

**Whiskey Lake
Sockeye Salmon Smolt
Data Report
2012**

**Prepared by:
CIAA Staff
2013**

The Whiskey Lake Project was made possible through an Alaska Sustainable Salmon Fund grant received from the Alaska Department of Fish and Game and the National Oceanic and Atmospheric Administration, and a State of Alaska Designated Legislative Grant.

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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 data report is a synopsis of the monitoring and evaluation studies conducted for Whiskey Lake. This Whiskey Lake Data Report encompasses data collected from the 2012 sockeye salmon smolt migration.

The purpose of the data 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.

The Whiskey Lake Data Report was prepared by CIAA under award of the Alaska Sustainable Salmon Fund (45918) from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, administered by the Alaska Department of Fish and Game (ADF&G). The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, the U.S. Department of Commerce, or ADF&G.

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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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ACKNOWLEDGEMENTS

Many individuals and agencies contributed to the success of the Whiskey Lake Project. Appreciation is extended to Cook Inlet Aquaculture Association interns, seasonal assistants, and full-time staff who invested many hours in planning and executing this project. Special thanks are also extended to the Alaska Department of Fish and Game for the support they provided during this project.

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ABSTRACT

As part of the continued evaluation of lakes in the Susitna River watershed to determine the sockeye salmon (*Onchorhynchus nerka*) abundance in key salmon producing lakes with and without northern pike (*Esox lucius*), Cook Inlet Aquaculture Association (CIAA) and the Alaska Department of Fish and Game (ADF&G) agreed to monitor sockeye salmon smolt migrations from Whiskey Lake. Whiskey Lake was known to have a population of invasive northern pike.

During the 2012 smolt migration, staff monitored environmental conditions at 5:00 PM from 17 May through 12 July. Water levels fluctuated 3.2 ft during that time period. Stream temperatures averaged 16°C (± 3.05) [mean \pm standard deviation] and ranged from 8 to 22°C. Air temperatures averaged 17°C (± 3.33) and ranged from 11 to 24°C. Twelve percent of the days were clear, 46% were partly cloudy, 37% were overcast and 5% had measured rainfall. A total of 49 mm of rain fell during that period.

The smolt migration was enumerated from 17 May through 13 July. During that time, 15,832 sockeye salmon smolt were captured while migrating from Whiskey Lake. Other fish captured during that time were 54 coho salmon smolt (*O. kisutch*), 15 Chinook salmon smolt (*O. tshawytscha*), 82 pink salmon smolt (*O. gorbuscha*), and 1 chum salmon smolt (*O. keta*).

Throughout the migration, staff collected 620 sockeye salmon smolt, and took scale samples, weight and measurements for fork length. Two samples were unreadable for age, so a total of 618 samples were used for analysis. Based on the samples read, there were 3 age classes. Within the sample, age-1 was the most abundant age class (44.7%), followed by age-0 (31.9%), and age-2 (23.5%). The average length of the sampled age-1 sockeye salmon smolt was 85.3 mm (± 1.2) and the average weight was 6.4 g (± 0.2). The average length of the age-0 sockeye salmon smolt was 55.2 mm (± 1.7) and the average weight of was 1.7 g (± 0.1). The average length of the age-2 sockeye salmon smolt was 99.6 mm (± 0.7) and the weight was 10.8 g (± 0.29).

During the same time period, staff also collected 15 coho salmon smolt, took scale samples, weight and measurements for fork length. Although the goal of the project was to sample sockeye salmon, coho salmon were also sampled when present. All samples were readable and used for analysis. Based on the samples read, there were 3 age classes. Within the sample, age-2 was the most abundant age class (46.7%), followed by age-1 (33.3%), and age-3 (20.0%). The average length of the sampled age-2 coho salmon smolt was 97.0 mm (± 3.2) and the average weight was 9.8 g (± 2.3). The average length of the sampled age-1 coho salmon was 74.0 mm (± 10.3) and the average weight was 5.4 g (± 2.0). The average length of the sampled age-3 coho salmon smolt was 121.0 mm (± 13.5) and the average weight was 18.4 g (± 7.2).

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INTRODUCTION AND PURPOSE

To better understand the recent low adult sockeye salmon (*Onchorhynchus nerka*) returns to Upper Cook Inlet, Cook Inlet Aquaculture Association (CIAA), in cooperation with the Alaska Department of Fish and Game (ADF&G), is assessing sockeye salmon populations at several key salmon producing lakes with and without invasive northern pike (*Esox lucius*) in the Susitna River drainage. The overall objective of this effort is to enumerate smolt and adult returns and to assess the characteristics of these populations in terms of age composition, sex, and size. When present, coho salmon were also sampled for age composition, sex, and size. Additionally, for some lake systems, CIAA and/or ADF&G are recording environmental conditions and water quality measurements as well as collecting genetic samples, and performing mark-recapture studies and hydroacoustic surveys. The goal is to collect sound biological data to provide the foundation on which decisions for management and rehabilitation strategies can be made. Understanding the adult-to-juvenile relationship will allow management biologists to analyze and evaluate the production and rearing condition of each lake.

The enumeration of salmon smolt migrations from Whiskey Lake was completed during 2012 to assess juvenile sockeye salmon migrations from the Susitna River drainage. Whiskey Lake was chosen for enumeration because invasive northern pike were present and status of its salmon population was unknown at the time.

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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 the Yentna River.

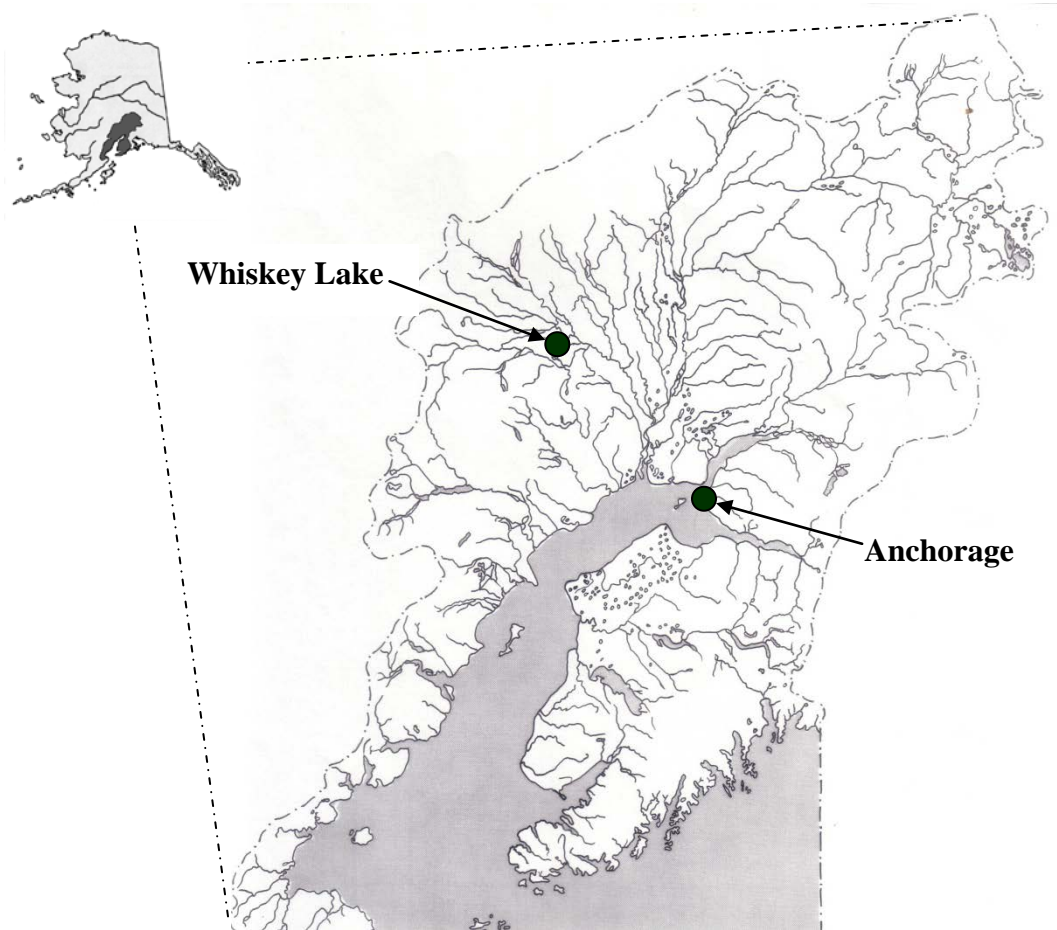


Figure 1: Whiskey Lake in relation to Cook Inlet and Alaska

WHISKEY LAKE

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

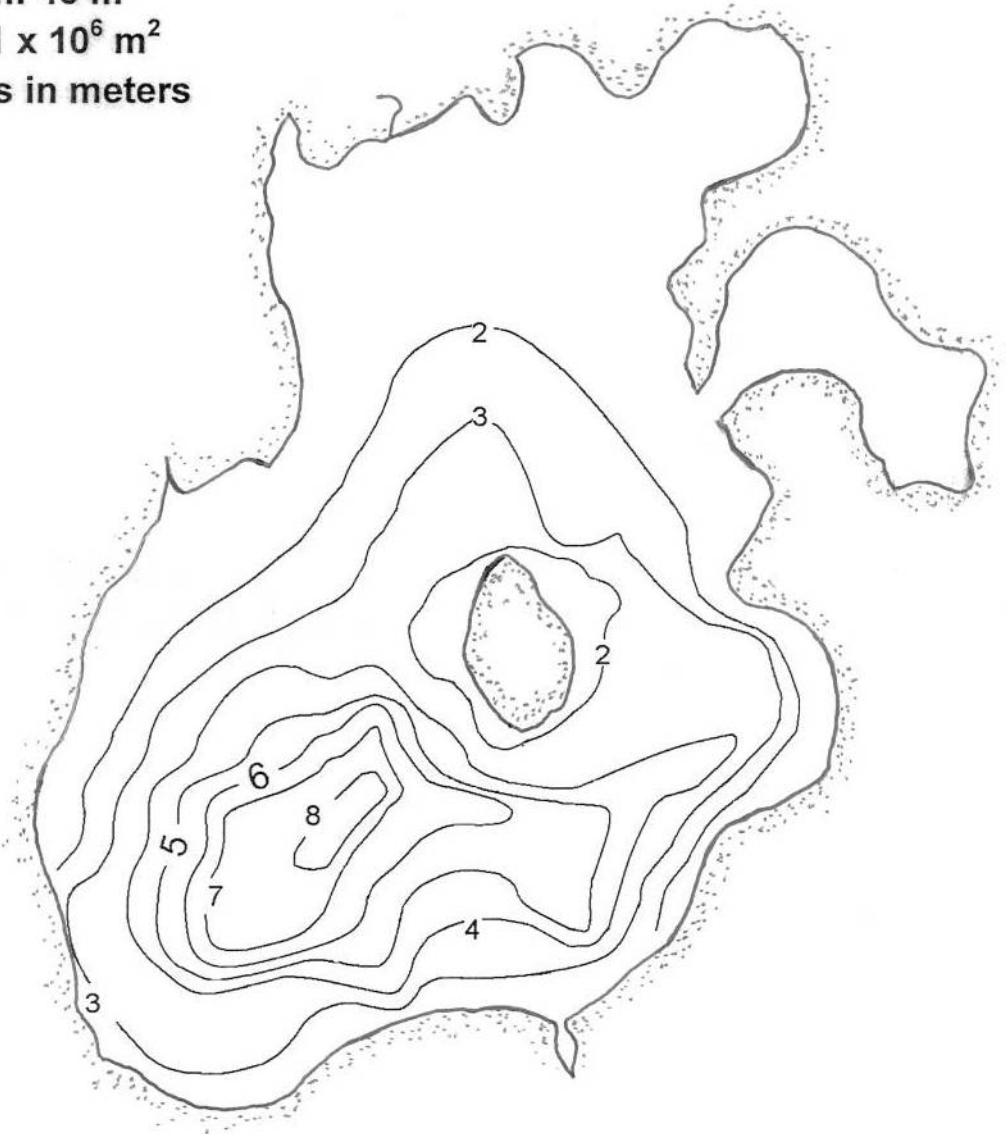


Figure 2: Bathymetric map of Whiskey Lake

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 fluctuation 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, 2012).

Smolt collection

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 that 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 two leads composed of vexar paneling, which were anchored upstream to each bank and functioned by directing smolts into the trap. The use of the vexar paneling enabled staff to sample the entire width of the creek to ensure a total smolt count.

Smolt enumeration and characteristics

Typically, staff checked the trap at least 4 times daily and all smolts were enumerated. Age (scales), weight, and length (AWL) data were from a subsample of the migrating smolts. Random samples (up to n=40 for sockeye salmon, and n=20 for coho salmon) were collected daily. Each smolt collected for evaluation was first anesthetized with MS-222, then fork length¹ measured to the nearest millimeter and weighed to the nearest 0.1 gram. Approximately 10 scales were removed from the primary growth area² and mounted on a glass slide for subsequent age determination. The Whiskey Lake Smolt Procedures Manual (CIAA, 2012) outlines the AWL procedures.

¹ Fork length is defined as the length from the tip of the snout to the fork of the tail.

² Primary growth area is located above the lateral line on a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin.

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RESULTS

Environmental Conditions

During the 2012 smolt migration, staff monitored environmental conditions at 5:00 PM from 17 May through 12 July. Water levels fluctuated 3.2 ft during that time period. Stream temperatures averaged 16°C (± 3.1) [mean \pm standard deviation] and ranged from 8 to 22°C. Air temperatures averaged 17°C (± 3.3) and ranged from 11 to 24°C. Twelve percent of the days were clear, 46% were partly cloudy, 37% were overcast and 5% had measured rainfall. A total of 49 mm of rain fell during that period.

Smolt Enumeration and Characteristics

The smolt migration was enumerated from 17 May through 13 July. During that time, 15,832 sockeye salmon smolt were captured while migrating from Whiskey Lake. Other fish captured during that time were 54 coho salmon smolt (*O. kisutch*), 15 Chinook salmon smolt (*O. tshawytscha*), 82 pink salmon smolt (*O. gorbuscha*), and 1 chum salmon smolt (*O. keta*).

Throughout the migration, staff collected 620 sockeye salmon smolt, and took scale samples, weight, and measurements for fork length. Two samples were unreadable for age, so a total of 618 samples were used for analysis. Based on the samples read, there were 3 age classes. Within the sample, age-1 was the most abundant age class (44.7%), followed by age-0 (31.9%), and age-2 (23.5%). The average length of the sampled age-1 sockeye salmon smolt was 85.3 mm (± 1.2) and the average weight was 6.4 g (± 0.2). The average length of the age-0 sockeye salmon smolt was 55.2 mm (± 1.7) and the average weight of was 1.7 g (± 0.1). The average length of the age-2 sockeye salmon smolt was 99.6 mm (± 0.7) and the weight was 10.8 g (± 0.29) (Table 1).

During the same time period, staff also collected 15 coho salmon smolt, took scale samples, weight, and measurements for fork length. All samples were readable and used for analysis. Based on the samples read, there were 3 age classes. Within the sample, age-2 was the most abundant age class (46.7%), followed by age-1 (33.3%), and age-3 (20.0%). The average length of the sampled age-2 coho salmon smolt was 97.0 mm (± 3.2) and the average weight was 9.8 g (± 2.3). The average length of the sampled age-1 coho salmon was 74.0 mm (± 10.3) and the average weight was 5.4 g (± 2.0). The average length of the sampled age-3 coho salmon smolt was 121.0 mm (± 13.5) and the average weight was 18.4 g (± 7.2) (Table 1).

Table 1: Whiskey Lake 2012 sockeye and coho salmon smolt AWL summary

| | 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 |
| Smolt 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 |
| Coho | NS | NS | 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 |

NS = No Sample

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RECOMMENDATIONS

Whiskey Lake is an important sockeye salmon producing lake in the Susitna River Valley and during the study period (2010–2012) it was one of the few lakes surveyed with a remaining salmon population where invasive northern pike were known to be present. It is important that this lake continue to be monitored for healthy smolt production at least once every five years. The data are important for comparisons between lakes with and without the presence of invasive northern pike.

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LITERATURE CITED

CIAA, 2012. Whiskey Lake Smolt Procedures Manual. Cook Inlet Aquaculture Association.

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

Appendix 1: Whiskey Lake 2012 environmental conditions

| Date | Sky | Precip. (mm) | Stage (ft) | Water Temp. (°C) | Air Temp. (°C) |
|-----------|-----|-----------------|---------------|------------------------|----------------------|
| 5/17/2012 | 1 | 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. | | 1 | 0.8 | 16 | 17 |
| Min. | | 0 | -0.9 | 8 | 11 |
| Max. | | 10 | 2.3 | 22 | 24 |

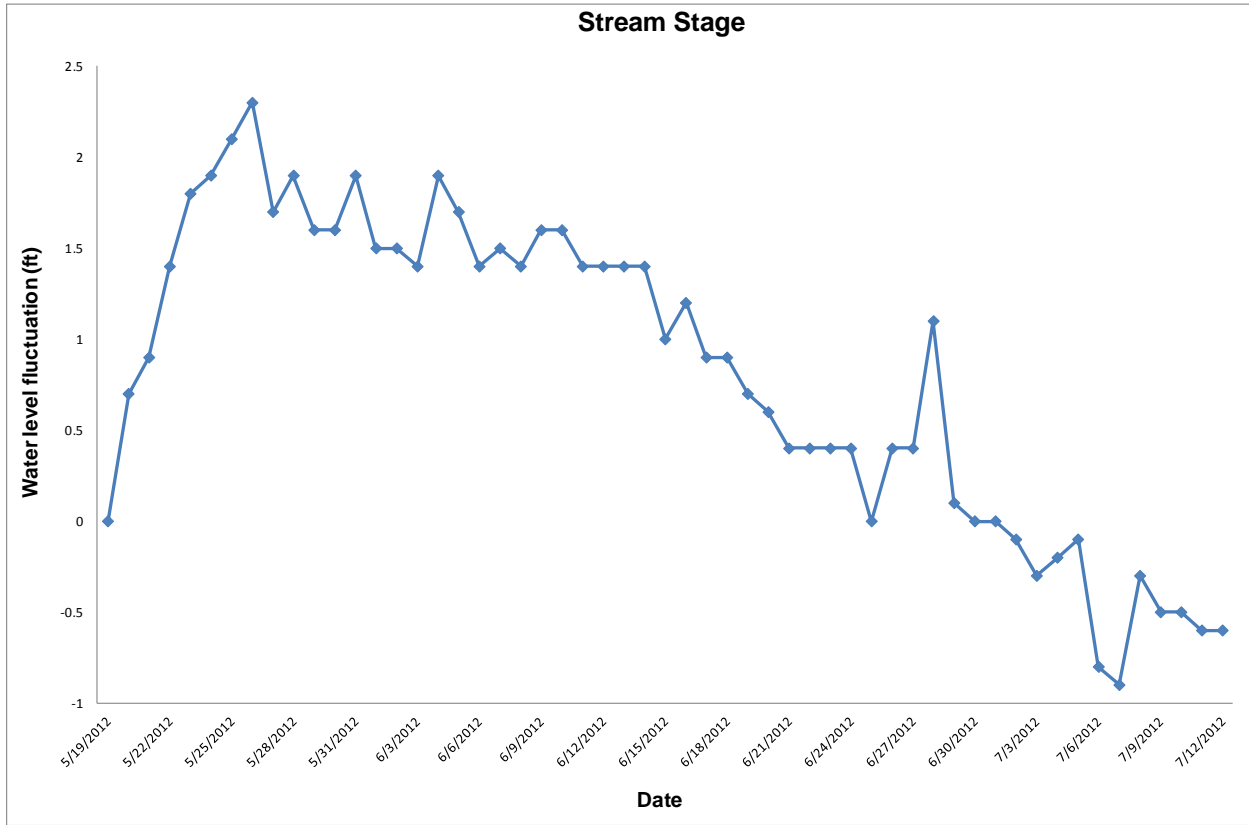
* - Does not reflect actual depth, only water level fluctuation.

| | Summary of Cloud Cover - Percent of Days | | | | |
|-------|--|-------|---------------|----------|------|
| | No. Days | Clear | Partly Cloudy | Overcast | Rain |
| Smolt | 57 | 12% | 46% | 37% | 5% |

ND = No Data

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

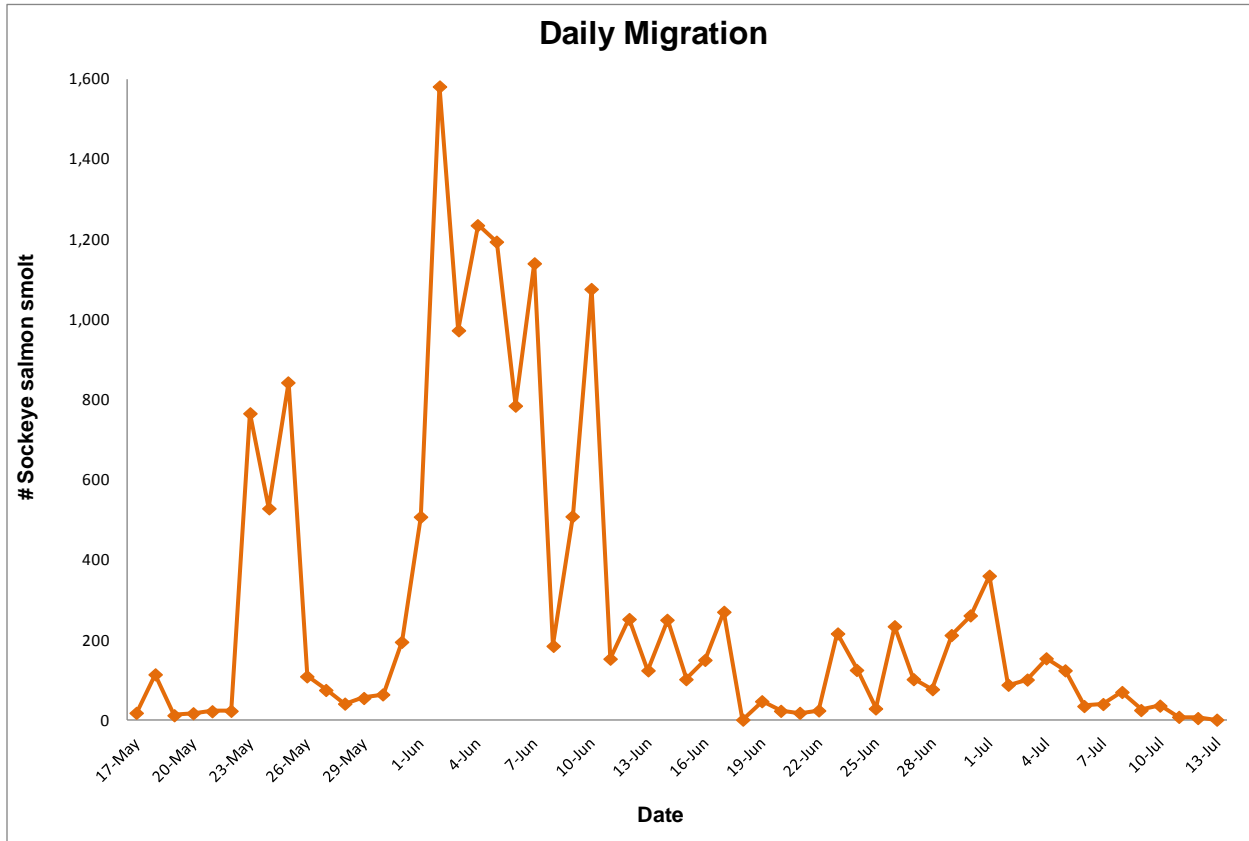
Appendix 2: Whiskey Lake 2012 water level fluctuation



Appendix 3: 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 4: Whiskey Lake 2012 daily smolt migration



Appendix 5: Whiskey Lake 2012 hourly sockeye salmon smolt migration

| | AM | | | | | | PM | | | | | | | | | | | | AM | | | | | |
|-----------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|
| | 6:00 | 7:00 | 8:00 | 9:00 | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00 | 21:00 | 22:00 | 23:00 | 0:00 | 1:00 | 2:00 | 3:00 | 4:00 | 5:00 |
| 5/17/2012 | | | | | | | | | | | 0 | | | 0 | | | | | | | 15 | | | 4 |
| 5/18/2012 | | | | | | 1 | | | | | 0 | | | | 0 | | | 91 | | | 23 | | | |
| 5/19/2012 | | | | | 0 | | | 0 | | | | | | | 1 | | | 5 | | | 7 | | | 0 |
| 5/20/2012 | | | 0 | | | 0 | | | 0 | | | | | | 2 | | | 0 | | | 16 | | | 0 |
| 5/21/2012 | | | | | 0 | | | | | | 0 | | | | 1 | | | 11 | | | 11 | | | 0 |
| 5/22/2012 | | | | | | 0 | | | | | | 2 | | | 0 | | | 0 | | | 22 | | | 0 |
| 5/23/2012 | | | | | | 0 | | | 638 | | | 0 | | | 73 | | | 35 | | | 1 | | | 19 |
| 5/24/2012 | | | | | | | | | | | 7 | | | | 2 | | | 326 | | | 30 | | | 17 |
| 5/25/2012 | | | | | | | 40 | 204 | | | | 467 | | | 97 | | | 14 | | | 10 | | | 11 |
| 5/26/2012 | | | | | | | 25 | | | | | 51 | | | 2 | | | 27 | | | 4 | | | 1 |
| 5/27/2012 | | | | | | | 0 | | | 49 | | | 0 | | 13 | | | 12 | | | 2 | | | 0 |
| 5/28/2012 | | | | | | | 4 | | | | | 11 | | | 14 | | | 11 | | | 2 | | | 0 |
| 5/29/2012 | | | | | | | | 17 | | | | 0 | | | 19 | | | 3 | | | 17 | | | 2 |
| 5/30/2012 | | | | | | | 1 | | | | | 0 | | 39 | 4 | | | 3 | | | 18 | | | |
| 5/31/2012 | | | 65 | | | | | | 29 | | | | 12 | | 27 | | | 28 | | | | | 35 | |
| 6/1/2012 | | | 60 | | | | | | 73 | | | 221 | | | 112 | | | 4 | | | | 38 | | |
| 6/2/2012 | | | 40 | 42 | | | 142 | 618 | | | 291 | | 376 | | 28 | | | 22 | | 23 | | | | |
| 6/3/2012 | | | 40 | | | | 517 | 268 | | | 52 | | | | 64 | | | 6 | | | | | 26 | |
| 6/4/2012 | | | 18 | | | | 124 | 13 | | | | | | | 617 | | | 321 | | | | 94 | | |
| 6/5/2012 | | | 43 | | | | 234 | 369 | | | 151 | | | | 272 | | | 102 | | | | 13 | | |
| 6/6/2012 | | | 99 | | | | 319 | 168 | | | 50 | | | | 38 | | | 56 | | | | 55 | | |
| 6/7/2012 | | | 316 | | | | 111 | 547 | | | | | 37 | | | | | 47 | | | | 16 | | |
| 6/8/2012 | | | 44 | | | | 19 | 26 | | 3 | | | | 12 | | | 9 | | | | | 73 | | |
| 6/9/2012 | | | 90 | | | | | 99 | | 96 | | | | | 89 | | | 82 | | | | 55 | | |
| 6/10/2012 | | | 483 | | 212 | | | 191 | | 27 | | | | | 58 | | | 68 | | 97 | | | | |
| 6/11/2012 | | | 51 | | | 24 | | | | | | | | | 71 | | | 1 | | | | 7 | | |
| 6/12/2012 | | | 29 | | | 4 | | | | | | 18 | | | 127 | | | 22 | | | | 53 | | |
| 6/13/2012 | | | 27 | | | 40 | | | | | | 34 | | | 19 | | | 0 | | 4 | | | | |
| 6/14/2012 | | | 58 | | | 89 | | | | | | 16 | | | 80 | | | 0 | | | | 8 | | |
| 6/15/2012 | | | 1 | | | 5 | | | | | | 75 | | | 18 | | | 2 | | 2 | | | | |
| 6/16/2012 | | | 2 | | | 37 | | | | | | 21 | | | 18 | | | 3 | | 0 | | | | |
| 6/17/2012 | | | 16 | | | 23 | | | 70 | | | 21 | | | 18 | | | 3 | | | | | | |
| 6/18/2012 | | | 0 | | | 0 | | | 129 | | | 96 | | | 2 | | | 5 | | | | 0 | | |
| 6/19/2012 | 0 | | | | | 5 | | | | | | 27 | | | | | 16 | | | | | | | |
| 6/20/2012 | 2 | | | | | | | 8 | | | | 7 | | | 4 | | | 3 | | | | | | |
| 6/21/2012 | 1 | | 7 | | | | 0 | | | | | 5 | | | 0 | | | 6 | | | | | | |
| 6/22/2012 | 0 | | 2 | | | | | | | 12 | | 0 | | | | | 11 | | | | | | | |
| 6/23/2012 | 18 | | 83 | | | | | | 81 | | | 7 | | | | | | 28 | | | | | | |
| 6/24/2012 | 28 | | 18 | | | 44 | | | 7 | | | | | | | | | 29 | | | | | | |
| 6/25/2012 | 12 | | 0 | | | | | | | | | 3 | | | | | | 15 | | | | | | |
| 6/26/2012 | 36 | | | | 99 | | | | | 23 | | | | 3 | | | | 74 | | | | | | |
| 6/27/2012 | 3 | | | | 47 | | | | 47 | | | 20 | | | | | | 26 | | | | | | |
| 6/28/2012 | 46 | | 7 | | | | | | | | | 19 | | | | | | 6 | | | | | | |
| 6/29/2012 | 29 | | 0 | | | | | | 46 | | | | 37 | | | | | 101 | | | | | | |
| 6/30/2012 | 11 | | 0 | | | | | | | | 230 | | | | 14 | | | 7 | | | | | | |
| 7/1/2012 | 6 | | | | | | | | 268 | | | 57 | | | 17 | | | 13 | | | | | | |
| 7/2/2012 | 4 | | | | 9 | | | | 23 | | | | | | 32 | | | 21 | | | | | | |
| 7/3/2012 | 13 | | 7 | | | | | | 10 | | | 34 | | | | | | 40 | | | | | | |
| 7/4/2012 | 19 | | 7 | | | | | | | | | 9 | | | | | | 120 | | | | | | |
| 7/5/2012 | 11 | | 49 | | | | | | | | | 56 | | | | | | 9 | | | | | | |
| 7/6/2012 | 4 | | | | | | | | | | | 13 | | | 3 | | | 0 | | | | | | |
| 7/7/2012 | 9 | | 15 | | | | | | | | | 0 | | | | 5 | | 12 | | | | | | |
| 7/8/2012 | 10 | | | | | | | | | | 15 | | | | | | | 8 | | | | | | |
| 7/9/2012 | 9 | | 2 | | | | | | | | | 15 | | | | | | 0 | | | | | | |
| 7/10/2012 | 5 | | 4 | | | | | | | | | 20 | | | | | | 8 | | | | | | |
| 7/11/2012 | | 0 | | | | | | | | | | 5 | | | | | | 4 | | | | | | |
| 7/12/2012 | | 4 | | | | | | | | | | 0 | | | | | | 2 | | | | | | |
| 7/13/2012 | | 0 | | | | | | | | | | 2 | | | | | | | | | | | | |

Appendix 6: Whiskey Lake 2012 cumulative sockeye salmon smolt migration

