

**Chelatna Lake
Adult Sockeye Salmon
Data Report
2009-2011**

**Prepared by:
CIAA Staff
2012**

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

This page was intentionally left blank

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 Chelatna Lake. This Chelatna Lake Data Report encompasses data collected from the 2009-2011 adult sockeye salmon escapement as it falls under the Alaskan Sustainable Salmon Fund.

The purpose of the data report is to provide a vehicle to distribute the information produced by the monitoring and evaluation studies. Data collected each year are presented with a summary of the information previously collected for comparative purposes. 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 later reports.

The Chelatna Lake Data Report was prepared by CIAA under award of the Alaskan Sustainable Salmon Fund (45888) from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, administered by the Alaska Department of Fish and Game. 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 the Alaska Department of Fish and Game.

The Cook Inlet Aquaculture Association maintains a strong policy of equal employment opportunity for all employees and applicants for employment. We hire, train, promote, and compensate employees without regard for race, color, religion, sex, sexual orientation, national origin, age, marital status, disability or citizenship, as well as other classifications protected by applicable federal, state or local laws.

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.

This page was intentionally left blank

ACKNOWLEDGEMENTS

Many individuals and agencies contributed to the success of the Chelatna 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 over the years. Special thanks are also extended to the Alaska Department of Fish and Game for the support they provided during this project.

This page was intentionally left blank

TABLE OF CONTENTS

DISCLAIMER	iii
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS	vii
LIST OF FIGURES	ix
LIST OF TABLES	xi
LIST OF APPENDICES	xiii
ABSTRACT	xv
INTRODUCTION and PURPOSE	1
PROJECT AREA	3
METHODS	5
Environmental Conditions	5
Weir	5
Adult Enumeration	5
RESULTS	6
Environmental Conditions	7
Adult Enumeration	7
RECOMMENDATIONS	10
LITERATURE CITED	13
APPENDICES	15

This page was intentionally left blank

LIST OF FIGURES

Figure 1: Chelatna Lake in relation to Cook Inlet and Alaska 3
Figure 2: Bathymetric map of Chelatna Lake..... 4

This page was intentionally left blank

LIST OF TABLES

Table 1: Summary of Chelatna Lake sockeye salmon escapement and population characteristics 9

This page was intentionally left blank

LIST OF APPENDICES

Appendix 1: Chelatna Lake 2009 environmental conditions.....	16
Appendix 2: Chelatna Lake 2009 water level fluctuation	17
Appendix 3: Chelatna Lake 2010 environmental conditions.....	18
Appendix 4: Chelatna Lake 2010 water level fluctuation	19
Appendix 5: Chelatna Lake 2011 environmental conditions.....	20
Appendix 6: Chelatna Lake 2011 water level fluctuation	21
Appendix 7: 2009 Chelatna Lake daily adult escapement.....	22
Appendix 8: Chelatna Lake 2009 hourly sockeye escapement	23
Appendix 9: 2010 Chelatna Lake daily adult escapement.....	24
Appendix 10: Chelatna Lake 2010 hourly sockeye escapement	25
Appendix 11: 2011 Chelatna Lake daily adult escapement.....	26
Appendix 12: Chelatna Lake 2011 hourly sockeye escapement	27
Appendix 13: Chelatna Lake daily escapement summary	28
Appendix 14: Chelatna Lake cumulative escapement summary	29
Appendix 15: Chelatna Lake 2009 age, sex, & length composition.....	30
Appendix 16: Chelatna Lake 2010 age, sex, & length composition.....	31
Appendix 17: Chelatna Lake 2011 age, sex, & length composition.....	32

This page was intentionally left blank

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 adult sockeye salmon returns to Chelatna Lake. Chelatna Lake was known to have a population of northern pike.

During the 2009 adult escapement, environmental conditions were monitored from 16 July through 26 August. Water levels fluctuated ± 0.3 feet during that time period. Stream temperatures averaged 15.1°C (± 0.24 SE) and ranged from 12 to 20°C . Air temperatures averaged 14.8°C (± 0.42 SE) and ranged from 10 to 21°C . A total of 188 mm of rain fell during that period.

The adult escapement was enumerated from 15 July through 5 September. During that time, 17,721 adult sockeye salmon returned to Chelatna Lake. Throughout the escapement, 936 adult sockeye salmon were captured, scale samples taken, sexed and measured for mid-eye fork length (MEF) to the nearest millimeter. ADF&G used 553 samples for age (scales), sex, length (ASL) analysis. Forty-six percent were males and 54% were females. The average length of the 256 male sockeye measured was 563mm (± 2 SE). The average length of the female sockeye measured was 548mm (± 2 SE). The average length of both males and females was 555mm (± 1 SE).

Based on the 553 scale samples analyzed, there were 8 age classes. Within the sample, age 1.3 was the most abundant age class (76.32%), followed by age 1.2 (14.47%), ages 0.3 and 1.4 (both 2.71%), age 0.2 (1.63%), age 2.3 (1.27%), age 2.2 (0.72%), and age 1.1 (0.18%).

During the 2010 adult escapement, environmental conditions were monitored from 15 July through 25 August. Water levels fluctuated ± 1.43 feet during that time period. Stream temperatures averaged 12°C (± 0.25 SE) and ranged from 9 to 15°C . Air temperatures averaged 14°C (± 0.61 SE) and ranged from 7 to 22°C . A total of 318 mm of rain fell during that period.

The adult escapement was enumerated from 14 July through 25 August. During that time, 37,734 adult sockeye salmon returned to Chelatna Lake. Throughout the escapement, 1,214 adult sockeye salmon were captured, scale samples taken, sexed and measured for MEF. ADF&G used 567 samples for ASL data analysis. Forty-six percent were males and 54% were females. The average length of the 259 male sockeye was 528 mm (± 2 SE). The average length of the 308 female sockeye was 489 mm (± 1 SE). The average length of both males and females was 524 mm ($\pm 1\%$ SE).

Based on the 567 scale samples analyzed, there were 6 age classes. Within the sample, age 1.2 was the most abundant age class (55.20%), followed by age 1.3 (34.57%), age 0.3 (8.29%), age 2.3 (1.23%), age 2.2 (0.53%), and age 0.2 (0.18%).

During the 2011 adult escapement, environmental conditions were monitored from 14 July through 24 August. Water levels fluctuated ± 2.69 feet during that time period. Stream temperatures averaged 12°C (± 0.30 SE) and ranged from 10 to 16°C . Air temperatures averaged 14°C (± 0.77 SE) and ranged from 5 to 25°C . A total of 342 mm of rain fell during that time period.

The adult escapement was enumerated from 14 July through 23 August. Due to flooding, escapement numbers reported do not reflect call-in data submitted from 3 August through 10 August, since total counts were not possible. Staff on site visually estimated the number of salmon swimming over the weir for 10 randomly selected hours per day. The total number of salmon counted swimming over the weir during this flood period was 5,328. Overall, 65,025 adult sockeye salmon returned to Chelatna Lake. Throughout the escapement, 522 adult sockeye salmon were captured, scale samples taken, sexed and measured for MEF. ADF&G used 500 samples for ASL analysis. Forty-five percent were males and 55% were females. The average length of the 259 male sockeye was 528 mm (± 2 SE). The average length of the 241 female sockeye was 553 mm (± 2 SE). The average length of both males and females was 568 mm (± 2 SE).

Based on the 500 scale samples analyzed, there were 6 age classes. Within the sample, age 1.3 was the most abundant (89.09%), followed by age 1.2 (7.95%), age 0.3 (1.59%), ages 2.2 and 2.3 (both 0.45%), and age 0.2 (0.45%).

INTRODUCTION and PURPOSE

To better understand the recent low adult sockeye salmon (*Oncorhynchus nerka*) returns to Upper Cook Inlet, the 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 northern pike (*Esox lucius*) in the Susitna River drainage. The overall objective of this effort is to enumerate the smolt and adult returns and to assess the characteristics of these populations in terms of age composition, sex and size. Additionally, for some lake systems, environmental conditions and water quality measurements are being collected as well as genetic samples, 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 adult salmon returns to Chelatna Lake was completed all years of a three year effort to enumerate sockeye salmon returns to the Susitna River drainage. Chelatna Lake was chosen for enumeration because it is one of the three main sockeye salmon producing lakes in the Susitna River drainage and invasive northern pike were known to be present.

This page was intentionally left blank

PROJECT AREA

Chelatna Lake is located at the base of the Alaska Range approximately 68 km Northwest of Talkeetna, Alaska (Figure 1). The Lake is located in T27N, R12W, Section 35. The lake lies near Denali National Park between two 1,219 m mountains and has a surface elevation of 422 m. Chelatna Lake has a surface area of 1,581 ha, and drainage area of 1,075 km², a euphotic volume of 155.67×10^6 m³, and total volume of 9.7×10^8 m³. Chelatna Lake has a maximum depth of 125 m, a mean depth of 61 m, and a 27 km shoreline included with a 2.9 ha island (Figure 2). Major tributaries to Chelatna Lake are Coffee Creek and Snowslide Creek. Both are glacier fed and produce the lake's semi-glacial characteristics. The lake's discharge forms Lake Creek, which flows 71 km to the Yentna River. Typical summer flows in Lake Creek range from 300 to 900 cfs, however, spring and fall freshet flows can exceed 900 cfs. Lake Creek typically has semi-clear flow. Turbidity in the creek is dependent on regional weather patterns and their effect on glacial melt at the head of the drainage (Fandrei, 1994).

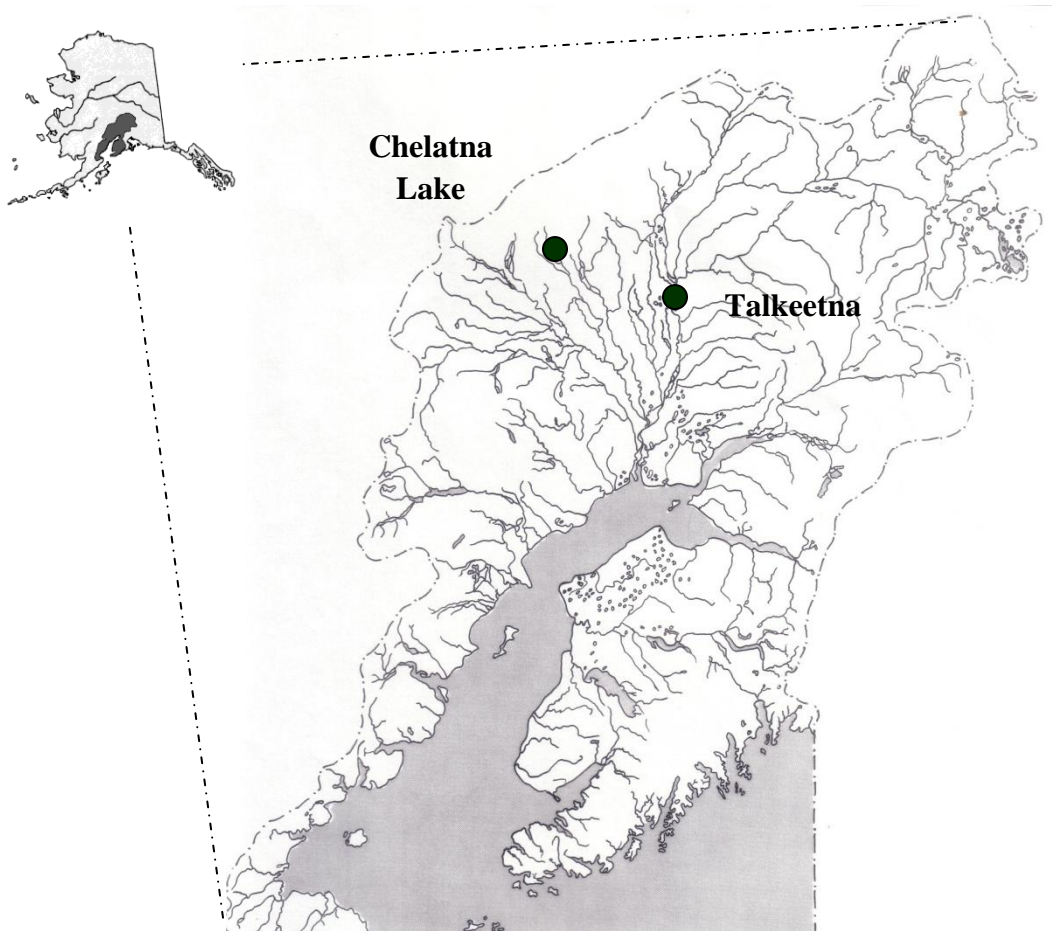


Figure 1: Chelatna Lake in relation to Cook Inlet and Alaska

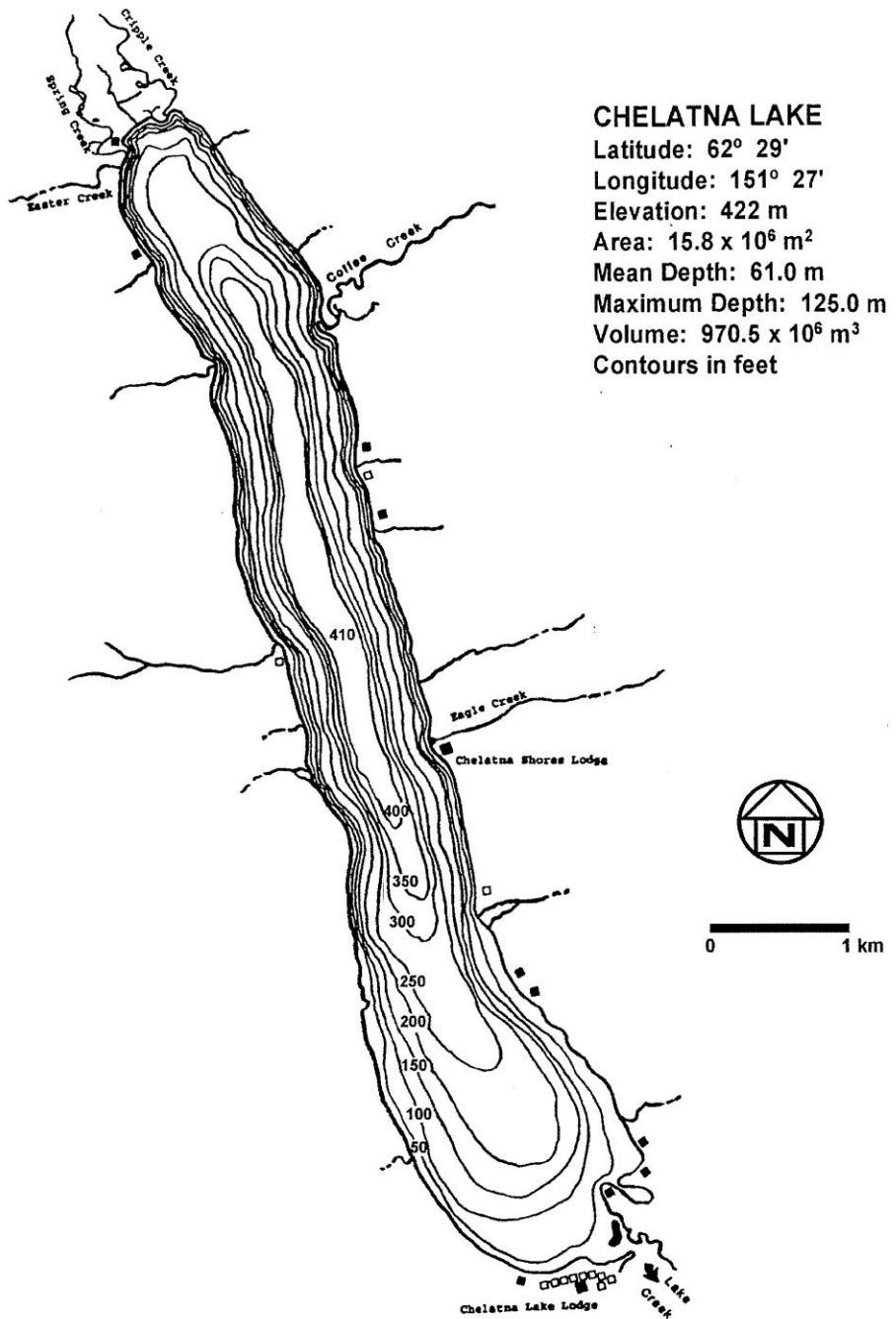


Figure 2: Bathymetric map of Chelatna Lake

METHODS

Environmental Conditions

To assess the environmental conditions during the adult sockeye salmon migration to Chelatna 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 2009, 2010, 2011).

Weir

To enumerate returning adult salmon and facilitate data collection, a floating weir approximately 44 meters wide was temporarily installed across Lake Creek, approximately two miles downstream of the outlet of Chelatna Lake. The floating weir was constructed and installed according to Stewart (2002, 2003) with minor changes in materials used. Approximately 3 meters of fixed weir material were installed on either end of the floating weir to create the fish passages and holding box. The fixed weir was constructed of 1.9 cm galvanized pipe and 7.6 cm aluminum channel. The galvanized pipe was picketed through 1.9 cm holes in the aluminum channel spaced 2.54 cm apart.

Adult Enumeration

Passage counts were conducted periodically during daylight hours. Count schedules varied based on the abundance and behavior of the migrating fish. As the number of adults increased, counts were made more frequently. The only delays of fish passage occurred during age-sex-length (ASL) sampling periods and at nighttime. Some flood periods occurred in which passage counts were not possible. Any escapement during these time periods were estimated and are not reflected in the data reported. Real time count data were posted on the CIAA website.

Age-sex-length data were recorded for adult sockeye by random selection of up to 40 individuals per day. Mid-eye to fork of tail (MEF)¹ length was measured to the nearest millimeter. To determine age, scales were taken from the preferred scale area on the left side of the salmon as described in (Koo 1955). Sex was recorded and the fish was then released upstream of the weir. Scale samples were analyzed by ADF&G.

¹ MEF length is defined as the measurement to the nearest millimeter from the middle of the eye to the fork of the tail

This page was intentionally left blank

RESULTS

Environmental Conditions

During the 2009 adult sockeye salmon escapement, environmental conditions were monitored from 16 July through 26 August. Water levels fluctuated on average 0.16 feet during that time period (as compared to water level recorded on Day 1). Stream temperatures averaged 15°C (± 0.24 SE) and ranged from 12 to 20°C. Air temperatures averaged 15°C (± 0.42 SE) and ranged from 10 to 21°C. No days were clear, 19% were partly cloudy, 29% were mostly cloudy, 33% were completely overcast, and 19% were rainy. Measurable rain was recorded on 34 days of the escapement. A total of 188 mm of rain fell during that period.

During the 2010 adult escapement, environmental conditions were monitored from 15 July through 25 August. Water levels fluctuated on average 0.58 feet during that time period (as compared to water level recorded on Day 1). Stream temperatures averaged 12°C (± 0.25 SE) and ranged from 9 to 15°C. Air temperatures averaged 14°C (± 0.61 SE) and ranged from 7 to 22°C. No days were clear, 14% were partly cloudy, 27% were mostly cloudy, 26% were completely overcast, and 33% were rainy. Measurable rain was recorded on 37 days of the escapement. A total of 318 mm of rain fell during that period.

During the 2011 adult escapement, environmental conditions were monitored from 14 July through 24 August. Water levels fluctuated on average 0.73 feet during that time period (as compared to water level recorded on Day 1). Stream temperatures averaged 12°C (± 0.30 SE) and ranged from 10 to 16°C. Air temperatures averaged 14°C (± 0.77 SE) and ranged from 5 to 25°C. No days were clear, 19% were partly cloudy, 24% were mostly cloudy, 21% were completely overcast, and 36% were rainy. Measurable rain was recorded on 31 days of the escapement. A total of 342 mm of rain fell during that time period.

Adult Enumeration

2009 - The adult escapement was enumerated from 15 July through 5 September. During that time, 17,721 adult sockeye salmon returned to Chelatna Lake. Other fish counted during that time were 385 adult coho salmon (*O. kisutch*), 131 adult king salmon (*O. tshawytscha*), 16 adult pink salmon (*O. gorbuscha*), 8 adult chum salmon (*O. keta*), 658 rainbow trout (*O. mykiss*), and 38 longnose sucker (*Catostomus catostomus*).

Throughout the escapement, 936 adult sockeye salmon were captured, scale samples taken, sexed and measured for MEF to the nearest millimeter. ADF&G used 553 samples ASL analysis. Forty-six percent were males and 54% were females. The average length of the 256 male sockeye measured was 563 mm (± 2 SE). The average length of the female sockeye measured was 548 mm (± 2 SE). The average length of both males and females was 555 mm (± 1 SE).

Based on the 553 scale samples analyzed, there were 8 age classes. Within the sample, age 1.3 was the most abundant age class (76.32%), followed by age 1.2 (14.47%), ages 0.3 and 1.4 (both 2.71%), age 0.2 (1.63%), age 2.3 (1.27%), age 2.2 (0.72%), and age 1.1 (0.18%).

2010 - The adult escapement was enumerated from 14 July through 25 August. During that time, 37,734 adult sockeye salmon returned to Chelatna Lake. Other fish counted during that time were 34 coho salmon, 26 king salmon, 895 pink salmon, 28 chum salmon, and 137 rainbow trout.

Throughout the escapement, 1,214 adult sockeye salmon were captured, scale samples taken, sexed and measured for MEF to the nearest millimeter. ADF&G used 567 samples for ASL data analysis. Forty-six percent were males and 54% were females. The average length of the 259 male sockeye was 528 mm (± 2 SE). The average length of the 308 female sockeye was 489 mm (± 1 SE). The average length of both males and females was 524 mm ($\pm 1\%$ SE).

Based on the 567 scale samples analyzed, there were 6 age classes. Within the sample, age 1.2 was the most abundant age class (55.20%), followed by age 1.3 (34.57%), age 0.3 (8.29%), age 2.3 (1.23%), age 2.2 (0.53%), and age 0.2 (0.18%).

2011 - The adult escapement was enumerated from 14 July through 23 August. Due to a flood event (03 August to 10 August), staff could not perform counts using the established methods. Rather, staff visually estimated the number of salmon swimming over the weir for thirteen randomly selected hours (during the day) on August 3, 4 and 10. No counts could be done between August 5 - 9 due to high water and visibility issues. Based on these hourly counts, the estimated total number of salmon that passed through the weir between 03 August and 10 August was extrapolated to be 5,328. Overall, 65,025 adult sockeye salmon returned to Chelatna Lake. Other fish counted during that time were 18 coho salmon, 7 king salmon, 7 pink salmon, 3 chum salmon, and 4 rainbow trout.

Throughout the escapement, 522 adult sockeye salmon were captured, scale samples taken, sexed and measured for MEF to the nearest millimeter. ADF&G used 500 samples for ASL analysis. Forty-five percent were males and 55% were females. The average length of the 259 male sockeye was 528 mm (± 2 SE). The average length of the 241 female sockeye was 553 mm (± 2 SE). The average length of both males and females was 568 mm (± 2 SE).

Based on the 500 scale samples collected, there were 6 age classes. Within the sample, age 1.3 was the most abundant (89.09%), followed by age 1.2 (7.95%), age 0.3 (1.59%), ages 2.2 and 2.3 (both 0.45%), and age 0.2 (0.45%).

Table 1: Summary of Chelatna Lake sockeye salmon escapement and population characteristics

Year	Escapement	Age Classes													
		0.2		0.3		1.2		1.3		2.2		1.4		2.3	
		(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)
2009	17,721	1.63%	436	2.71%	578	14.47%	484	76.32%	569	0.72%	503	2.71%	590	1.27%	584
2010	37,734	0.18%	519	8.29%	566	55.20%	495	34.57%	559	0.53%	453	0.00%	-	1.23%	566
2011	65,025	0.45%	460	1.59%	579	7.95%	487	89.09%	575	0.45%	513	0.00%	-	0.45%	558
Mean	40,160	0.75%	472	4.20%	574	25.87%	489	66.66%	568	0.57%	490	0.90%	590	0.98%	569
Min	17,721	0.18%	436	1.59%	566	7.95%	484	34.57%	559	0.45%	453	0.00%	590	0.45%	558
Max	65,025	1.63%	519	8.29%	579	55.20%	495	89.09%	575	0.72%	513	2.71%	590	1.27%	584

This page was intentionally left blank

RECOMMENDATIONS

Chelatna Lake is one of the major sockeye salmon producers in the Susitna River drainage. CIAA recommends extending the Chelatna Lake sockeye salmon monitoring study to help ensure managers meet escapement goals. The project should continue to collect data consistent with previous monitoring efforts in order to provide further comparative data.

This page was intentionally left blank

LITERATURE CITED

- CIAA, 2009. Chelatna Lake Adult Procedures Manual. Cook Inlet Aquaculture Association.
- CIAA 2010. Chelatna Lake Adult Procedures Manual. Cook Inlet Aquaculture Association.
- CIAA 2011. Chelatna Lake Adult Procedures Manual. Cook Inlet Aquaculture Association
- Fandrei, Gary. 1994. Chelatna Lake Sockeye Salmon Enhancement Progress Report. Cook Inlet Aquaculture Association. 17-18.
- Koo, T.S.Y. 1955. Biology of the red salmon, *Onchorhynchus nerka* (Walbaum), of Bristol Bay, Alaska as revealed by a study of their scales. Doctoral dissertation, University of Washington, Seattle.
- Stewart, R. 2002. Resistance board weir panel construction manual, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A02-21, Anchorage.
- Stewart, R. 2003. Techniques for installing a resistance board weir. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A03-26, Anchorage.

This page was intentionally left blank

APPENDICES

Appendix 1: Chelatna Lake 2009 environmental conditions

Adult Migration					
Date	Sky	Precip. (mm)	Stage* (ft)	Water Temp. (°C)	Air Temp. (°C)
16-Jul	4	2.5	0	15	16
17-Jul	5	15.5	0.04	15	12
18-Jul	4	11.7	0.15	15	12
19-Jul	3	0.3	0.14	20	17
20-Jul	5	2.0	0.07	15	12
21-Jul	5	13.0	0.11	15	10
22-Jul	4	16.5	0.19	15	12
23-Jul	5	17.8	0.27	15	11
24-Jul	3	3.6	0.3	15	17
25-Jul	3	0.3	0.21	17	21
26-Jul	5	4.8	0.17	15	11
27-Jul	4	5.1	0.17	14	14
28-Jul	4	0.8	0.15	15	17
29-Jul	3	0.0	0.11	17	20
30-Jul	4	0.3	0.11	14	14
31-Jul	4	0.0	0.09	14	13
1-Aug	4	0.4	0.11	14	15
2-Aug	4	1.0	0.1	12	13
3-Aug	3	4.3	0.14	15	15
4-Aug	4	3.3	0.15	14	11
5-Aug	5	15.2	0.21	13	11
6-Aug	3	4.8	0.27	15	18
7-Aug	2	0.8	0.24	14	15
8-Aug	4	0.3	0.18	15	14
9-Aug	4	6.6	0.21	15	12
10-Aug	5	3.6	0.25	14	13
11-Aug	2	2.5	0.24	15	14
12-Aug	3	0.1	0.22	16	19
13-Aug	3	0.0	0.23	15	19
14-Aug	3	2.0	0.23	15	15
15-Aug	3	2.5	0.21	15	17
16-Aug	2	3.3	0.16	15	15
17-Aug	2	4.3	0.18	14	14
18-Aug	3	0.1	0.17	16	17
19-Aug	2	0.0	0.14	16	19
20-Aug	2	0.0	0.12	17	18
21-Aug	4	10.2	0.16	16	14
22-Aug	2	0.0	0.15	16	17
23-Aug	3	0.3	0.13	16	15
24-Aug	2	20.3	0.14	20	15
25-Aug	5	1.3	0.13	12	14
26-Aug	4	6.4	0.11	15	15
Total		188			
Avg.		4.5	0.16	15	15
Min.		0.0	0.00	12	10
Max.		20.3	0.30	20	21

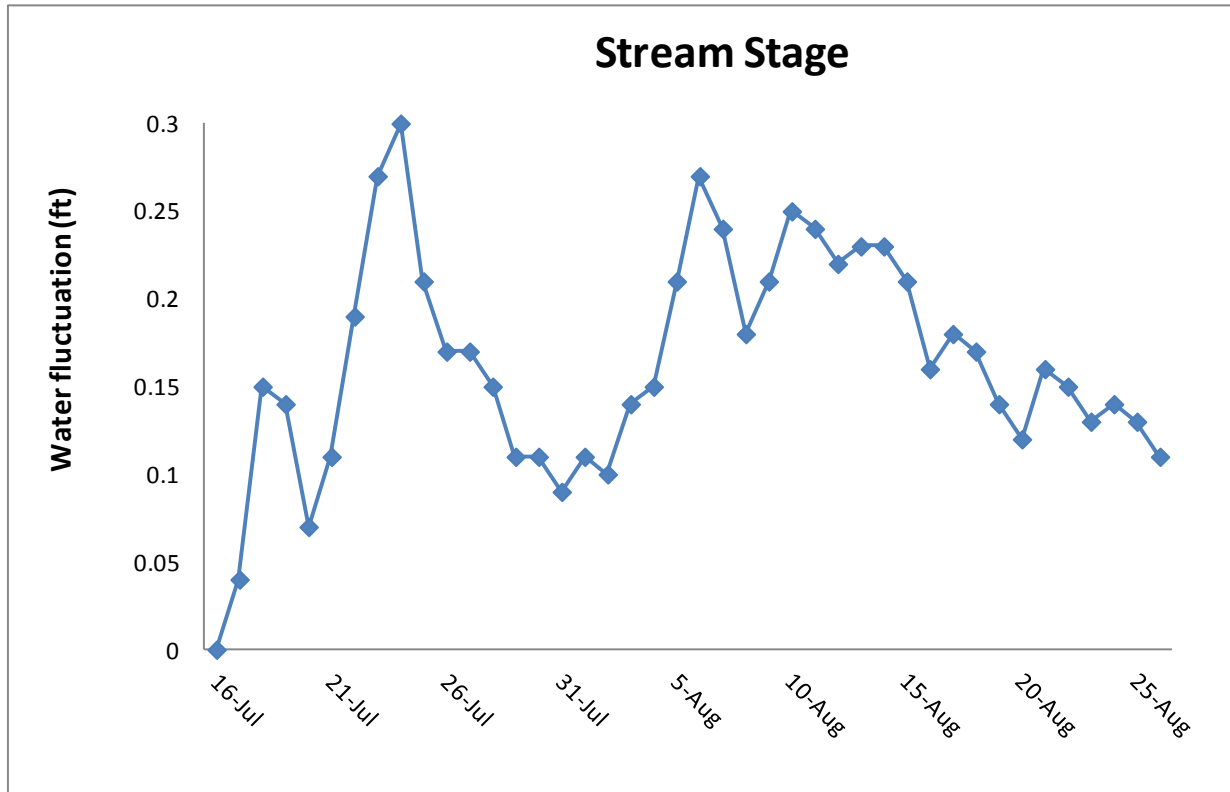
* - Does not reflect actual water depth, only water level fluctuation.

Summary of Cloud Cover - Percent of Days

	No. Days	Overcast	Partly Cloudy	Clear
Adults	42	52%	48%	0%

ND = No Data
 1.0 = Clear
 2.0 = Cloud Cover <50%
 3.0 = Cloud Cover >50%
 4.0 = Overcast
 5.0 = Rain

Appendix 2: Chelatna Lake 2009 water level fluctuation



Appendix 3: Chelatna Lake 2010 environmental conditions

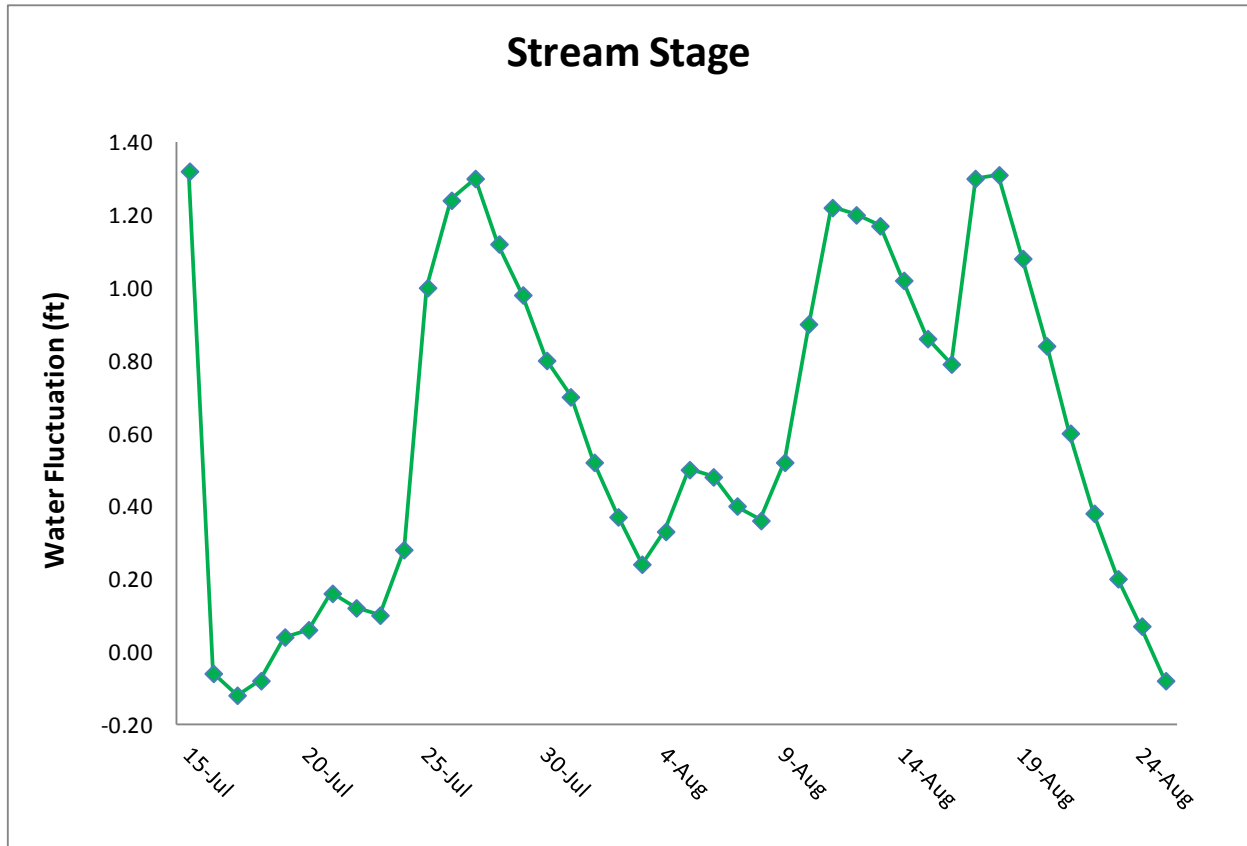
Adult Migration					
Date	Sky	Precip. (mm)	Stage* (ft)	Water Temp. (°C)	Air Temp. (°C)
15-Jul	3	8.6	0.00	13	14
16-Jul	3	0.3	-0.06	13	22
17-Jul	4	0.0	-0.12	12	13
18-Jul	5	20.8	-0.08	11	11
19-Jul	5	14.7	0.04	11	11
20-Jul	5	7.6	0.06	11	10
21-Jul	4	15.2	0.16	11	14
22-Jul	3	2.0	0.12	13	15
23-Jul	4	4.6	0.10	11	13
24-Jul	5	18.8	0.28	10	7
25-Jul	5	19.8	1.00	10	9
26-Jul	5	25.4	1.24	10	10
27-Jul	3	10.7	1.30	10	15
28-Jul	5	7.6	1.12	9	10
29-Jul	5	8.1	0.98	9	12
30-Jul	3	5.1	0.80	11	18
31-Jul	3	4.3	0.70	13	18
1-Aug	4	0.8	0.52	13	16
2-Aug	3	2.8	0.37	13	17
3-Aug	3	0.3	0.24	15	22
4-Aug	5	18.5	0.33	13	14
5-Aug	3	7.6	0.50	15	17
6-Aug	4	1.5	0.48	12	13
7-Aug	4	0.3	0.40	12	11
8-Aug	4	1.8	0.36	13	11
9-Aug	4	18.3	0.52	10	11
10-Aug	5	10.4	0.90	10	10
11-Aug	5	14.7	1.22	9	10
12-Aug	5	9.7	1.20	9	10
13-Aug	4	10.2	1.17	12	16
14-Aug	5	3.8	1.02	10	16
15-Aug	5	0.5	0.86	13	18
16-Aug	4	10.4	0.79	11	10
17-Aug	4	30.5	1.30	11	12
18-Aug	2	0.8	1.31	12	15
19-Aug	2	0.0	1.08	12	18
20-Aug	2	0.0	0.84	12	20
21-Aug	3	0.3	0.60	12	15
22-Aug	3	1.0	0.38	13	18
23-Aug	2	0.0	0.20	14	20
24-Aug	2	0.0	0.07	14	21
25-Aug	2	0.0	-0.08	13	20
Total		318			
Avg.		7.6	0.58	12	14
Min.		0.0	-0.12	9	7
Max.		30.5	1.31	15	22

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

Summary of Cloud Cover - Percent of Days				
	No. Days	Partly		
		Overcast	Cloudy	Clear
Adults	42	60%	40%	0%

1.0 = Clear
 ND = No Data 2.0 = Cloud Cover <50%
 3.0 = Cloud Cover >50%
 4.0 = Overcast
 5.0 = Rain

Appendix 4: Chelatna Lake 2010 water level fluctuation



Appendix 5: Chelatna Lake 2011 environmental conditions

Adult Migration					
Date	Sky	Precip. (mm)	Stage* (ft)	Water Temp. (°C)	Air Temp. (°C)
14-Jul	5	1.3	0.00	14	15
15-Jul	3	3.8	-0.04	16	21
16-Jul	3	0.0	-0.08	15	17
17-Jul	5	7.9	0.01	13	11
18-Jul	5	20.8	0.27	12	12
19-Jul	2	0.8	0.31	14	20
20-Jul	2	0.0	0.21	14	22
21-Jul	2	0.0	0.16	16	21
22-Jul	3	0.0	0.17	16	25
23-Jul	5	6.4	0.20	13	9
24-Jul	5	17.8	0.31	13	12
25-Jul	4	10.9	0.44	13	11
26-Jul	3	0.5	0.46	13	15
27-Jul	2	0.0	0.41	15	20
28-Jul	3	0.0	0.31	15	20
29-Jul	4	0.0	0.21	15	17
30-Jul	4	0.0	0.16	15	18
31-Jul	4	4.6	0.11	14	14
1-Aug	5	20.3	0.30	11	9
2-Aug	5	35.6	1.51	10	9
3-Aug	5	13.2	2.11	10	12
4-Aug	5	20.3	2.11	11	8
5-Aug	5	12.2	2.61	10	8
6-Aug	5	12.7	2.31	10	5
7-Aug	3	33.0	2.21	10	11
8-Aug	5	5.6	2.01	10	7
9-Aug	4	35.6	1.96	10	10
10-Aug	2	0.8	1.61	11	16
11-Aug	2	0.0	1.33	12	21
12-Aug	5	0.0	1.06	12	14
13-Aug	4	1.8	0.81	11	15
14-Aug	3	0.5	0.66	12	15
15-Aug	2	1.3	0.46	13	22
16-Aug	2	0.0	0.36	13	23
17-Aug	3	12.2	0.29	13	15
18-Aug	3	12.2	0.36	12	15
19-Aug	5	6.1	0.33	11	10
20-Aug	4	11.4	0.40	11	12
21-Aug	4	2.3	0.43	11	13
22-Aug	4	2.5	0.39	10	11
23-Aug	5	23.9	0.61	10	11
24-Aug	3	3.6	0.61	11	11
Total		342			
Avg.		8.1	0.73	12	14
Min.		0.0	-0.08	10	5
Max.		35.6	2.61	16	25

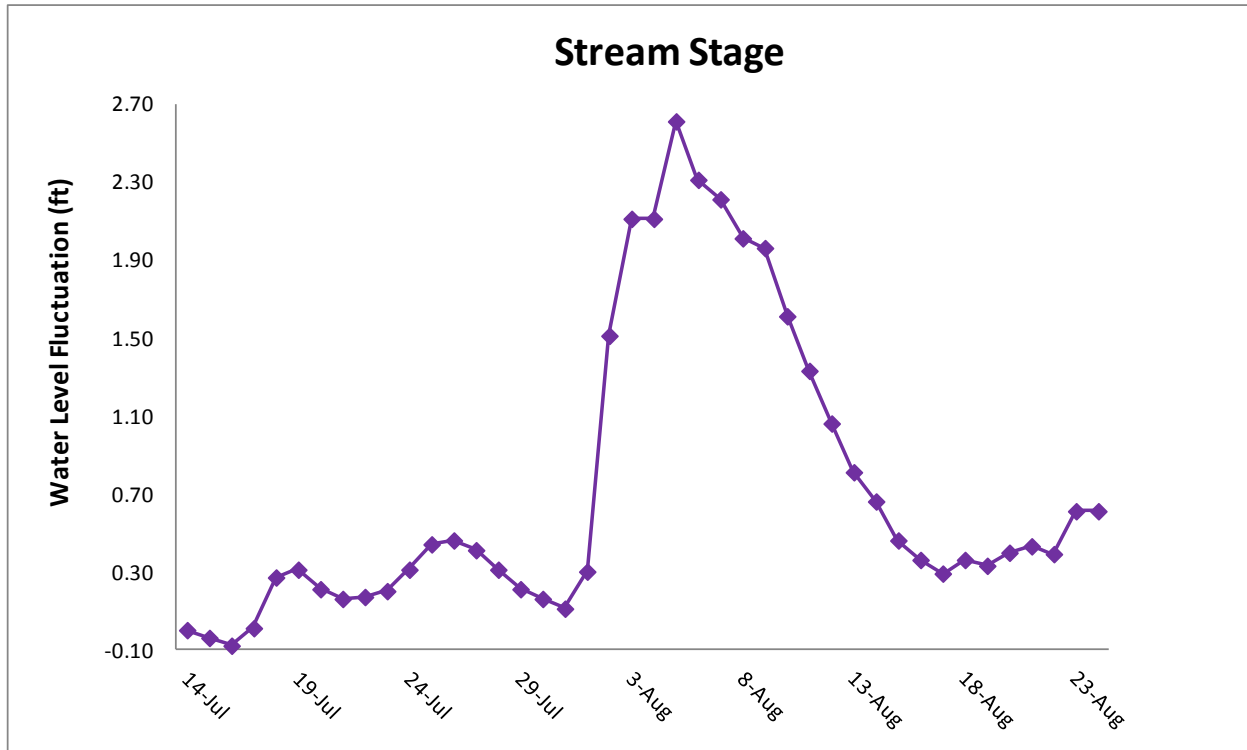
* - Does not reflect actual water depth, only water level fluctuation.

Summary of Cloud Cover - Percent of Days

	No. Days			
	Overcast	Partly Cloudy	Clear	Clear
Adults	42	57%	19%	0%

ND = No Data
 1.0 = Clear
 2.0 = Cloud Cover <50%
 3.0 = Cloud Cover >50%
 4.0 = Overcast
 5.0 = Rain

Appendix 6: Chelatna Lake 2011 water level fluctuation



Appendix 7: 2009 Chelatna Lake daily adult escapement

Date	Sockeye		Coho	King	Pink	Chum	Rainbow	Long Nose Sucker
	Daily Escapement	Total Return	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement
15-Jul	0	0	0	0	0	0	0	0
16-Jul	0	0	0	0	0	0	0	0
17-Jul	0	0	0	0	0	0	0	0
18-Jul	0	0	0	0	0	0	0	4
19-Jul	23	23	0	0	0	0	0	0
20-Jul	12	35	0	0	0	0	1	10
21-Jul	591	626	0	0	0	0	2	10
22-Jul	1342	1,968	0	0	0	0	3	3
23-Jul	1536	3,504	0	0	0	0	16	1
24-Jul	821	4,325	0	0	0	0	8	0
25-Jul	837	5,162	0	0	0	0	1	0
26-Jul	869	6,031	0	0	0	0	1	0
27-Jul	746	6,777	0	1	1	0	5	2
28-Jul	833	7,610	0	0	0	0	2	0
29-Jul	948	8,558	0	2	0	0	5	2
30-Jul	920	9,478	0	4	8	0	23	3
31-Jul	576	10,054	0	0	0	0	4	0
1-Aug	414	10,468	0	0	0	0	5	0
2-Aug	578	11,046	0	2	0	0	7	0
3-Aug	531	11,577	0	1	4	0	3	1
4-Aug	525	12,102	0	3	1	0	13	0
5-Aug	322	12,424	0	6	0	0	22	1
6-Aug	239	12,663	1	3	0	0	15	1
7-Aug	325	12,988	1	0	0	0	7	0
8-Aug	452	13,440	3	0	1	0	8	0
9-Aug	829	14,269	31	12	0	1	21	0
10-Aug	624	14,893	19	2	0	0	5	0
11-Aug	697	15,590	22	4	0	0	41	0
12-Aug	391	15,981	23	20	0	0	41	0
13-Aug	219	16,200	9	11	0	1	35	0
14-Aug	211	16,411	25	6	0	0	31	0
15-Aug	254	16,665	13	13	0	1	25	0
16-Aug	240	16,905	13	4	0	0	48	0
17-Aug	111	17,016	20	11	0	2	20	0
18-Aug	145	17,161	12	4	0	0	30	0
19-Aug	55	17,216	1	0	0	0	4	0
20-Aug	142	17,358	13	5	0	0	18	0
21-Aug	68	17,426	1	1	0	0	29	0
22-Aug	64	17,490	48	5	0	0	21	0
23-Aug	47	17,537	16	1	0	1	32	0
24-Aug	40	17,577	6	3	0	1	26	0
25-Aug	16	17,593	5	1	0	1	5	0
26-Aug	28	17,621	5	4	0	0	18	0
27-Aug	16	17,637	0	1	0	0	5	0
28-Aug	15	17,652	3	0	0	0	9	0
29-Aug	25	17,677	21	0	0	0	8	0
30-Aug	-1	17,676	0	0	0	0	3	0
31-Aug	14	17,690	0	0	0	0	0	0
1-Sep	4	17,694	0	0	0	0	2	0
2-Sep	9	17,703	44	1	0	0	16	0
3-Sep	6	17,709	9	0	1	0	8	0
4-Sep	6	17,715	17	0	0	0	5	0
5-Sep	6	17,721	4	0	0	0	1	0
Total	17,721		385	131	16	8	658	38

Appendix 8: Chelatna Lake 2009 hourly sockeye escapement

	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
7/15/2009																	0							0
7/16/2009				0			0		0		0					0		0						
7/17/2009				0			0		0		0					0		0			0			
7/18/2009			0				0	0	0		0	0				0		0		0	0			
7/19/2009				0				3			16	2			1			1						
7/20/2009			0	0	0		2	1				9												
7/21/2009					0		168				5	9		27	102		268	12						
7/22/2009				25	0				94	66	67	106	508		144			332						
7/23/2009				0					4	3	4	71	25	271		844	197				117			
7/24/2009				0	3		20	51	293	31	6	10	12	390	1	4								
7/25/2009				180	32		56	192	7	5	8	9	255	72	21									
7/26/2009				23	6		5	6	11	330	295	98	15	19	61									
7/27/2009				95	4		8	30	0	12	30	442	93	20	12									
7/28/2009				8	13		148	135	196	4	62	0	105	0	31	131								
7/29/2009				5	10		8	17	326	257	148	76	43	17	41									
7/30/2009				0	0		7	16	18	573	20	65	122	24	75									
7/31/2009				0	4		0	70	137	6	42	21	68	182	46									
8/1/2009				0	0		0	32	35	67	40	46	12	71	111									
8/2/2009				8	2		6	225	9	108	39	90	61	5	25									
8/3/2009				9	7		0	111	86	34	101	26	113	19	25									
8/4/2009				76	0		13	16	192	12	82	32	69	17	16									
8/5/2009				5	0		3	125	38	46	0	0	0	89	16									
8/6/2009				7	6		8	55	42	48	24	17	11	0	21									
8/7/2009					2			91	25	6	5	140	36		20									
8/8/2009					16		20	92	7	13	124	87	52				41							
8/9/2009				5	17		18		418	95		45	50		145	36								
8/10/2009				4	6		12	0	407	89	59	23	18	6										
8/11/2009				7	7		8	1	477	40	28	3	31		95									
8/12/2009				6	18		16		189	97	15	21		29										
8/13/2009				1	2		2	45	110	2	9	0	25	15	8									
8/14/2009				0	2		3	3	6	4	115	10	19	47	2									
8/15/2009				3	4		9	7	15	47	67	55	26	19	2									
8/16/2009				4	3		11	15	7	76	61	21				42								
8/17/2009				2	4		10	15	10	29	22	6	11	2										
8/18/2009				0	0		10	14	3	41	17	25	17	7	11									
8/19/2009				1	2		0	7	4	12	18	11	0	0										
8/20/2009							5	10	32	46	16	6	9	1									17	
8/21/2009					41													27						
8/22/2009							28			24		9	12	-9										
8/23/2009							9			6		14	9		9									
8/24/2009							24		12		2		2		0									
8/25/2009							8		9			-3	2											
8/26/2009							15		8		2			3										
8/27/2009					4			5			4		0		3									
8/28/2009							15				0		0											
8/29/2009				11						5		2		7										
8/30/2009										-1														
8/31/2009												2			12									
9/1/2009												4												
9/2/2009							4			1	4													
9/3/2009							2				4				0									
9/4/2009				1					5															
9/5/2009							5					1												

Appendix 9: 2010 Chelatna Lake daily adult escapement

Date	Sockeye		Coho	King	Pink	Chum	Rainbow	Long Nose Sucker
	Daily Escapement	Total Return	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement
14-Jul	0	0	0	0	0	0	0	0
15-Jul	0	0	0	0	0	0	0	0
16-Jul	0	0	0	0	0	0	0	0
17-Jul	0	0	0	0	0	0	0	0
18-Jul	0	0	0	0	0	0	0	0
19-Jul	0	0	0	0	0	0	0	0
20-Jul	0	0	0	0	0	0	0	0
21-Jul	221	221	0	0	0	0	4	0
22-Jul	1447	1,668	0	0	0	0	9	0
23-Jul	1946	3,614	0	0	3	0	1	0
24-Jul	2309	5,923	0	0	0	0	2	0
25-Jul	1346	7,269	0	0	0	0	9	0
26-Jul	1333	8,602	0	0	0	1	1	0
27-Jul	1815	10,417	0	0	0	0	1	0
28-Jul	1655	12,072	0	0	0	0	1	0
29-Jul	1456	13,528	0	0	4	0	0	0
30-Jul	1487	15,015	0	0	4	0	2	0
31-Jul	2042	17,057	0	0	6	0	0	0
1-Aug	3193	20,250	0	5	72	1	4	0
2-Aug	3602	23,852	0	0	183	0	1	0
3-Aug	2207	26,059	1	2	83	1	0	0
4-Aug	1768	27,827	0	0	98	0	2	0
5-Aug	1007	28,834	0	0	113	2	6	0
6-Aug	1316	30,150	0	4	8	2	4	0
7-Aug	1162	31,312	0	3	22	2	1	0
8-Aug	853	32,165	1	5	13	1	1	0
9-Aug	1272	33,437	2	1	41	2	3	0
10-Aug	849	34,286	0	1	61	1	2	0
11-Aug	328	34,614	0	0	27	0	2	0
12-Aug	50	34,664	0	0	1	0	0	0
13-Aug	530	35,194	0	1	41	0	0	0
14-Aug	611	35,805	2	2	33	3	6	0
15-Aug	481	36,286	4	1	48	2	6	0
16-Aug	262	36,548	8	0	24	1	6	0
17-Aug	4	36,552	0	0	0	0	0	0
18-Aug	174	36,726	2	0	5	1	0	0
19-Aug	220	36,946	0	1	1	1	12	0
20-Aug	346	37,292	4	0	3	3	10	0
21-Aug	137	37,429	4	0	0	0	4	0
22-Aug	74	37,503	2	0	0	1	3	0
23-Aug	132	37,635	2	0	0	3	11	0
24-Aug	87	37,722	2	0	1	0	23	0
25-Aug	12	37,734	0	0	0	0	0	0
Total	37,734		34	26	895	28	137	0

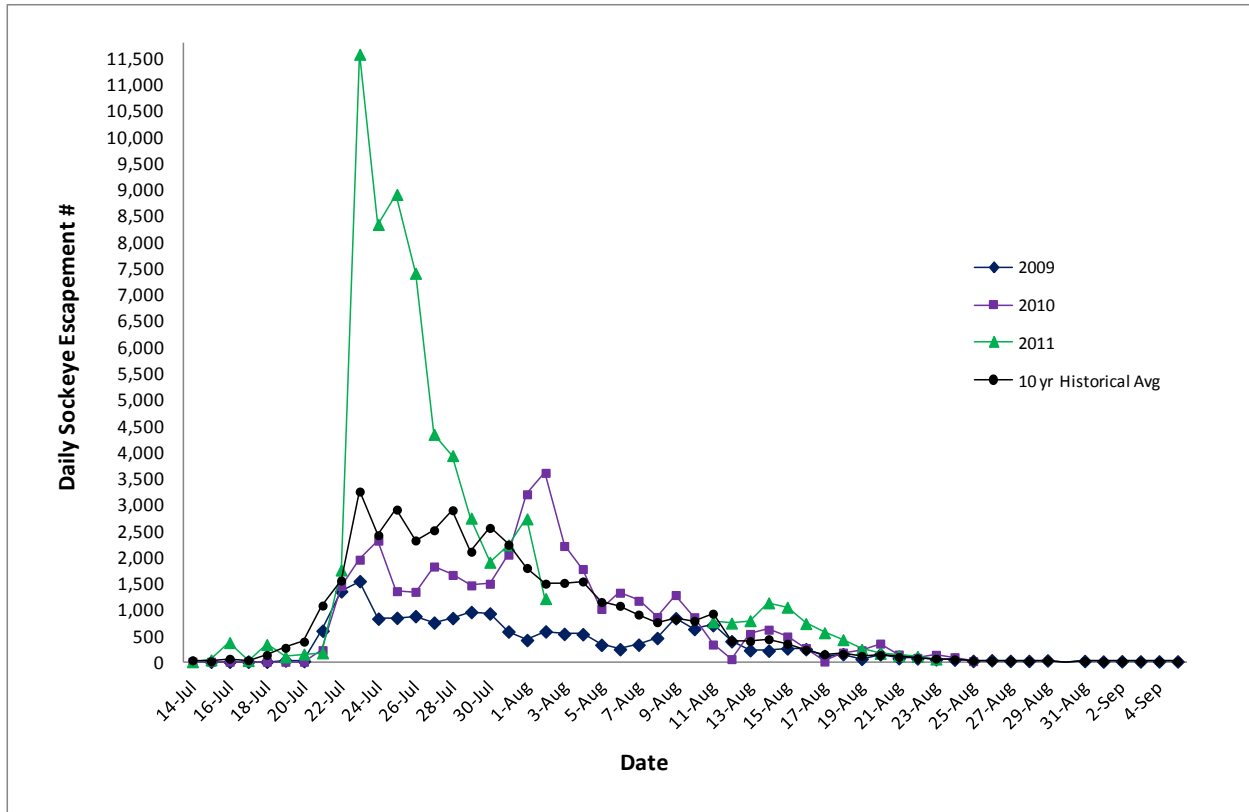
Appendix 10: Chelatna Lake 2010 hourly sockeye escapement

	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				
7/14/2010																0												
7/15/2010							0				0						0											
7/16/2010							0				0							0										
7/17/2010					0						0							0				0						
7/18/2010				0							0							0										
7/19/2010				0							0							0					0					
7/20/2010					0						0								0				0					
7/21/2010				0							14					207						0						
7/22/2010				40					515								892				0							
7/23/2010				40							689				1217													
7/24/2010												40				2269												
7/25/2010				21								19				1356												
7/26/2010				40								306				348												
7/27/2010				43								489		277	136													
7/28/2010				43				202	522	348		518		244	172	120												
7/29/2010				40					268	129		642	312		65													
7/30/2010				43					211			382	513	238		100												
7/31/2010				43				301				418	784		321	175												
8/1/2010													40			1214						1887						
8/2/2010			636				1064		616	42		836				408												
8/3/2010				907					40			501				759												
8/4/2010			41							304			1423															
8/5/2010			204					140			42			279			342											
8/6/2010			40								432			343		501												
8/7/2010				571					217	108			47			219												
8/8/2010							393		14			41		405														
8/9/2010			109					118			40	311	473		155	66												
8/10/2010			40				253				396		121	39														
8/11/2010							46				26			91	165													
8/12/2010			10				40																					
8/13/2010			10					118			301		42			59												
8/14/2010			77				101		55			61	41	139	137													
8/15/2010				188				86		40	39		34			94												
8/16/2010				159						41		62																
8/17/2010							4					0																
8/18/2010			27				51		49			47																
8/19/2010					55				14			41		110														
8/20/2010				176					40		106			20		4												
8/21/2010				39				19					79															
8/22/2010				54					11			7		2														
8/23/2010				83				30				19				0												
8/24/2010				5				49				24		5		4												
8/25/2010			12																									

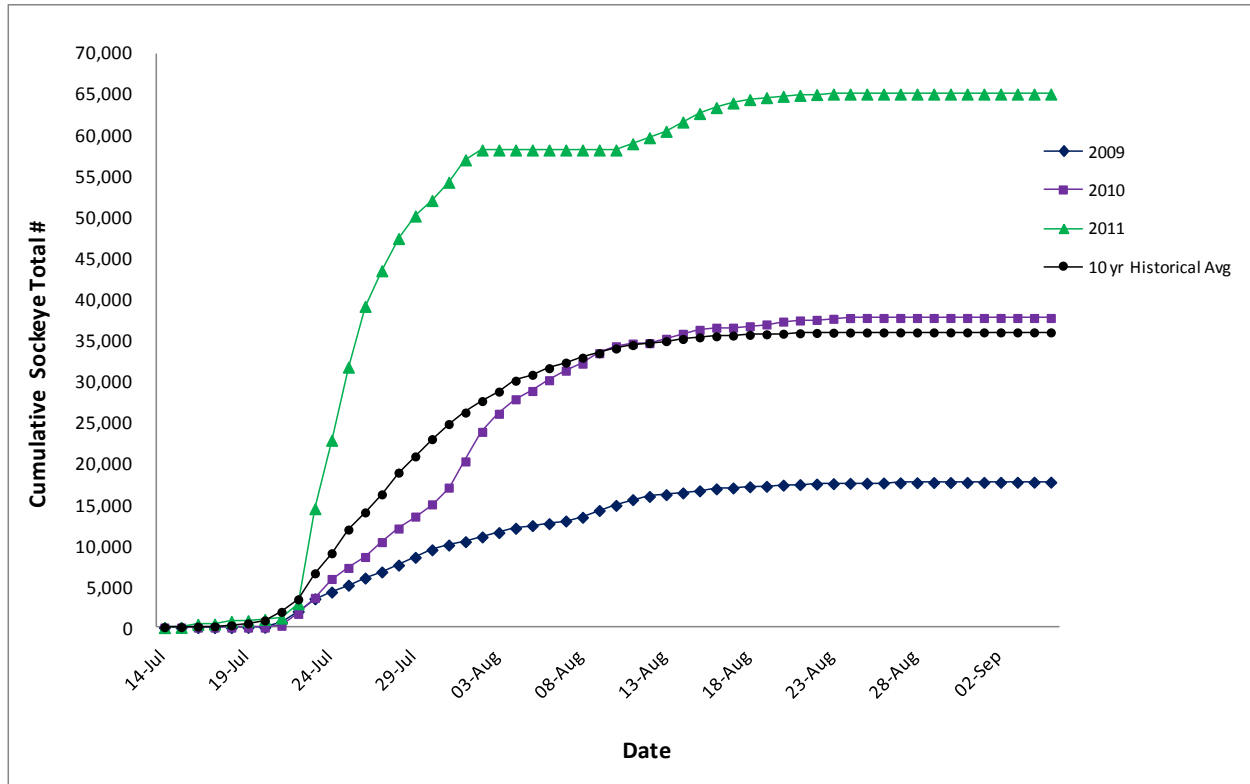
Appendix 11: 2011 Chelatna Lake daily adult escapement

Date	Sockeye			Coho	King	Pink	Chum	Rainbow
	Daily Escapement	Tags	Total Return	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement
14-Jul	0	0	0	0	0	0	0	0
15-Jul	35	0	35	0	0	0	0	0
16-Jul	366	0	401	0	0	0	0	0
17-Jul	23	0	424	0	0	0	0	0
18-Jul	329	0	753	0	0	0	0	0
19-Jul	94	0	847	0	0	0	0	0
20-Jul	146	0	993	0	0	0	0	2
21-Jul	169	3	1,162	0	0	0	0	0
22-Jul	1749	14	2,911	0	0	0	1	0
23-Jul	11583	51	14,494	0	0	0	0	0
24-Jul	8338	83	22,832	0	3	0	2	1
25-Jul	8911	106	31,743	0	0	2	0	0
26-Jul	7407	144	39,150	0	0	0	0	0
27-Jul	4336	105	43,486	1	0	1	0	0
28-Jul	3931	80	47,417	0	1	0	0	0
29-Jul	2738	73	50,155	0	-2	2	0	0
30-Jul	1897	58	52,052	0	1	2	0	1
31-Jul	2228	36	54,280	0	0	0	0	0
1-Aug	2724	45	57,004	0	3	0	0	0
2-Aug	1204	19	58,208	0	0	0	0	0
3-Aug	ND	3	58,208	ND	ND	ND	ND	ND
4-Aug	ND	0	58,208	ND	ND	ND	ND	ND
5-Aug	ND	0	58,208	ND	ND	ND	ND	ND
6-Aug	ND	0	58,208	ND	ND	ND	ND	ND
7-Aug	ND	0	58,208	ND	ND	ND	ND	ND
8-Aug	ND	0	58,208	ND	ND	ND	ND	ND
9-Aug	ND	0	58,208	ND	ND	ND	ND	ND
10-Aug	ND	0	58,208	ND	ND	ND	ND	ND
11-Aug	762	9	58,970	0	0	0	0	0
12-Aug	737	14	59,707	3	0	0	0	0
13-Aug	783	14	60,490	0	0	0	0	0
14-Aug	1123	37	61,613	1	0	0	0	0
15-Aug	1040	38	62,653	5	0	0	0	0
16-Aug	728	54	63,381	1	0	0	0	0
17-Aug	553	40	63,934	0	0	0	0	0
18-Aug	421	29	64,355	2	0	0	0	0
19-Aug	237	18	64,592	0	0	0	0	0
20-Aug	160	5	64,752	1	0	0	0	0
21-Aug	119	7	64,871	1	0	0	0	0
22-Aug	102	6	64,973	1	1	0	0	0
23-Aug	52	1	65,025	2	0	0	0	0
Total	65,025	1,092		18	7	7	3	4

Appendix 13: Chelatna Lake daily escapement summary



Appendix 14: Chelatna Lake cumulative escapement summary



Appendix 15: Chelatna Lake 2009 age, sex, & length composition

	Age Group								Total
	0.2	1.1	0.3	1.2	1.3	2.2	1.4	2.3	
Males	194	0	226	1,325	6,009	32	355	129	8,270
Percent	1.09%	0.00%	1.27%	7.42%	33.64%	0.18%	1.99%	0.72%	46.29%
Sample Size	6	0	7	41	186	1	11	4	256
Mean Lth (mm)	429	0	585	469	585	543	588	597	563
Std. Error	6	0	8	7	2		10	6	2
Females	97	32	258	1,260	7,625	97	129	97	9,595
Percent	1	0.18%	1	7.05%	42.68%	0.54%	0.72%	0.54%	53.71%
Sample Size	3	1	8	39	236	3	4	3	297
Mean Lth (mm)	450	331	572	501	556	490	597	567	548
Std. Error	46	2	9	5	2	21	7	12	2
Both Sexes	291	32	484	2,585	13,634	129	484	226	17,865
Percent	1.63%	0.18%	2.71%	14.47%	76.32%	0.72%	2.71%	1.27%	100.00%
Sample Size	9	1	15	80	422	4	15	7	553
Mean Lth (mm)	436	331	578	484	569	503	590	584	555
Std. Error	16		6	4	1	21	7	6	1

Appendix 16: Chelatna Lake 2010 age, sex, & length composition

	Age Group						Total
	0.2	0.3	1.2	1.3	2.2	2.3	
Males	0	1,732	8,784	6,456	132	132	17,237
Percent	0.00%	4.59%	23.28%	17.11%	0.35%	0.35%	45.68%
Sample Size		26	132	97	2	2	259
Mean Lth (mm)		578	489	569	438	583	528
Std. Error		4	3	3	8	39	2
Females	68	1,396	12,045	6,588	68	332	20,497
Percent	0.18%	3.70%	31.92%	17.46%	0.18%	0.88%	54.32%
Sample Size	1	21	181	99	1	5	308
Mean Lth (mm)	519	550	500	549	484	559	489
Std. Error		6	2	2	5	3	1
Both Sexes	68	3,128	20,829	13,045	200	464	37,734
Percent	0.18%	8.29%	55.20%	34.57%	0.53%	1.23%	100.00%
Sample Size	1	47	313	196	3	7	567
Mean Lth (mm)	519	566	495	559	453	566	524
Std. Error		4	2	2	8	11	1

Appendix 17: Chelatna Lake 2011 age, sex, & length composition

	Age Group						Total
	0.2	0.3	1.2	1.3	2.2	2.3	
Males	0	442	1,183	27,785	0	0	29,411
Percent	0.00%	0.68%	1.82%	42.73%	0.00%	0.00%	45.23%
Sample Size		3	8	188	0	0	199
Mean Lth (mm)		590	469	590	0	0	528
Std. Error		3	18	2	0	0	2
Females	293	592	3,993	30,146	293	293	35,608
Percent	0.45%	0.91%	6.14%	46.36%	0.45%	0.45%	54.76%
Sample Size	2	4	27	204	2	2	241
Mean Lth (mm)	460	570	492	562	513	558	553
Std. Error	5	10	6	2	18	27	2
Both Sexes	293	1,034	5,176	57,931	293	293	65,025
Percent	0.45%	1.59%	7.96%	89.09%	0.45%	0.45%	99.99%
Sample Size	2	7	35	392	2	2	440
Mean Lth (mm)	460	579	487	575	513	558	568
Std. Error	5	6	6	2	18	27	2