

**Fish Lake
Sockeye Salmon Smolt
Data Report
2011**

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The Fish Lake Project was made possible through an Alaska Sustainable Salmon Fund grant received from the Alaska Department of Fish and Game and the National Oceanic and Atmospheric Administration (project # 45918), and a State of Alaska Designated Legislative Grant (09-DC-020)

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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 Fish Lake. This Fish Lake Data Report encompasses data collected from the 2011 sockeye smolt migrations as it falls under the Alaska 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 other reports.

The Fish Lake Data Report was prepared by CIAA under award of the Alaska Sustainable Salmon Fund (AKSSF) 45918 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, and administered by the Alaska Department of Fish and Game (ADF&G). The statements, findings, conclusions, and recommendations are those of the author 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 (*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 salmon smolt out migration from Fish Lake. Out migrating smolt were enumerated from 18 May until 24 June. During this time, 1,196 sockeye salmon (*O. nerka*) and 24,980 coho salmon (*O. kisutch*) were enumerated in the smolt trap. Representative samples and measurements were taken of both sockeye and coho to determine mean length, weight and age. Other fish counted during this time were 127 adult rainbow trout (*O. mykiss*), and 1 adult Dolly Varden (*Salvelinus malma*). The close proximity of Fish Lake to the Parks Highway makes it an ideal study site when compared to the many other similar but more remote lakes in the area. The absence of northern pike in Fish Lake provides us an opportunity to examine relative salmon production in future years with the factor of invasive pike being ruled out as a cause of potential fluctuations. For these reasons CIAA recommends continued monitoring of Fish Lake outmigration.

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INTRODUCTION AND PURPOSE

To better understand the recent low adult sockeye salmon (*Oncorhynchus 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), assessed 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 was to enumerate the smolt and adult returns and 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 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 will allow management biologists to analyze and evaluate the production and rearing condition of each lake.

The enumeration of salmon smolt migrations from Fish Lake was performed only in 2011. Fish Lake was chosen for enumeration because invasive northern pike were not known to be present and because the lake is a historically salmon-producing system.

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PROJECT AREA

Fish Lake is located approximately 73 miles “as the crow flies” north of Anchorage, Alaska (Figure 1) and the nearest town is Talkeetna, which lies approximately 4 miles north of Fish Lake on the Talkeetna Spur Highway. The lake has surface area of 0.24 mi² and outlet Birch Creek which empties into the Susitna River. Fish Lake lies in the Trapper Creek-Susitna River watershed which encompasses approximately 291 mi² of the larger Lower Susitna River watershed (3,695 mi²). The creek is listed in the Anadromous Waters Catalog under code 247-41-10200-2320-3010-0010 as containing sockeye salmon (*O. nerka*). Data were extracted from the Fish Resource Monitor managed by the Alaska Department of Fish and Game Division of Sport Fish Research and Tech Services.

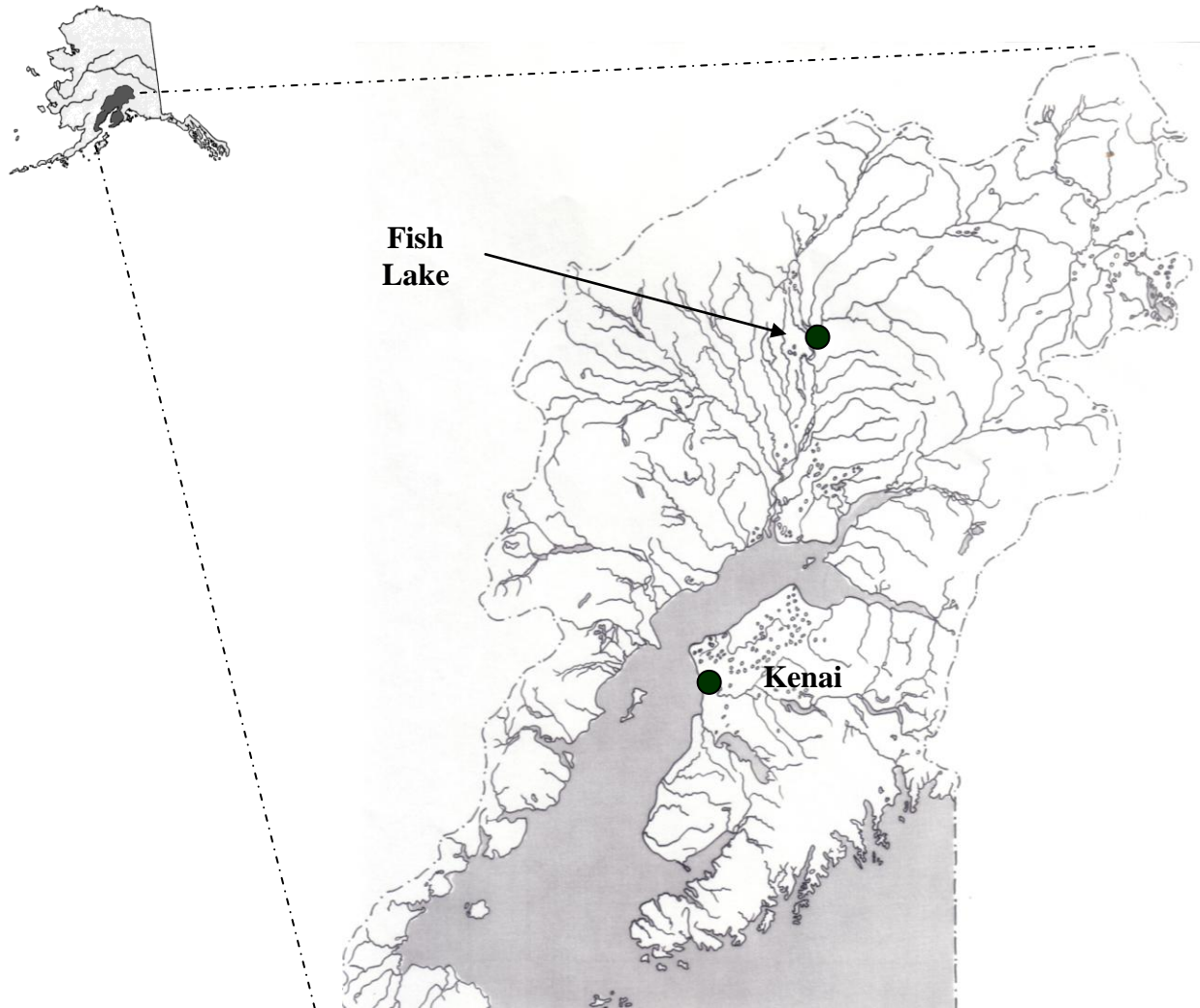


Figure 1. Fish Lake in Relation to Cook Inlet and Alaska

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METHODS

Limnological Sampling

Assessments of water quality were not conducted during the 2011 adult escapement.

Environmental Conditions

To assess the environmental conditions during the salmon smolt migration to Fish Lake, percent cloud cover was visually estimated, water level fluctuations in Birch Creek were measured to the nearest tenth of a foot, precipitation measured to the nearest millimeter, and water and air temperatures measured to the nearest degree Celsius. All measurements were recorded at 5:00 PM each day (CIAA Staff, 2011).

Smolt Enumeration

To enumerate the smolt migration, a smolt trap was temporarily placed in Birch Creek. The smolt trap consisted of a modified fyke net with Vexar® netting leads and a double compartment live-box. The leads and fyke net funneled migrating smolt into the live-box. A swing gate remotely controlled by the trap operators directed smolt into one of two live-box compartments where they were enumerated and a sample was collected. A total count was made during the smolt migrations.

Smolt Characteristics

The Fish Lake smolt characteristics were assessed by collecting a sample of the migrating smolts and measured for age, weight, and length. Throughout each day, field personnel randomly collected sockeye (up to 40 per day) and coho samples (up to 20 per day). Each smolt collected for evaluation was first measured to the nearest millimeter for fork length¹ and then weighed to

¹ Standard fork length was measured from the tip of the snout to the fork of the tail.

the nearest 0.1 g. Several scales were also removed from the primary growth area² and mounted on a glass slide for subsequent age determination. Scale samples were read by CIAA full-time staff at headquarters in Kenai.

² 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

Limnological Conditions

Limnological conditions were not evaluated during the 2011 field season.

Environmental Conditions

During the 2011 smolt migration, environmental conditions were monitored from 18 May to 24 June. Stream levels fluctuated +0.50 foot during this time. Stream temperatures averaged 12°C and ranged from 8 to 17°C. Lake temperatures averaged 16°C and ranged from 5 to 20°C. Air temperatures averaged 10°C and ranged from 1 to 20°C. Sixteen percent of the days were clear, 39% were partly cloudy, and 16% were completely overcast. Measurable rain was recorded on 5 of the days during the smolt migration. A total of 14 mm of rain fell during this period.

Smolt Enumeration

The 2011 Fish Lake salmon smolt migration was enumerated from 18 May and continued daily until 24 June. The staff arrived and constructed the collection facility on 17 May. During the enumeration, 1,196 sockeye salmon (*O. nerka*) and 24,980 coho salmon (*O. kisutch*) were captured in the smolt trap. Other fish counted during this time were 127 adult rainbow trout (*O. mykiss*), and 1 adult Dolly Varden (*Salvelinus malma*). The reported ice-out of Fish Lake was 28 May.

Counting was discontinued after the daily sockeye count fell below 1% of the total count for the year. Because the counting effort was ended, the count of out migrating coho was incomplete.

Smolt Characteristics

Based on the sockeye smolt samples collected, an estimated 93.5% ($\pm 0.01\%$) were age 1, 6.0% ($\pm 0.6\%$) were age 2, and 0.5% ($\pm 3.5\%$) were age 3. The average length and weight of age 1 sockeye smolt were 75 mm (± 0.7 mm) and 3.8 g (± 0.1 g). The average length and weight of age 2 sockeye smolt were 101 mm (± 6 mm) and 10 g (± 1.9 g). The average length and weight of age

3 sockeye smolt were 136 mm (± 12.4 mm) and 20.3 g (± 11.6 g).

Based on the coho smolt samples collected, an estimated, 68.0% ($\pm 0.1\%$) were age 2, and 10.7% ($\pm 0.4\%$) were age 3. The average length and weight of age 2 coho smolt were 116 mm (± 1 mm) and 15.8 g (± 0.7 g). The average length and weight of age 3 coho smolt were 138 mm (± 4.2 mm) and 26.3 g (± 2.9 g). Additionally 21.3% ($\pm 0.2\%$) were age 1 with average lengths and weights of 97 mm (± 3 mm) and 9.6 g (± 0.7 g). At the time of this report it is not clear whether these age 1 coho had undergone smoltification or were migrating to other rearing areas downstream.

RECOMMENDATIONS

The assessment of the Fish Lake salmon stocks provides base line data from which future comparisons could be made regarding the status of Fish Lake Salmon. It also may be an important indicator of salmon production (especially coho salmon) in the smaller lakes of the Susitna drainage and could be used as a model system for productivity in other small systems. The close proximity of Fish Lake to the Parks Highway makes it an ideal study site when compared to the many other similar but more remote lakes in the area. Furthermore, the absence of northern pike in Fish Lake provides us an opportunity to examine relative salmon production in future years with the factor of invasive pike being ruled out as a cause of potential fluctuations. Since any possible future declines in salmon production in this system would presumably not be caused by pike predation, Fish Lake may be an important indicator of other pathogens within the Susitna drainage. For these reasons the CIAA believes that Fish Lake should be monitored periodically as salmon continue to decline in the greater Susitna drainage.

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LITERATURE CITED

Cook Inlet Aquaculture Association Staff. 2011. Fish Lake Procedures Manual. Cook Inlet Aquaculture Association. 40610 Kalifornsky Beach Road Kenai, Alaska 99611.

Alaska Department of Fish and Game Division of Sport Fish Research and Tech Services. (n.d.). Fish Resource Monitor. Retrieved February 13, 2012, from <http://gis.sf.adfg.state.ak.us/FlexMaps/fishresourcemonitor.html?mode=awcCached>

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APPENDICES

Appendix 1. Fish Lake 2011 – Environmental Conditions

Date	Sky	Water			Water Temp. (°C)	Air Temp. (°C)
		Precip. (mm)	Fluctuation (ft)	Flow		
18-May	2	ND	0	ND	5	ND
19-May	4	1.0	-0.02	ND	6	8
20-May	3	ND	-0.03	ND	5	1
21-May	3	ND	-0.04	ND	8	8
22-May	2	0.0	-0.05	ND	8	9
23-May	1	0.0	-0.06	ND	8	8
24-May	1	0.0	-0.11	ND	10	8
25-May	2	0.0	-0.04	ND	12	10
26-May	1	0.0	-0.18	ND	12	9
27-May	2	0.0	-0.21	ND	15	12
28-May	2	0.0	-0.24	ND	15	9
29-May	1	0.0	-0.25	ND	16	11
30-May	2	0.0	-0.27	ND	20	13
31-May	2	0.0	-0.30	ND	17	11
1-Jun	4	0.0	-0.30	ND	18	12
2-Jun	4	0.0	-0.30	ND	18	12
3-Jun	5	1.0	-0.31	ND	18	8
4-Jun	5	10.0	-0.30	ND	17	8
5-Jun	2	0.0	-0.30	ND	18	8
6-Jun	2	0.0	-0.28	ND	17	7
7-Jun	3	1.0	-0.30	ND	18	10
8-Jun	2	0.0	-0.31	ND	19	12
9-Jun	2	0.0	-0.34	ND	18	13
10-Jun	2	0.0	-0.36	ND	18	12
11-Jun	3	0.0	-0.38	ND	18	9
12-Jun	3	0.0	-0.38	ND	18	13
13-Jun	3	0.0	-0.40	ND	18	9
14-Jun	3	0.0	-0.40	ND	18	9
15-Jun	3	0.0	-0.40	ND	18	9
16-Jun	3	0.0	-0.31	ND	18	10
17-Jun	3	0.0	-0.42	ND	19	13
18-Jun	2	0.0	-0.42	ND	19	12
19-Jun	5	1.0	-0.43	ND	20	11
20-Jun	3	0.0	-0.43	ND	19	13
21-Jun	2	0.0	-0.44	ND	19	20
22-Jun	2	0.0	-0.45	ND	19	15
23-Jun	1	0.0	-0.45	ND	19	11
24-Jun	1	0.0	-0.50	ND	20	14
Total		14				
Avg.		0.4		ND	16	10
Min.		0.0	-0.50	ND	5	1
Max.		10.0	0.00	ND	20	20

Summary of Cloud Cover - Percent of Days					
	No.	Meas.	Partly		
	Days	Rain	Overcast	Cloudy	Clear
Smolts	38	13%	16%	68%	16%
1 = Clear 2 = Cloud Cover <50% 3 = Cloud Cover >50% 4 = Overcast 5 = Rain ND = No Data					

Appendix 2. Fish Lake 2011 – Daily Migration

Date	Sockeye			Coho			Chinook		Pink		Chum		Rainbow		Dolly Varden	
	Daily	Mort.	Total	Daily	Mort.	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total
18-May	19	0	19	4	0	4	0	0	0	0	0	0	11	11	0	0
19-May	5	0	24	12	0	16	0	0	0	0	0	0	8	19	0	0
20-May	24	0	48	124	0	140	0	0	0	0	0	0	15	34	0	0
21-May	27	0	75	106	0	246	0	0	0	0	0	0	12	46	0	0
22-May	37	0	112	192	0	438	0	0	0	0	0	0	10	56	0	0
23-May	108	0	220	193	0	631	0	0	0	0	0	0	1	57	0	0
24-May	127	0	347	281	0	912	0	0	0	0	0	0	8	65	0	0
25-May	79	0	426	521	0	1,433	0	0	0	0	0	0	6	71	0	0
26-May	50	0	476	1,109	0	2,542	0	0	0	0	0	0	5	76	0	0
27-May	24	0	500	342	0	2,884	0	0	0	0	0	0	5	81	0	0
28-May	34	0	534	482	0	3,366	0	0	0	0	0	0	4	85	0	0
29-May	71	0	605	1,051	0	4,417	0	0	0	0	0	0	11	96	0	0
30-May	204	0	809	2,049	0	6,466	0	0	0	0	0	0	5	101	0	0
31-May	161	0	970	2,288	0	8,754	0	0	0	0	0	0	5	106	0	0
1-Jun	63	0	1,033	1,421	0	10,175	0	0	0	0	0	0	4	110	0	0
2-Jun	63	0	1,096	1,466	0	11,641	0	0	0	0	0	0	1	111	0	0
3-Jun	12	0	1,108	1,028	0	12,669	0	0	0	0	0	0	3	114	0	0
4-Jun	17	0	1,125	961	0	13,630	0	0	0	0	0	0	2	116	0	0
5-Jun	16	0	1,141	1,008	0	14,638	0	0	0	0	0	0	1	117	0	0
6-Jun	8	0	1,149	772	0	15,410	0	0	0	0	0	0	1	118	0	0
7-Jun	8	0	1,157	967	0	16,377	0	0	0	0	0	0	1	119	1	1
8-Jun	7	0	1,164	664	0	17,041	0	0	0	0	0	0	0	119	0	1
9-Jun	9	0	1,173	576	0	17,617	0	0	0	0	0	0	3	122	0	1
10-Jun	4	0	1,177	725	0	18,342	0	0	0	0	0	0	2	124	0	1
11-Jun	4	0	1,181	442	0	18,784	0	0	0	0	0	0	0	124	0	1
12-Jun	4	0	1,185	453	0	19,237	0	0	0	0	0	0	0	124	0	1
13-Jun	4	0	1,189	598	0	19,835	0	0	0	0	0	0	0	124	0	1
14-Jun	4	0	1,193	537	0	20,372	0	0	0	0	0	0	0	124	0	1
15-Jun	0	0	1,193	226	0	20,598	0	0	0	0	0	0	0	124	0	1
16-Jun	0	0	1,193	543	0	21,141	0	0	0	0	0	0	0	124	0	1
17-Jun	2	0	1,195	863	0	22,004	0	0	0	0	0	0	1	125	0	1
18-Jun	0	0	1,195	421	0	22,425	0	0	0	0	0	0	1	126	0	1
19-Jun	0	0	1,195	886	0	23,311	0	0	0	0	0	0	1	127	0	1
20-Jun	0	0	1,195	304	0	23,615	0	0	0	0	0	0	0	127	0	1
21-Jun	1	0	1,196	264	0	23,879	0	0	0	0	0	0	0	127	0	1
22-Jun	0	0	1,196	304	0	24,183	0	0	0	0	0	0	0	127	0	1
23-Jun	0	0	1,196	356	0	24,539	0	0	0	0	0	0	0	127	0	1
24-Jun	0	0	1,196	441	0	24,980	0	0	0	0	0	0	0	127	0	1
Total	1,196	0	1,196	24,980	0	24,980	0	0	0	0	0	0	127	0	0	1

Appendix 3. Fish Lake 2011 – Sockeye Smolt Hourly Count

Date	AM					PM											AM					Total Hrs Counted	No. Sockeye Counted				
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2			3	4	5	
18-May															0	0	0	5	2	2	0	0	10	0	10	19	
19-May																0	0	2	3	0	0	0	0	0	0	9	5
20-May																0	0	5	5	7	3	4	0	0	0	9	24
21-May																5	2	10	5	5	0	0	0	0	0	9	27
22-May																2	15	10	5	5	0	0	0	0	0	9	37
23-May																0	0	40	50	18	0	0	0	0	0	9	108
24-May																0	20	47	50	10	0	0	0	0	0	9	127
25-May																10	29	30	10	0	0	0	0	0	7	79	
26-May																2	10	10	18	10	0				6	50	
27-May																10	10	10	10	2	0	0			6	24	
28-May			2													0	0	5	9	20	0	0			9	34	
29-May			0													10	0	0	0	11	10	40			7	71	
30-May			10													20	20	30	30	30	20	10			9	204	
31-May			0													40	40	40	20	20	0				7	161	
1-Jun			0													20	20	13	5	5					6	63	
2-Jun			3													10	10	10	10		20				6	63	
3-Jun			0														5	5	2	0					5	12	
4-Jun			0														10	5	2	0	0				6	17	
5-Jun			0													2	2	5	5						6	16	
6-Jun			0														2	2	2	2	2				5	8	
7-Jun			0														2	2	1	1					6	8	
8-Jun			0													3	2	1	1						5	7	
9-Jun			0													2	3	2	2						5	9	
10-Jun			0													1	1	1	1						5	4	
11-Jun			0													1	1	1	1						5	4	
12-Jun			0													1	1	1	1						5	4	
13-Jun			0													2	1	0	1						5	4	
14-Jun			0														2	2	0	0					5	4	
15-Jun			0														0	0	0	0					4	0	
16-Jun			0														0	0	0	0					5	0	
17-Jun			0														1	1	0	0					5	2	
18-Jun			0														0	0	0	0					5	0	
19-Jun			0														0	0	0	0					5	0	
20-Jun			0														0	0	0	0					5	0	
21-Jun			0														0	1	0	0					5	1	
22-Jun			0														0	0	0	0					5	0	
23-Jun			0														0	0	0	0					5	0	
24-Jun			0														0	0	0	0					5	0	

*Hours shaded in red are critical counting hours when smolt salmon migration typically occurs.

239 1,196

Appendix 4. Fish Lake 2011 – Update

Dates:	18-May to 24-Jun	No.	%	C.I.
Sockeyes:		1,196	100%	
Mortalities:		0	0.0%	
Age 1:		1,119	93.5%	(±0.01%)
Age 2:		71	6.0%	(±0.6%)
Age 3:		72	0.5%	(±3.5%)
Coho:		24,980		
Age 1:		5,330	21.3%	(±0.2%)
Age 2:		16,985	68.0%	(±0.1%)
Age 3:		2,665	10.7%	(±0.4%)
Rainbow Trout:		127		
Dolly Varden:		1		

