

**Judd Lake
Sockeye Salmon
Data Report
2009-2011**

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The Judd 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.

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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 report is a synopsis of the monitoring and evaluation studies conducted for Judd Lake. This Judd Lake Data Report encompasses data collected from the 2009 through the 2011 adult sockeye salmon escapement as it falls under the Alaskan Sustainable Salmon Fund grant.

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 Judd 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.

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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 Judd Lake project from 2009 through 2011. Appreciation is extended to the 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 go 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 (*Oncorhynchus 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 Judd Lake. Judd Lake was not known to have a population of northern pike.

The 2009 Judd Lake adult escapement was enumerated from 16 July and continued daily until 7 September. During this time 44,602 adult sockeye (*O. nerka*) salmon returned to Talachulitna Creek. During the adult enumeration staff collected 1,433 samples of which 643 adult sockeye salmon scale samples were analyzed for age composition. The age composition of the sockeye salmon escapement was largely comprised of age group 1.3 at 48.83%, followed by age group 2.3 at 23.48%, age group 2.2 at 17.26%, age group 1.2 at 10.27%, and age group 1.4 at 0.16%. Male sockeye salmon comprised 55.68% of the population with an average length of 548 mm (± 1 SE). Female sockeye salmon comprised 44.32% of the population with an average length of 546 mm (± 1 SE).

The 2010 Judd Lake adult escapement was enumerated from 13 July and continued daily until 4 September. During this time 18,466 adult sockeye (*O. nerka*) salmon returned to Talachulitna Creek. During the adult enumeration staff collected 1,337 samples of which 547 adult sockeye salmon scale samples were analyzed for age composition. The age composition of the sockeye salmon escapement was largely comprised of age group 2.3 at 69.84%, followed by age group 1.3 at 24.68%, age group 1.2 at 4.02%, age group 2.2 at 1.10%, and age group 3.2 at 0.36%. Male sockeye salmon comprised 60.14% of the population with an average length of 565 mm (± 1 SE). Female sockeye salmon comprised 39.86% with an average length of 543 mm (± 1 SE).

The 2011 Judd Lake adult escapement was enumerated from 17 July and continued daily until 4 September. During this time 39,909 adult sockeye (*O. nerka*) salmon returned to Talachulitna Creek. During the adult enumeration staff collected 1,016 samples of which 549 adult sockeye

salmon scale samples were analyzed for age composition. The age composition of the sockeye salmon escapement was largely comprised of age group 1.3 at 91.80%, followed by age group 2.3 at 4.55%, age group 1.2 at 2.19%, age group 2.2 at 1.10%, and age group 0.3 at 0.37%. Male sockeye salmon comprised 53.01% with an average length of 578 mm (± 2 SE). Female sockeye salmon comprised 47.00% with an average length of 556 mm (± 1 SE).

INTRODUCTION AND PURPOSE

To better understand the recent low adult sockeye salmon returns to the Susitna River drainage system, the Cook Inlet Aquaculture Association (CIAA), in cooperation with the Alaska Department of Fish and Game (ADF&G), is assessing sockeye salmon (*Oncorhynchus nerka*) 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 Judd Lake was completed for all three years of the project to assess sockeye salmon returns to the Susitna River drainage. Judd Lake was chosen for enumeration to provide comparative data of historical adult salmon returns and to compare adult salmon returns for lakes with and without an invasive northern pike population.

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PROJECT AREA

Judd Lake is located in the Yentna River basin of the larger Susitna River drainage. Judd Lake is classified under the Catalog of waters important for spawning, rearing, or migration of anadromous fishes – Southcentral Region as water body number, 247-41-10200-2053-3205-4053-5066-0010 (Johnson, et al 2010). The lake discharges via Talachulitna Creek where monitoring activities took place near the outlet of the lake (AWC 247-41-10200-2053-3205-4053-5066) during all three years of the project. Figure 2 displays bathymetric data and profile of Judd Lake (Glick, 2011).

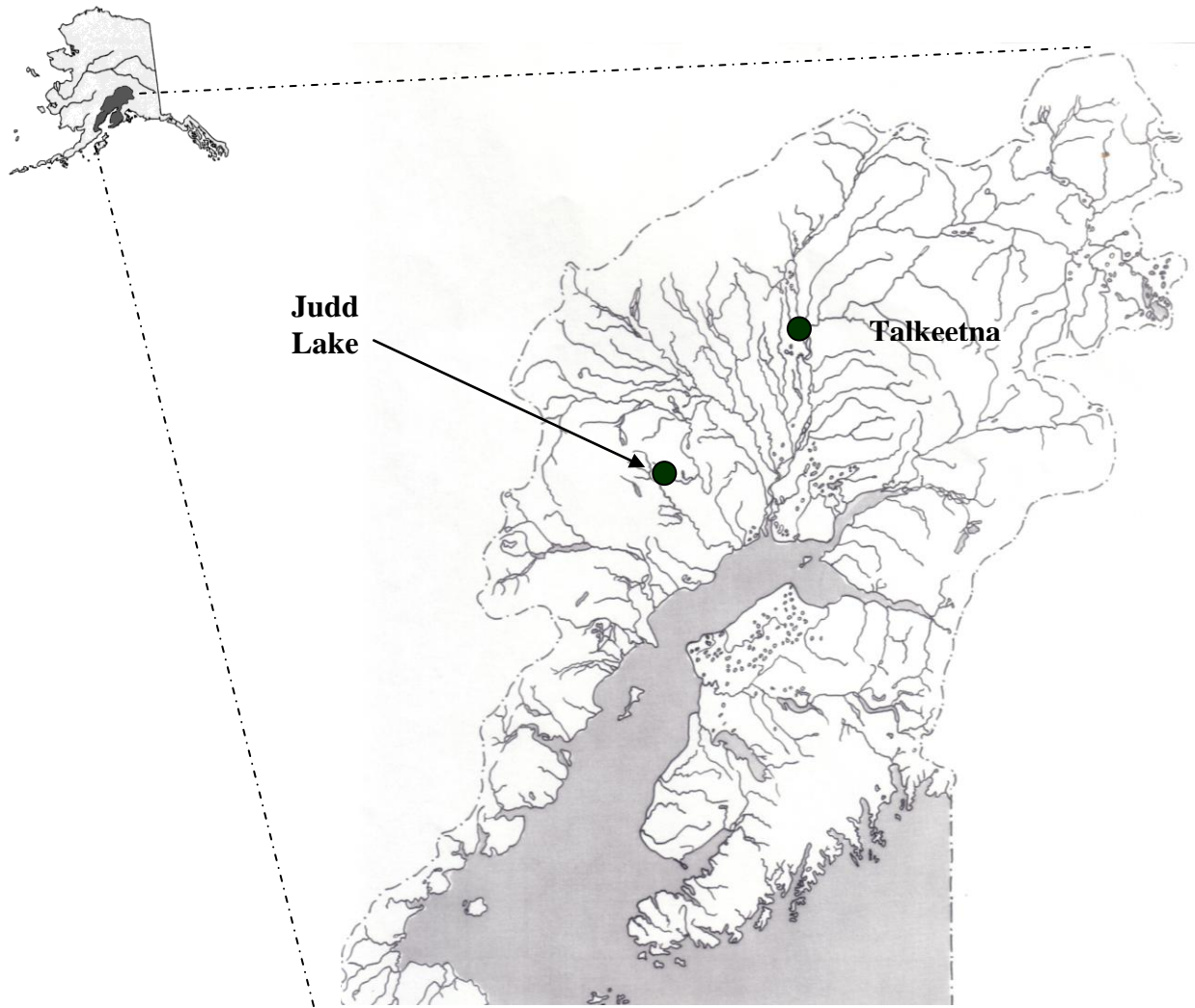
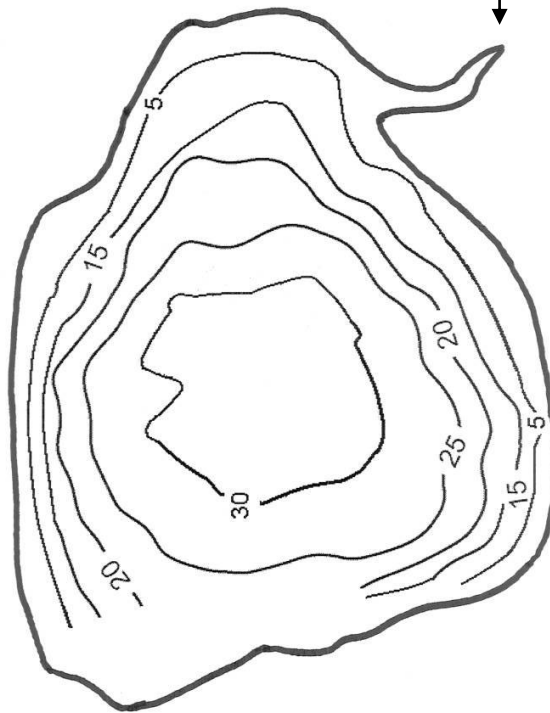


Figure 1 Judd Lake in relation to Cook Inlet and Alaska

JUDD LAKE
Latitude: 61° 34'
Longitude: 151° 33'
Elevation: 299 m
Area: $1.3 \times 10^6 \text{ m}^2$
Contours in meters



Lake Outlet



0 500 m

Figure 2 Bathymetric Map of Judd Lake

METHODS

Standard Cook Inlet Aquaculture Association (CIAA) procedures were followed for collecting data for environmental conditions and adult enumerations and were consistent from 2009 through 2011 (Cook Inlet Aquaculture Association Staff, 2009).

Environmental Conditions

To assess the environmental conditions during the adult sockeye salmon migration to Judd Lake, percent cloud cover was visually estimated, water levels were recorded to the nearest tenth of a foot, precipitation measured to the nearest millimeter, and water and air temperatures measured to the nearest degree centigrade. All measurements were recorded at 5:00 P.M. each day. Stream stage was not comparable from year to year.

Adult Enumeration

To enumerate and collect adult salmon returning to Larson Creek, a counting weir was temporarily installed in Larson Creek each year from 2009 to 2011. The 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.

Field personnel visually identified to species and counted the adult fish as they ascended Larson Creek. By removing one or two pickets, fish were permitted to pass through the weir. Initially counts were made at least twice a day. As the number of adult fish passing through the weir increased, counts were made more frequently. Field personnel also visually checked each fish as it passed through the weir for a numbered tag inserted by ADF&G as part of a mark-recapture study. The data was submitted to ADF&G at the end of each year for analysis.

In addition to the enumeration of the adult salmon escapement, the sex, age and mid-eye fork length of the returning population of sockeye salmon was also assessed by collecting a sample of sockeye salmon as they passed through the weir. The sex of each adult sockeye salmon collected was visually determined and the mid-eye fork length measured to the nearest millimeter. For age

evaluation, field personnel removed a scale from the primary growth area¹. All scales were submitted to ADF&G for age determination. All captured fish were unharmed and released upstream.

From 2009 through 2011, up to 40 adult sockeye salmon were randomly collected each day. During the 2009 adult enumeration staff collected 1,433 samples of which 643 adult sockeye scale samples were analyzed for age composition. During the 2010 adult enumeration staff collected 1,337 samples of which 547 adult sockeye scale samples were analyzed for age composition. During the 2011 adult enumeration staff collected 1,016 samples of which 549 adult sockeye scale samples were analyzed for age composition. The large discrepancy between the number of scale samples CIAA staff collected compared with the number of scale samples ADF&G staff analyzed is a result of several factors including but not limited to a loss of data during transference and travel, unreadable scales due to poor scale quality, and/or limited ADF&G staff time to read all scale samples collected.

¹ *The 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.*

RESULTS AND DISCUSSION

Environmental Conditions

During the 2009 adult sockeye salmon migration environmental conditions were monitored from 15 July to 7 September. Water levels fluctuated 1.22 feet during the monitoring period. Stream temperatures averaged 15°C and ranged from 13 to 21°C. Air temperatures averaged 14°C and ranged from 6 to 23°C. Twenty-two percent of the days were clear, 29% were partly cloudy, and 49% were completely overcast. Measurable rain was recorded on 35 days during the adult migration. A total of 123 mm of rain fell during that period.

During the 2010 adult sockeye migration environmental conditions were monitored from 13 July to 3 September. From 16 July through 13 August, water levels fluctuated 1.60 feet. The staff gauge was moved to different locations for unknown reasons on 14 August, 17 August, 18 August, and 22 August; the data cannot be compared to prior measurements and is considered unreliable during that time period. From 23 August through 3 September, water levels fluctuated 1.11 feet. Stream temperatures averaged 6°C and ranged from 1 to 14°C. Air temperatures averaged 12°C and ranged from 9 to 18°C. Four percent of the days were clear, 38% were partly cloudy, and 58% were completely overcast. Measurable rain was recorded on 39 days during the adult migration. A total of 275 mm of rain fell during that period.

During the 2011 adult sockeye migration environmental conditions were monitored from 17 July to 4 September. Water levels fluctuated 1.25 feet during the monitoring period. Stream temperatures averaged 13°C and ranged from 10 to 16°C. Air temperatures averaged 14°C and ranged from 9 to 20°C. Twelve percent of the days were clear, 34% were partly cloudy, and 54% were completely overcast. Measurable rain was recorded on 34 days during the adult migration. A total of 413 mm of rain fell during this period.

Adult Enumeration

The 2009 Judd Lake adult escapement was enumerated from 16 July and continued daily until 7 September. During this time 44,602 adult sockeye (*O. nerka*) salmon returned to Talachulitna Creek. Other fish counted during this time were 587 adult coho (*O. kisutch*) salmon, 32 adult chinook (*O. tshawytscha*) salmon, 90 adult pink (*O. gorbuscha*) salmon, 58 adult chum (*O. keta*) salmon, 15 adult rainbow trout (*O. mykiss*), and 20 adult dolly varden (*Salvelinus malma malma*). The age composition of the sockeye salmon escapement was largely comprised of age group 1.3 at 48.83%, followed by age group 2.3 at 23.48%, age group 2.2 at 17.26%, age group 1.2 at 10.27%, and age group 1.4 at 0.16%. Male sockeye salmon comprised 55.68% of the population with an average length of 548 mm (± 1 SE). Female sockeye salmon comprised 44.32% of the population with an average length of 546 mm (± 1 SE).

The 2010 Judd Lake adult escapement was enumerated from 13 July and continued daily until 4 September. During this time 18,466 adult sockeye (*O. nerka*) salmon returned to Talachulitna Creek. Other fish counted during this time were 41 adult coho (*O. kisutch*) salmon, 6 adult chinook (*O. tshawytscha*) salmon, 98 adult pink (*O. gorbuscha*) salmon, 86 adult chum (*O. keta*) salmon, and 4 adult rainbow trout (*O. mykiss*). The age composition of the sockeye salmon escapement was largely comprised of age group 2.3 at 69.84%, followed by age group 1.3 at 24.68%, age group 1.2 at 4.02%, age group 2.2 at 1.10%, and age group 3.2 at 0.36%. Male sockeye salmon comprised 60.14% of the population with an average length of 565 mm (± 1 SE). Female sockeye salmon comprised 39.86% with an average length of 543 mm (± 1 SE).

The 2011 Judd Lake adult escapement was enumerated from 17 July and continued daily until 4 September. During this time 39,909 adult sockeye (*O. nerka*) salmon returned to Talachulitna Creek. Other fish counted during this time were 65 adult coho (*O. kisutch*) salmon, 1 adult chinook (*O. tshawytscha*) salmon, 11 adult pink (*O. gorbuscha*) salmon, 45 adult chum (*O. keta*) salmon, 2 adult rainbow (*O. mykiss*) trout, and 7 adult dolly varden (*S. malma malma*). The age composition of the sockeye salmon escapement was largely comprised of age group 1.3 at 91.80%, followed by age group 2.3 at 4.55%, age group 1.2 at 2.19%, age group 2.2 at 1.10%, and age group 0.3 at 0.37%. Male sockeye salmon comprised 53.01% with an average length of

578 mm (± 2 SE). Female sockeye salmon comprised 47.00% with an average length of 556 mm (± 1 SE).

Table 1 Summary of Judd Lake Adult Sockeye Salmon Characteristics

Year	Escapement	Age Classes													
		0.3		1.2		1.3		2.2		1.4		2.3		3.2	
		(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)
2009	44,602	0.00%	-	10.27%	497	48.83%	566	17.26%	512	0.16%	621	23.48%	556	0.00%	-
2010	18,466	0.00%	-	4.02%	488	24.68%	562	1.10%	506	0.00%	-	69.84%	559	0.36%	556
2011	39,909	0.37%	548	2.19%	478	91.80%	571	1.10%	500	0.00%	-	4.55%	562	0.00%	-
Mean	34,326	0.12%	548	5.49%	488	55.10%	566	6.49%	506	0.05%	621	32.62%	559	0.12%	556
Min	18,466	0.00%	548	2.19%	478	24.68%	562	1.10%	500	0.00%	621	4.55%	556	0.00%	556
Max	44,602	0.37%	548	10.27%	497	91.80%	571	17.26%	512	0.16%	621	69.84%	562	0.36%	556

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RECOMMENDATIONS

The Judd Lake sockeye salmon escapement should continue to be monitored in the future in order to provide comparisons between similar systems with northern pike that are showing diminishing salmon returns.

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APPENDICES

Appendix 1 Judd Lake 2009 – Environmental Conditions

Adult Migration					
Date	Sky	Precip. (mm)	Stage* (ft)	Water Temp. (°C)	Air Temp. (°C)
15-Jul	1	0.00	0.40	21	23
16-Jul	1	0.00	0.40	20	21
17-Jul	3	0.45	0.38	20	16
18-Jul	5	0.55	0.38	19	13
19-Jul	5	9.00	0.41	18	13
20-Jul	4	2.00	0.40	18	15
21-Jul	5	4.00	0.41	17	11
22-Jul	4	8.50	0.42	16	10
23-Jul	5	7.50	0.43	16	11
24-Jul	4	3.70	0.43	17	11
25-Jul	5	1.00	0.41	16	9
26-Jul	4	10.50	0.46	15	10
27-Jul	3	10.50	0.52	17	15
28-Jul	5	6.50	0.68	16	12
29-Jul	4	24.50	1.34	15	18
30-Jul	5	0.25	1.31	15	14
31-Jul	3	14.00	1.15	15	11
1-Aug	2	0.25	1.04	14	14
2-Aug	4	0.00	0.95	14	14
3-Aug	1	0.00	0.91	16	18
4-Aug	5	0.50	0.84	15	12
5-Aug	4	12.50	0.88	15	14
6-Aug	4	2.70	0.91	15	12
7-Aug	2	0.15	0.86	15	17
8-Aug	1	0.00	0.82	16	20
9-Aug	2	0.00	0.79	16	16
10-Aug	1	0.00	0.75	16	17
11-Aug	3	0.00	0.71	16	20
12-Aug	4	0.00	0.69	14	10
13-Aug	5	0.00	0.67	14	11
14-Aug	5	0.15	0.75	14	10
15-Aug	4	0.22	1.00	14	12
16-Aug	3	0.25	1.01	14	15
17-Aug	2	0.00	0.94	14	17
18-Aug	5	0.00	0.90	14	15
19-Aug	2	1.00	0.96	14	19
20-Aug	1	0.03	0.94	14	15
21-Aug	1	0.00	0.94	15	15
22-Aug	3	0.00	0.94	15	16
23-Aug	5	0.55	0.88	13	7
24-Aug	2	0.19	0.88	14	11
25-Aug	1	0.00	0.86	15	15
26-Aug	5	0.05	0.80	14	9
27-Aug	3	0.24	0.82	14	14
28-Aug	5	0.14	0.82	13	11
29-Aug	2	0.22	0.86	14	18
30-Aug	2	0.00	0.84	14	17
31-Aug	4	0.00	0.80	13	10
1-Sep	5	0.25	0.82	13	7
2-Sep	5	0.40	1.20	13	6
3-Sep	1	0.04	1.60	13	11
4-Sep	1	0.00	1.20	13	20
5-Sep	1	0.00	1.40	14	22
6-Sep	1	0.00	1.20	13	18
7-Sep	3	0.05	1.20	14	17
Total		123			
Avg.		2	0.82	15	14
Min.		0	0.38	13	6
Max.		25	1.60	21	23

Ice Out = 10-May

	No. Days	Meas. Rain	Partly		
			Overcast	Cloudy	Clear
Adults	55	64%	49%	29%	22%

1.0 = Clear
 2.0 = Cloud Cover <50%
 3.0 = Cloud Cover >50%
 4.0 = Overcast
 5.0 = Rain

* This data reflects fluctuations in water level only.

Appendix 2 Judd Lake 2009 – Adult Escapement

Date	Sockeye		Coho	King	Pink	Chum	Rainbow	D.V.
	Daily Escapement	Total Return	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement
16-Jul	0	0	0	0	0	0	0	0
17-Jul	0	0	0	2	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	0	0	0	0	0	0	0	0
22-Jul	2	2	0	0	0	0	0	0
23-Jul	0	2	0	0	0	0	0	0
24-Jul	17	19	0	0	0	0	1	3
25-Jul	1,016	1,035	0	0	0	0	0	1
26-Jul	1,030	2,065	0	0	0	0	0	2
27-Jul	2,192	4,257	0	0	0	0	1	1
28-Jul	4,192	8,449	0	0	0	0	0	5
29-Jul	4,196	12,645	0	17	0	0	0	1
30-Jul	2,225	14,870	0	0	0	0	0	2
31-Jul	2,238	17,108	0	0	0	4	0	1
1-Aug	2,135	19,243	0	3	19	1	0	0
2-Aug	3,233	22,476	0	0	14	-2	0	0
3-Aug	583	23,059	0	0	0	0	1	1
4-Aug	1,426	24,485	0	0	9	0	0	1
5-Aug	659	25,144	3	0	4	2	0	0
6-Aug	571	25,715	1	0	7	0	0	0
7-Aug	900	26,615	0	0	3	1	0	0
8-Aug	1,616	28,231	6	3	9	1	0	0
9-Aug	2,252	30,483	3	0	2	0	0	0
10-Aug	1,201	31,684	2	0	4	0	0	0
11-Aug	1,554	33,238	7	0	0	1	0	0
12-Aug	2,361	35,599	4	3	2	3	0	0
13-Aug	2,269	37,868	6	0	3	5	0	0
14-Aug	1,917	39,785	7	0	2	14	0	0
15-Aug	1,385	41,170	16	1	7	15	0	0
16-Aug	851	42,021	13	1	2	4	1	2
17-Aug	424	42,445	1	0	1	1	0	0
18-Aug	572	43,017	2	2	1	2	0	0
19-Aug	605	43,622	7	0	0	3	1	0
20-Aug	221	43,843	1	0	0	0	0	0
21-Aug	180	44,023	3	0	1	0	2	0
22-Aug	100	44,123	3	0	0	0	0	0
23-Aug	51	44,174	4	0	0	0	0	0
24-Aug	50	44,224	2	0	0	0	0	0
25-Aug	71	44,295	10	0	0	0	0	0
26-Aug	52	44,347	0	0	0	1	0	0
27-Aug	91	44,438	7	0	0	2	0	0
28-Aug	37	44,475	0	0	0	0	0	0
29-Aug	99	44,574	18	0	0	0	0	0
30-Aug	41	44,615	2	0	0	1	1	0
31-Aug	35	44,650	2	0	0	0	2	0
1-Sep	15	44,665	0	0	0	0	0	0
2-Sep	-13	44,652	160	0	0	-1	2	0
3-Sep	3	44,655	92	0	0	0	2	0
4-Sep	-22	44,633	92	0	0	0	0	0
5-Sep	-14	44,619	12	0	0	0	1	0
6-Sep	-11	44,608	74	0	0	0	0	0
7-Sep	-6	44,602	27	0	0	0	0	0
Total		44,602	587	32	90	58	15	20

Appendix 3 Judd Lake 2009 - Age, Sex and Length Composition of Sockeye Salmon Escapement

Sample period: 16 July - 7 September	Age Group					Total
	1.2	1.3	2.2	1.4	2.3	
Males	3,470	10,334	5,758	71	5,201	24,834
Percent	7.78%	23.17%	12.91%	0.16%	11.66%	55.68%
Sample Size	50	149	83	1	75	358
Mean Lth (mm)	498	575	515	621	562	548
Std. Error	4	2	3	ND	4	1
Females	1,111	11,445	1,940	0	5,272	18,657
Percent	2.49%	25.66%	4.35%	0.00%	11.82%	44.32%
Sample Size	16	165	28	0	76	285
Mean Lth (mm)	495	557	502	ND	550	546
Std. Error	8	2	5	ND	3	1
Both Sexes	4,581	21,779	7,698	71	10,473	44,602
Percent	10.27%	48.83%	17.26%	0.16%	23.48%	100.00%
Sample Size	66	314	111	1	151	643
Mean Lth (mm)	497	566	512	621	556	547
Std. Error	4	1	2	ND	2	1

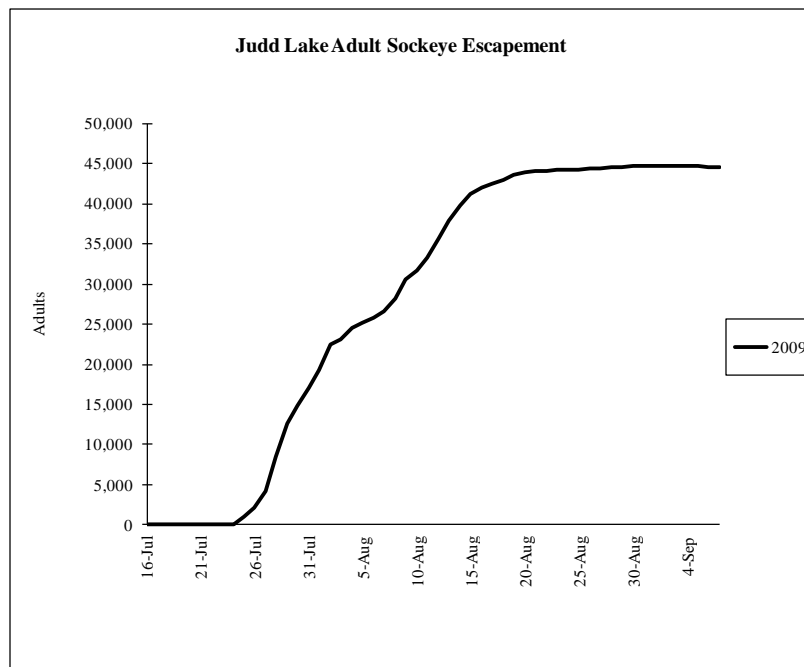
Appendix 4 Judd Lake 2009 – Adult Sockeye Escapement Hourly Log

Date	Hour												No.												
	AM						PM																		
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	
16-Jul								0				0					0								0
17-Jul			0		0			0				0				0									0
18-Jul			0		0		0			0		0			0										0
19-Jul			0			0			0			0			0										0
20-Jul			0		0		0				0				0										0
21-Jul			0		0	0			0			0			0										0
22-Jul			0				2		0	0		0			0										2
23-Jul			0		0			0		0		0			0										0
24-Jul			0			4		2				0			0			6	5						17
25-Jul			0	4	14	18	104	0	1				473	143	148	6		105							1,016
26-Jul			2				2	40	10	175	122		256		213	196	14								1,030
27-Jul				263	2			22	14	185	901	443	96			266									2,192
28-Jul		13						603	23	1,290	15	104	912		389	254							589		4,192
29-Jul			167		484	551			32	853	276	300	872	79		417		165							4,196
30-Jul				740		58	10			2	107	5		329	305			540	129						2,225
31-Jul			142				3				16	27	813	80		588							569		2,238
1-Aug					102					13	26	7	463	420		680	132	230	62						2,135
2-Aug				17	85				20	148	326		500	307	210	603		757	260						3,233
3-Aug						5	9				38				1		15	17	498						583
4-Aug							10	9	20	302	126		507		191	154		107							1,426
5-Aug							11	9	3	12	136		300		87	101									659
6-Aug								11				21	101		163			269							571
7-Aug									2	3				8	22	162	373		330						900
8-Aug											11		11	40	700	445	205		204						1,616
9-Aug						53		27	19	365		300		606		516		366							2,252
10-Aug					51			4			24	13	122			335		652							1,201
11-Aug								39	217			174	11		500	101		512							1,554
12-Aug								121	43	319		237	268	346	309	311		407							2,361
13-Aug								33	214		406	596		231	112	415		262							2,269
14-Aug								41	235		401	207	144	328		279	157	125							1,917
15-Aug								31	286	225		291		128	179	153	92								1,385
16-Aug							122				40	206	55	165		184	79								851
17-Aug						29		4		10	163				28		72	118							424
18-Aug					14	28		18	8			148	19	274			63								572
19-Aug						63	10			22	53				277	150	30								605
20-Aug							19	5				12		110		75									221
21-Aug							0	0	2			8		9	88	73									180
22-Aug							0	9		0		11		20	21	35	4								100
23-Aug							0	2		0				12		8	10	19							51
24-Aug								6						17		27									50
25-Aug									13				8		41	9									71
26-Aug									0				14		10		9	19							52
27-Aug									7				6	2		46	30								91
28-Aug								0	0		2				16		9	10							37
29-Aug								0		3		0		21			75								99
30-Aug								0		0		7	9		17	8									41
31-Aug								0	0			10			10	15									35
1-Sep									0			0		13		2									15
2-Sep									0			6	16				-35								-13
3-Sep									-2					10		-2	-3								3
4-Sep									-13			-2			0		-7								-22
5-Sep									-9			0				-5									-14
6-Sep									2			0					-13								-11
7-Sep									-3			0		-2		-1									-6
																							44,602		

Appendix 5 Judd Lake 2009 – Update

Adult Migration

Dates:	16-Jul to	7-Sep		
			No.	%
Sockeyes:			44,602	100%
Mortalities:			0	0%
Age 1.2:			4,581	10.27%
Age 1.3:			21,779	48.83%
Age 2.2:			7,698	17.26%
Age 1.4:			71	0.16%
Age 2.3:			10,473	23.48%
Coho:			587	
King:			32	
Pink:			90	
Chum:			58	
Rainbow:			15	
Dolly Varden			20	



Appendix 6 Judd Lake 2010 – Environmental Conditions

Adult Migration						
Date	Sky	Precip. (mm)	Stage (ft)	Flow	Water	Air
					Temp. (°C)	Temp. (°C)
13-Jul	5	ND	ND	ND	ND	ND
14-Jul	3	15	ND	ND	13	17
15-Jul	4	7	ND	ND	12	14
16-Jul	1	10	1.70	ND	14	18
17-Jul	4	0	1.70	ND	13	11
18-Jul	5	6	1.70	ND	12	11
19-Jul	5	13	1.75	ND	12	10
20-Jul	5	6	1.80	ND	12	12
21-Jul	4	4	1.70	ND	13	15
22-Jul	4	15	1.70	ND	12	14
23-Jul	3	2	1.70	ND	13	13
24-Jul	4	0	1.70	ND	12	9
25-Jul	5	17	1.80	ND	11	9
26-Jul	5	5	2.50	ND	11	10
27-Jul	3	5	2.70	ND	11	12
28-Jul	4	0	2.60	ND	11	11
29-Jul	4	1	2.10	ND	11	11
30-Jul	5	2	1.10	ND	11	12
31-Jul	3	14	2.10	ND	13	15
1-Aug	3	1	2.10	ND	3	17
2-Aug	3	0	1.11	ND	3	14
3-Aug	4	1	1.10	ND	4	15
4-Aug	5	42	2.10	ND	5	12
5-Aug	3	7	2.30	ND	3	13
6-Aug	4	4	2.30	ND	4	10
7-Aug	5	2	2.20	ND	5	9
8-Aug	5	1	2.20	ND	5	10
9-Aug	5	31	2.30	ND	5	11
10-Aug	4	10	2.30	ND	4	10
11-Aug	4	2	2.25	ND	4	11
12-Aug	4	1	2.05	ND	4	11
13-Aug	4	0	2.00	ND	4	11
14-Aug	4	10	ND	ND	4	14
15-Aug	4	3	ND	ND	4	12
16-Aug	5	3	ND	ND	5	10
17-Aug	5	10	ND	ND	5	10
18-Aug	2	3	ND	ND	2	16
19-Aug	2	0	ND	ND	2	10
20-Aug	1	0	ND	ND	1	13
21-Aug	2	0	ND	ND	2	13
22-Aug	2	0	ND	ND	2	13
23-Aug	2	0	1.53	ND	2	17
24-Aug	2	0	1.60	ND	2	13
25-Aug	2	0	1.61	ND	2	12
26-Aug	3	0	1.59	ND	3	13
27-Aug	5	4	1.56	ND	5	10
28-Aug	5	10	1.60	ND	5	11
29-Aug	3	3	1.59	ND	3	12
30-Aug	3	5	1.58	ND	3	10
31-Aug	3	1	1.54	ND	3	13
1-Sep	3	1	1.25	ND	3	11
2-Sep	3	1	0.75	ND	3	12
3-Sep	4	1	0.50	ND	4	12
Total		275				
Avg.		5	-	ND	6	12
Min.		0	0.50	ND	1	9
Max.		42	2.70	ND	14	18

Ice Out = 23 - May

Summary of Cloud Cover - Percent of Days					
	No. Days	Meas. Rain	Percent of Days		
			Overcast	Partly Cloudy	Clear
Adults	53	74%	58%	38%	4%

* This data reflects fluctuations in water levels only.

*16 July - 13 August water level fluctuated 1.6 ft.
 *23 August - 3 September water level fluctuated 1.11 ft.
 These two time periods are not comparable.

Appendix 7 Judd Lake 2010 – Adult Escapement

Date	Sockeye		Coho	King	Pink	Chum	Rainbow	D.V.
	Daily Escapement	Total Return	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement
13-Jul	0	0	0	0	0	0	0	0
14-Jul	0	0	0	2	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	0	0	0	0	0	0	0	0
22-Jul	0	0	0	0	0	0	0	0
23-Jul	0	0	0	0	0	0	0	0
24-Jul	164	164	2	0	0	0	0	0
25-Jul	10	174	0	0	0	0	0	0
26-Jul	0	174	0	0	0	0	0	0
27-Jul	50	224	0	0	0	0	0	0
28-Jul	614	838	1	0	0	0	0	0
29-Jul	560	1,398	2	0	0	0	0	0
30-Jul	1,571	2,969	0	0	0	0	0	0
31-Jul	804	3,773	1	0	0	0	0	0
1-Aug	1,325	5,098	16	0	0	1	0	0
2-Aug	2,347	7,445	8	0	0	6	0	0
3-Aug	1,408	8,853	0	0	0	0	0	0
4-Aug	1,221	10,074	0	1	12	5	0	0
5-Aug	482	10,556	0	0	1	0	0	0
6-Aug	943	11,499	0	0	1	1	0	0
7-Aug	866	12,365	0	0	5	5	0	0
8-Aug	806	13,171	0	0	6	9	0	0
9-Aug	523	13,694	0	1	7	6	2	0
10-Aug	450	14,144	0	0	5	7	0	0
11-Aug	657	14,801	0	1	10	3	0	0
12-Aug	485	15,286	0	0	2	6	0	0
13-Aug	320	15,606	0	0	8	8	1	0
14-Aug	505	16,111	0	1	8	7	0	0
15-Aug	404	16,515	0	0	9	5	0	0
16-Aug	480	16,995	0	0	7	9	0	0
17-Aug	191	17,186	0	0	0	1	0	0
18-Aug	347	17,533	0	0	14	5	0	0
19-Aug	81	17,614	1	0	1	0	0	0
20-Aug	13	17,627	0	0	1	0	0	0
21-Aug	64	17,691	0	0	0	0	0	0
22-Aug	9	17,700	0	0	0	0	0	0
23-Aug	45	17,745	0	0	0	0	0	0
24-Aug	148	17,893	0	0	0	0	0	0
25-Aug	117	18,010	0	0	0	0	0	0
26-Aug	87	18,097	0	0	1	0	0	0
27-Aug	17	18,114	0	0	0	1	0	0
28-Aug	82	18,196	1	0	0	1	0	0
29-Aug	83	18,279	1	0	0	0	0	0
30-Aug	47	18,326	1	0	0	0	0	0
31-Aug	29	18,355	4	0	0	0	0	0
1-Sep	27	18,382	1	0	0	0	0	0
2-Sep	36	18,418	1	0	0	0	0	0
3-Sep	34	18,452	0	0	0	0	0	0
4-Sep	14	18,466	1	0	0	0	1	0
Total		18,466	41	6	98	86	4	0

Appendix 8 Judd Lake 2010 - Age, Sex and Length Composition of Sockeye Salmon Escapement

Sample period: 24 July - 4 September	Age Group					Total
	1.2	1.3	2.2	2.3	3.2	
Males	608	2,430	102	7,900	66	11,105
Percent	3.29%	13.16%	0.55%	42.78%	0.36%	60.14%
Sample Size	18	72	3	234	2	329
Mean Lth (mm)	488	573	513	570	525	565
Std. Error	10	3	3	2	10	1
Females	135	2,127	102	4,997	0	7,226
Percent	0.73%	11.52%	0.55%	27.06%	0.00%	39.86%
Sample Size	4	63	3	148	0	218
Mean Lth (mm)	487	548	499	543	ND	543
Std. Error	12	2	9	2	ND	1
Both Sexes	742	4,557	203	12,897	66	18,466
Percent	4.02%	24.68%	1.10%	69.84%	0.36%	100.00%
Sample Size	22	135	6	382	2	547
Mean Lth (mm)	488	562	506	559	525	556
Std. Error	9	2	5	1	10	1

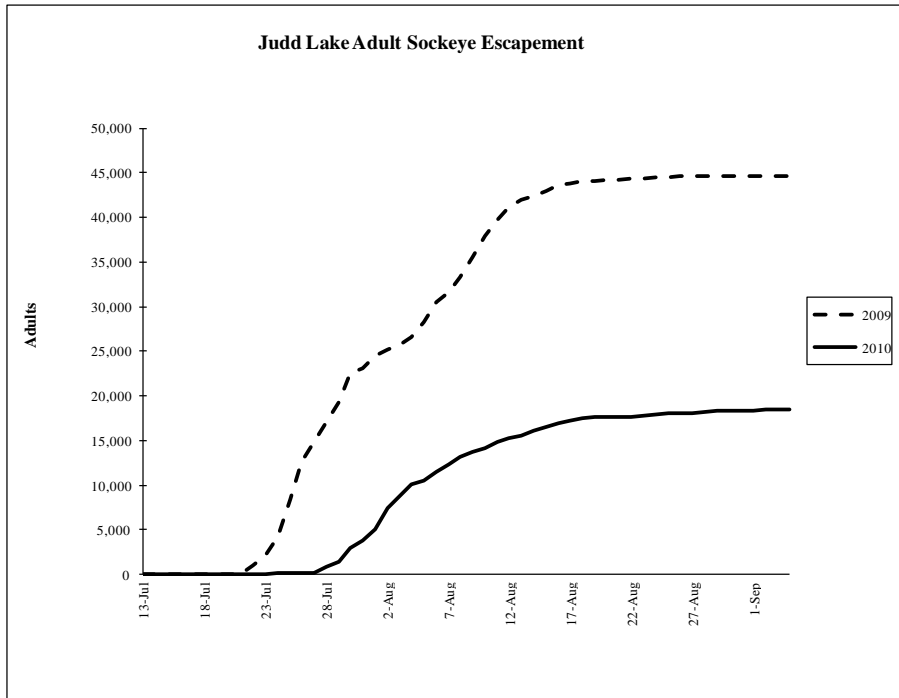
Appendix 9 Judd Lake 2010 – Adult Sockeye Escapement Hourly Log

Date	Hour												No.												
	AM						PM																		
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	
13-Jul														0		0									0
14-Jul				0				0					0			0									0
15-Jul					0				0							0									0
16-Jul					0			0						0			0								0
17-Jul				0			0		0									0							0
18-Jul				0			0			0							0								0
19-Jul				0				0		0							0		0						0
20-Jul				0				0		0								0							0
21-Jul				0			0			0				0					0						0
22-Jul				0				0											0						0
23-Jul				0				0			0			0					0						0
24-Jul				0				0				130		12				22							164
25-Jul				0				0					7		3			0		0					10
26-Jul					0			0					0			0			0						0
27-Jul				10			10		5			10			15										50
28-Jul				0				0		0				0			614								614
29-Jul					0		0		0		0		265						295						560
30-Jul				0			0		0			4			1,567										1,571
31-Jul					0		0		0		20			729					55						804
1-Aug				0			0		0			1		939				385							1,325
2-Aug				0			0			0		636					1,666		45						2,347
3-Aug				0			0			0	351						1,057								1,408
4-Aug				0			0			0		20		684				517							1,221
5-Aug				0			0		0	0			290					192							482
6-Aug					0		0		0			656						287							943
7-Aug					0		0			0			0	453				413							866
8-Aug				0			0			0		384						422							806
9-Aug				0			0			0		338						185							523
10-Aug				0			0			0			4	237				209							450
11-Aug				5			5	34	77				365					171							657
12-Aug				0						0			326					0	159						485
13-Aug				0						0			9		251				60						320
14-Aug					0		0			0			380						125						505
15-Aug				0			0			0			290					114							404
16-Aug					0		0			0			225					255							480
17-Aug				0				0				35		82	74										191
18-Aug												52	116	179											347
19-Aug													42					39							81
20-Aug													5					8							13
21-Aug													22					42							64
22-Aug													1			8									9
23-Aug													13			32			0						45
24-Aug													40		77				31						148
25-Aug														66				51							117
26-Aug															23				64						87
27-Aug														6				11							17
28-Aug														39				43							82
29-Aug										7		15			25										83
30-Aug													33			13									47
31-Aug														20				7							29
1-Sep														12				13							27
2-Sep												26				3									36
3-Sep													20			1									34
4-Sep													12		2										14
																									18,466

Appendix 10 Judd Lake 2010 – Update

Adult Migration

Dates:	13-Jul to	4-Sep	No.	%
Sockeyes:			18,466	100%
Mortalities:			0	0%
Age 1.2:			742	4.02%
Age 1.3:			4,557	24.68%
Age 2.2:			203	1.10%
Age 2.3:			12,897	69.84%
Age 3.2:			66	0.36%
Coho:			41	
King:			6	
Pink:			98	
Chum:			86	
Rainbow:			4	
Dolly Varden:			0	



Appendix 11 Judd Lake 2011 – Environmental Conditions

Adult Migration						
Date	Sky	Precip. (mm)	Stage* (ft)	Flow	Water Temp. (°C)	Air Temp. (°C)
17-Jul	4	0	1.00	ND	ND	14
18-Jul	4	0	1.00	ND	13	12
19-Jul	1	6	1.01	ND	15	15
20-Jul	2	0	1.00	ND	14	14
21-Jul	3	0	1.01	ND	15	16
22-Jul	1	0	0.95	ND	16	20
23-Jul	5	0	1.00	ND	14	13
24-Jul	5	28	1.20	ND	15	13
25-Jul	3	34	1.60	ND	14	13
26-Jul	3	34	1.40	ND	14	15
27-Jul	2	34	1.35	ND	15	16
28-Jul	2	3	1.25	ND	14	16
29-Jul	2	3	1.25	ND	14	18
30-Jul	3	3	1.25	ND	14	17
31-Jul	4	1	1.22	ND	15	16
1-Aug	5	8	1.30	ND	13	14
2-Aug	5	43	1.40	ND	13	11
3-Aug	5	25	2.20	ND	12	10
4-Aug	5	9	2.20	ND	11	9
5-Aug	2	4	2.10	ND	12	18
6-Aug	5	15	1.90	ND	10	9
7-Aug	2	15	1.80	ND	11	13
8-Aug	4	15	1.74	ND	11	10
9-Aug	5	4	1.65	ND	11	10
10-Aug	2	4	1.60	ND	11	15
11-Aug	1	0	1.57	ND	13	20
12-Aug	4	0	1.52	ND	11	18
13-Aug	4	0	1.48	ND	12	15
14-Aug	4	0	1.47	ND	12	13
15-Aug	2	0	1.41	ND	11	15
16-Aug	3	0	1.35	ND	13	18
17-Aug	3	4	1.30	ND	13	16
18-Aug	4	6	1.30	ND	12	16
19-Aug	5	21	1.39	ND	12	10
20-Aug	5	19	1.65	ND	12	11
21-Aug	2	7	1.68	ND	13	13
22-Aug	4	2	1.50	ND	12	11
23-Aug	5	7	1.52	ND	12	10
24-Aug	3	4	1.45	ND	13	12
25-Aug	5	11	1.49	ND	11	10
26-Aug	1	0	1.50	ND	12	13
27-Aug	5	1	1.52	ND	12	12
28-Aug	1	0	1.48	ND	11	14
29-Aug	1	0	1.45	ND	12	16
30-Aug	5	7	1.27	ND	11	11
31-Aug	5	24	1.57	ND	11	10
1-Sep	2	0	1.62	ND	12	16
2-Sep	5	4	1.56	ND	12	10
3-Sep	5	2	1.53	ND	11	11
4-Sep	5	7	1.62	ND	11	9
Total		413				
Avg.		8	-	ND	13	14
Min.		0	0.95	ND	10	9
Max.		43	2.20	ND	16	20

* This data reflects fluctuations in water level only.

Ice out = May 30

Summary of Cloud Cover - Percent of Days					
No. Days	Meas. Rain	Overcast	Partly Cloudy	Clear	
Adults	50	68%	54%	34%	12%

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

ND = No Data

Appendix 12 Judd Lake 2011 – Adult Escapement

Date	Sockeye			Coho	King	Pink	Chum	Rainbow	D.V.
	Daily Escapement	Tags	Total Return	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement
17-Jul	0	0	0	0	0	0	0	0	0
18-Jul	0	0	0	0	0	0	0	0	0
19-Jul	0	0	0	0	0	0	0	0	0
20-Jul	0	0	0	0	0	0	0	0	0
21-Jul	0	0	0	0	0	0	0	0	2
22-Jul	0	0	0	0	0	0	0	0	0
23-Jul	0	0	0	0	0	0	0	0	0
24-Jul	45	0	45	0	0	0	0	0	2
25-Jul	802	0	847	0	0	0	1	0	0
26-Jul	2,977	6	3,824	0	0	0	0	1	0
27-Jul	3,059	15	6,883	0	0	0	0	1	1
28-Jul	2,745	16	9,628	0	0	0	0	0	0
29-Jul	2,468	15	12,096	0	0	0	0	0	0
30-Jul	2,806	26	14,902	0	0	0	1	0	0
31-Jul	2,716	34	17,618	0	0	0	2	0	2
1-Aug	4,015	69	21,633	0	0	0	1	0	0
2-Aug	4,598	88	26,231	0	1	0	4	0	0
3-Aug	1,406	17	27,637	0	0	0	1	0	0
4-Aug	456	11	28,093	0	0	0	1	0	0
5-Aug	512	10	28,605	0	0	0	0	0	0
6-Aug	116	3	28,721	0	0	0	1	0	0
7-Aug	1,059	18	29,780	0	0	0	1	0	0
8-Aug	1,185	20	30,965	0	0	0	0	0	0
9-Aug	1,061	15	32,026	0	0	0	1	0	0
10-Aug	1,075	23	33,101	0	0	0	2	0	0
11-Aug	663	10	33,764	0	0	9	2	0	0
12-Aug	841	18	34,605	0	0	0	2	0	0
13-Aug	742	13	35,347	0	0	0	1	0	0
14-Aug	764	19	36,111	0	0	2	0	0	0
15-Aug	665	7	36,776	0	0	0	0	0	0
16-Aug	529	15	37,305	0	0	0	1	0	0
17-Aug	552	23	37,857	0	0	0	4	0	0
18-Aug	398	16	38,255	0	0	0	1	0	0
19-Aug	522	21	38,777	0	0	0	6	0	0
20-Aug	378	15	39,155	0	0	0	8	0	0
21-Aug	98	8	39,253	0	0	0	2	0	0
22-Aug	110	8	39,363	0	0	0	1	0	0
23-Aug	81	3	39,444	2	0	0	0	0	0
24-Aug	75	3	39,519	1	0	0	1	0	0
25-Aug	50	1	39,569	1	0	0	0	0	0
26-Aug	48	2	39,617	0	0	0	0	0	0
27-Aug	32	0	39,649	1	0	0	0	0	0
28-Aug	31	1	39,680	0	0	0	0	0	0
29-Aug	22	1	39,702	1	0	0	0	0	0
30-Aug	23	0	39,725	0	0	0	0	0	0
31-Aug	86	5	39,811	15	0	0	0	0	0
1-Sep	37	1	39,848	15	0	0	0	0	0
2-Sep	17	0	39,865	12	0	0	0	0	0
3-Sep	31	0	39,896	10	0	0	0	0	0
4-Sep	13	0	39,909	7	0	0	0	0	0
Total		576	39,909	65	1	11	45	2	7

Appendix 13 Judd Lake 2011 - Age, Sex and Length Composition of Sockeye Salmon Escapement

Sample period: 17 July - 4 September	Age Group					Total
	0.3	1.2	1.3	2.2	2.3	
Males	0	583	19,555	219	798	21,156
Percent	0.00%	1.46%	49.00%	0.55%	2.00%	53.01%
Sample Size	0	8	269	3	11	291
Mean Lth (mm)	-	482	582	511	568	578
Std. Error	-	9	2	7	7	2
Females	148	291	17,081	219	1,018	18,610
Percent	0.37%	0.73%	42.80%	0.55%	2.55%	47.00%
Sample Size	2	4	235	3	14	258
Mean Lth (mm)	548	470	559	488	558	556
Std. Error	6	8	2	10	4	1
Both Sexes	148	874	36,636	439	1,816	39,909
Percent	0.37%	2.19%	91.80%	1.10%	4.55%	100.01%
Sample Size	2	12	504	6	25	549
Mean Lth (mm)	548	478	571	500	562	568
Std. Error	6	7	1	6	4	1

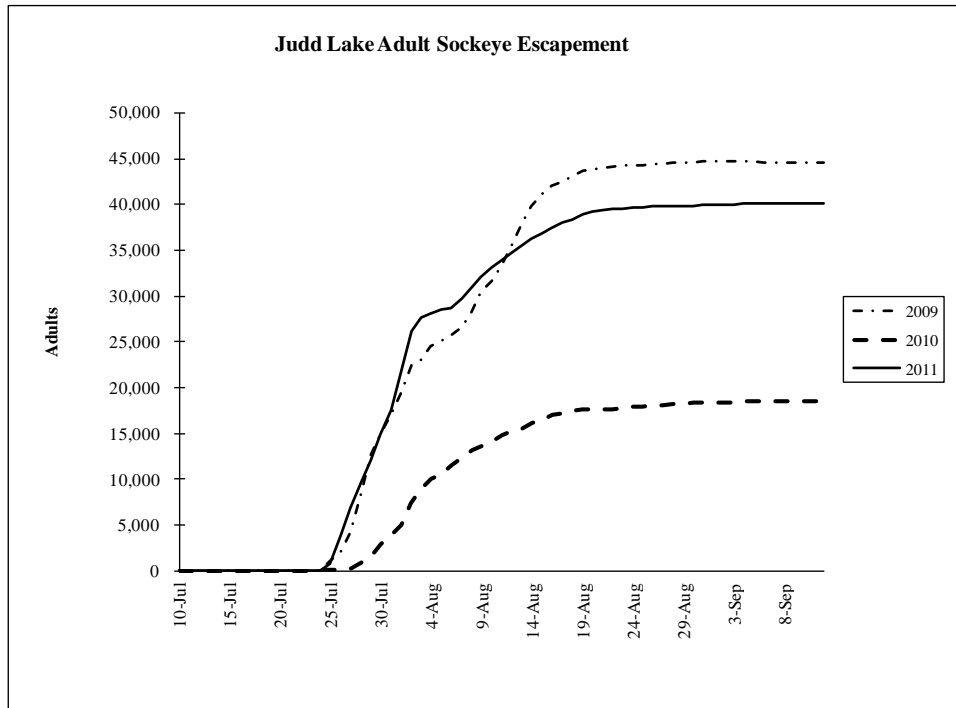
Appendix 14 Judd Lake 2011 – Adult Sockeye Escapement Hourly Log

Date	Hour												No.												
	AM						PM																		
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	
17-Jul							0				0					0									0
18-Jul					0						0					0									0
19-Jul					0			0						0			0								0
20-Jul					0			0						0			0								0
21-Jul				0			0				0			0											0
22-Jul					0			0							0										0
23-Jul					0		0	0					0			0									0
24-Jul					2		0		9		0					6			28						45
25-Jul					0		1					10			791										802
26-Jul					9					1,852						1,116									2,977
27-Jul					0		685					1,332					1,042								3,059
28-Jul						0			9		2,243						493								2,745
29-Jul					0	15		1,156					1,297					0							2,468
30-Jul					0	41			2,022							743									2,806
31-Jul					0	48				231		1,391				1,046									2,716
1-Aug					782				1,291			623			1,319										4,015
2-Aug					848					2,957					793										4,598
3-Aug					28				1,022						356										1,406
4-Aug					0		9			34				413											456
5-Aug					0		15			143					354			0							512
6-Aug					0	12			44			0	60												116
7-Aug					0	62				621						376		0							1,059
8-Aug					0		23			17		541				604									1,185
9-Aug					0						620				441										1,061
10-Aug					0		0			30			622			423									1,075
11-Aug								134		15			227		287										663
12-Aug					49		58				372		83			279									841
13-Aug					55				170					517											742
14-Aug					19		38							313		394									764
15-Aug					88					27				550											665
16-Aug							40							340		107									529
17-Aug					42							244			237										552
18-Aug					71										134										398
19-Aug						102				162					159										522
20-Aug						75				288					79										378
21-Aug						132					167				56										98
22-Aug						20					22				56										110
23-Aug						10					17				83										81
24-Aug						27					13				41										75
25-Aug						13					11				51										50
26-Aug						4					3				43										48
27-Aug						7					0				41										32
28-Aug						13					2				17										31
29-Aug						7					3				21										22
30-Aug						0					2				20										31
31-Aug						4					2				17										23
1-Sep						32					7				47										86
2-Sep						6					3				28										37
3-Sep						3					0				14										17
4-Sep						11					8				12										31
4-Sep						1					5				7										13
																									39,909

Appendix 15 Judd Lake 2011 – Update

Adult Migration

Dates:	17-Jul to	4-Sep	No.	%
Sockeyes:			39,909	100%
Mortalities:			0	0%
Age 0.3:			148	0.37%
Age 1.2:			874	2.19%
Age 1.3:			36,636	91.80%
Age 2.2:			439	1.10%
Age 2.3:			1,816	4.55%
Coho:			65	
King:			1	
Pink:			11	
Chum:			45	
Rainbow:			2	
Dolly Varden			7	



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