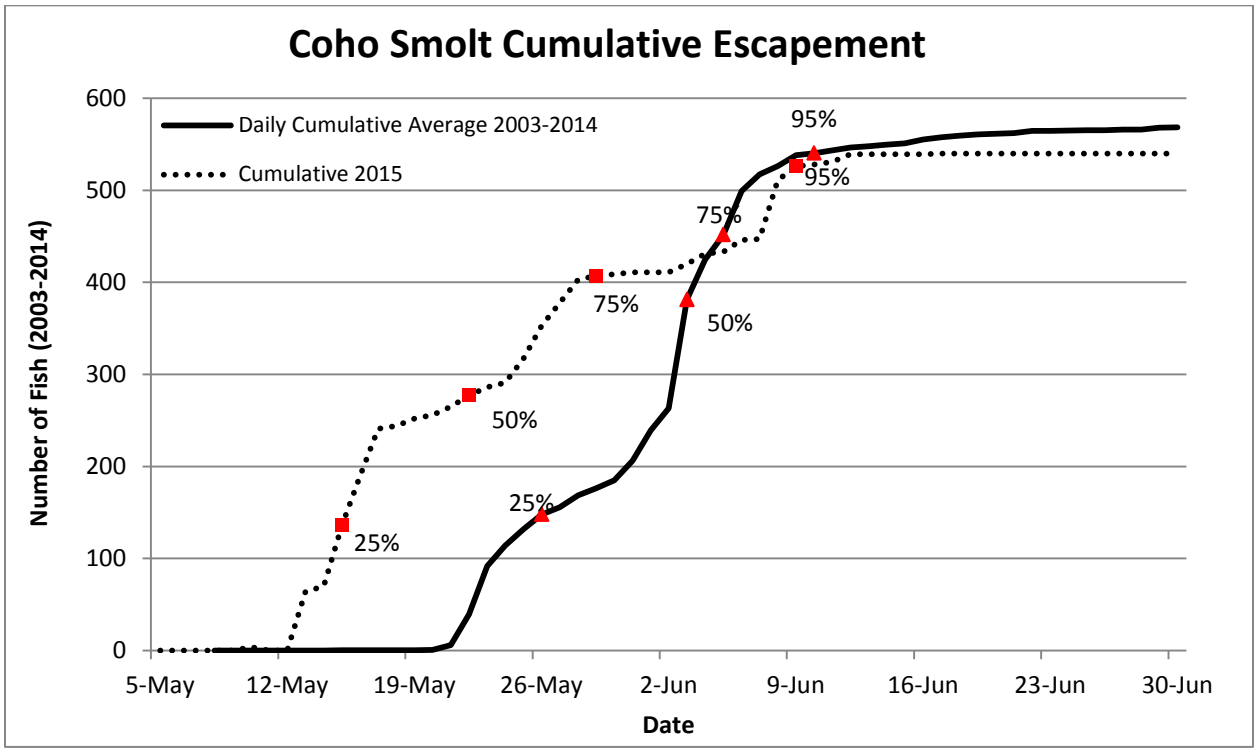

Figure 9. Daily cumulative comparison of 2015 coho smolt out-migration and the average from 2003-2014.[3,4]

[2] Note: water temperature was not recorded in 2003.
[3] Note: only 9 years between 2003-2014 were sampled for smolt. See Appendix 1 for years sampled.
[4] Note: coho salmon have not always been counted and recorded.

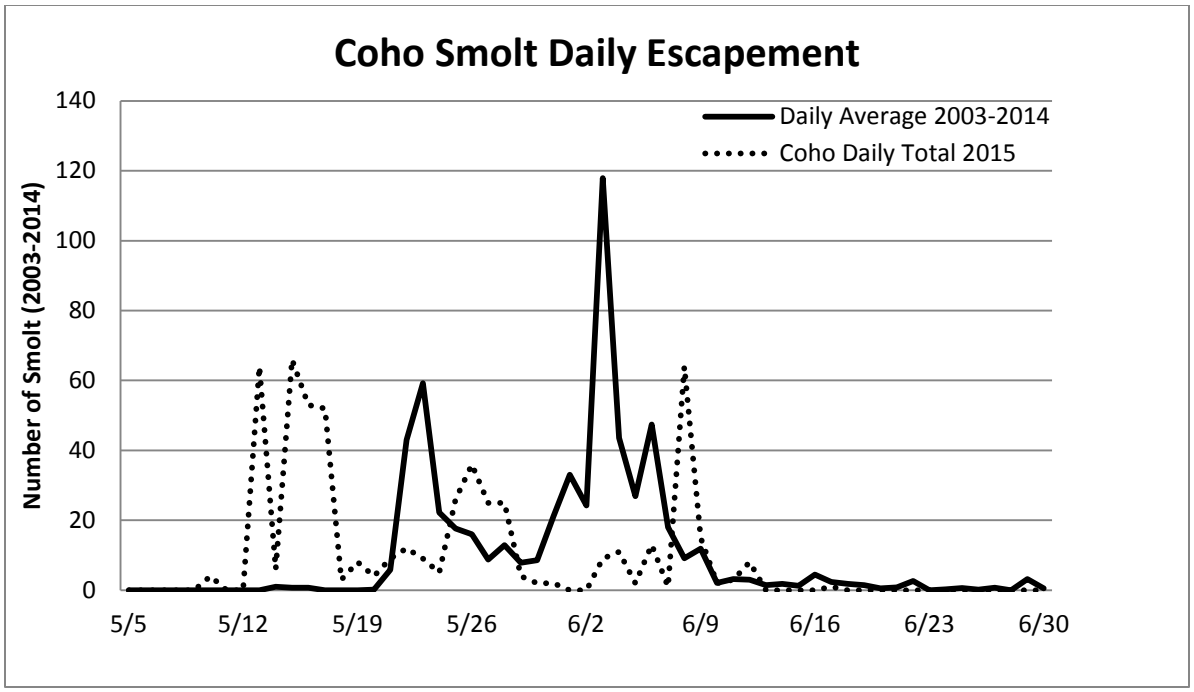

Figure 10. Daily comparison of 2015 coho smolt out-migration and the average from 2003-2014.[5]

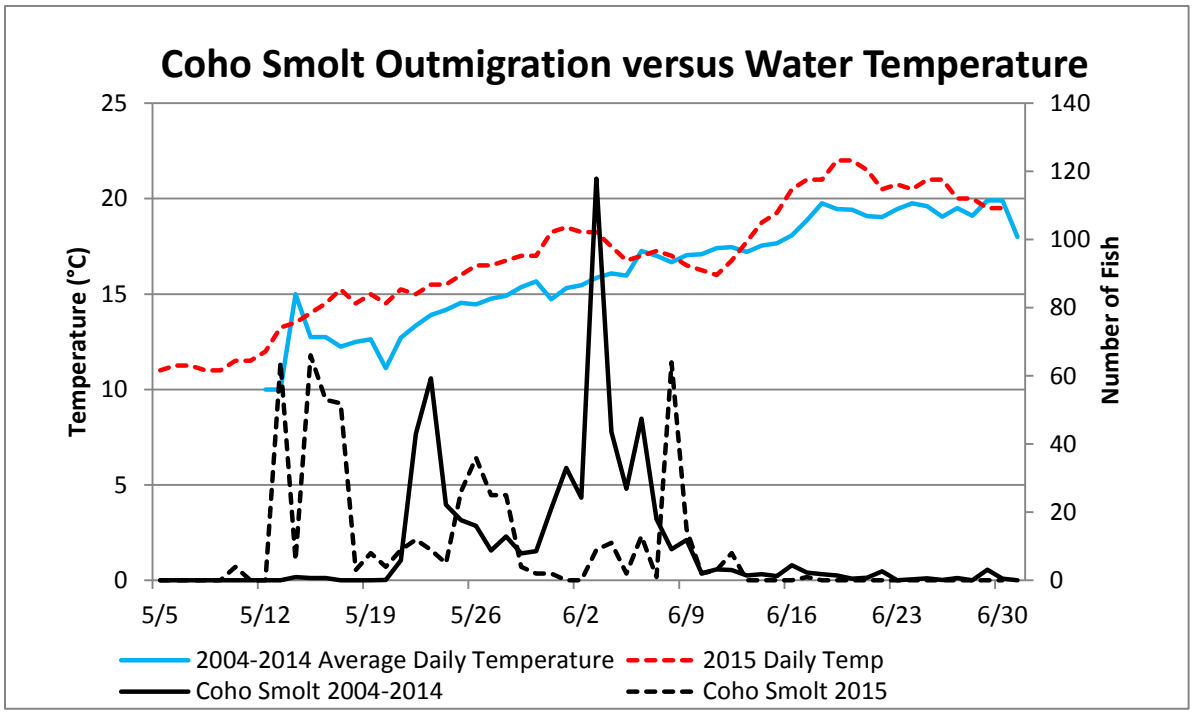

Figure 11. A comparison of 2015 and daily average 2003-2014 coho smolt counts to the water temperature for each relative timeframe.[6]

[5] Note: only 9 years between 2003-2014 were sampled for smolt. See Appendix 1 for years sampled.
[6] Note: water temperature was not recorded in 2003.

Adult Weir Data

The weir was fully operational at 1015 hours on July 13, 2015. The weir was checked daily from July 13 until September 25, with a total of 4,768 sockeye and 527 coho passing through the weir. However, pinks and chums are primarily creek spawners; therefore, only a handful of pinks passed the weir into the lake and one chum tried to enter the lake. Coho salmon are also known to be stream spawners (Groot and Margolis 1991), which is likely why their numbers are low at the weir. The first sockeye passed the weir on July 24 and the last sockeye passed the weir on September 25 (Table 2). The first coho passed through the weir on July 25 and the last coho passed the weir on September 24 (Table 2). No major problems occurred during the time that the weir was in use. The weir was removed at 1420 hours on September 25, 2015.

The average water temperature for the 2015 adult enumeration was 16.2 °C. This year, a higher than average ambient air temperature caused the water temperature to stay high until it gradually dropped in the fall (National Weather Service 2015). Ambient air temperature was above average for 45 days out of the 75 days sampled (National Weather Service 2015).

Table 2. Adult daily and cumulative counts of sockeye and coho salmon at the Sixmile Creek weir, JBER 2015.

		Sockeye		**Coho**	
Date	*Temp (°C)*	*Daily*	*Cumulative*	*Daily*	*Cumulative*
13-Jul	-	0	0	0	0
14-Jul	-	0	0	0	0
15-Jul	-	0	0	0	0
16-Jul	-	0	0	0	0
17-Jul	-	0	0	0	0
18-Jul	19	0	0	0	0
19-Jul	20	0	0	0	0
20-Jul	20.5	0	0	0	0
21-Jul	20	0	0	0	0
22-Jul	20	0	0	0	0
23-Jul	19.5	4	4	0	0
24-Jul	20	5	9	0	0
25-Jul	20.5	862	871	1	1
26-Jul	19.75	337	1208	12	13
27-Jul	20.5	61	1269	0	13
28-Jul	20.5	144	1413	1	14
29-Jul	20.25	11	1424	2	16
30-Jul	21	1	1425	3	19

		Sockeye		Coho	
Date	*Temp (°C)*	*Daily*	*Cumulative*	*Daily*	*Cumulative*
31-Jul	-	8	1433	4	23
1-Aug	-	28	1461	13	36
2-Aug	-	288	1749	8	44
3-Aug	-	101	1850	10	54
4-Aug	22	182	2032	7	61
5-Aug	22	234	2266	16	77
6-Aug	21.5	313	2579	12	89
7-Aug	21.75	146	2725	4	93
8-Aug	21	266	2991	9	102
9-Aug	20.25	180	3171	10	112
10-Aug	20.25	215	3386	7	119
11-Aug	19.75	177	3563	9	128
12-Aug	19.75	132	3695	24	152
13-Aug	19.75	83	3778	22	174
14-Aug	19.75	65	3843	22	196
15-Aug	18.5	75	3918	11	207
16-Aug	18	66	3984	5	212
17-Aug	18	130	4114	17	229
18-Aug	18.5	94	4208	18	247
19-Aug	20	44	4252	27	274
20-Aug	18	62	4314	8	282
21-Aug	17.5	60	4374	4	286
22-Aug	17.25	32	4406	5	291
23-Aug	17.25	34	4440	6	297
24-Aug	17.5	41	4481	17	314
25-Aug	17.5	62	4543	9	323
26-Aug	17	32	4575	3	326
27-Aug	16.25	39	4614	4	330
28-Aug	15.5	25	4639	5	335
29-Aug	14	15	4654	14	349
30-Aug	13.5	12	4666	27	376
31-Aug	13.25	24	4690	118	494
1-Sep	12	5	4695	0	494
2-Sep	13	9	4704	0	494
3-Sep	13	9	4713	0	494
4-Sep	13	5	4718	2	496
5-Sep	13	9	4727	2	498
6-Sep	13.5	2	4729	1	499
7-Sep	14	2	4731	1	500
8-Sep	14	6	4737	1	501

		Sockeye		Coho	
Date	*Temp (°C)*	*Daily*	*Cumulative*	*Daily*	*Cumulative*
9-Sep	13.5	3	4740	0	501
10-Sep	13.5	0	4740	3	504
11-Sep	13	0	4740	1	505
12-Sep	13	2	4742	1	506
13-Sep	12	1	4743	0	506
14-Sep	12	2	4745	2	508
15-Sep	12	4	4749	2	510
16-Sep	12	3	4752	4	514
17-Sep	11	4	4756	2	516
18-Sep	10	1	4757	3	519
19-Sep	10	3	4760	4	523
20-Sep	11	2	4762	0	523
21-Sep	10	4	4766	0	523
22-Sep	9	0	4766	2	525
23-Sep	8.5	0	4766	0	525
24-Sep	8.5	0	4766	2	527
25-Sep	8	2	4768	0	527
TOTALS	**16.2 Average**		**4768**		**527**

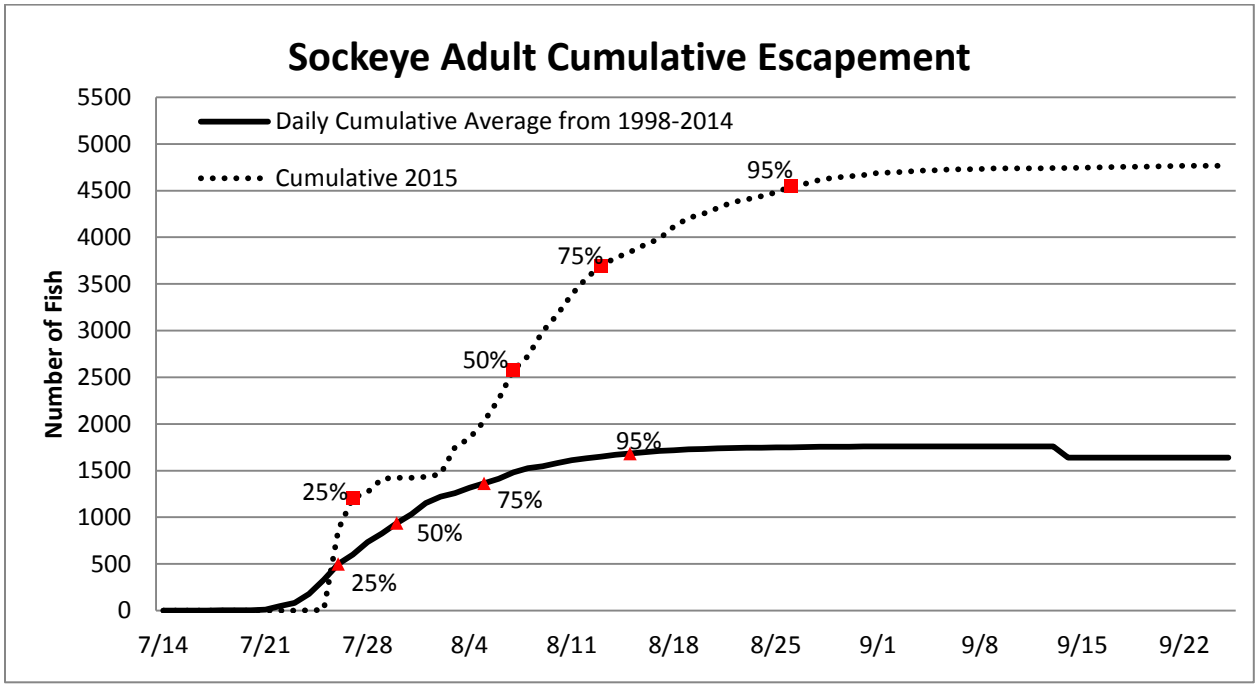

Figure 12. Comparison of cumulative for the 2015 sockeye run and the average cumulative from 1998-2014.

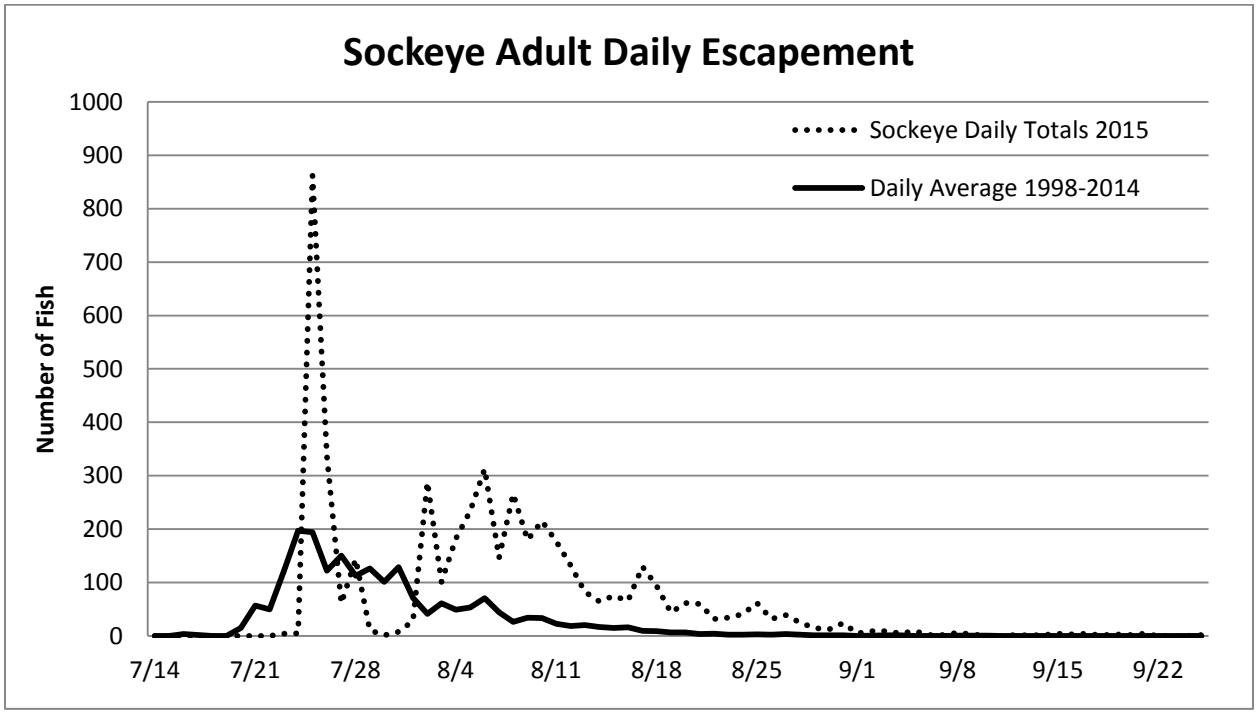

Figure 13. Comparison of daily totals from the 2015 sockeye run and the average from 1998-2014.

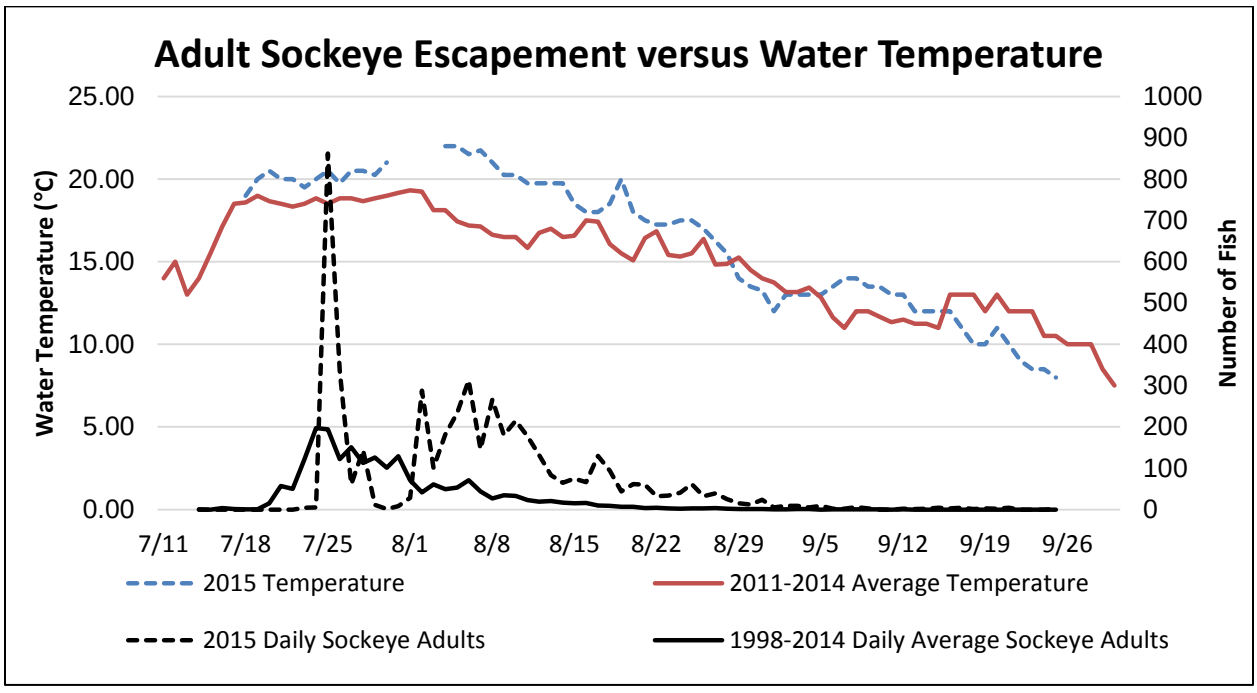

Figure 14. A comparison of 2015 and daily average 2003-2014 sockeye adult counts to the water temperature for each relative timeframe[7].

[7] Note: On July 31, the thermometer broke and was replaced on August 4.

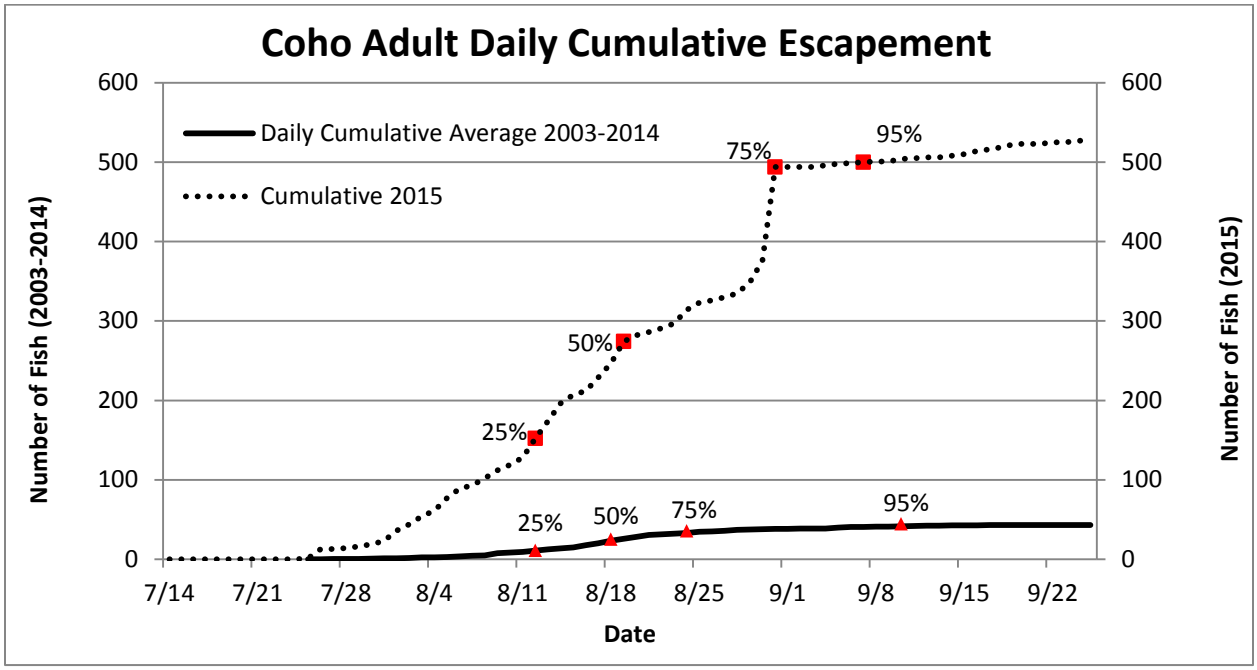

Figure 15. Comparison of cumulative escapement for the 2015 coho run and the average cumulative escapement from 2004-2014.

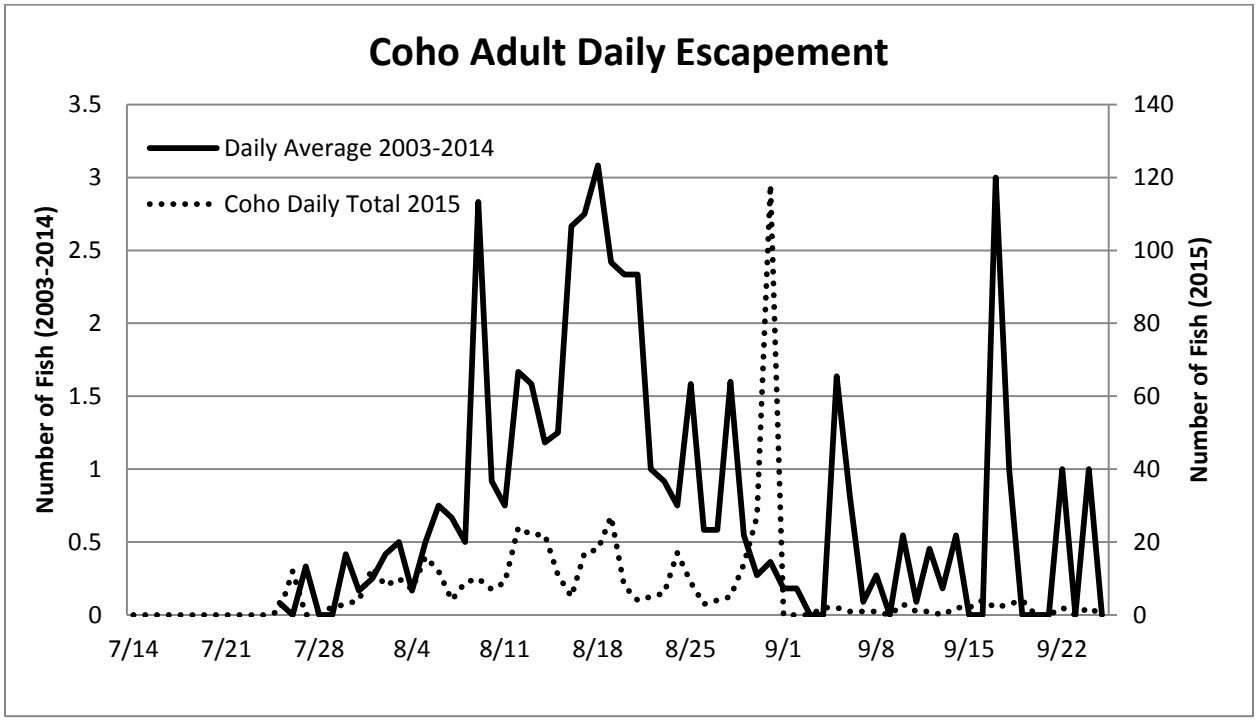

Figure 16. Comparison of daily totals from the 2015 coho run and the average from 2004-2014.

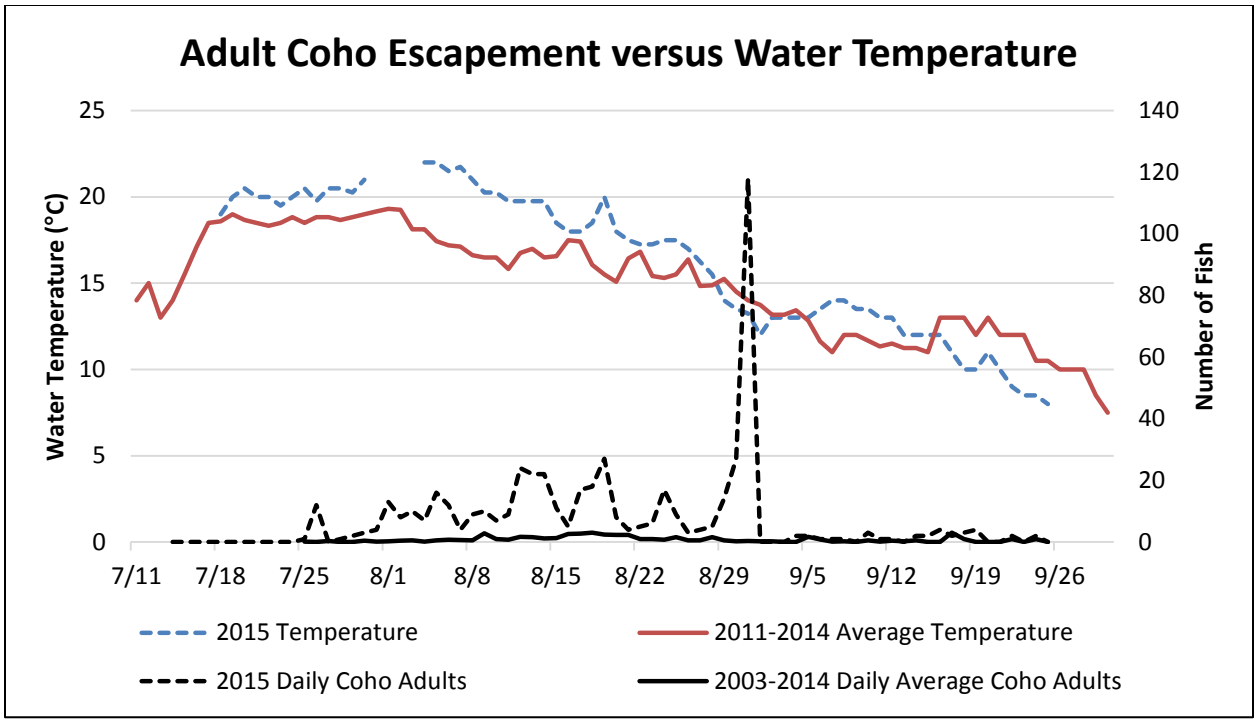

Figure 17. A comparison of 2015 and daily average 2003-2014 coho adult counts to the water temperature for each relative timeframe[8].

Stream Surveys

After reviewing all of the data, a total of 13 years had at least one stream walk conducted, if not two. The earliest stream walk occurred in 1996, while the last stream survey occurred in 2014. Stream surveys started occurring annually in 2001 and continued until 2009. In 2009 and 2010, ADF&G was operating the weir and did not do any stream surveys. In 2011 the annual stream surveys were started again. From 2001 through 2004, there was only one stream survey annually and it occurred on the last day of the adult weir operation. The first year that two stream walks occurred was in 2005 and consecutively after, with the exception of 2007, which only had one.

The stream survey that occurred in 1996 was removed from the rest of the data since there was only one stream survey during the 1990s, and, at the time, the weir was in a different location. Eliminating this stream survey removed it from being an outlier in the dataset. Also, this data attempted to only look at living salmon, while other years counted living and dead salmon.

Figure 18 shows the comparison of sockeye salmon recorded during the stream surveys and the number of sockeye salmon recorded passing the weir by years. The graph shows that the majority of the fish have passed the weir by the time the stream walk was conducted. In the

[8] Note: On July 31, the thermometer broke and was replaced on August 4.

case of 2003 and 2013 there seemed to be a small amount of sockeye lingering in the creek. While in 2001all but 20 fish had passed the weir. The combination of these numbers is important for enumerating the sockeye in the entire Sixmile watershed at the time of the annual stream survey.

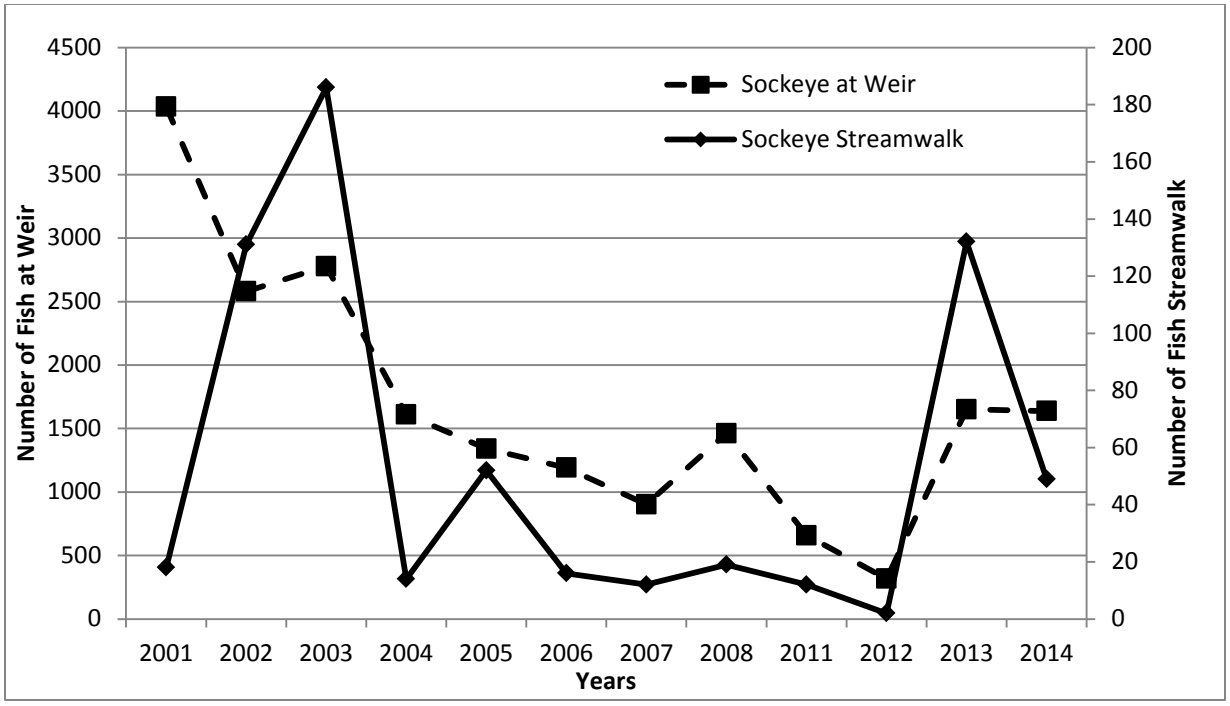

Figure 18. A comparison of sockeye seen during stream walks and sockeye seen at the weir.

Figure 19 compares the number of coho salmon seen at the weir site and the number that were observed during the annual stream walks from 2001 until 2014. The number of coho salmon seen at the weir is low and data is limited because coho were not the primary species of concern until 2012. Coho salmon are known to be stream spawners as opposed to lake spawners (Groot and Margolis 1991); therefore, less coho would pass the weir to spawn in either Lower Sixmile or Upper Sixmile lakes. Once coho were being recorded at the weir, a trend emerged between the number of fish seen during the stream walks and the number recorded at the weir. When the stream survey showed high numbers of coho the number of coho seen at the weir also showed a high number of coho.

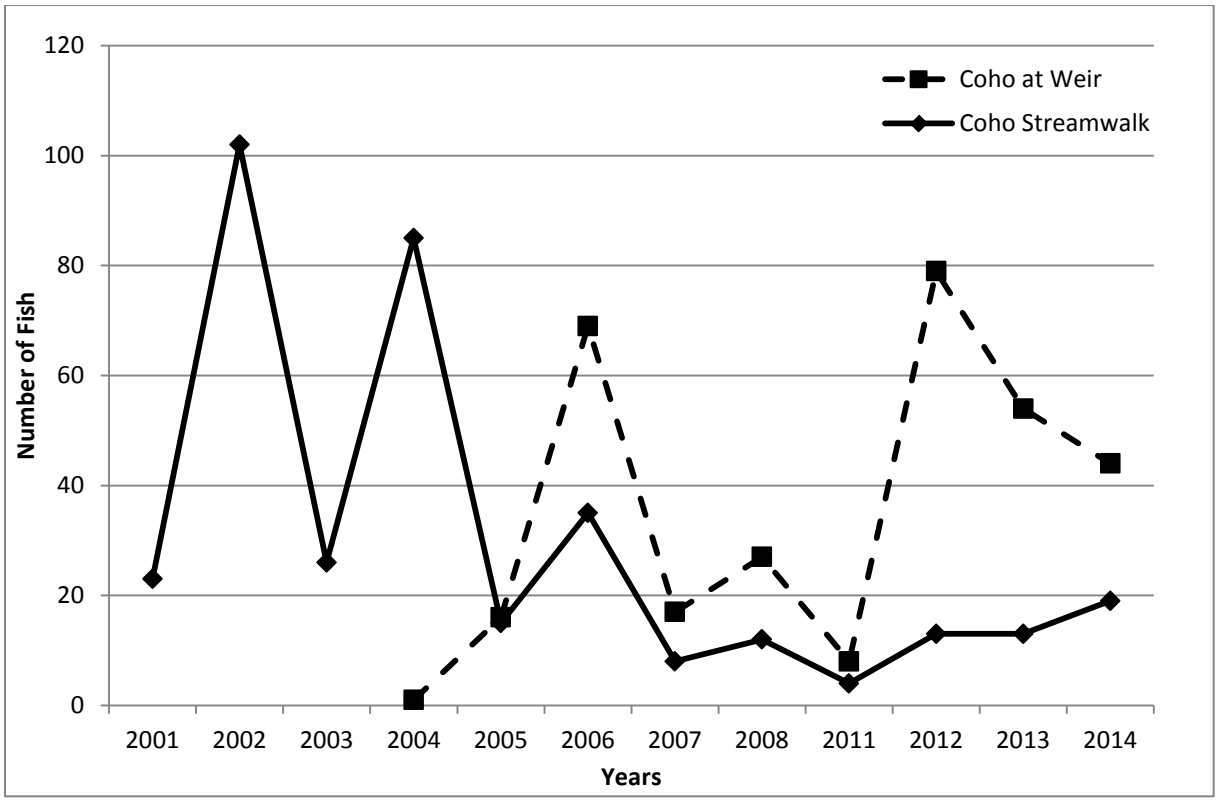

Figure 19. A comparison of coho seen during stream walks and coho seen at the weir.

Table 3 shows the number of all species seen on stream walks and during which weeks these stream walks were conducted throughout the 12 years. During the 12 years of stream surveys, a stream survey was never conducted during the week of September 19-25. Therefore, in Table 3, this week has NA in the species columns. Pink salmon needed to be shown on a secondary scale because there were far more pink salmon than any other salmon species seen during the walks.

The table also shows the seasonal shift in salmon species utilizing the creek. For example, the table shows that there are far more pink salmon in the streams in mid to late August then there are in early to late September. There are more sockeye salmon seen in August as well; however, there seems to be a small push of sockeye in mid-September. Coho salmon are seen in late August with another push during the second week of September. The number of chum that utilize the creek to spawn is very low and diminishes by mid-September.

Table 3. A comparison of the number of salmon seen during the stream surveys from 2001–2014, broken down into which week the stream surveys occurred.

	Sockeye	Coho	Pink	Chum
Aug 15 - 21	146	23	5,288	8
Aug 22 - 28	330	136	5,196	6
Aug 29 - Sep 4	12	15	642	3
Sep 5 - 11	35	138	1,592	4
Sep 12 - 18	101	24	13	1
Sep 19 - 25	NA	NA	NA	NA
Sep 26 – Oct 2	9	13	0	0

Fish Ladder Extension

The fish ladder extension was completed and added onto the existing ladder on July 15, 2015 (Figure 20). The ladder extension was constructed out of 3/16" steel plate, 6' long, with the downstream lip resting on a pre-formed concrete block (18" x 18" x 2") underwater. The extension was 28" tall, and the inside baffles matched the existing baffles at 22" across the outside, 14" across the inside, and 5 ¼" tall on the inside. A two-foot steel overlap was placed on the existing ladder and the extension to hold them together. Once everything was lined up on site, holes were drilled though the overlap and existing fish ladder so that bolts could be installed. Vertical tubes were welded to the outer sides near the exit with 1 ¼" rebar rods dropped through the tubes to prevent the ladder from moving. The rebar was 10' long, and 7.5' were driven into the streambed. As seen in Figure 21, the terminus portion of the ladder extension now sits underwater, allowing for easier passage for adult salmon. It was observed that adult salmon did utilize the ladder with greater ease. However, even with the ladder extension it is likely to still be a velocity barrier for juvenile salmon.

Figure 20. The updated fish ladder fitted with the extension.

Figure 21. Terminus portion of the ladder shown as being underwater.

Discussion and Conclusion

The primary objective of this project was to identify and count the out-migration of smolt salmon and the returning adult salmon for the Sixmile Creek drainage. By using these counts, we expect to identify inter-annual trends by comparing historical data to the current year's data. We were also trying to identify any temperature-driven effects to the stock. Including the 2015 field season, there are ten years of data on out-migrating salmon smolt, 18 years of data on the returning adult sockeye salmon at the bridge location, and 13 years for returning adult coho salmon.

During the 2015 season, Sixmile Creek had the fifth highest recorded annual count of out-migrating sockeye smolt in ten years of data (Appendix 1). The smolt trap was installed earlier than usual, on May 5, with the first fish – 4 sockeye – passing through the trap on May 10. For 2015, the major push of out-migrating sockeye smolt occurred earlier than in 2014 and earlier than the historical average (Figures 6 and 7). The cumulative historical 95th percentile for out-migrating sockeye smolt has typically been reached on June 18. The 2015 field season reached the cumulative 95th percentile of out-migrating sockeye smolt on June 11 (Figure 6). This difference could be explained by environmental factors. During the sampling time for smolts, there were about 40 days that the average air temperature was warmer than the historical air temperature average (National Weather Service 2015). The 2014–2015, winter was also warmer than average, causing less lake ice and thus earlier ice melt. With the ice cover melting earlier, the water temperature increased earlier than previous years (Figure 10). This could have led to the earlier start of the 2015 sockeye out-migration as sockeye prefer a temperature of 4° C –10° C while out-migrating (Groot and Margolis 1991).

The 2015 coho smolt count was the second highest recorded in nine sampling years, but significantly lower than 2014. The total counted was 540, as seen in Table 1. The first 50% of the 2015 coho smolt out-migrated on May 22, about 12 days later than the previous years' average of June 3 (Figure 11). However, the 95th percentile of coho was reached on June 9, only one day earlier than the cumulative historic average (Figure 11). Compared to the 2003–2014 average initial daily out-migration peak of May 23 of an average of 59 fish, the 2015 daily out-migration peak was about 10 days earlier occurring on May 13 with 64 fish (Figure 10). Coho demonstrated a decline in out-migration numbers as water temperatures approached 17° C (Figure 11).

The 2015 adult sockeye salmon return was 4,768 fish. This is the highest recorded annual return counted in the past 18 years and a large increase from the previous year, with the 2014 count being just 1,638 (Figure 12). The largest and main return peak occurred on July 25

with a total of 862 sockeye passing through the weir. For 2015, 95% of the sockeye had passed through the weir by August 25 (Figure 10), 11 days later than the 1998–2014 average. When the peak of the sockeye run for all years sampled is examined, the week of July 23 to July 29 has the highest average returning sockeye counts (Figure 13 and Appendix 3).

The 2015 adult coho cumulative escapement of 527 was the highest passage seen historically, with eight fish more than the 2003–2014 cumulative total of 519 coho observed (Figure 15). The historical cumulative average of 43 coho was surpassed on August 2nd when the 44th coho of the 2015 field season passed into the lake. By August 31st, a total of 118 coho passed through the weir, making it the highest fish passage day observed as of yet.
The water temperature on this day was 13.25°C , a 3 degree decrease (Figure 17) from just four days prior on August 27 with a temperature of 16.25°C. This decrease, and continued decrease, in water temperature could have facilitated coho passage through the weir on August 31. It is known that water temperatures can be a factor in whether the salmon choose to migrate up-river to spawn or not. Ideal migration temperatures for adult salmon range from 6.0 °C to 12.0°C (Wilson and Kelly 1984). The average water temperature was above this range until September 1 when it measured as 12.0°C, which is when the water temperature started to lower. It may be prudent to continue collecting future water temperatures to statistically evaluate any possible correlations between fish run timing and water temperature.

The collection of coho genetics required a thorough and careful identification process of adult spawning salmon. Each salmon was carefully identified before clipping genetics or releasing into the lake. This detailed evaluation of each species created a confidence in identification and in final adult salmon counts. The use of the custom picket weir also allowed for a more organized release and thus improved identification of fish species.

It was noticed that with the extension of the fish ladder, fish seemed to push through the weir in larger numbers instead of smaller consistent numbers. Also, there seemed to be more pink salmon moving up the ladder than what has been seen in the past. It was observed that the adult salmon of all species moved through the ladder with more ease.

Recommendations

1. Adult sockeye escapement in Sixmile drainage has been monitored for 26 years. This should be continued for both the adult sockeye and coho salmon return. Since the adult coho run has been inconsistently enumerated, the run should continue to be evaluated. Also, monitoring the out-migrating smolts needs to continue for both for sockeye and coho salmon species.

2. Water temperature monitoring should continue because temperature is a key factor for determining when smolts and adults migrate. During the 2013-2015 field seasons, increased water temperatures were thought to contribute to an earlier smolt out-migration.
3. There has been four years of consistent smolt data suggest starting a comparison of out-migrating smolt to adults.

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Appendices

Appendix 1. Smolt sockeye escapement counts by date, Sixmile Creek drainage, 2003-2015.

	Year										Average
Date	2003	2004	2005	2006	2009	2010	2012	2013	2014	2015	2003-2006, 2009-2010,2012-2014
5-May										0	
6-May										0	
7-May										0	
8-May										0	
9-May										0	
10-May										0	
11-May										1	0
12-May				0				0		0	0
13-May				0						0	0
14-May	0			4						0	4
15-May	0	4		1		0				1	2
16-May	21	2		2		0				177	6
17-May	1	126		1		0				807	32
18-May	21	7		0		0				34	6
19-May	8	402		13	26					25	90
20-May	165	407	92	44	114	0		0		14	103
21-May	220	185	121	118	86	8		-	3	39	82
22-May	815	464	30	181	192			0	1086	91	346
23-May	1,383	146	15	637	402	5		0	3987	479	731
24-May	740	325	155	1,725	87	1	0	0	641	38	408
25-May	864	319	312	986	375	14	70	0	162	182	345
26-May	460	616	309	1,919	83	7	234	0	309	333	437
27-May	731	266	229	1,897	209		69	1	121	1086	440
28-May	445	714	365	229	38	34	2,404	0	196	1335	492
29-May	673	63	125	1,424	28	26	2,134	0	368	243	538
30-May	275	693	20	1,316	23	6	430	40	2	3	312
31-May	1,047	172	595	781	8	5	562	104	2095	74	597
1-Jun	506	74	447	836	64	47	12	320	56	14	262
2-Jun	688	41	961	882	117	117	20	386	49	81	362
3-Jun	521	394	660	418	123	67	23	881	448	924	393

	Year										Average
Date	2003	2004	2005	2006	2009	2010	2012	2013	2014	2015	2003-2006, 2009-2010,2012-2014
4-Jun	128	92	600	90	238	150	636	615	810	562	373
5-Jun	384	13	608	254	1,071	639	2,049	2,227	155	336	822
6-Jun	243	140	265	350	483	5	891	963	38	1245	375
7-Jun	1,104	37	96	107	963	162	2,677	2,376	2782	596	1145
8-Jun	111	25	234	114	1,103	84	1,017	2,255	58	349	556
9-Jun	478	47	274	65	636	616	1,029	1,349	358	567	539
10-Jun	173	22	129	174	357	427	813	779	0	80	319
11-Jun	1,076	0	143	29	44	277	195	352	10	364	236
12-Jun	3,660	58	144	62	123	281	505	1,757	1	146	732
13-Jun	1,536	7	134	148	488	176	1,129	771	0	0	488
14-Jun	779	26	132	223	303	30	2,603	1,395	1	43	610
15-Jun	573	18	344	230	237	23	1,075	1,049	0	0	394
16-Jun	96	11	190	113	10	181	799	1,256	0	0	295
17-Jun	134	2	161	596	42	80	612	737	0	0	263
18-Jun	20	12	118	188	318	220	546	159	1	3	176
19-Jun	14	17	366	30	47	28	146	50	0	1	78
20-Jun	6	16	88	72	38	20	34	49	0	4	36
21-Jun	3	5	122	53	35	26	97	14	0	1	39
22-Jun	9	1	213	14		26	60	291	0	0	77
23-Jun	2	35	62	12	29	61	101	93	6	4	45
24-Jun			27	73	12	99	15	44	5	1	39
25-Jun			308	16	0	51	51	45	0	0	67
26-Jun			218	188	18	9	41	18	2	0	71
27-Jun			88	80		2	203	7	0	0	63
28-Jun			20	129	3	3	23	1	1	1	26
29-Jun			27	297	1	16	60	12	5	0	60
30-Jun			28	100		8	279	11	4	0	72
1-Jul					40	0		56	0		24
2-Jul									0		
Totals	20,113	6,004	9,575	17,221	8,614	4,037	23,644	20,463	13,760	10,280	14,007
Totals	20,113	6,004	9,575	17,221	8,614	4,037	23,644	20,463	13,760	10,280	13,371

The first total in the average column (14,007) is the sum of those averages. The second total in the average column (13,371) is the average from all of the yearly totals (2003-2015).

Appendix 2. Smolt coho escapement counts by date, Sixmile Creek drainage, 2003-2015.

	Year										Average
Date	2003	2004	2005	2006	2009	2010	2012	2013	2014	2015	2003-2006, 2009-2010,2012-2014
5-May										0	
6-May										0	
7-May										0	
8-May										0	
9-May										0	
10-May										4	
11-May										0	
12-May										0	
13-May										64	
14-May	1									6	1
15-May	2	0				0				66	1
16-May	2	0				0				53	1
17-May	0	0				0				52	0
18-May	0	0			0	0				3	0
19-May	0	0			0					8	0
20-May	0	0	1		0	0		0		4	0
21-May	24	0	3	1	0	0		**0**	19	9	6
22-May	13	4	5	9	7			0	263	12	43
23-May	0	0	0	24	3	0		0	447	9	59
24-May	0	0	47	24	1	0	25	0	103	5	22
25-May	0	0	39	19	11	2	0	0	88	26	18
26-May	0	0	16	48	3	4	0	0	73	36	16
27-May	0	0	7	19	1		15	0	28	25	9
28-May	0	0	5	7	0	2	20	0	82	25	13
29-May	0	1	0	9	0	0	10	0	51	4	8
30-May	1	14	7	9	1	2	2	0	41	2	9
31-May	0	1	17	3	0	0	1	15	153	2	21
1-Jun	0	0	51	1	2	1	0	12	230	0	33
2-Jun	0	0	59	3	0	1	1	9	145	0	24
3-Jun	0	0	1	1	0	1	0	54	1004	9	118

	Year										Average
Date	2003	2004	2005	2006	2009	2010	2012	2013	2014	2015	2003-2006, 2009-2010,2012-2014
4-Jun	0	0	16	0	0	0	0	13	363	11	44
5-Jun	1	0	7	2	4	0	9	17	202	2	27
6-Jun	3	0	15	2	0	0	1	16	390	13	47
7-Jun	0	0	6	1	1	4	1	26	123	1	18
8-Jun	0	0	4	0	3	1	4	17	53	64	9
9-Jun	0	1	5	0	2	1	1	21	76	15	12
10-Jun	0	0	4	0	0	3	0	11	1	2	2
11-Jun	0	0	8	1	0	6	0	2	12	3	3
12-Jun	0	0	3	5	0	1	2	12	4	8	3
13-Jun	0	1	2	0	0	5	0	5	0	0	1
14-Jun	0	0	5	1	3	1	3	3	0	0	2
15-Jun	0	0	4	0	0	0	0	7	0	0	1
16-Jun	0	0	28	1	0	2	4	4	1	0	4
17-Jun	0	0	3	13	0	0	2	3	0	1	2
18-Jun	0	0	6	1	4	4	0	1	0	0	2
19-Jun	2	0	8	0	1	0	2	0	0	0	1
20-Jun	0	0	2	0	2	0	0	0	1	0	1
21-Jun	0	1	4	0	0	0	1	0	1	0	1
22-Jun	0	0	1	0		0	1	1	18	0	3
23-Jun	0	0	0	0	0	0	0	0	0	0	0
24-Jun			1	0	0	1	0	0	0	0	0
25-Jun			1	0	1	0	0	0	2	0	1
26-Jun			1	0	0	0	0	0	0	0	0
27-Jun			1	0		0	2	1	0	0	1
28-Jun			0	0		0	0	0	0	0	0
29-Jun			0	0		0	0	0	19	0	3
30-Jun			0	0		0	0	0	3	0	1
1-Jul								0			0
2-Jul											
Totals	49	23	393	204	50	42	107	250	3,996	540	590
Totals	49	23	393	204	50	42	107	250	3,996	540	565

The first total in the average column (590) is the sum of those averages. The second total in the average column (565) is the average from all of the yearly totals (2003-2015).

Appendix 3. Adult sockeye escapement counts by date, Sixmile Creek drainage, 1998-2015.

	Year																		Average
Date	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	1998-2014
1-Jul											0								
2-Jul											0								
3-Jul											0								
4-Jul																			
5-Jul																			
6-Jul																			
7-Jul																			
8-Jul				4							1								3
9-Jul											0								0
10-Jul				1							0								1
11-Jul											0			0					0
12-Jul											0			0					0
13-Jul											0		0	0					0
14-Jul							1				0	0	0	0			0	0	0
15-Jul											0	0	0	0			0	0	0
16-Jul	2										0	0	0	2	0	27	0	0	4
17-Jul	3										0	0	0	0	0	10	0	0	2
18-Jul	1				0						0	0	0	0	0	0	0	0	0
19-Jul					0						1	0	0	0	0	0	0	0	0
20-Jul	3			149	0						0	0	0	0	0	0	0	0	15
21-Jul	17			133	0		5				1	0	0	1	0	0	469	0	57
22-Jul	17			285	0		107			1	0	0	119	0	0	1	69	0	50
23-Jul	43		518	300	0		100			1	0	0	487	0	0	0	142	4	122
24-Jul	487		178	1,188	0		18			1	8	358	200	0	0	0	122	5	197
25-Jul	184		78	405	328	158	0	276		4	516	582	67	198	1	3	111	862	194
26-Jul	56		21	26	173	251	2	124			344	268	0	241	4	152	48	337	122
27-Jul	48		3	130	476	364	2	22		219	100	537	0	18	1	309	30	61	151
28-Jul	4			286	300	394	13	2		14	32	264	7	0	4	197	61	144	113

	Year																		Average
Date	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	1998-2014
29-Jul	154		200	297	363	279	24	2		1	9	260	247	2	1	27	27	11	126
30-Jul	20		180	91	162	132	321	31	205	3	67	86	119	1	141	14	51	1	102
31-Jul	20		133	305	59	176	301	160	359	80	112	181	103	0	22	0	49	8	129
1-Aug	21		44	151	91	95	43	92	50	171	46	70	187	0	57	3	16	28	71
2-Aug	0		38	59	40	44	26	72	2	34	31	100	151	2	28	27	9	288	41
3-Aug	138		24	45	86	88	41	40	3	13	17	12	140	115	10	196	10	101	621
4-Aug	48		5	70	76	86	59	35	3	7	21	14	34	57	0	255	15	182	49
5-Aug	0		33	26	65	128	30	50	154	36	20	44	141	5	0	83	38	234	53
6-Aug	115	386		11	49	70	9	21	84	125	2	76	107	0	10	45	25	313	71
7-Aug	56	206	48	16	67	83	17	51	39	37	9	21	40	0	5	29	26	146	44
8-Aug	0	1	17			34	62	14	41	1	14	37	98	0	0	13	66	266	27
9-Aug	56	7	3	13	62	58	39	28	18	5	15	74	135	0	0	19	54	180	34
10-Aug	40		30		28	18	147	37	12	9	5	32	61	0	8	46	27	215	33
11-Aug	29			9	30	11	38	14	33	22	22	64	11	2	0	39	17	177	23
12-Aug	25	4	4	2		82	22	16	15	48	9	31	4	0	3	17	20	132	19
13-Aug	24	14	3		42	22	31	16	70	6	21	13	9	0	0	27	33	83	21
14-Aug	17	3	1			40	12	65	7	10	18	13		0	3	32	11	65	17
15-Aug	13	3			36	41	21	18	5	11	3	37	9	5	2	12	9	75	15
16-Aug	9	3		23		44	9	18	16	5	3	61	10	0	4	20	17	66	16
17-Aug	12		3			32	14	7	8	4	0	17	17	0	10	3	9	130	10
18-Aug	0	3	5	4	11	15	6	41	11	10	9	16	4	0	1	8	11	94	9
19-Aug	0			5		9	1	17	16		2	14	6	3	0	7	10	44	7
20-Aug	0				19	3	7	9	9	4	1	15	5	1	0	4	12	62	6
21-Aug	0	1					7	7	6	2	1	8	3	0	0	5	7	60	4
22-Aug	0	2	1		15	2	0	9	10	8	2	9	2	0	0	0	6	32	4
23-Aug	0	4	1				1	12	3	8	0	4	2	0	0	2	1	34	3
24-Aug					1		7	3	1	1	0	5	5	2	0	1	3	41	2
25-Aug						10	0	10	3		0	5	0	0	0	3	0	62	3
26-Aug		7					13	6	1		0	1	0	0	0	0	2	32	3
27-Aug		2				9	28	5	1		1	1	0	0	0	0	0	39	4

	Year																		Average
Date	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	1998-2014
28-Aug		6			1		15	0	4	2	0	0		0	0	0	1	25	2
29-Aug							3	4	0		0	4	0	1	0	0	0	15	1
30-Aug							4	2	3		0	0	0	0	0	0	1	12	1
31-Aug							0	5	0		0	0	2	0	0	3	0	24	1
1-Sep							1		0		0		0	0	0	0	0	5	0
2-Sep							0		0		0		0	2	1	3	0	9	1
3-Sep		3					3		0		0		0	0	0	3	0	9	1
4-Sep		7					1		0		0		0	0	0	1	0	5	1
5-Sep							0		0		0		0	0	0	0	0	9	0
6-Sep		1					0		0		0		0	0	0	2	0	2	0
7-Sep							0		0		0		0	0	0	0	1	2	0
8-Sep							0		0		0		0	0	1	1	1	6	0
9-Sep													0	0	0	2	0	3	0
10-Sep													1	0	0	0	1	0	0
11-Sep														0	0	0	0	0	0
12-Sep														0	0	1	0	2	0
13-Sep														0			0	1	0
14-Sep														0			0	2	0
15-Sep														0			0	4	0
16-Sep																	0	3	0
17-Sep																	0	4	0
18-Sep																	0	1	0
19-Sep																	0	3	0
20-Sep																	0	2	0
21-Sep																	0	4	0
22-Sep																	0	0	0
23-Sep																	0	0	0
24-Sep																	0	0	0
25-Sep																	0	2	0

	Year																		Average
Date	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	1998-2014
26-Sep																	0		0
27-Sep																	0		0
28-Sep																	0		0
29-Sep																	0		0
30-Sep																	0		0
1-Oct																	0		0
Totals	1,662	663	1,571	4,034	2,580	2,778	1,611	1,341	1,192	903	1,463	3,334	2,533	658	317	1,652	1,638	4,768	2,047
Totals	1,662	663	1,571	4,034	2,580	2,778	1,611	1,341	1,192	903	1,463	3,334	2,533	658	317	1,652	1,638	4,768	2,041

The first total in the average column (2,047) is the sum of those averages. The second total in the average column (2,041) is the average from all of the yearly totals (1998-2015)

Appendix 4. Adult coho escapement counts by date, Sixmile Creek drainage, 2003-2015.

	Year													Average
Date	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2003-2014
14-Jul	0												0	
15-Jul	0												0	
16-Jul	0												0	
17-Jul	0												0	
18-Jul	0												0	
19-Jul	0												0	
20-Jul	0												0	
21-Jul	0												0	
22-Jul	0												0	
23-Jul	0												0	
24-Jul	0												0	
25-Jul	0	0	0	0	0	0	0	0	0	0	0	1	1	0
26-Jul	0	0	0	0	0	0	0	0	0	0	0	0	12	0
27-Jul	0	0	1	0	0	0	3	0	0	0	0	0	0	0
28-Jul	0	0	0	0	0	0	0	0	0	0	0	0	1	0
29-Jul	0	0	0	0	0	0	0	0	0	0	0	0	2	0
30-Jul	0	0	5	0	0	0	0	0	0	0	0	0	3	1
31-Jul	0	0	0	1	0	1	0	0	0	0	0	0	4	0
1-Aug	0	0	0	0	0	3	0	0	0	0	0	0	13	0
2-Aug	0	0	0	0	0	0	4	0	0	0	0	1	8	0
3-Aug	0	0	0	0	0	2	0	0	0	4	0	0	10	1
4-Aug	2	0	0	0	0	0	0	0	0	0	0	0	7	0
5-Aug	0	0	0	1	0	1	1	0	0	3	0	0	16	1
6-Aug	0	0	4	0	0	0	1	2	0	2	0	0	12	1
7-Aug	1	0	0	0	1	0	2	0	0	4	0	0	4	1
8-Aug	0	0	0	0	0	0	6	0	0	0	0	0	9	1
9-Aug	0	0	1	0	1	5	21	3	0	1	0	2	10	3
10-Aug	0	0	0	1	0	1	5	2	0	2	0	0	7	1

														Average
						Year								
Date		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2003-2014
12-Aug	1	0	0	2	0	0	6	1	0	6	3	1	9	2
13-Aug	0	0	0	11	2	0	3	2	0	0	1	0	24	2
14-Aug	0	0	0	7	1	0	0		0	3	1	1	22	1
15-Aug	1	0	0	0	2	5	2	1	0	3	1	0	22	1
16-Aug	0	0	0	4	0	4	3	1	0	15	3	2	11	3
17-Aug	0	0	0	2	2	0	7	0	0	17	4	1	5	3
18-Aug	0	0	0	4	4	1	20	0	0	6	1	1	17	4
19-Aug	0	0	0	3	0	2	21	0	3	0	0	0	18	3
20-Aug	1	0	0	5	0	0	20	1	0	0	0	1	27	3
21-Aug	0	0	0	1	0	1	18	0	1	7	0	0	8	3
22-Aug	0	0	0	3	2	0	4	0		0	1	1	4	1
23-Aug	0	0	0	6	1	0	3	0	0	0	0	1	5	1
24-Aug	0	0	1	0	0	0	2	0	2	0	3	1	6	1
25-Aug	1	0	2	4	0	0	11	0	0	0	1	0	17	2
26-Aug	0	0	1	6	0	0	0	0	0	0	0	0	9	1
27-Aug	1	0	0	4	0	1	0	0	0	0	0	1	3	1
28-Aug		0	0	4	1	0	5	0	0	4	0	2	4	2
29-Aug		0	0	0	0	0	2		1	0	0	3	5	0
30-Aug		1	0	0	0	0	0	0	0	1	1	0	14	0
31-Aug		0	1	0	0	0	1	0	0	1	1	0	27	0
1-Sep		0	0	0	0	0	0	0	0	0	0	2	118	0
2-Sep		0	0	0	0	0	0	0	1	0	1	0	0	0
3-Sep		0	0	0	0	0	0	0	0	0	0	0	0	0
4-Sep		0	0	0	0	0	0	0	0	0	0	0	0	0
5-Sep		0	0	0	0	0	0	0	0	0	17	1	2	2
6-Sep		0	0	0	0	0	0	1	0	0	8	0	2	1
7-Sep		0	0	0	0	0	0	0	0	0	0	1	1	0
8-Sep		0	0	0	0	0	0	0	0	0	3	0	1	0
9-Sep		0	0	0	0	0	0	0	0	0	0	0	1	0

	Year													Average
Date	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2003-2014
11-Sep		0	0	0	0	0	0	0	0	0	0	1	3	0
12-Sep		0	0	0	0	0	0	0	0	0	1	4	1	0
13-Sep		0	0	0	0	0	0	0	0	0	0	2	1	0
14-Sep		0	0	0	0	0	0	0	0	0	0	6	0	0
15-Sep		0	0	0	0	0	0	0	0	0	0	0	2	0
16-Sep												0	2	0
17-Sep												3	4	3
18-Sep												1	2	1
19-Sep												0	3	0
20-Sep												0	4	0
21-Sep												0	0	0
22-Sep												1	0	1
23-Sep												0	2	0
24-Sep												1	0	1
25-Sep												0	2	0
26-Sep												0	0	0
27-Sep												0		0
28-Sep												0		0
29-Sep												0		0
30-Sep												0		0
1-Oct												0		0
Totals	8	1	16	69	17	27	178	18	8	79	54	44	527	50
Totals	8	1	16	69	17	27	178	18	8	79	54	44	527	80

The first total in the average column (50) is the sum of those averages. The second total in the average column (80) is the average from all of the yearly totals (2003-2015).