

Whiskey Lake
Salmon Smolt
Progress Report
2014

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The 2014 Whiskey Lake Project was made possible through enhancement taxes paid by commercial fishermen in Area H, Cook Inlet and associated waters.

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DISCLAIMER

The Cook Inlet Aquaculture Association (CIAA) conducts salmon enhancement and restoration projects in Area H, Cook Inlet, and associated waters. As an integral part of these projects a variety of monitoring and evaluation studies are conducted. The following progress report is a synopsis of the monitoring and evaluation studies conducted for Whiskey Lake. This Whiskey Lake Progress Report gives the 2014 update of data collected at Whiskey Lake and includes any historical data collected in the tables and appendices for comparative purposes.

The purpose of this progress report is to provide a vehicle to distribute the information produced by the monitoring and evaluation studies. These reports are intended to provide a general description of project activity and are not an exhaustive evaluation of any restoration or enhancement project. The information presented in this report has not undergone an extensive review. As reviews are completed, the information may be updated and presented in other reports.

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Our equal employment opportunity philosophy applies to all aspects of employment with CIAA including recruiting, hiring, training, transfer, promotion, job benefits, pay, dismissal, and educational assistance.

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ABSTRACT

Cook Inlet Aquaculture Association (CIAA) has been collecting salmon smolt migration data at Whiskey Lake since 2012 to help assess the salmon population at Whiskey Lake. In cooperation with the United States Geological Survey, CIAA has also been studying the impact of invasive northern pike in Whiskey Lake. Extensive harvest of pike began in 2014 and is planned to continue in 2015. Smolt enumeration data will allow CIAA to assess the impact pike removal has on the salmon production of the lake. Staff collected data beginning 20 May 2014 through 20 July 2014. A total of 1,395 sockeye salmon smolt (*Oncorhynchus nerka*), and 142 coho salmon smolt (*O. kisutch*) were enumerated during that time period. Water level of the outlet stream fluctuated a total of 0.4 ft, and the average water and air temperatures were 16°C and 14°C, respectively. A total of 47 mm of rainfall was recorded. In anticipation of low numbers of smolt emigrating from Whiskey Lake and to avoid excess handling, age, weight, length (AWL) sampling was not performed in 2014.

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INTRODUCTION AND PURPOSE

The Susitna River Valley salmon populations are believed to be impacted by northern pike (*Esox lucius*) invasion and their colonization in many lakes throughout the watershed (Southcentral Northern Pike Control Committee, 2007). This has led to the listing of Susitna River sockeye salmon (*Oncorhynchus nerka*) as a stock of yield concern by the Alaska Board of Fisheries.

In light of recent low returns of adult salmon to Upper Cook Inlet, Cook Inlet Aquaculture Association (CIAA), in cooperation with the Alaska Department of Fish and Game (ADF&G), assessed sockeye salmon populations at several key salmon producing lakes with and without invasive northern pike in the Susitna River drainage over a three-year period. Based on this assessment by CIAA and ADF&G, it was concluded that lakes with populations of northern pike have salmon populations that were either extirpated or have declined in numbers according to historical record. In an effort to develop a rehabilitation plan at some of the more affected lakes, CIAA requested and received a grant from the Alaska Sustainable Salmon Fund (AKSSF) to identify priority harvest areas for northern pike by assessing movement patterns, spawning areas and preferred habitat associations. Work began on this project in May of 2012. Following a capture-mark-recapture project to estimate the numbers of northern pike living in Whiskey Lake, an intensive northern pike removal effort began in 2014.

To assess the success of the northern pike removal effort, CIAA monitored the Whiskey Lake salmon smolt migration prior to and during the northern pike removal effort. Because CIAA is unaware of any other factors limiting production of salmon smolt in Whiskey Lake, it is assumed that removal of invasive northern pike, or at least a drastic reduction in their numbers, would cause salmon smolt production to increase. It is unknown how fast the salmon population will respond to the removal of the northern pike from the system. Additionally, other native fish species in Whiskey Lake like lake trout (*Salvelinus namaycush*) and rainbow trout (*O. mykiss*) would also potentially benefit from the removal of northern pike.

This report presents data from the 2014 salmon smolt migration from Whiskey Lake, as well as the data collected during the 2012 and 2013 salmon smolt migrations.

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PROJECT AREA

Whiskey Lake is located at 61°59' W latitude and 151°24' N longitude at the base of the Shell Hills in the Susitna River drainage, approximately 118 kilometers northwest of Anchorage, Alaska (Figure 1). It has an elevation of 45 meters and a surface area of $1.1 \times 10^6 \text{m}^2$ (Figure 2) (Spafard and Edmundson, 2000). There is one small unnamed tributary of Whiskey Lake located on the north side of the lake. The lake's discharge forms Whiskey Creek, which flows into Hewitt Creek and the Yentna River.

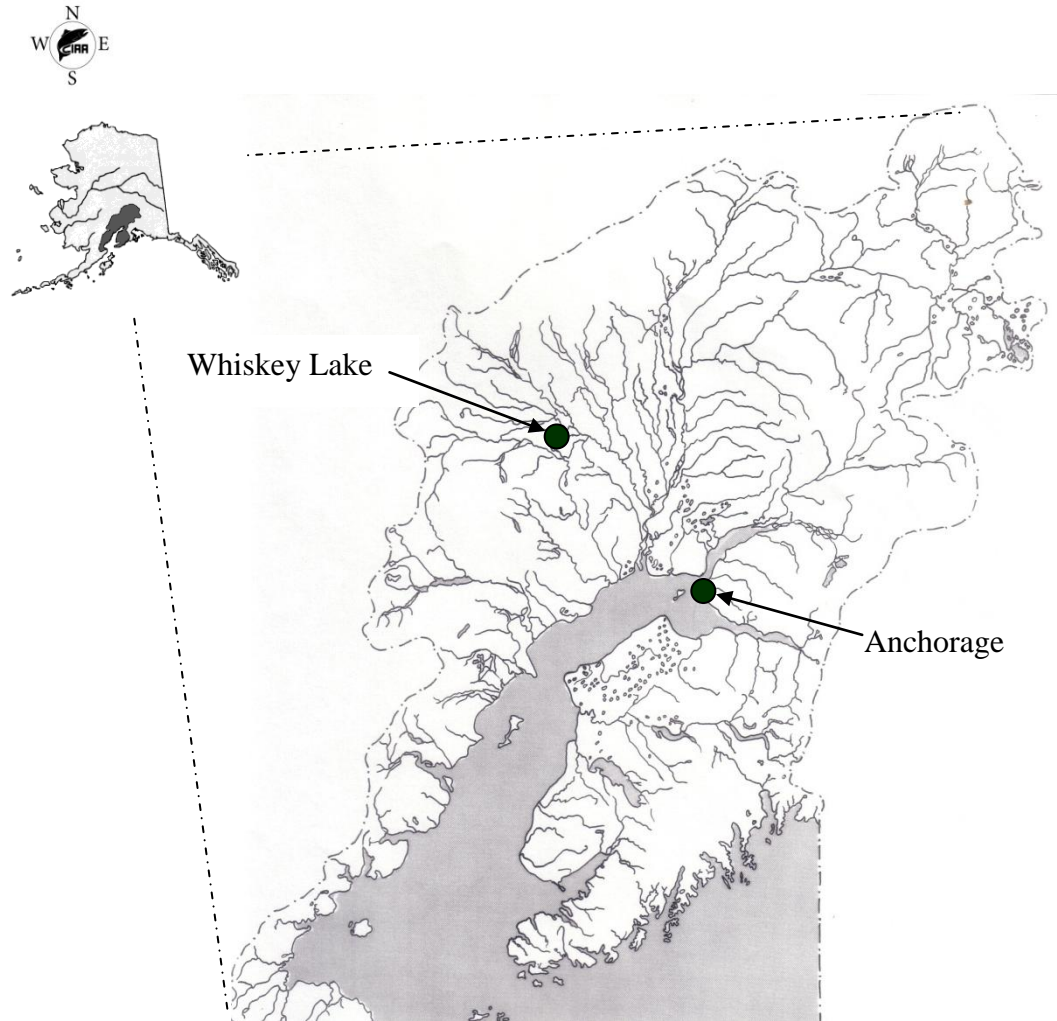


Figure 1: Whiskey Lake in Relation to Cook Inlet and Alaska

WHISKEY LAKE

Latitude: 61° 59'
Longitude: 151° 24'
Elevation: 45 m
Area: 1.1 x 10⁶ m²
Contours in meters

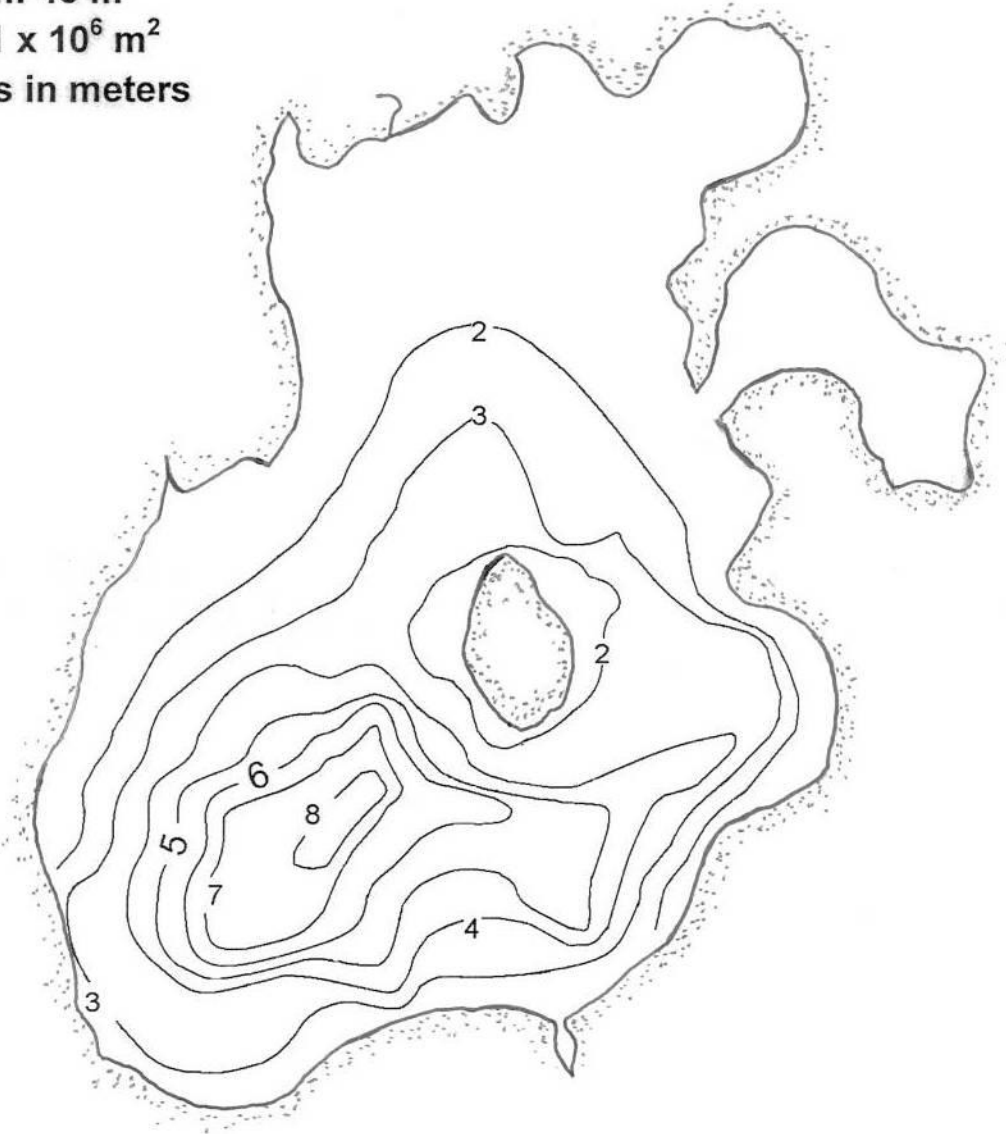


Figure 2: Bathymetric Map of Whiskey Lake

METHODS

Environmental Conditions

To assess the environmental conditions during the sockeye salmon smolt migration at Whiskey Lake percent cloud cover was visually estimated, water level recorded to the nearest 0.1 ft, precipitation measured to the nearest millimeter, and water and air temperatures (Celsius) were recorded at 5:00 PM daily. Standard CIAA procedures were followed for collecting these observations (CIAA, 2013).

Smolt Collection and Enumeration

To enumerate the smolt migration, a collection facility was temporarily placed in Whiskey Creek, approximately 50 meters downstream from the outlet of Whiskey Lake. A trap installed in mid-to-late May, which was comprised of a modified fyke net attached to a double compartment live box, was positioned in the main flow of the creek. There were 2 leads composed of vexar paneling, which were anchored upstream to each bank and functioned by directing smolts into the trap. The vexar paneling directed all migrating smolt into the trap ensuring a total smolt count. Typically, staff checked the trap at least 4 times daily and all smolts were identified to species and enumerated. Usually for smolt enumeration projects, CIAA staff collects age, weight, length (AWL) samples on a subset of the emigrating smolt. Due to the low number of smolt observed in 2013 and the anticipated low run in 2014, staff decided to not perform AWL samples in 2014 in order to reduced handling time of smolt.

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RESULTS

Environmental Conditions

During the 2014 smolt migration, staff monitored environmental conditions at 5:00 PM from 20 May through 20 July. Water levels fluctuated 0.4 ft during that time period (Figure 3). Stream temperatures averaged 16°C (± 2.8) [mean \pm standard deviation] and ranged from 11 to 21°C. Air temperatures averaged 14°C (± 3.5) and ranged from 8 to 21°C. Thirteen percent of the days were clear, 44% were partly cloudy, 21% were overcast, and 22% had measured rainfall. A total of 47 mm of rain fell during that period.

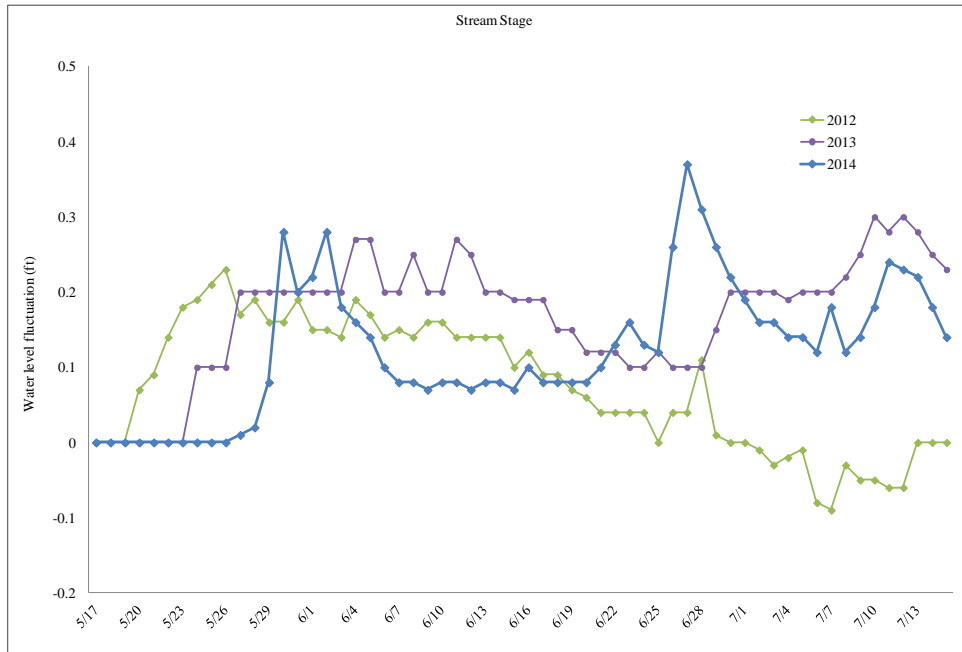


Figure 3: Whiskey Creek Water Fluctuations for 2012, 2013, and 2014.

Smolt Enumeration and Characteristics

The 2014 smolt migration was enumerated from 20 May through 20 July. During that time, 1,395 sockeye salmon smolt were captured while migrating from Whiskey Lake (figures 4 and 5). During this time 142 coho salmon smolt (*O. kisutch*) were also captured (figures 6 and 7).

Table 1. Whiskey Lake Sockeye and Coho Salmon Smolt Age, Weight and Length Summary for 2012, 2013, and 2014.

Year	Species	Age Class (%)								Mean length (mm)								Mean weight (g)							
		Age 0	95% C.I.	Age 1	95% C.I.	Age 2	95% C.I.	Age 3	95% C.I.	Age 0	SD	Age 1	SD	Age 2	SD	Age 3	SD	Age 0	SD	Age 1	SD	Age 2	SD	Age 3	SD
2012	Sockeye	31.9%	0.2	44.7%	0.1	23.5%	0.3	NS	NS	55.2	0.4	85.3	1.2	99.6	0.7	NS	NS	1.7	0.1	6.4	0.2	10.8	0.3	NS	NS
2013	Sockeye	25.0%	0.4	50.0%	0.2	24.8%	0.4	0.2%	N/A	55.6	3.4	75.7	6.4	86.3	7.2	120.0	N/A	1.1	0.3	3.4	1.3	5.8	2.0	15.5	N/A
2014*	Sockeye	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
2012	Coho	N/A	N/A	33.3%	9.6	46.7%	6.1	20.0%	17.9	NS	NS	74.0	10.3	97.0	3.2	121.0	13.5	NS	NS	5.4	2.0	9.8	2.3	18.4	7.2
2013	Coho	31.6%	7.7	21.1%	12.1	42.1%	5.4	5.3%	N/A	54.8	4.9	69.0	6.1	93.9	9.7	122.0	N/A	1.8	0.5	3.2	1.2	8.4	2.9	21.1	N/A
2014*	Coho	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

N/A = Because only one sample was collected, there are no confidence intervals or standard deviation.

NS = No samples were taken.

2014* = No samples were taken in 2014 in order to limit handling of smolt

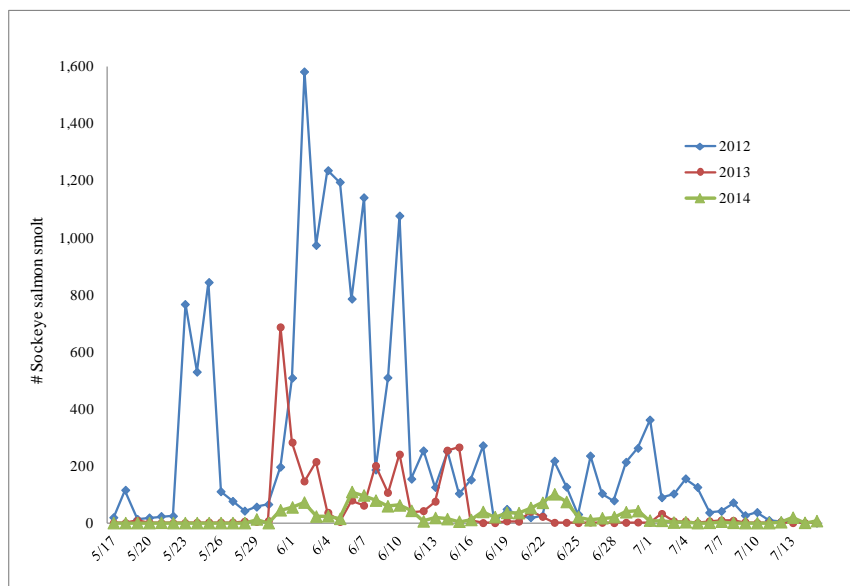


Figure 4: Whiskey Lake Daily Sockeye Salmon Smolt Migration for 2012, 2013, and 2014.

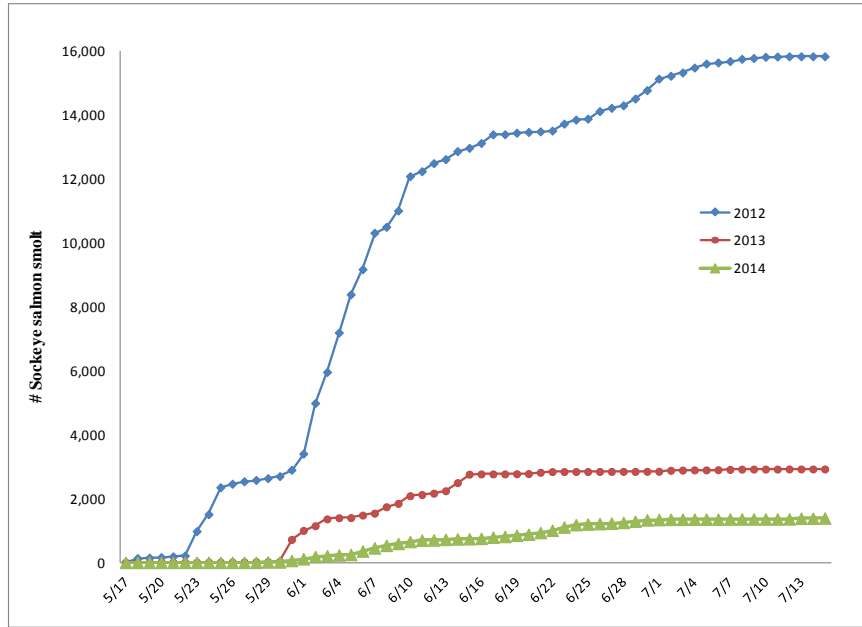


Figure 5: Whiskey Lake Cumulative Sockeye Salmon Smolt Migration for 2012, 2013, and 2014.

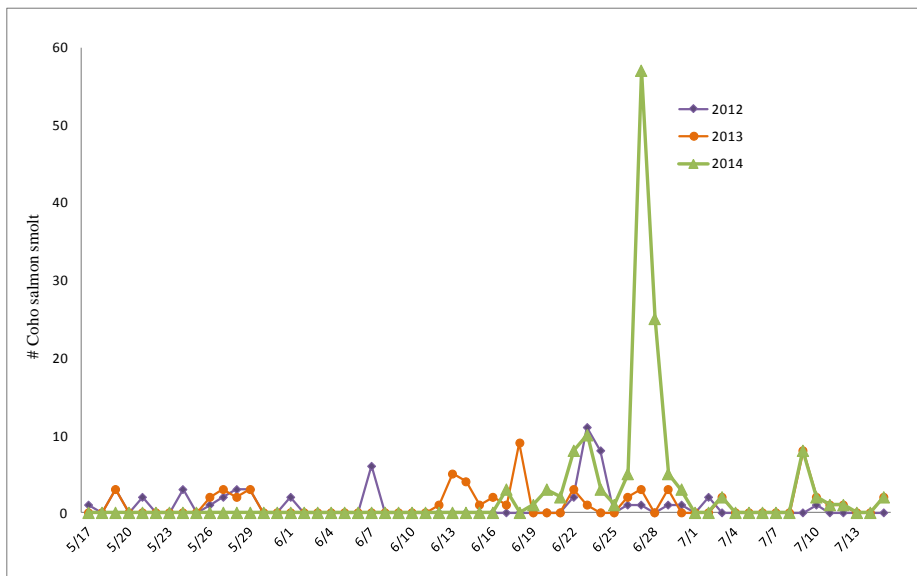


Figure 6: Whiskey Lake Daily Coho Salmon Smolt Migration for 2012, 2013, and 2014.

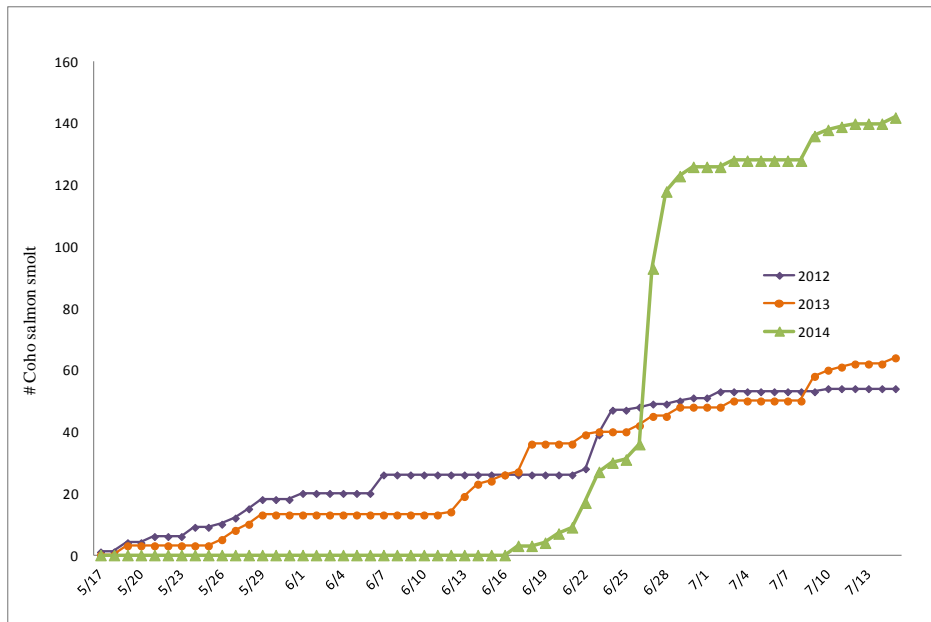


Figure 7: Whiskey Lake Cumulative Coho Salmon Smolt Migration for 2012, 2013, and 2014.

RECOMMENDATIONS

The collection of additional information on Whiskey Lake's fish populations is critical to understanding the population dynamics of this important salmon producing system. It is recommended that monitoring of the salmon smolt migration from Whiskey Lake continue on an annual basis. This will provide valuable information for assessing future changes in salmon production. Northern pike removal began in 2014 in Whiskey Lake and subsequent smolt monitoring will provide data to assess the effectiveness of removing the pike.

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LITERATURE CITED

CIAA, 2013. Whiskey Lake Smolt Procedures Manual. Cook Inlet Aquaculture Association.

Southcentral Alaska Northern Pike Control Committee. 2007. Management Plan for Invasive Northern Pike in Alaska. Alaska Department of Fish and Game. 62 pp.

Spafard, M.A., and J.A. Edmundson. 2000. A Morphometric Atlas of Alaskan Lakes: Cook Inlet, Prince William Sound, and Bristol Bay Areas. Alaska Department of Fish and Game Regional Information Report. 2A00-23: 24.

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APPENDICES

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Appendix 1: Whiskey Lake 2012 Environmental Conditions

Date	Sky	Precip. (mm)	Stage (ft)	Water Temp. (°C)	Air Temp. (°C)
5/17/2012)	0	ND	ND	ND
5/18/2012	1	0	ND	8	14
5/19/2012	4	0	0	8	14
5/20/2012	3	0	0.7	8	11
5/21/2012	4	0	0.9	12	18
5/22/2012	3	0	1.4	12	14
5/23/2012	4	0	1.8	16	19
5/24/2012	3	0	1.9	14	13
5/25/2012	3	10	2.1	14	15
5/26/2012	4	0	2.3	14	17
5/27/2012	2	5	1.7	13	14
5/28/2012	3	0	1.9	15	15
5/29/2012	2	3	1.6	15	14
5/30/2012	4	0	1.6	14	12
5/31/2012	4	3	1.9	15	13
6/1/2012	2	0	1.5	16	16
6/2/2012	3	1	1.5	17	21
6/3/2012	4	0	1.4	16	18
6/4/2012	4	8	1.9	16	13
6/5/2012	2	0	1.7	16	17
6/6/2012	2	0	1.4	15	16
6/7/2012	1	0	1.5	16	18
6/8/2012	4	1	1.4	16	15
6/9/2012	4	5	1.6	16	16
6/10/2012	4	2	1.6	16	14
6/11/2012	3	3	1.4	17	16
6/12/2012	4	6	1.4	15	12
6/13/2012	3	4	1.4	16	16
6/14/2012	3	0	1.4	16	14
6/15/2012	3	0	1.0	16	18
6/16/2012	3	0	1.2	17	18
6/17/2012	2	0	0.9	18	22
6/18/2012	2	0	0.9	19	22
6/19/2012	2	0	0.7	20	23
6/20/2012	2	0	0.6	19	22
6/21/2012	1	0	0.4	22	24
6/22/2012	1	0	0.4	22	24
6/23/2012	4	0	0.4	20	17
6/24/2012	4	0	0.4	20	14
6/25/2012	4	0	ND	19	20
6/26/2012	4	0	0.4	14	15
6/27/2012	3	0	0.4	18	19
6/28/2012	4	0	1.1	18	18
6/29/2012	3	0	0.1	19	19
6/30/2012	3	0	0.0	18	17
7/1/2012	1	0	0.0	20	23
7/2/2012	4	0	-0.1	20	21
7/3/2012	5	0	-0.3	17	17
7/4/2012	5	0	-0.2	17	16
7/5/2012	4	0	-0.1	18	18
7/6/2012	3	0	-0.8	20	22
7/7/2012	5	0	-0.9	19	18
7/8/2012	1	0	-0.3	17	11
7/9/2012	4	0	-0.5	19	19
7/10/2012	3	0	-0.5	17	17
7/11/2012	3	0	-0.6	17	15
7/12/2012	4	0	-0.6	18	18
Total		49			
Avg.	3	1	0.8	16	17
Min.	1	0	-0.9	8	11
Max.	5	10	2.3	22	24

* - Does not reflect actual depth, only water level fluctuation.

Summary of Cloud Cover - Percent of Days				
No. Days	Clear	Partly Cloudy	Overcast	Rain
56	11%	46%	38%	5%

ND = No Data

- 1 = Clear
- 2 = Cloud Cover <50%
- 3 = Cloud Cover >50%
- 4 = Overcast
- 5 = Rain

Appendix 2: Whiskey Lake 2013 Environmental Conditions

Date	Sky	Precip. (mm)	Stage* (ft)	Water Temp. (°C)	Air Temp. (°C)
5/19/2013	2	0	0	5	9
5/20/2013	2	0	0	5	10
5/21/2013	1	0	0	5	12
5/22/2013	1	0	0	6	15
5/23/2013	1	0	0	6	19
5/24/2013	1	0	0.1	7	20
5/25/2013	1	0	0.1	7	21
5/26/2013	1	0	0.1	8	21
5/27/2013	2	0	0.2	9	23
5/28/2013	1	0	0.2	10	22
5/29/2013	1	0	0.2	10	23
5/30/2013	2	0	0.2	10	21
5/31/2013	2	0	0.2	10	20
6/1/2013	2	0	0.2	11	18
6/2/2013	4	5	0.2	12	15
6/3/2013	3	0	0.2	12	16
6/4/2013	3	0	0.3	13	16
6/5/2013	2	0	0.3	13	18
6/6/2013	1	0	0.2	13	20
6/7/2013	2	0	0.2	15	23
6/8/2013	2	0	0.3	16	21
6/9/2013	2	0	0.2	17	22
6/10/2013	3	0	0.2	17	22
6/11/2013	2	0	0.3	16	23
6/12/2013	2	0	0.3	16	24
6/13/2013	1	0	0.2	18	22
6/14/2013	2	0	0.2	18	21
6/15/2013	2	0	0.2	19	21
6/16/2013	2	0	0.2	21	27
6/17/2013	2	0	0.2	20	31
6/18/2013	3	0	0.2	21	27
6/19/2013	3	0	0.2	21	27
6/20/2013	2	0	0.1	21	24
6/21/2013	3	0	0.1	20	21
6/22/2013	3	0	0.1	20	17
6/23/2013	3	0	0.1	21	19
6/24/2013	2	0	0.1	21	22
6/25/2013	5	0	0.1	20	19
6/26/2013	1	0	0.1	20	22
6/27/2013	1	0	0.1	21	24
6/28/2013	4	0	0.1	21	17
6/29/2013	3	0	0.2	21	13
6/30/2013	4	0	0.2	20	12
7/1/2013	5	1	0.2	20	12
7/2/2013	5	2	0.2	21	12
7/3/2013	5	1	0.2	20	11
7/4/2013	5	6	0.2	20	11
7/5/2013	5	6	0.2	20	12
7/6/2013	5	8	0.2	20	10
7/7/2013	5	8	0.2	20	13
7/8/2013	5	8	0.2	16	15
7/9/2013	5	10	0.3	16	11
7/10/2013	3	3	0.3	18	11
7/11/2013	2	0	0.3	18	17
7/12/2013	2	2	0.3	19	17
7/13/2013	1	0	0.3	18	21
7/14/2013	1	0	0.3	18	26
7/15/2013	4	0	0.2	18	22
Total		60			
Avg.	3	1	0.2	16	19
Min.	1	0	0.0	5	9
Max.	5	10	0.3	21	31

* - Does not reflect actual depth, only water level fluctuation.

Summary of Cloud Cover - Percent of Days

No. Days	Clear	Partly Cloudy	Overcast	Rain
58	24%	52%	7%	17%

- 1 = Clear
- 2 = Cloud Cover <50%
- 3 = Cloud Cover >50%
- 4 = Overcast
- 5 = Rain

Appendix 3: Whiskey Lake 2014 Environmental Conditions

Date	Sky	Precip. (mm)	Stage* (ft)	Water Temp. (°C)	Air Temp. (°C)
5/20/2014	1	0.0	0.0	nd	nd
5/21/2014	3	0.0	0.0	nd	nd
5/22/2014	3	0.0	0.0	11	nd
5/23/2014	2	0.0	0.0	11	nd
5/24/2014	3	0.0	0.0	12	nd
5/25/2014	4	0.0	0.0	12	nd
5/26/2014	4	0.0	0.0	12	nd
5/27/2014	5	6.0	0.0	12	nd
5/28/2014	5	8.0	0.0	12	nd
5/29/2014	5	6.0	0.1	12	nd
5/30/2014	5	21.0	0.3	12	nd
5/31/2014	4	8.5	0.2	11	nd
6/1/2014	4	13.5	0.2	11	nd
6/2/2014	2	6.0	0.3	12	nd
6/3/2014	1	0.0	0.2	14	nd
6/4/2014	2	0.0	0.2	13	nd
6/5/2014	2	0.0	0.1	13	nd
6/6/2014	2	0.0	0.1	15	nd
6/7/2014	2	0.3	0.1	17	nd
6/8/2014	3	0.0	0.1	16	nd
6/9/2014	3	0.5	0.1	15	nd
6/10/2014	3	1.3	0.1	12	nd
6/11/2014	2	2.3	0.1	14	nd
6/12/2014	5	0.9	0.1	14	11
6/13/2014	4	3.8	0.1	15	12
6/14/2014	5	0.5	0.1	16	12
6/15/2014	4	4.3	0.1	15	12
6/16/2014	5	7.0	0.1	15	9
6/17/2014	2	2.8	0.1	15	12
6/18/2014	4	1.9	0.1	14	11
6/19/2014	4	0.0	0.1	16	15
6/20/2014	1	3.3	0.1	17	16
6/21/2014	5	13.0	0.1	15	8
6/22/2014	2	12.5	0.1	15	11
6/23/2014	3	0.5	0.2	15	14
6/24/2014	3	0.0	0.1	15	17
6/25/2014	5	2.5	0.1	15	9
6/26/2014	5	46.5	0.3	15	9
6/27/2014	3	14.6	0.4	16	13
6/28/2014	1	0.8	0.3	17	19
6/29/2014	4	1.5	0.3	16	18
6/30/2014	2	0.0	0.2	17	17
7/1/2014	3	0.0	0.2	17	16
7/2/2014	2	0.0	0.2	20	21
7/3/2014	1	0.0	0.2	21	16
7/4/2014	1	0.0	0.1	21	21
7/5/2014	1	0.0	0.1	21	21
7/6/2014	4	4.5	0.1	20	14
7/7/2014	3	7.8	0.2	19	17
7/8/2014	2	0.8	0.1	20	17
7/9/2014	5	4.5	0.1	18	12
7/10/2014	5	22.0	0.2	18	12
7/11/2014	5	10.0	0.2	18	13
7/12/2014	3	3.5	0.2	18	14
7/13/2014	2	0.0	0.2	17	16
7/14/2014	4	0.0	0.2	17	15
7/15/2014	4	0.7	0.1	18	17
7/16/2014	3	0.0	0.1	18	17
7/17/2014	2	0.0	0.1	18	16
7/18/2014	4	0.6	0.1	18	14
7/19/2014	5	16.0	0.2	16	9
7/20/2014	1	2.7	0.2	18	16
Total		262			
Avg.	3	4	0.1	16	14
Min.	1	0	0.0	11	8
Max.	5	47	0.4	21	21

* - Does not reflect actual depth, only water level fluctuation.
 nd= no data was recorded for that day

Summary of Cloud Cover - Percent of Days

No. Days	Clear	Partly Cloudy	Overcast	Rain
62	13%	44%	21%	23%

- 1 = Clear
- 2 = Cloud Cover <50%
- 3 = Cloud Cover >50%
- 4 = Overcast
- 5 = Rain

Appendix 4: Whiskey Lake 2012 Daily Smolt Migration

Date	Sockeye		Coho		Chinook		Pink		Chum		Rainbow	
	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total
17-May	19	19	1	1	0	0	0	0	0	0	0	0
18-May	115	134	0	1	0	0	0	0	0	0	0	0
19-May	13	147	3	4	0	0	0	0	0	0	0	0
20-May	18	165	0	4	0	0	0	0	0	0	0	0
21-May	23	188	2	6	0	0	0	0	0	0	0	0
22-May	24	212	0	6	0	0	0	0	0	0	0	0
23-May	766	978	0	6	0	0	0	0	0	0	0	0
24-May	529	1,507	3	9	0	0	0	0	0	0	0	0
25-May	843	2,350	0	9	0	0	0	0	0	0	0	0
26-May	110	2,460	1	10	0	0	0	0	0	0	0	0
27-May	76	2,536	2	12	2	2	0	0	0	0	0	0
28-May	42	2,578	3	15	1	3	0	0	0	0	0	0
29-May	56	2,634	3	18	1	4	0	0	0	0	0	0
30-May	65	2,699	0	18	1	5	0	0	0	0	0	0
31-May	196	2,895	0	18	1	6	0	0	0	0	0	0
1-Jun	508	3,403	2	20	5	11	0	0	0	0	0	0
2-Jun	1,581	4,984	0	20	0	11	0	0	1	1	0	0
3-Jun	973	5,957	0	20	0	11	0	0	0	1	0	0
4-Jun	1,235	7,192	0	20	0	11	17	17	0	1	0	0
5-Jun	1,194	8,386	0	20	0	11	4	21	0	1	0	0
6-Jun	785	9,171	0	20	0	11	11	32	0	1	0	0
7-Jun	1,140	10,311	6	26	0	11	14	46	0	1	0	0
8-Jun	186	10,497	0	26	0	11	9	55	0	1	0	0
9-Jun	509	11,006	0	26	0	11	8	63	0	1	0	0
10-Jun	1,076	12,082	0	26	0	11	8	71	0	1	0	0
11-Jun	154	12,236	0	26	0	11	1	72	0	1	0	0
12-Jun	253	12,489	0	26	0	11	4	76	0	1	0	0
13-Jun	125	12,614	0	26	0	11	1	77	0	1	0	0
14-Jun	251	12,865	0	26	0	11	1	78	0	1	0	0
15-Jun	103	12,968	0	26	0	11	4	82	0	1	0	0
16-Jun	151	13,119	0	26	0	11	0	82	0	1	0	0
17-Jun	271	13,390	0	26	0	11	0	82	0	1	0	0
18-Jun	2	13,392	0	26	0	11	0	82	0	1	0	0
19-Jun	48	13,440	0	26	0	11	0	82	0	1	0	0
20-Jun	24	13,464	0	26	0	11	0	82	0	1	0	0
21-Jun	19	13,483	0	26	0	11	0	82	0	1	0	0
22-Jun	25	13,508	2	28	3	14	0	82	0	1	0	0
23-Jun	217	13,725	11	39	0	14	0	82	0	1	0	0
24-Jun	126	13,851	8	47	0	14	0	82	0	1	0	0
25-Jun	30	13,881	0	47	0	14	0	82	0	1	0	0
26-Jun	235	14,116	1	48	0	14	0	82	0	1	0	0
27-Jun	103	14,219	1	49	1	15	0	82	0	1	0	0
28-Jun	78	14,297	0	49	0	15	0	82	0	1	0	0
29-Jun	213	14,510	1	50	0	15	0	82	0	1	0	0
30-Jun	262	14,772	1	51	0	15	0	82	0	1	0	0
1-Jul	361	15,133	0	51	0	15	0	82	0	1	0	0
2-Jul	89	15,222	2	53	0	15	0	82	0	1	0	0
3-Jul	102	15,324	0	53	0	15	0	82	0	1	0	0
4-Jul	155	15,479	0	53	0	15	0	82	0	1	0	0
5-Jul	125	15,604	0	53	0	15	0	82	0	1	0	0
6-Jul	36	15,640	0	53	0	15	0	82	0	1	0	0
7-Jul	41	15,681	0	53	0	15	0	82	0	1	0	0
8-Jul	71	15,752	0	53	0	15	0	82	0	1	0	0
9-Jul	26	15,778	0	53	0	15	0	82	0	1	0	0
10-Jul	37	15,815	1	54	0	15	0	82	0	1	0	0
11-Jul	9	15,824	0	54	0	15	0	82	0	1	0	0
12-Jul	6	15,830	0	54	0	15	0	82	0	1	0	0
13-Jul	2	15,832	0	54	0	15	0	82	0	1	0	0
Total		15,832		54		15		82		1		0

Appendix 5: Whiskey Lake 2013 Daily Smolt Migration

Date	Sockeye		Coho		Chinook		Pink		Chum		Rainbow	
	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total
19-May	8	8	3	3	0	0	0	0	0	0	0	0
20-May	1	9	0	3	0	0	0	0	0	0	0	0
21-May	0	9	0	3	0	0	0	0	0	0	0	0
22-May	0	9	0	3	0	0	0	0	0	0	0	0
23-May	0	9	0	3	0	0	0	0	0	0	0	0
24-May	1	10	0	3	0	0	0	0	0	0	0	0
25-May	2	12	0	3	0	0	0	0	0	0	0	0
26-May	2	14	2	5	0	0	0	0	0	0	0	0
27-May	2	16	3	8	0	0	0	0	0	0	0	0
28-May	5	21	2	10	0	0	0	0	0	0	0	0
29-May	4	25	3	13	0	0	0	0	0	0	0	0
30-May	7	32	0	13	0	0	0	0	0	0	0	0
31-May	686	718	0	13	0	0	0	0	0	0	0	0
1-Jun	282	1,000	0	13	0	0	0	0	0	0	0	0
2-Jun	146	1,146	0	13	0	0	0	0	0	0	0	0
3-Jun	214	1,360	0	13	0	0	0	0	0	0	0	0
4-Jun	36	1,396	0	13	0	0	0	0	0	0	0	0
5-Jun	4	1,400	0	13	0	0	0	0	0	0	0	0
6-Jun	79	1,479	0	13	0	0	0	0	0	0	0	0
7-Jun	61	1,540	0	13	0	0	0	0	0	0	0	0
8-Jun	200	1,740	0	13	0	0	0	0	0	0	0	0
9-Jun	106	1,846	0	13	0	0	0	0	0	0	0	0
10-Jun	240	2,086	0	13	0	0	0	0	0	0	0	0
11-Jun	37	2,123	0	13	0	0	0	0	0	0	0	0
12-Jun	42	2,165	1	14	0	0	0	0	0	0	0	0
13-Jun	75	2,240	5	19	0	0	0	0	0	0	0	0
14-Jun	254	2,494	4	23	0	0	0	0	0	0	0	0
15-Jun	265	2,759	1	24	0	0	0	0	0	0	0	0
16-Jun	8	2,767	2	26	0	0	0	0	0	0	0	0
17-Jun	0	2,767	1	27	0	0	0	0	0	0	0	0
18-Jun	0	2,767	9	36	0	0	0	0	0	0	0	0
19-Jun	6	2,773	0	36	0	0	0	0	0	0	0	0
20-Jun	5	2,778	0	36	0	0	0	0	0	0	0	0
21-Jun	40	2,818	0	36	0	0	0	0	0	0	0	0
22-Jun	22	2,840	3	39	0	0	0	0	0	0	0	0
23-Jun	1	2,841	1	40	0	0	0	0	0	0	0	0
24-Jun	1	2,842	0	40	0	0	0	0	0	0	0	0
25-Jun	0	2,842	0	40	0	0	0	0	0	0	0	0
26-Jun	2	2,844	2	42	0	0	0	0	0	0	0	0
27-Jun	1	2,845	3	45	0	0	0	0	0	0	0	0
28-Jun	0	2,845	0	45	0	0	0	0	0	0	0	0
29-Jun	1	2,846	3	48	0	0	0	0	0	0	0	0
30-Jun	2	2,848	0	48	0	0	0	0	0	0	0	0
1-Jul	1	2,849	0	48	0	0	0	0	0	0	0	0
2-Jul	32	2,881	0	48	0	0	0	0	0	0	0	0
3-Jul	6	2,887	2	50	0	0	0	0	0	0	0	0
4-Jul	6	2,893	0	50	0	0	0	0	0	0	0	0
5-Jul	0	2,893	0	50	0	0	0	0	0	0	0	0
6-Jul	6	2,899	0	50	0	0	0	0	0	0	0	0
7-Jul	9	2,908	0	50	0	0	0	0	0	0	0	0
8-Jul	8	2,916	0	50	0	0	0	0	0	0	0	0
9-Jul	3	2,919	8	58	0	0	0	0	0	0	0	0
10-Jul	0	2,919	2	60	0	0	0	0	0	0	0	0
11-Jul	0	2,919	1	61	0	0	0	0	0	0	0	0
12-Jul	3	2,922	1	62	0	0	0	0	0	0	0	0
13-Jul	0	2,922	0	62	0	0	0	0	0	0	0	0
14-Jul	0	2,922	0	62	0	0	0	0	0	0	0	0
15-Jul	0	2,922	2	64	0	0	0	0	0	0	0	0
Total		2,922		64		0		0		0		0

Appendix 6: Whiskey Lake 2014 Daily Smolt Migration

Date	Sockeye		Coho		Chinook		Pink		Chum		Rainbow	
	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total
20-May	0	0	0	0	0	0	0	0	0	0	0	0
21-May	1	1	0	0	0	0	0	0	0	0	0	0
22-May	0	1	0	0	0	0	0	0	0	0	0	0
23-May	0	1	0	0	0	0	0	0	0	0	0	0
24-May	0	1	0	0	0	0	0	0	0	0	0	0
25-May	0	1	0	0	0	0	0	0	0	0	0	0
26-May	0	1	0	0	0	0	0	0	0	0	0	0
27-May	0	1	0	0	0	0	0	0	0	0	0	0
28-May	0	1	0	0	0	0	0	0	0	0	0	0
29-May	13	14	0	0	0	0	0	0	0	0	0	0
30-May	0	14	0	0	0	0	0	0	0	0	0	0
31-May	45	59	0	0	0	0	0	0	0	0	0	0
1-Jun	55	114	0	0	0	0	0	0	0	0	0	0
2-Jun	72	186	0	0	0	0	0	0	0	0	0	0
3-Jun	23	209	0	0	0	0	0	0	0	0	0	0
4-Jun	24	233	0	0	0	0	0	0	0	0	0	0
5-Jun	15	248	0	0	0	0	0	0	0	0	0	0
6-Jun	109	357	0	0	0	0	0	0	0	0	0	0
7-Jun	97	454	0	0	0	0	0	0	0	0	0	0
8-Jun	79	533	0	0	0	0	0	0	0	0	0	0
9-Jun	59	592	0	0	0	0	0	0	0	0	0	0
10-Jun	62	654	0	0	0	0	0	0	0	0	0	0
11-Jun	43	697	0	0	0	0	0	0	0	0	0	0
12-Jun	6	703	0	0	0	0	0	0	0	0	0	0
13-Jun	18	721	0	0	0	0	0	0	0	0	0	0
14-Jun	14	735	0	0	0	0	0	0	0	0	0	0
15-Jun	5	740	0	0	0	0	0	0	0	0	0	0
16-Jun	11	751	0	0	0	0	0	0	0	0	0	0
17-Jun	39	790	3	3	0	0	0	0	0	0	0	0
18-Jun	21	811	0	3	0	0	0	0	0	0	0	0
19-Jun	36	847	1	4	0	0	0	0	0	0	0	0
20-Jun	35	882	3	7	0	0	0	0	0	0	0	0
21-Jun	53	935	2	9	0	0	0	0	0	0	0	0
22-Jun	71	1,006	8	17	0	0	0	0	0	0	0	0
23-Jun	101	1,107	10	27	0	0	0	0	0	0	0	0
24-Jun	74	1,181	3	30	0	0	0	0	0	0	0	0
25-Jun	21	1,202	1	31	0	0	0	0	0	0	0	0
26-Jun	10	1,212	5	36	0	0	0	0	0	0	0	0
27-Jun	17	1,229	57	93	0	0	0	0	0	0	0	0
28-Jun	21	1,250	25	118	0	0	0	0	0	0	0	0
29-Jun	38	1,288	5	123	0	0	0	0	0	0	0	0
30-Jun	42	1,330	3	126	0	0	0	0	0	0	0	0
1-Jul	9	1,339	0	126	0	0	0	0	0	0	0	0
2-Jul	8	1,347	0	126	0	0	0	0	0	0	0	0
3-Jul	2	1,349	2	128	0	0	0	0	0	0	0	0
4-Jul	3	1,352	0	128	0	0	0	0	0	0	0	0
5-Jul	0	1,352	0	128	0	0	0	0	0	0	0	0
6-Jul	1	1,353	0	128	0	0	0	0	0	0	0	0
7-Jul	5	1,358	0	128	0	0	0	0	0	0	0	0
8-Jul	1	1,359	0	128	0	0	0	0	0	0	0	0
9-Jul	0	1,359	8	136	0	0	0	0	0	0	0	0
10-Jul	0	1,359	2	138	0	0	0	0	0	0	0	0
11-Jul	0	1,359	1	139	0	0	0	0	0	0	0	0
12-Jul	3	1,362	1	140	0	0	0	0	0	0	0	0
13-Jul	19	1,381	0	140	0	0	0	0	0	0	0	0
14-Jul	1	1,382	0	140	0	0	0	0	0	0	0	0
15-Jul	7	1,389	2	142	0	0	0	0	0	0	0	0
16-Jul	1	1,390	0	142	0	0	0	0	0	0	0	0
17-Jul	2	1,392	0	142	0	0	0	0	0	0	0	0
18-Jul	0	1,392	0	142	0	0	0	0	0	0	0	0
19-Jul	2	1,394	0	142	0	0	0	0	0	0	0	0
20-Jul	1	1,395	0	142	0	0	0	0	0	0	0	0
Total		1,395		142		0		0		0		0

Appendix 7: Whiskey Lake 2014 Hourly Smolt Migration

Date	5am	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm	12am	1am	2am	3am	4am	Total	
5/21/2014													1												1	
5/22/2014																										0
5/23/2014																										0
5/24/2014																										0
5/25/2014																										0
5/26/2014																										0
5/27/2014																										0
5/28/2014																										0
5/29/2014				13																						13
5/30/2014																										0
5/31/2014				34													11									45
6/1/2014				42													13									55
6/2/2014																	72									72
6/3/2014				1						2								20								23
6/4/2014				19													5									24
6/5/2014				14													1									15
6/6/2014				40													69									109
6/7/2014				55													42									97
6/8/2014				13													66									79
6/9/2014				9													50									59
6/10/2014				27													35									62
6/11/2014				1													42									43
6/12/2014				5													1									6
6/13/2014				9													9									18
6/14/2014				8													6									14
6/15/2014																	5									5
6/16/2014				6													2									8
6/17/2014				6													36									42
6/18/2014				12													9									21
6/19/2014				37																						37
6/20/2014				27													11									38
6/21/2014				2													53									55
6/22/2014				12													67									79
6/23/2014				53													58									111
6/24/2014				44													33									77
6/25/2014				22																						22
6/26/2014				12													3									15
6/27/2014				18													56									74
6/28/2014				46													22									68
6/29/2014				22													21									43
6/30/2014				24													21									45
7/1/2014				3													6									9
7/2/2014				1													14									15
7/3/2014				16													55									71
7/4/2014				9													12									21
7/5/2014				3													11									14
7/6/2014				1													7									8
7/7/2014				5																						5
7/8/2014				1																						2
7/9/2014																	1									0
7/10/2014																										0
7/11/2014																										0
7/12/2014				3																						3
7/13/2014				5													14									19
7/14/2014				1													1									2
7/15/2014				2													7									9
7/16/2014																	1									1
7/17/2014																	2									2
7/18/2014																										0
7/19/2014				2																						2
7/20/2014																						1				1

Data represents hourly passages of both coho and sockeye smolt