

**Chelatna Lake
Adult Sockeye Salmon
Data Report
2012**

**Prepared by:
CIAA Staff
May 2013**

The Chelatna Lake Project was made possible through 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 Chelatna Lake. This Chelatna Lake Data Report encompasses data collected from the 2012 sockeye salmon adult escapement.

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 other reports.

The Chelatna Lake Data Report was prepared by CIAA under award of a State of Alaska Designated Legislative Grant (09-DC-020) administered by the Alaska Department of Commerce, Community and Economic Development (DCCED). The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the DCCED.

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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 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. 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 invasive 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 invasive northern pike.

During the 2012 adult sockeye salmon escapement, environmental conditions were monitored from 13 July through 20 August. Water levels fluctuated 1.7 ft during that time period. Stream temperatures averaged 13°C (± 0.3) [mean \pm standard error] and ranged from 9 to 16°C. Air temperatures averaged 15°C (± 0.7) and ranged from 8 to 24°C. Ten percent of the days were clear, 33% were partly cloudy, 18% were completely overcast, and 38% were rainy. A total of 222 mm of rain fell during that period.

The adult escapement was enumerated from 13 July through 19 August. During that time, 36,736 adult sockeye salmon returned to Chelatna Lake. Other fish counted during that time were 14 adult coho salmon (*O. kisutch*), 96 adult Chinook salmon (*O. tshawytscha*), 616 adult pink salmon (*O. gorbuscha*), and 7 adult chum salmon (*O. keta*).

Throughout the escapement, 1,015 adult sockeye salmon were captured, scale samples taken, sexed, and measured for lengths from mid eye to tail fork (METF) to the nearest millimeter. From the sockeye salmon sampled, 191 were unreadable for age, so a total of 824 were used for analysis. Forty-seven percent were males and 53% were females. The average length of the male sockeye salmon measured was 569 mm (± 3.0). The average length of the female sockeye salmon measured was 535 mm (± 2.0). The average length of both male and female sockeye salmon was 551 mm (± 2.0).

Based on the 824 scale samples analyzed, there were 6 age classes. Within the sample, age-1.3 was the most abundant age class (72%), followed by age-1.2 (19%), age-2.3 (4%), age-0.3 (3%), age-1.4 (1%), and age-2.2 (0.5%).

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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), assessed sockeye salmon populations at several key salmon producing lakes with and without invasive northern pike (*Esox lucius*) in the Susitna River drainage from 2009–2011. The overall objective of this effort was 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 were collected as well as genetic samples, mark-recapture studies, and the performance of hydroacoustic surveys. The goal was 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 allows management biologists to analyze and evaluate the production and rearing condition of each lake.

The enumeration of adult salmon returns to Chelatna Lake has been completed every year since 2006. 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. The fact that northern pike were present, in conjunction with the need for ADF&G to obtain accurate sockeye salmon escapement numbers for management of the Upper Cook Inlet fisheries prompted CIAA to maintain the adult weir counts at Chelatna Lake for an additional year (2012).

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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) (Spafard and Edmundson, 2000). The major tributary of Chelatna Lake is Coffee Creek. It is glacier fed and produces 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).

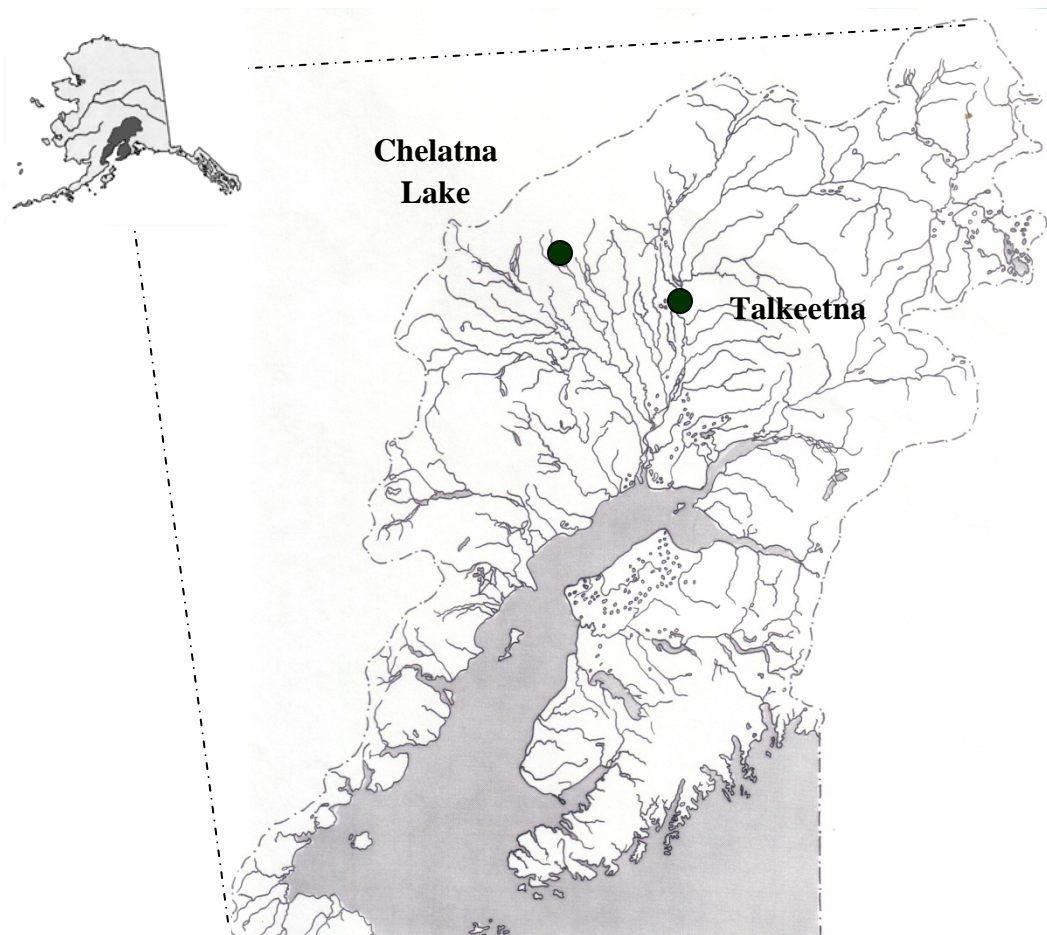


Figure 1: Chelatna Lake in relation to Cook Inlet and Alaska

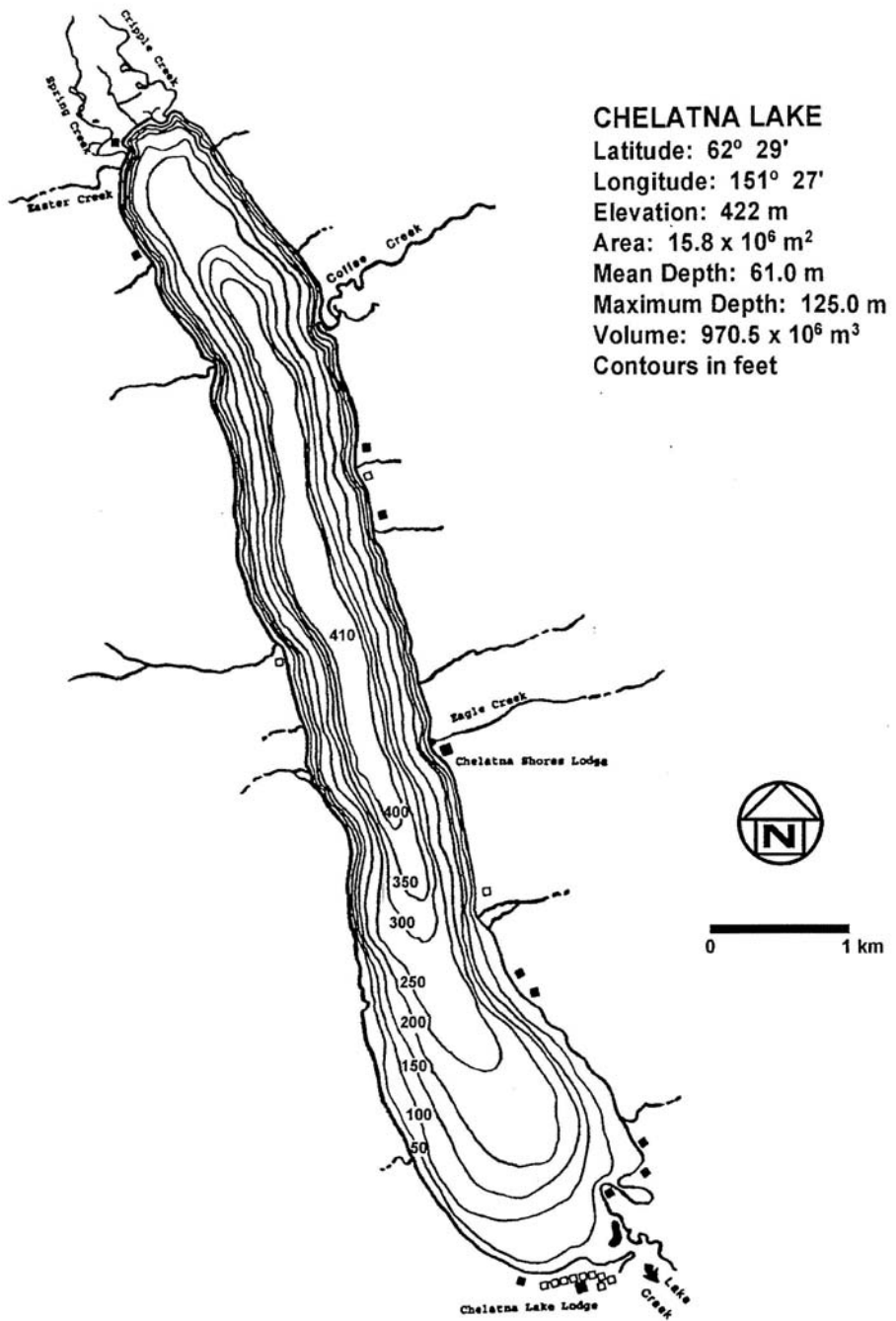


Figure 2: Bathymetric map of Chelatna Lake

METHODS

Environmental Conditions

To assess the environmental conditions during the adult sockeye salmon migration to Chelatna Lake, staff visually estimated percent cloud cover, recorded water level fluctuation to the nearest 0.1 ft, measured precipitation to the nearest millimeter, and recorded water and air temperatures (Celsius) at 5:00 PM daily. Standard CIAA procedures were followed for collecting these observations (CIAA, 2012).

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 three 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, spaced 2.5 cm apart, in the aluminum channel.

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. Daily enumeration 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. Lengths from mid eye to tail fork (METF)¹ were 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 METF is defined as the measurement to the nearest millimeter from the middle of the eye to the fork of the tail.

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RESULTS

Environmental Conditions

During the 2012 adult sockeye salmon escapement, environmental conditions were monitored from 13 July through 20 August. Water levels fluctuated 1.7 ft during that time period. Stream temperatures averaged 13°C (± 0.3) [mean \pm standard error] and ranged from 9 to 16°C. Air temperatures averaged 15°C (± 0.7) and ranged from 8 to 24°C. Ten percent of the days were clear, 33% were partly cloudy, 18% were completely overcast, and 38% were rainy. A total of 222 mm of rain fell during that period.

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Based on the 824 scale samples analyzed, there were 6 age classes. Within the sample, age-1.3 was the most abundant age class (72%), followed by age-1.2 (19%), age-2.3 (4%), age-0.3 (3%), age-1.4 (1%), and age-2.2 (0.5%) (Table 1).

Table 1: Summary of Chelatna Lake sockeye salmon escapement and population characteristics, 2009–2012

Year	Total Escapement	Age Group													
		0.2		0.3		1.2		1.3		2.2		1.4		2.3	
		(%)	length (mm)	(%)	length (mm)	(%)	length (mm)	(%)	length (mm)	(%)	length (mm)	(%)	length (mm)	(%)	length (mm)
2012	36,736	-	-	3	567	19	490	72	567	0.5	517	1	559	4	550
2011	65,025	0.5	460	2	579	8	487	89	575	0.5	503	-	-	0.5	558
2010	37,734	0.2	519	9	566	55	495	35	559	0.5	453	-	-	1	566
2009	17,721	2	436	3	578	14	484	76	569	0.7	503	3	590	1	584

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RECOMMENDATIONS

Chelatna Lake is one of the major sockeye salmon producers in the Susitna River drainage. It is recommended to extend the Chelatna Lake sockeye salmon monitoring study. Extended monitoring is warranted because Chelatna Lake has a known population of invasive northern pike that have been shown to have a negative impact on native fish species. It is important to ensure the health of this salmon population, so managers will be able to meet escapement goals for the Susitna River drainage. It is also recommended that a program for removal of invasive northern pike be implemented to help counteract the negative impacts they may cause on native salmon and trout species in the lake.

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LITERATURE CITED

- CIAA, 2012. 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.
- 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.
- 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.

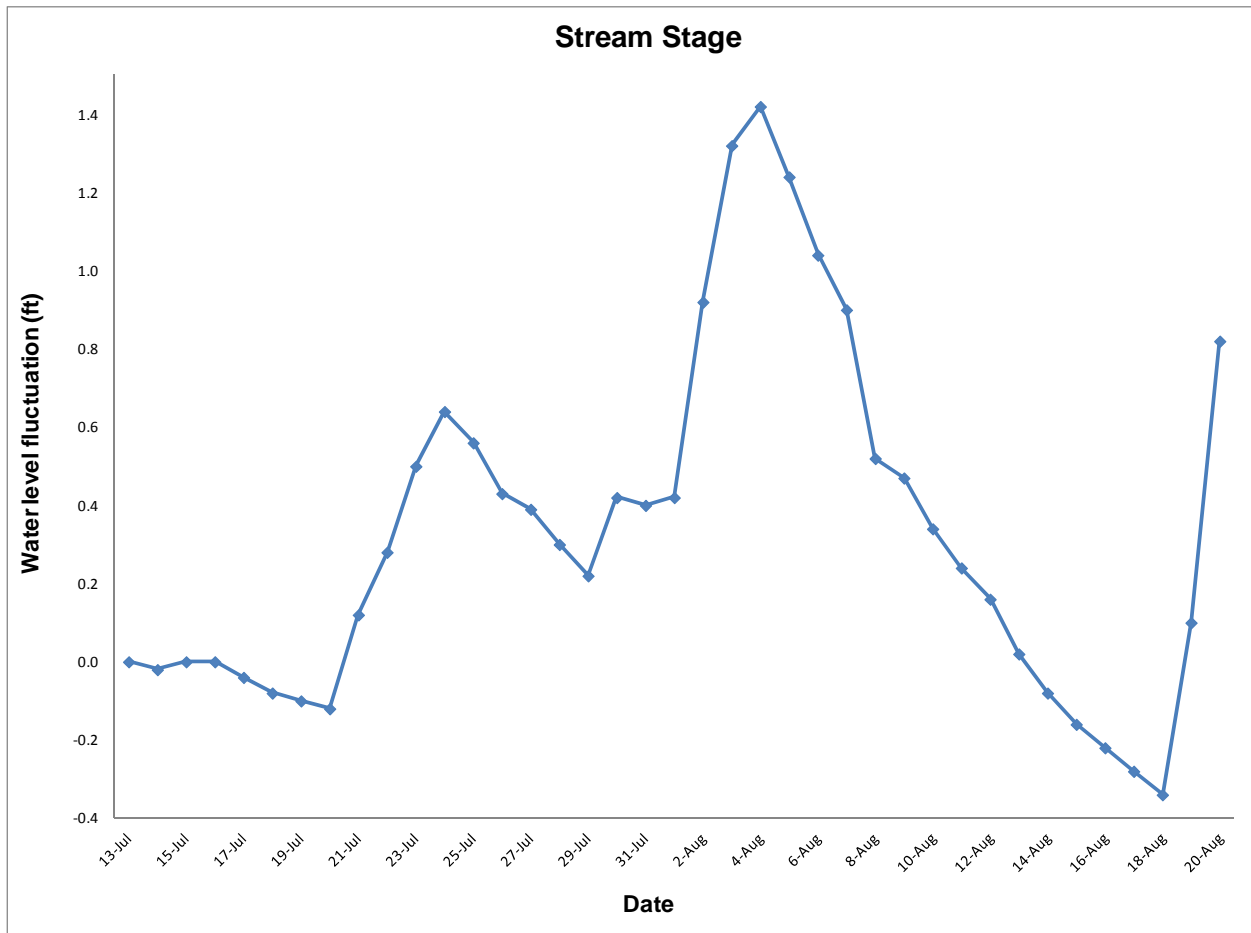
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APPENDICES

Appendix 1: Chelatna Lake 2012 environmental conditions

Date	Sky	Precip. (mm)	Stage (ft)	Water Temp. (°C)	Air Temp. (°C)
13-Jul	4	2	0.0	11	13
14-Jul	5	6	0.0	11	11
15-Jul	5	7	0.0	12	11
16-Jul	5	1	0.0	12	12
17-Jul	1	0	0.0	14	22
18-Jul	1	0	-0.1	15	24
19-Jul	2	0	-0.1	15	21
20-Jul	5	0	-0.1	14	14
21-Jul	5	27	0.1	11	12
22-Jul	5	15	0.3	11	11
23-Jul	4	10	0.5	12	11
24-Jul	4	0	0.6	12	14
25-Jul	2	0	0.6	14	19
26-Jul	2	0	0.4	13	16
27-Jul	1	0	0.4	14	17
28-Jul	3	0	0.3	12	15
29-Jul	4	1	0.2	11	13
30-Jul	5	32	0.4	12	10
31-Jul	3	2	0.4	13	15
1-Aug	5	13	0.4	11	8
2-Aug	5	17	0.9	11	13
3-Aug	4	6	1.3	11	11
4-Aug	5	21	1.4	11	8
5-Aug	4	1	1.2	10	10
6-Aug	3	0	1.0	10	18
7-Aug	5	1	0.9	12	11
8-Aug	1	0	0.5	15	18
9-Aug	3	0	0.5	15	21
10-Aug	3	0	0.3	14	20
11-Aug	2	0	0.2	15	21
12-Aug	2	0	0.2	14	19
13-Aug	2	0	0.0	16	22
14-Aug	2	0	-0.1	15	20
15-Aug	4	0	-0.2	14	16
16-Aug	3	4	-0.2	15	14
17-Aug	5	2	-0.3	13	10
18-Aug	5	2	-0.3	11	8
19-Aug	5	33	0.1	9	8
20-Aug	5	21	0.8	10	11
Total		222			
Avg.		6	0.3	13	15
Min.		0	-0.3	9	8
Max.		33	1.4	16	24
* - Does not reflect actual depth, only water level fluctuation.					
Summary of Cloud Cover - Percent of Days					
	No. Days	Clear	Partly Cloudy	Overcast	Rain
Adult	39	10%	33%	18%	38%
ND = No Data				1 = Clear	
				2 = Cloud Cover <50%	
				3 = Cloud Cover >50%	
				4 = Overcast	
				5 = Rain	

Appendix 2: Chelatna Lake 2012 water level fluctuation



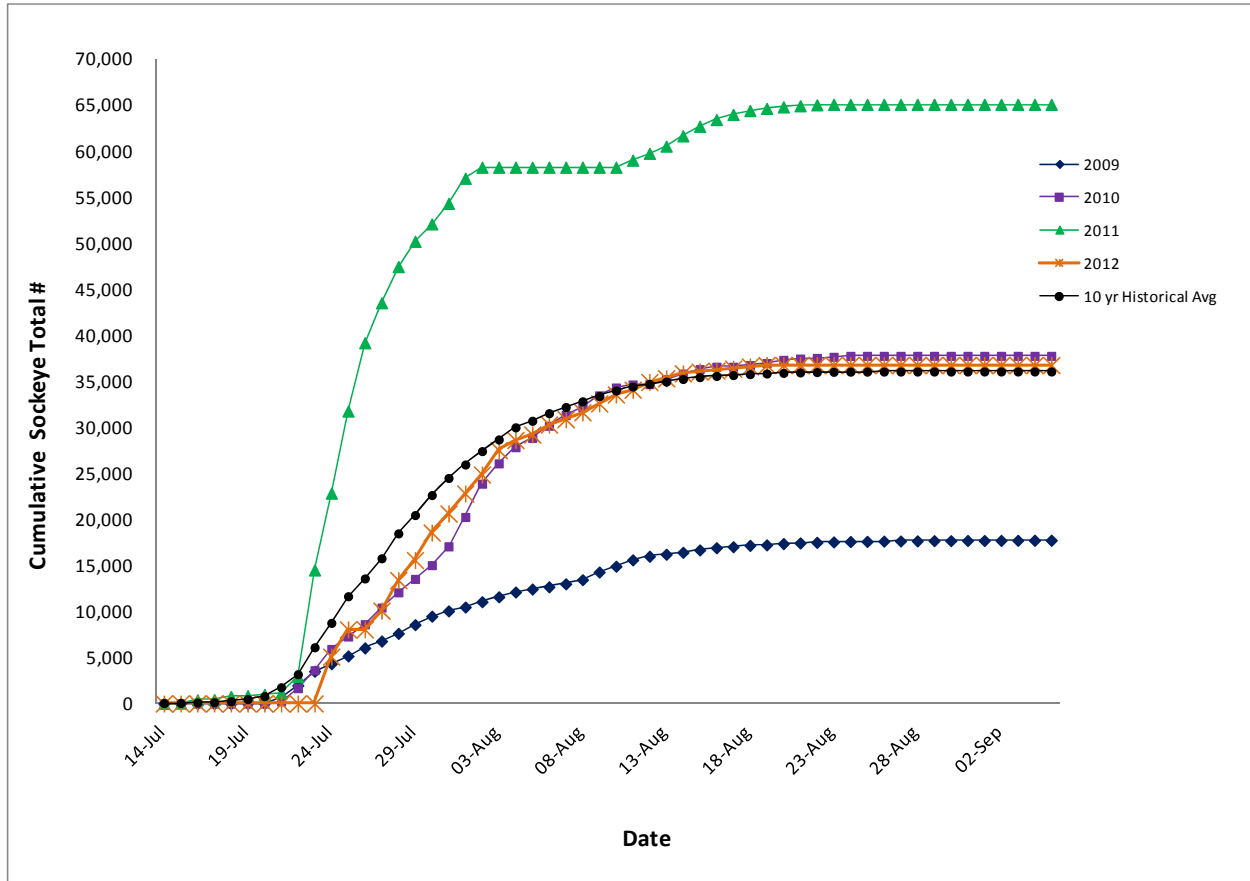
Appendix 3: Chelatna Lake 2012 daily adult escapement

Date	Sockeye		Coho		Chinook		Pink		Chum		Rainbow		Longnose Sucker	
	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total
13-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-Jul	5,087	5,087	0	0	0	0	0	0	0	0	0	0	0	0
25-Jul	2,949	8,036	0	0	0	0	0	0	0	0	0	0	0	0
26-Jul	10	8,046	0	0	0	0	1	1	0	0	0	0	0	0
27-Jul	2,036	10,082	0	0	0	0	0	1	0	0	0	0	0	0
28-Jul	3,307	13,389	0	0	0	0	11	12	0	0	0	0	0	0
29-Jul	2,182	15,571	0	0	0	0	9	21	0	0	0	0	0	0
30-Jul	2,980	18,551	0	0	0	0	62	83	0	0	0	0	0	0
31-Jul	2,069	20,620	0	0	0	0	21	104	0	0	0	0	0	0
1-Aug	2,173	22,793	0	0	0	0	26	130	0	0	0	0	0	0
2-Aug	2,054	24,847	0	0	0	0	26	156	0	0	0	0	0	0
3-Aug	2,645	27,492	0	0	1	1	33	189	1	1	0	0	0	0
4-Aug	1,104	28,596	0	0	0	1	42	231	0	1	0	0	0	0
5-Aug	606	29,202	0	0	5	6	38	269	0	1	0	0	0	0
6-Aug	1,071	30,273	0	0	2	8	44	313	0	1	0	0	0	0
7-Aug	591	30,864	0	0	1	9	11	324	2	3	0	0	0	0
8-Aug	743	31,607	2	2	0	9	32	356	1	4	0	0	0	0
9-Aug	963	32,570	0	2	1	10	87	443	1	5	0	0	0	0
10-Aug	975	33,545	0	2	0	10	61	504	0	5	0	0	0	0
11-Aug	511	34,056	0	2	48	58	0	504	0	5	0	0	0	0
12-Aug	839	34,895	0	2	0	58	25	529	2	7	0	0	0	0
13-Aug	393	35,288	0	2	38	96	0	529	0	7	0	0	0	0
14-Aug	537	35,825	2	4	0	96	20	549	0	7	0	0	0	0
15-Aug	203	36,028	2	6	0	96	18	567	0	7	0	0	0	0
16-Aug	103	36,131	0	6	0	96	24	591	0	7	0	0	0	0
17-Aug	212	36,343	3	9	0	96	17	608	0	7	0	0	0	0
18-Aug	243	36,586	5	14	0	96	8	616	0	7	0	0	0	0
19-Aug	150	36,736	0	14	0	96	0	616	0	7	0	0	0	0
Total		36,736		14		96		616		7		0		0

Appendix 4: Chelatna Lake 2012 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
7/13/2012										0					0									
7/14/2012										0					0									
7/15/2012								0			0					0								
7/16/2012		0								0														
7/17/2012											0													
7/18/2012								0				0												
7/19/2012						0					0			0										
7/20/2012							0																	
7/21/2012			0	0							0													
7/22/2012				0																				
7/23/2012			0								0													
7/24/2012									5087															
7/25/2012							2949																	
7/26/2012						10																		
7/27/2012										2036														
7/28/2012												3307												
7/29/2012											2182													
7/30/2012														2980										
7/31/2012										2069														
8/1/2012									2173															
8/2/2012										2054														
8/3/2012								2645																
8/4/2012								1104																
8/5/2012									606															
8/6/2012											1071													
8/7/2012					591																			
8/8/2012						743																		
8/9/2012											963													
8/10/2012								975																
8/11/2012		511																						
8/12/2012											839													
8/13/2012											393													
8/14/2012						537																		
8/15/2012											203													
8/16/2012											103													
8/17/2012											212													
8/18/2012						243																		
8/19/2012											150													

Appendix 5: Chelatna Lake 2012 cumulative escapement



Appendix 6: Chelatna Lake 2012 age, sex, and length composition

	Age Group						Total
	0.3	1.2	1.3	2.2	1.4	2.3	
Males	444	1,509	14,382	89	89	799	17,312
Percent	1.2	4.1	39.3	0.2	0.2	2.2	47.3
Sample Size	5	17	162	1	1	9	195
Mean Length	603	479	578	523	605	556	569
Std. Error	6	11	3	-	-	18	3
Sample Size	5	17	162	1	1	9	195
Females	799	5,416	12,073	89	178	710	19,265
Percent	2.2	14.8	33.0	0.2	0.5	1.9	52.7
Sample Size	9	61	136	1	2	8	217
Mean Length	547	493	553	511	536	542	535
Std. Error	22	3	2	-	2	9	2
Sample Size	9	61	136	1	2	8	217
Both Sexes	1,243	6,925	26,455	178	267	1,509	36,577
Percent	3.4	18.9	72.3	0.5	0.7	4.1	100.0
Sample Size	14	78	298	2	3	17	412
Mean Length	567	490	567	517	559	550	551
Std. Error	14	3	2	-	2	10	2
Sample Size	14	78	298	2	3	17	412