Red Salmon Lake
Data Report
2011

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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 Red Salmon Lake. This Red Salmon Lake Data Report encompasses data collected during the 2011 adult sockeye salmon 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. This report is intended to provide a general description of project activity and is 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 Red Salmon Lake Data Report was prepared by Cook Inlet Aquaculture Association 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 (ADF&G. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, the U.S. Department of Commerce, or ADF&G.

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

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ACKNOWLEDGEMENTS

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ABSTRACT

As part of the continued evaluation of lakes in the Susitna River watershed to determine the sockeye salmon (*Onchorynchus 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 Red Salmon Lake. The 2011 Red Salmon Lake adult escapement was the first time Cook Inlet Aquaculture Association (CIAA) monitored the escapement by use of weir.

The adult escapement was enumerated from 27 July and continued daily until 2 September. During this time, 711 adult sockeye salmon (*O.nerka*) were passed through the weir. A foot survey conducted on 29 August estimated 700 adult sockeye salmon congregating several yards downstream of weir. Other fish counted during this time were 1 adult coho salmon (*O. kisutch*), 5 adult king salmon (*O. tshawytscha*), 6 adult pink salmon (*O.gorbuscha*), 270 adult chum salmon (*O. keta*), 21 adult rainbow (O. mykiss), and 7 Dolly Varden (*Salvelinus malma*).

During the escapement, 93 adult sockeye salmon were sampled for age and length characteristics. Of those sampled 3.17% were age 0.3, 3.17% were age 1.2, 89.42% were age 1.3, 1.06% were age 2.2, and 3.17% were 2.3. Due to limited sample size, the statistical standard error is high and therefore caution should be exercised in interpreting the results.

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INTRODUCTION AND PURPOSE

To better understand the recent low adult sockeye salmon (*Onchorynchus nerka*) 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 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 evaluation of adult sockeye salmon returns to Red Salmon Lake was completed in the last year of the three year project. At this point, the key production lakes (4 lakes; Shell Lake, Chelatna Lake, Judd Lake and Larson Lake) had been identified and were being monitored yearly. This left three lakes to be evaluated each year which could be discretionally determined based on assessment needs. Red Salmon Lake was chosen because sockeye salmon were known to be present and it was unknown if northern pike had invaded this lake system.

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PROJECT AREA

Red Salmon Lake is located approximately 85 miles west of Anchorage, Alaska (Figure 1). Red Salmon Lake lies in the Lower Skwentna River watershed which encompasses approximately 377 mi^2 of the larger Yentna River watershed (6,137 mi^2). Red Salmon Lake with surface area of 0.18 mi^2 and has an outlet flowing into the Skwentna River and is listed in the Anadromous Waters Catalog under code 247-41-10200-2053-3205-4099-0010 as containing spawning and rearing sockeye salmon (*O. nerka).*

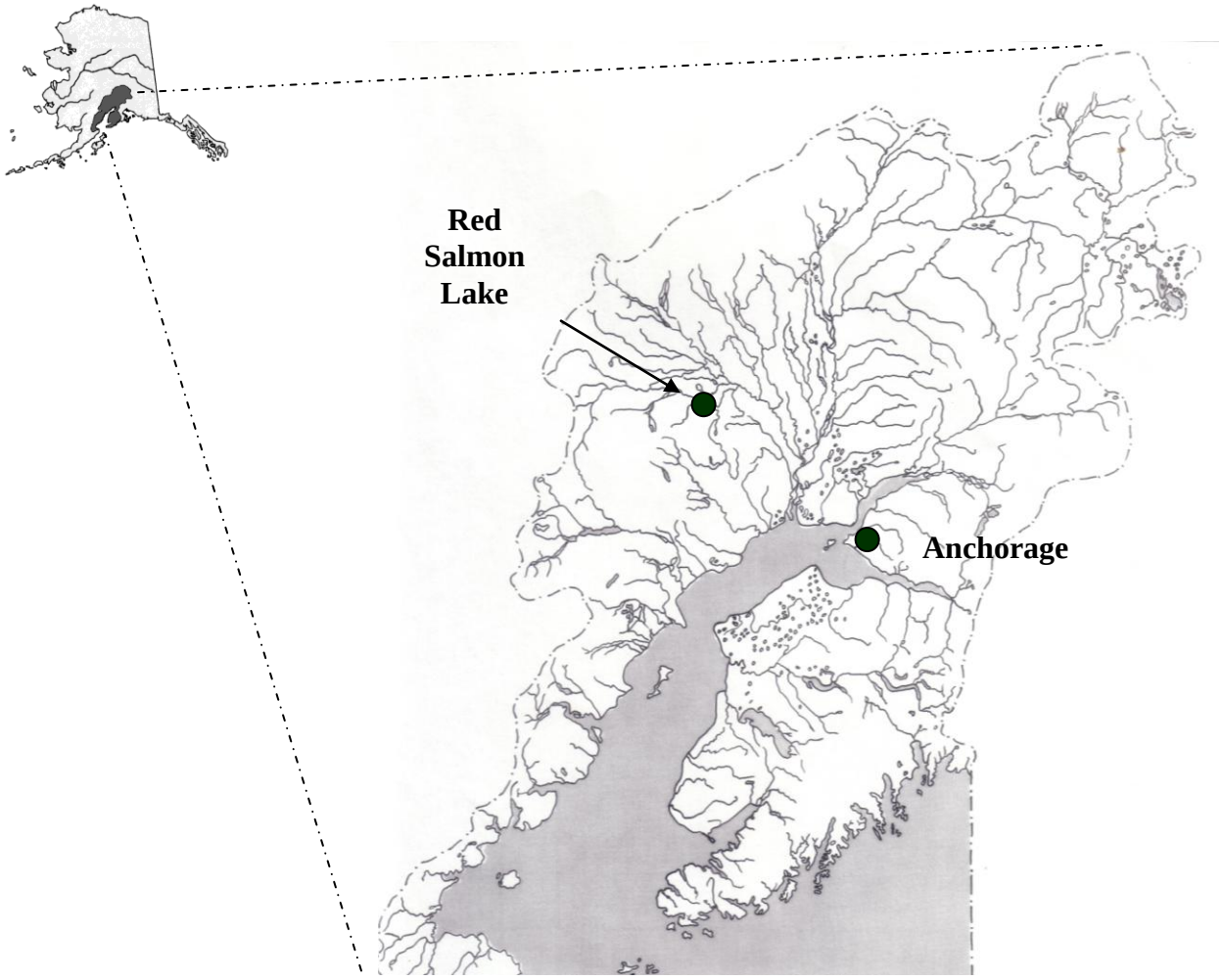

Figure 1 Red Salmon Lake in relation to Cook Inlet and Alaska

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METHODS

Environmental Conditions

Environmental conditions were recorded daily at 5:00 pm and consisted of the percent cloud cover (visual determination), stream stage (measured to the nearest tenth of a foot), precipitation (measured to the nearest millimeter) and water and air temperatures. Standard CIAA procedures were followed for collecting these observations (CIAA 2011).

Adult Enumeration

To enumerate returning adult salmon and facilitate data collection, a counting weir was temporarily installed in Red Salmon Creek. 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 checked the weir several times a day and would open 1-2 pickets on the weir to allow fish to move upstream. CIAA adult salmon enumeration includes an assessment of the sex, age, and standard fork length[1] of the returning population of fish.

During the adult escapement salmon samples were to be randomly collected up to 40 per day. However, due to difficulties in getting the fish into live boxes for sample collection (low water levels), samples were not collected for the later part of the run. Each adult collected for evaluation was first measured to the nearest millimeter for standard fork length[1] and sex visually determined.

For age evaluation, field personnel removed a scale from the primary growth area. 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. The fish were unharmed and released upstream. Scale samples were sent to the ADF&G Soldotna office for age analysis.

1Standard fork length was defined as the measurement from mid-eye to the fork of the tail.

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RESULTS AND DISCUSSION

Environmental Conditions

During the 2011 adult escapement, environmental conditions were monitored from 28 July to 2 September. Stream stage measurements averaged 1.51 feet (± 0.1 ft). Stream temperatures averaged 11°C (±1.6°C). Air temperatures averaged 13°C (±3.2°C). Eight percent of the days were clear, 30% were partly cloudy, and 62% were completely overcast. Measurable rain was recorded on 31 days. A total of 149 mm of rain fell during this period.

Adult Enumeration

The adult escapement was enumerated from 27 July and continued daily until 2 September. During this time, 714 adult sockeye salmon were passed through the weir. A foot survey conducted on 29 August estimated 700 adult sockeye salmon were congregating several yards downstream of weir. Other fish counted during this time were 1 adult coho salmon (*O. kisutch*), 5 adult king salmon (*O. tshawytscha*), 6 adult pink salmon (*O.gorbuscha*), 270 adult chum salmon (*O. keta*), 21 adult rainbow (*O. mykiss*), and 7 dolly varden (*Salvelinus malma*).

During the escapement, 153 adult sockeye salmon were sampled for age and length characteristics. The majority of this sampling occurred in the first two-thirds of the run. For the last one-third of the run, CIAA staff experienced difficulties with fish moving into the live trap due to low water levels, hence no sampling was done. Of the 153 samples collected, only 93 (60.7%) could be read for age determination. Of those sampled (n=93) 3.17% were age 0.3, 3.17% were age 1.2, 89.42% were age 1.3, 1.06% were age 2.2, and 3.17% were 2.3. Age analysis was provided by ADF&G.

Based on the samples collected, 44% of the return were males while the remaining 56% were females (first 2/3 of the run only). Average length for all returning salmon sampled was 566 mm (2% SE). Average length for females was 553 (3% SE) and for males was 582 (3% SE).

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RECOMMENDATIONS

CIAA found no evidence of northern pike in the lake system and a fair return of sockeye salmon both to the lake and outlet creek. Based on these results, CIAA will not monitor this year class smolt migration but recommends regular monitoring (every 5 years) be completed to assess any changes to the salmon production or introduction of northern pike.

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LITERATURE CITED

CIAA. (2011). Red Salmon Lake Procedures Manual.

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APPENDICES

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Appendix 1 Red Salmon Lake – Environmental Conditions

Date	Sky	Precip. (mm)	Stage (ft)	Water Temp. (°C)	Air Temp. (°C)
28-Jul	2	0.0	1.39	14	21
29-Jul	2	0.4	1.38	15	18
30-Jul	5	0.0	1.34	15	17
31-Jul	5	5.6	1.37	13	14
1-Aug	5	1.9	1.39	11	12
2-Aug	5	3.9	1.38	10	10
3-Aug	5	11.5	1.55	10	12
4-Aug	5	0.6	1.60	10	13
5-Aug	2	0.4	1.55	12	15
6-Aug	5	0.1	1.50	10	10
7-Aug	3	5.5	1.50	11	13
8-Aug	5	0.8	1.47	10	11
9-Aug	3	14.0	1.58	10	11
10-Aug	2	0.0	1.50	11	16
11-Aug	1	0.0	1.50	12	19
12-Aug	5	0.1	1.45	11	14
13-Aug	4	2.8	1.44	12	15
14-Aug	2	0.2	1.42	11	16
15-Aug	2	0.0	1.40	12	15
16-Aug	2	0.0	1.38	12	20
17-Aug	5	5.1	1.39	12	16
18-Aug	5	2.5	1.39	11	14
19-Aug	5	15.0	1.48	10	10
20-Aug	4	22.0	1.80	9	12
21-Aug	4	1.2	1.70	10	12
22-Aug	4	0.2	1.68	10	10
23-Aug	5	12.5	1.70	9	10
24-Aug	4	0.5	1.68	9	10
25-Aug	5	17.5	1.71	9	11
26-Aug	2	1.7	1.69	11	14
27-Aug	4	2.0	1.60	10	11
28-Aug	1	0.3	1.55	12	14
29-Aug	1	0.2	1.51	12	16
30-Aug	4	0.5	1.48	9	10
31-Aug	5	15.0	1.53	9	9
1-Sep	2	0.4	1.50	10	15
2-Sep	5	5.0	1.47	9	9
Total		149			
Avg.		4.0	1.51	11	13
SD		6.0	0.1	1.6	3.2
Min.		0.0	1.34	9	9
Max.		22.0	1.80	15	21

Summary of Cloud Cover - Percent of Days

	No. Days	Meas. Rain	Overcast	Partly Cloudy	Clear
Adults	37	84%	62%	30%	8%

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

ND = No Data

Appendix 2 Red Salmon Lake – Adult Escapement

	Sockeye		Coho	King	Pink	Chum	Rainbow	D.V.
Date	Daily Escapement	Total Return	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement
27-Jul	0	0	0	1	0	0	0	0
28-Jul	0	0	0	0	0	0	0	0
29-Jul	0	0	0	2	0	0	1	0
30-Jul	0	0	0	-2	0	0	1	0
31-Jul	0	0	0	-3	0	0	0	0
1-Aug	0	0	0	-2	0	0	0	0
2-Aug	0	0	0	-1	0	0	0	0
3-Aug	0	0	0	0	0	0	0	0
4-Aug	0	0	0	4	0	0	3	0
5-Aug	0	0	0	4	0	0	1	0
6-Aug	2	2	0	0	0	0	1	0
7-Aug	2	4	0	-1	0	0	2	0
8-Aug	0	4	0	-1	0	0	0	0
9-Aug	351	355	0	0	0	0	2	0
10-Aug	10	365	0	0	0	0	4	0
11-Aug	3	368	0	0	0	0	1	0
12-Aug	1	369	0	0	0	0	0	0
13-Aug	0	369	0	0	0	0	0	0
14-Aug	0	369	0	0	0	0	0	0
15-Aug	4	373	0	3	0	1	0	0
16-Aug	23	396	0	0	0	0	2	0
17-Aug	47	443	0	1	2	35	2	2
18-Aug	11	454	0	0	1	3	0	1
19-Aug	3	457	0	0	0	1	0	1
20-Aug	15	472	0	0	0	7	0	0
21-Aug	8	480	0	0	0	5	0	0
22-Aug	40	520	0	0	2	27	1	1
23-Aug	19	539	0	0	1	30	0	1
24-Aug	24	563	0	0	0	30	0	0
25-Aug	15	578	0	0	0	31	0	0
26-Aug	12	590	0	0	0	1	0	0
27-Aug	20	610	1	0	0	24	0	1
28-Aug	10	620	0	0	0	6	0	0
29-Aug	21	641	0	0	0	11	0	0
30-Aug	3	644	0	0	0	14	0	0
31-Aug	24	668	0	0	0	11	0	0
1-Sep	29	697	0	0	0	18	0	0
2-Sep	17	714	0	0	0	15	0	0
Total	714		1	5	6	270	21	7

Stream survey estimated 700 sockeye salmon downstream of weir and is not included in the daily count.

Appendix 3 Red Salmon Lake – Adult Sockeye Age Class

	Age Group					
	0.3	1.2	1.3	2.2	2.3	Total
Males	0	8	292	0	15	333
Percent	0.00%	1.06%	40.87%	0.00%	2.12%	44.05%
Sample Size	0	1	38	0	2	41
Mean Length[a]	-	432	585	-	599	582
Std. Error	-		4	-	1	3
Females	23	15	347	8	8	423
Percent	3.17%	2.12%	48.54%	1.06%	1.06%	55.95%
Sample Size	3	2	45	1	1	52
Mean Length	556	516	556	527	540	553
Std. Error	24	19	3	-	-	3
Both Sexes	23	23	638	8	23	714
Percent	3.17%	3.17%	89.42%	1.06%	3.17%	100%
Sample Size	3	3	83	1	3	93
Mean Length	556	488	569	527	579	566
Std. Error	24	19	2	-	1	2

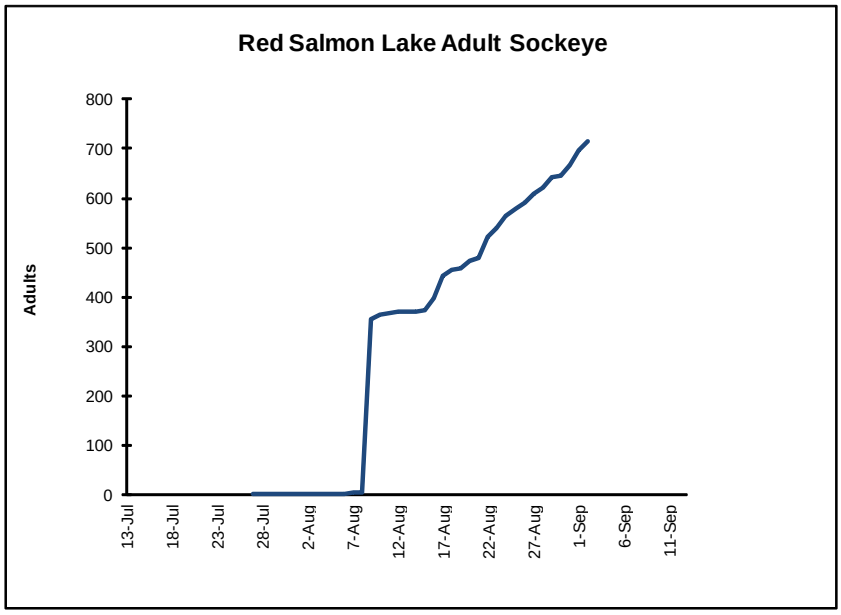
Data analysis provided by ADFG

[a]Mean length in mm

Appendix 4 Red Salmon Lake – Update

Misc. Activities	
Adult Crew On-site:	27-Jul
Adult Crew Off-site:	3-Sep

Adult Migration			
Dates:	27-Jul to	2-Sep	
		No.	%
Sockeyes:		711	100%
Mortalities:		0	
Age 0.3:		23	3.17%
Age 1.2:		23	3.17%
Age 1.3:		636	89.42%
Age 2.2:		8	1.06%
Age 2.3:		23	3.17%
Coho:		1	
King:		5	
Pink:		6	
Chum:		270	
Rainbow:		21	
Dolly Varden		7	



Appendix 5 Red Salmon Lake – Hourly Counts

Sockeye

Time	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	26-Aug	27-Aug	28-Aug	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep
6:00 AM																																						
7:00 AM																																						
8:00 AM				0	0	0	0	0	0	0	0	0	0																								
9:00 AM														0	0	0																						
10:00 AM																	0							0		0												
11:00 AM			0			0												0	0	0	0	15	4				8	16	3		6	10	-1					Removed weir
12:00 PM	0			0	0		0	0	0	0	0	0	0					1			0				6												
1:00 PM		0		0					0							0		0											2				2	1	8			
2:00 PM				0										0																						30	2	
3:00 PM											0								0		5																	
4:00 PM	0									0		0										5																
5:00 PM			0	0	0	0				0							1						7	3							10					15	
6:00 PM		0					0	0	0		2		0	40	2	3		0		4	18				9	8	38	3					19	2		-1		
7:00 PM												2		291					0										13	6		11			16			
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Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**351**	**10**	**3**	**1**	**1**	**0**	**4**	**23**	**47**	**11**	**3**	**15**	**8**	**46**	**19**	**24**	**15**	**12**	**20**	**10**	**21**	**3**	**24**	**29**	**17**	**0**