

**Larson Lake  
Progress Report  
2006**

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**This year's operation of the Larson Lake Project was made possible through enhancement taxes paid by the commercial fishermen in Area H, Cook Inlet and associated waters, a grant administered through the National Oceanic and Atmospheric Administration and the Alaska Department of Fish and Game provided by Senator Ted Stevens, and a legislative grant from the State of Alaska through the Department of Commerce, Community and Economic Development .**

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## **DISCLAIMER**

The Cook Inlet Aquaculture Association 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 progress report is a synopsis of the monitoring and evaluation studies conducted for the Larson Lake project.

The purpose of the progress 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 progress reports.

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## **ACKNOWLEDGEMENTS**

Many individuals and agencies contributed to the success of the Larson Lake Project in 2006. Appreciation is extended to Cook Inlet Aquaculture Association seasonal field assistant Paul Blanche and Interns Mike Johnson and Luke Becker, as well as all full time staff who endured many long hours in the field. Special thanks go to the Alaska Department of Fish and Game for the support they provided during this project.

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## ABSTRACT

The enumeration of adult sockeye salmon, *Oncorhynchus nerka*, was undertaken in 2006 as part of an area wide assessment of the Susitna River sockeye salmon population. The escapement of sockeye salmon into Larson Lake was 57,411 fish. Adult sockeye salmon averaged 515 mm (standard fork length); however male length average (536 mm) was greater than female average length (493 mm). Age 1.2 dominated the age composition with 69.32%. Age 1.3 and age 2.2 were 12.50% and 14.20% respectively. Less than 4% of the escapement was 2.3. Male to female ratio was virtually 1:1.

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## INTRODUCTION AND PURPOSE

Cook Inlet Aquaculture Association, CIAA, was asked to monitor salmon escapement and smolt emigration in Larson Lake in 1984. The Alaska Department of Fish and Game undertook the project in 1982 as a fisheries phase of the pre-fertilization assessment. A cooperative effort between ADF&G and CIAA was formulated to pool budgets necessary to accumulate base conditions necessary to determine suitability for artificial enrichment.

Larson Lake was identified in the *Cook Inlet Regional Salmon Enhancement Plan, 1981 – 2000* (Cook Inlet Regional Planning Team, 1981) as having potential for an additional production of 64,000 sockeye salmon through the technique of artificial enrichment.

Fertilizer was applied in 1986 and 1987. However, fertilizer applications ceased in 1988 when many Larson Lake residents complained about the activities. CIAA terminated the project and only conducted smolt monitoring in 1988. ADF&G picked up adult escapement monitoring activities from 1997 to 2000.

In 2005 CIAA acquired a grant through the Southeast Sustainable Salmon Fund to monitor adult salmon populations. CIAA approached ADF&G Area Management Biologists and requested identification of the systems which they most wanted escapement information. Larson Lake was one of the sites the CIAA Board of Directors chose from the list.

The monitoring of Larson Lake continued in 2006 through a cooperative study among ADF&G Sport Fish Division, ADF&G Commercial Fish Division, and CIAA. Through this effort, Larson Lake adult enumeration will occur through 2008 and a smolt enumeration will begin in 2007 and continue through 2009.

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## PROJECT AREA

Larson Lake is located in the foothills of the Talkeetna Mountains approximately 10.5 km east of Talkeetna, Alaska (Figure 1). The Lake is located in T26N, R3W Section 8. The lake covers 176.9 ha, has a maximum depth of 42.6 m, a mean depth of 16.4 m, a 10.3 km shoreline, and is located at an elevation of 186 m above sea level (Figure 2).

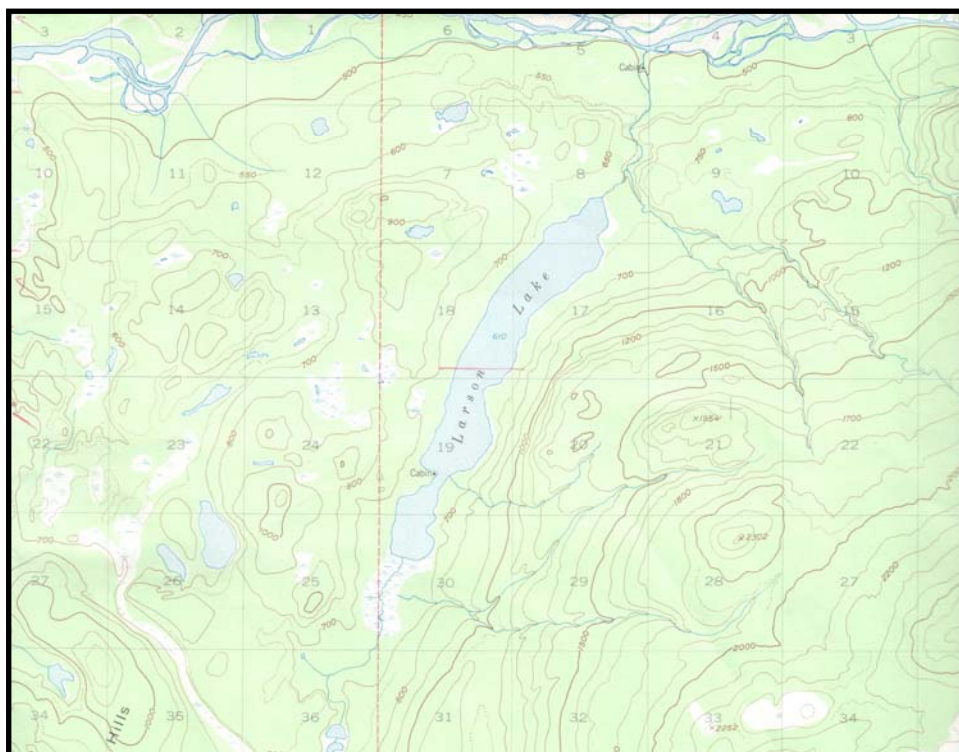


Figure 1. Excerpt from U.S. Geological Survey Iliamna A- 4; Scale 1:63,360

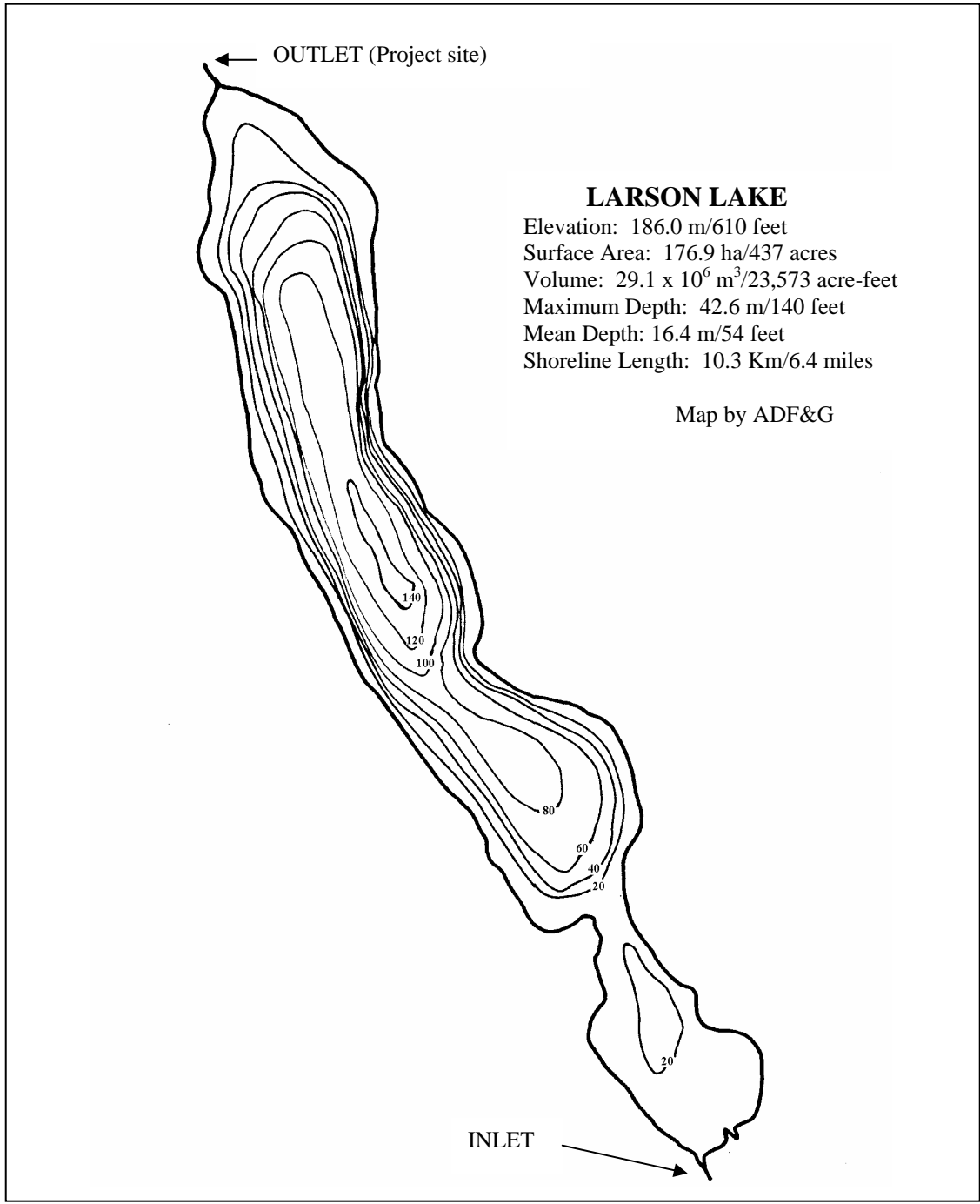


Figure 2. Hydrographic map of Larson Lake

## METHODS

### **Limnological Sampling and Environmental Conditions**

During 2006, water quality samples were collected three times during August and September. Two sites (A and B) were sampled for dissolved oxygen, temperature and light transmission profiles, Secchi disk transparency and zooplankton densities. Samples for analysis of phosphorus, carbon, chlorophyll *a*, phaeophytin *a*, nitrogen, calcium, magnesium, iron, conductivity, pH, alkalinity, turbidity, and color were also collected with a Kemmerer sampler one meter below the surface and from the midhypolimnion from the primary site (A).

Water and Zooplankton samples were collected by CIAA. Sample collection procedures are described by Koenings, et al. (1986). Water and Zooplankton density analyses are completed by ADF&G.

In addition to the limnological samples collected from Larson Lake, percent cloud cover was estimated, precipitation measured to the nearest millimeter, and Larson Creek water and air temperatures were recorded at 5:00 PM each day by CIAA as part of the escapement enumeration activities. Standard CIAA procedures, described in the *CIAA Adult Enumeration Procedures Manual*, were followed for collecting these measurements.

### **Adult Escapement**

The escapement enumeration of adult sockeye salmon to Larson Lake includes the assessment of sex, age, and standard fork length<sup>1</sup> of the returning population of fish.

To enumerate returning salmon, sample and collect sex, age, and length information, an adult counting weir was temporarily installed in Larson. 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.

By removing one or two pickets fish were permitted to pass through the weir. Field personnel counted the adult fish as they ascended Larson Creek. Initially counts were made at least twice a day. As the number of fish ascending Larson Creek increased, counts were made more frequently to prevent fish from accumulating behind the weir.

An average return based on the counts done by ADF&G from 1998 to 2000 and from Cook Inlet Aquaculture Association's 2005 data, assumed that approximately 26,000 sockeye salmon would return to Larson Lake. Based on this assumption and the goal to obtain an adequate sample size for determining, age, sex, and sized, approximately every 52<sup>nd</sup> fish counted upstream was temporarily held, measure, and released upstream. The adult return was more than projected and additional fish were collected and measured.

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<sup>1</sup> Standard fork length is defined as the measurement from mid-eye to the fork of the tail

## RESULTS AND DISCUSSION

### Limnological Sampling and Environmental Conditions

Water chemistry and zooplankton samples from 2006 are summarized in Table 1.

Environmental conditions during the Larson Lake adult sockeye migration were monitored from 14 July to 18 August 2006. No stream stage measurements and water temperature were taken this year. Air temperatures averaged 17.3°C and ranged from 10.7 to 24.8°C. Eight percent of the days were clear, 22% were partly cloudy (<50% cloud cover), 17% were more than partly cloudy (>50% cloud cover) and 53% were completely overcast. Rain was recorded on 25 of the days during the adult migration. A total of 1,786 mm of rain fell during this period (Appendix 1).

Table 1. Average open water quality characteristics of Larson Lake.

AVERAGE WATER QUALITY - 1 METER										
Year	Sp. Cond (umhos/cm)	pH (SU)	Alk (mg/l)	Turb. (NTU)	TP (ug/l)	TKN (ug/l)	Chl a (ug/l)	EZD (m)	Secchi (m)	Zooplankton (mg/m2)
2006	67	6.4	12	0.6	5.2	177.8	0.50	10.7	5.25	997

Averages prior to 1992 compiled by ADF&G.  
EZD and Secchi provided by CIAA.  
Open water season only.

AVERAGE WATER QUALITY - HYPOLIMNION							
Year	Sp. Cond (umhos/cm)	pH (SU)	Alk (mg/l)	Turb. (NTU)	TP (ug/l)	TKN (ug/l)	Chl a (ug/l)
2006	90	6.2	12	0.6	5.6	133.4	0.17

Averages prior to 1992 compiled by ADF&G.  
EZD and Secchi provided by CIAA.  
Open water season only.

### Adult Escapement

Adult sockeye salmon return was monitored from 14 July to 18 August 2006 (Appendix 2). During this time a total of 57,411 adult sockeye salmon returned to the weir at Larson Lake.

The percentage of adult male and adult female sockeye salmon returning to Larson Lake in 2006 was 51.14% and 48.86%, respectively. Male fish averaged 536 mm (21.1 in) in length and the females averaged 493 mm (19.4 in). An estimated 3.98% of the fish were age 2.3, 12.5% were age 1.3, 14.2% were 2.2, and 69.32% were 1.2 (Table 2).

Table 2. Summary of Larson Lake salmon escapement, age distribution and fish length - 2006.

Year	Number	Escapement		Sex		Major Age Classes							
		Hatchery (%)	(C.I.)	(%) Male	(%) female	1.2 (%)	Lth(mm)	1.3 (%)	Lth(mm)	2.2 (%)	Lth(mm)	2.3 (%)	Lth(mm)
2005	9955	0		50.3	49.7	13.1	496	24.1	552	22.5	499	40.3	537
2006	56,305	0		51.14	48.86	69.32	505	12.5	560	14.2	507	3.98	566
Mean	33,130	0		51	49	41	501	18	556	18	503	22	552
Min	9,955	0		50	49	13	496	13	552	14	499	4	537
Max	56,305	0		51	50	69	505	24	560	23	507	40	566

Note: Total escapement is Lake escapement and not fish returning to wier (morts and sampled fish)

## **RECOMMENDATIONS**

There are no recommendations for operations of future weir counts at Larson Lake.

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## LITERATURE CITED

Cook Inlet Aquaculture Association. 2005. Adult Enumeration Procedures Manual. CIAA. Kenai, Alaska.

*Cook Inlet Regional Salmon Enhancement Plan, 1981 – 2000*. Cook Inlet Regional Planning Team, 1981. 79 pages.

Koenings, J.P., J.A. Edmundson, J.M. Edmundson, and G.B. Kyle. 1986. Limnology Field and Laboratory Manual: Methods for Assessing Aquatic Production. Alaska Department of Fish and Game. Division of Fisheries Rehabilitation, Enhancement and Development. Soldotna, AK. 222 pages.

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## **APPENDICES**

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Date	Sky	Precip. (mm)	Stage (ft)	Flow	Water Temp. (°C)	Air Temp. (°C)
14-Jul	4	4	ND	ND	ND	14.6
15-Jul	4	5	ND	ND	ND	14.3
16-Jul	4	18	ND	ND	ND	14.9
17-Jul	4	4	ND	ND	ND	16.1
18-Jul	2	0	ND	ND	ND	20.1
19-Jul	2	0	ND	ND	ND	20.0
20-Jul	3	2	ND	ND	ND	19.1
21-Jul	3	0	ND	ND	ND	19.7
22-Jul	2	0	ND	ND	ND	23.8
23-Jul	2	8	ND	ND	ND	23.3
24-Jul	3	2	ND	ND	ND	18.5
25-Jul	4	19	ND	ND	ND	15.9
26-Jul	3	41	ND	ND	ND	17.9
27-Jul	1	0	ND	ND	ND	24.8
28-Jul	2	0	ND	ND	ND	23.6
29-Jul	4	10	ND	ND	ND	14.7
30-Jul	4	160	ND	ND	ND	13.5
31-Jul	2	3	ND	ND	ND	20.9
1-Aug	3	20	ND	ND	ND	20.9
2-Aug	3	4	ND	ND	ND	17.9
3-Aug	4	0	ND	ND	ND	12.4
4-Aug	4	10	ND	ND	ND	16.4
5-Aug	2	0	ND	ND	ND	22.7
6-Aug	1	0	ND	ND	ND	22.0
7-Aug	1	0	ND	ND	ND	23.7
8-Aug	2	0	ND	ND	ND	23.4
9-Aug	4	2	ND	ND	ND	17.9
10-Aug	5	10	ND	ND	ND	13.3
11-Aug	5	50	ND	ND	ND	13.3
12-Aug	5	330	ND	ND	ND	12.1
13-Aug	5	220	ND	ND	ND	11.6
14-Aug	5	180	ND	ND	ND	12.3
15-Aug	5	120	ND	ND	ND	12.7
16-Aug	5	150	ND	ND	ND	11.6
17-Aug	5	50	ND	ND	ND	11.7
18-Aug	5	364	ND	ND	ND	10.7
Total	36	1786				

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

ND = No Data

Appendix 2. Larson Lake 2006 – Sockeye Migration.

Date	Escapement		Morts	Total	pit tags
	Daily	Total			
14-Jul	3	3		3	
15-Jul	0	3		3	
16-Jul	0	3		3	
17-Jul	0	3		3	
18-Jul	0	3		3	
19-Jul	0	3		3	
20-Jul	0	3		3	
21-Jul	1	4		4	
22-Jul	6	10		10	
23-Jul	117	127		127	
24-Jul	284	411		411	
25-Jul	1,514	1,925		1,925	
26-Jul	1,053	2,978		2,978	
27-Jul	648	3,626		3,626	
28-Jul	2,961	6,587		6,587	
29-Jul	1,580	8,167		8,167	
30-Jul	1,815	9,982		9,982	
31-Jul	5,990	15,972		15,972	55
1-Aug	5,652	21,624		21,624	57
2-Aug	3,202	24,826		24,826	35
3-Aug	4,138	28,964		28,964	50
4-Aug	6,364	35,328		35,328	64
5-Aug	3,521	38,849		38,849	59
6-Aug	3,482	42,331		42,331	ND
7-Aug	3,750	46,081		46,081	59
8-Aug	4,493	50,574		50,574	105
9-Aug	1,636	52,210		52,210	44
10-Aug	1,369	53,579		53,579	43
11-Aug	940	54,519		54,519	32
12-Aug	1,057	55,576		55,576	58
13-Aug	835	56,411		56,411	35
14-Aug	326	56,737		56,737	9
15-Aug	439	57,176		57,176	9
16-Aug	171	57,347		57,347	19
17-Aug	64	57,411		57,411	5
18-Aug	0	57,411		57,411	1
	57,411		0		739

Appendix 3. Larson Lake 2006 – Update.

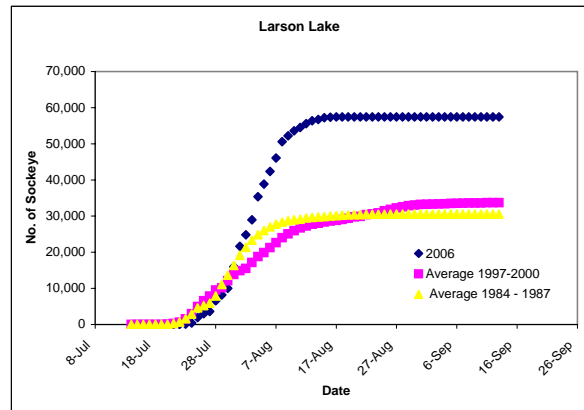
Smolt Migration

Dates:	
Sockeyes captured:	
Percent age 1:	
Percent age 2:	
Percent hatchery:	
Coho:	
King:	
Pink:	
Chum:	

**To Begin in 2007**

Adult Migration

Dates:	13-Jul	to	19-Aug
Sockeye total return:			
Weir return:			57,411
Sport/PU Harvest:			ND
Commercial Harvest:			ND
Otoliths:			ND
Coho:			35
King:			25
Pink:			224
Chum:			26
Rainbows:			31
Dollies:			1
Other:			0



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