

**Big Lake  
Sockeye Salmon Enhancement  
Progress Report  
2004**

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**This year's operation of the Big Lake Sockeye Salmon Enhancement Project was made possible through enhancement taxes paid by the commercial fishermen in Area H, Cook Inlet and associated waters, through the harvest and sale of surplus fish and from the Southeast Sustainable Salmon Fund received from the National Oceanic and Atmospheric Administration.**

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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 Big Lake sockeye salmon enhancement 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**

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# TABLE OF CONTENTS

DISCLAIMER.....	iii
ACKNOWLEDGEMENTS.....	v
TABLE OF CONTENTS.....	vii
LIST OF FIGURES.....	ix
LIST OF TABLES.....	xi
ABSTRACT.....	xiii
INTRODUCTION AND PURPOSE.....	1
PROJECT AREA.....	3
METHODS.....	5
Limnological Sampling and Environmental Conditions.....	5
Smolt Enumeration.....	5
Smolt Characteristics and Enhanced Contribution.....	7
Adult Escapement.....	10
Gamete Collection, Incubation and Rearing.....	10
Fish Transport and Stocking.....	12
RESULTS AND DISCUSSION.....	13
Limnology and Environmental Conditions.....	13
Smolt Enumeration.....	13
Smolt Characteristics and Enhanced Contribution.....	13
Adult Escapement.....	15
RECOMMENDATIONS.....	17
LITERATURE CITED.....	19
APPENDICES.....	21

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## LIST OF FIGURES

Figure 1. Area Map of Big Lake, Mat-Su Borough, South Central Alaska. ....	3
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## LIST OF TABLES

Table 1. Summary of sockeye salmon gamete collection and fry releases at Big Lake, 1993 - 2004.....	11
Table 2. Age structure, length, and weight characteristics of Big Lake sockeye smolt, 2002 - 2004 .....	14
Table 3. The contribution of enhanced sockeye to the Big Lake smolt emigration, 2002 - 2004.....	14

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## ABSTRACT

Big Lake, located in the Matanuska-Susitna Valley 24 kilometers west of Wasilla, Alaska, has been managed by the Alaska Department of Fish and Game (ADF&G) for sockeye salmon (*Oncorhynchus nerka*) enhancement since 1976. Initial salmon enhancement activities were conducted by ADF&G. The Cook Inlet Aquaculture Association (CIAA) began assisting ADF&G in the enhancement project in 1991; and, since 1993, has completed all the field activities.

On 19 May and 20 May 2004, an estimated 5.004 million sockeye fry (0.46 g) were released into Big Lake. All 5.004 million fry were released to Meadow Creek northeast of the lake and all the released fish were otolith marked.

In 2004, smolt emigration monitoring began on 16 May and continued daily until 23 June. During this time, a total of 256,321 sockeye salmon (*O. nerka*) and 35,954 coho salmon (*O. kisutch*) smolts migrated from the lake.

Based on otolith marks, 61.0% ( $\pm 2.8\%$ ) of the emigrating sockeye smolts were enhanced. An estimated 90.0% ( $\pm 8.1\%$ ) were age 1 and 10.0% ( $\pm 19.4\%$ ) were age 2. The average length and weight of the age 1 sockeye smolts was 124.0 mm ( $\pm 0.4$  mm) and 20.8 g ( $\pm 0.3$  g). The age 2 sockeye smolts were 153.7 mm ( $\pm 6.1$  mm) and 39.2 g ( $\pm 5.1$  g).

Of the emigrating coho smolts, an estimated, 14.2% ( $\pm 1.4\%$ ) were age 1, 76.7% ( $\pm 1.7\%$ ) were age 2 and 9.1% ( $\pm 1.2\%$ ) were age 3. The average length and weight of the age 1 coho smolts was 132.8 mm ( $\pm 0.10$  mm) and 24.6 g ( $\pm 0.10$  g). the age 2 coho smolts were 144.1 mm ( $\pm 0.04$  mm) and 30.7 g ( $\pm 0.03$  g), and the age 3 coho smolts were 177.1 mm ( $\pm 0.20$  mm) and 55.5g ( $\pm 0.02$  g).

Adult sockeye salmon escapement was monitored in 2004 by ADF&G.

Between 11 August and 28 August 2004, 2,590,000 million eggs were collected and shipped to Trail Lakes Hatchery for fertilization and incubation. An estimated 84.7% (2.194 million) have survived to the eyed stage.

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## INTRODUCTION AND PURPOSE

The Alaska Department of Fish and Game began sockeye salmon (*Oncorhynchus nerka*) enhancement activities at Big Lake in 1975. In 1993, the Cook Inlet Aquaculture Association (CIAA) became involved in the Big Lake Enhancement Project and conducted the gamete collection, incubation, and fry release activities; ADF&G remained responsible for limnological data gathering at Big Lake.

Though ADF&G conducted smolt enumeration activities during its involvement in the Big Lake Project, this is the third year CIAA has conducted smolt migration enumeration activities since taking over the project.

Historical information on ADF&G activities can be found in Enhancement of Big Lake Sockeye Salmon (*Oncorhynchus nerka*): Summary of Fisheries Production (1976 – 1989) by R. S. Chlupach and G.B. Kyle, or by contacting ADF&G directly.

The CIAA Big Lake Project is the enhancement of the Big Lake sockeye return for the common property fishery. Production from this project contributes to the commercial fishery in Cook Inlet and a significant personal use fishery on Fish Creek.

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## PROJECT AREA

Big Lake is located in the Matanuska-Susitna Valley of South Central Alaska 24 kilometers west of Wasilla, Alaska (Figure 1). The main tributary of Big Lake is Meadow Creek; the outlet is Fish Creek, which flows approximately 23 km into Knick Arm of Cook Inlet (Chlupach and Kyle 1990).

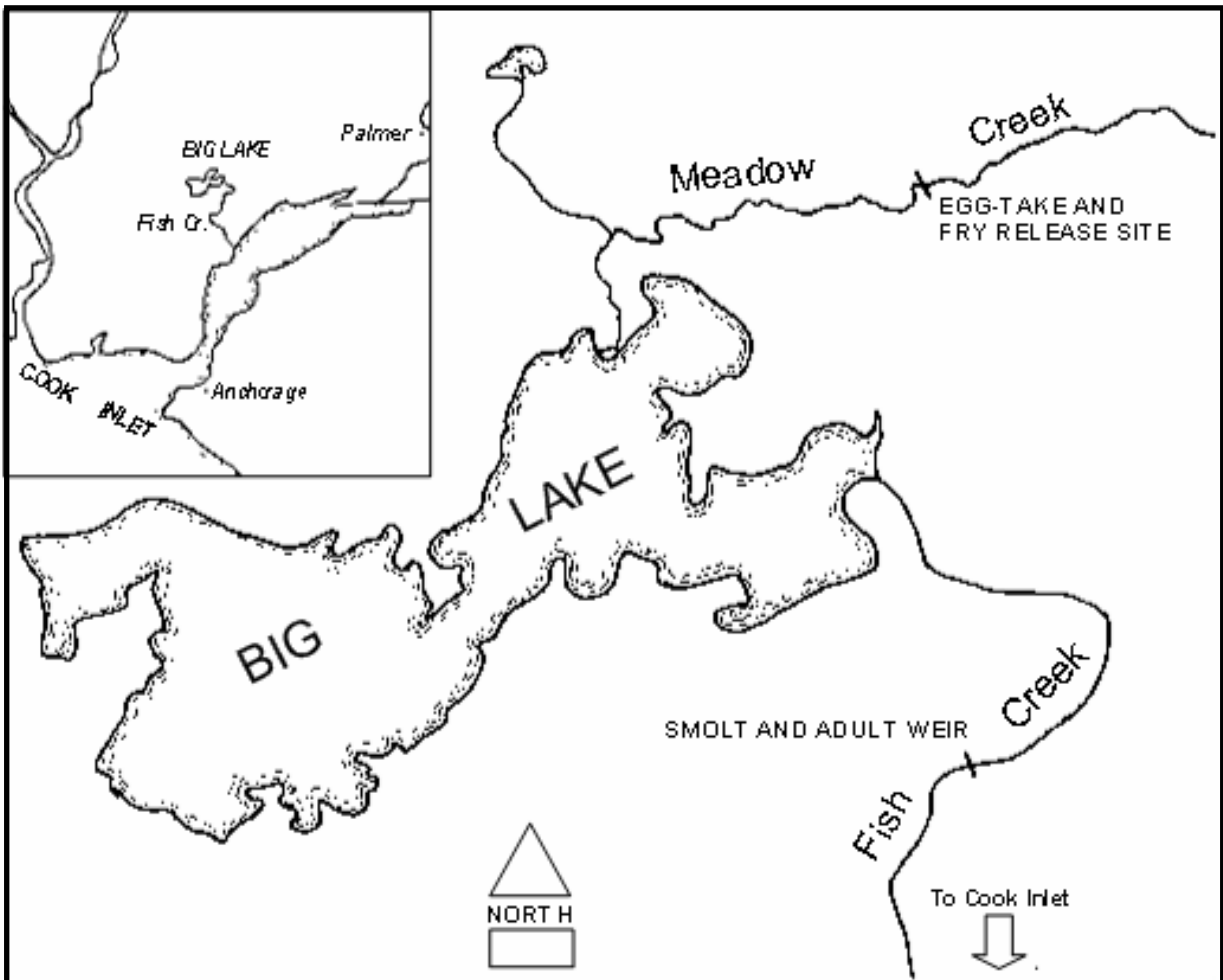


Figure 1. Area Map of Big Lake, Mat-Su Borough, South Central Alaska.

Fish present in the Big Lake watershed include all five species of Pacific salmon (*O. nerka*, *O. kisutch*, *O. tshawytscha*, *O. gorbuscha*, and *O. keta*); however, sockeye salmon and coho salmon are the dominate species of the lake. Other salmonids present are rainbow trout (*O. mykiss*) and Arctic char (*Salvelinus alpinus*). Several other species that comprise the fish fauna of Big Lake include: round whitefish (*Prosopium cylindraceum*), burbot (*Lota lota*), longnose sucker (*Catostomus catostomus*), slimy sculpin (*Cottus cognatus*), prickly sculpin (*C. asper*), Threespine stickleback (*Gasterosteus aculeatus*), ninespine stickleback (*Pungitius pungitius*), and Arctic lamprey (*Lampetra japonica*) (Chlupach and Kyle 1990).

## **METHODS**

In general, Big Lake salmon egg takes, hatchery incubation, fry rearing, and smolt enumeration monitoring follow procedures recommended by ADF&G.

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

During 2004, there was no assessment of water quality conducted by ADF&G or CIAA.

Percent cloud cover was estimated, precipitation measured to the nearest millimeter and Fish Creek water and air temperatures were recorded at 5:00 PM each day during by CIAA as part of the smolt enumeration activities. Standard CIAA procedures were followed for collecting these measurements.

### **Smolt Enumeration**

To enumerate the smolt migration, a smolt trap was temporarily placed in Fish Creek. The smolt trap consisted of a modified fyke net with nylon mesh leads extended with Vexar® netting and a double compartment live-box. The leads and fyke net funneled migrating smolts into the live-box. A swing gate remotely controlled by the trap operators directed smolts into one of two live-box compartments where they were counted and released downstream, momentarily held for a sub-sample count, or passed through the trap system uncounted.

Total counts of smolts migrating from Big Lake were made until the migration of fish exceeded 1,000 to 2,000 fish per hour. At migrations rates greater than 2,000 fish per hour, fish densities in the trap become too great and the fish become stressed. To avoid stressing the fish during periods of peak migration, a 10% sub-sampling procedure was used to enumerate the fish.

To enumerate migrating smolts with the 10% sub-sampling procedure, the counting period was divided into 20-minute intervals. During each 20-minute interval, migrating fish were directed into the live-box for two minutes and then counted. During the remaining 18 minutes, migrating smolts passed through the trap uncounted. To estimate the number of smolts migrating during the 20-minute interval, the two-minute smolt count was multiplied by 10.

Assuming the two-minute sub-sampling intervals were randomly distributed throughout sub-sampling<sup>1</sup> and smolts moved through the weir randomly, the total smolt migration was estimated as follows:

If:

$T_c$  = number of fish counted with the total count procedure,

$\hat{T}_s$  = number of fish counted with the 10% sub-sampling procedure,

$\hat{T}$  = the total smolt migration,

$y$  = the number of fish counted in each two minute sub-sampling interval,

$n$  = the number of two minute sub-sampling intervals sampled, and

$N$  = the number of possible two minute sub-sampling intervals,

Then, the total smolt migration ( $\hat{T}$ ) is:

$$\hat{T} = T_c + \hat{T}_s;$$

with a variance of:

$$v(\hat{T}_s) = N^2((N - n) / N) \sum (y_i - \bar{y})^2 / (n(n - 1));$$

and 95% confidence limits of:

$$\hat{T}_s \pm 2\sqrt{v(\hat{T}_s)}.$$

The variance about the estimated smolt migration,  $\hat{T}$ , is equal to the variance about  $\hat{T}_s$ , because  $T_c$  is a total count with 0 variance.

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<sup>1</sup> Predetermined randomly selected 2-minute sub-sampling intervals assured random distribution within each 20-minute period.

In 2004, migrating smolts were enumerated from 16 May through 23 June. The 10% sub-sampling procedure was used to enumerate 43% of the sockeye smolt and 13% of the coho smolt. A detailed description of smolt enumeration procedures is available in CIAA's Big Lake Enhancement Project procedure manual (CIAA, 2002).

### **Smolt Characteristics and Enhanced Contribution**

CIAA has released sockeye salmon fry to Big Lake since 1993. This is the second year the smolt migration was enumerated by CIAA. The smolt characteristics and enhanced contribution were assessed by collecting a sample of the migrating sockeye and coho smolts to collect an otolith and determine the smolts' age, weight, and length characteristics.

Since 1993, CIAA has marked the otolith of all salmon fry released to Big Lake with a thermal mark<sup>2</sup>. The purpose of this mark is to determine the contribution of released fish to the smolt population. In 2004, the otoliths of sockeye smolts collected for age, weight and length measurements were removed and checked for a thermal mark. Otoliths were not collected from migrating coho smolts.

In 2004, smolts collected for measurement and otolith removal were sampled in proportion to the daily smolt migration. This was accomplished by collecting 40 sockeye smolt each day and every 70<sup>th</sup> coho smolt that was counted and passed through the smolt trap. The numbering sequence began when the first fish passed through the trap and continued consecutively until the smolt migration was complete. The number of migrating smolts was lower than predicted; however, age, weight and length measurements were made on 1205 sockeye smolts. Age, weight and length measurements were made on 605 coho smolts.

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<sup>2</sup> The otolith mark is a hatchery induced thermal band produced by controlled temperature changes during incubation.

Each smolt collected for evaluation was first measured to the nearest millimeter for fork length<sup>3</sup> and then weighed to the nearest 0.1 gram. Several scales were also removed from the primary growth area<sup>4</sup> and mounted on a glass slide for subsequent age determination. The otoliths were then removed and placed in a labeled one-dram vial. Ethanol was added to the vial to cover the otoliths.

After the smolt migration was complete, the otoliths were shipped to Trail Lakes Hatchery. Staff at the Kenai office processed the otoliths and checked each for a hatchery mark following procedures described by Glick and Shields (1993). Of the 1205 sockeye smolts sampled, 1175 pairs of otoliths were collected and 1146 were readable.

Sockeye smolt characteristics, the proportion of enhanced sockeye smolt and the proportion of age 1 and 2 sockeye smolt in the migrating population, were estimated with the following notations and formulas provided by ADF&G.

If:

$N$  = total number of migrating smolts,

$N_h$  = number of smolts in stratum  $h$ , ( $N = \sum N_h$ ),

$n$  = total number of smolts sampled,

$n_h$  = number of smolts sampled in stratum  $h$ , ( $n = \sum n_h$ ),

$a$  = total number of enhanced smolts sampled,

$a_h$  = number of enhanced smolts sampled in stratum  $h$ , ( $a = \sum a_h$ ),

$p_h = a_h / n_h$ , the proportion of enhanced smolts in stratum  $h$ ,

$q_h = 1 - p_h$ , the proportion of wild smolts in stratum  $h$ ,

$c_i$  = number of age =  $i$  smolts sampled,

$c_{hi}$  = number of age =  $i$  smolts sampled in stratum  $h$ , ( $c_i = \sum c_{hi}$ ),

$l_{hi} = c_{hi} / n_{hi}$ , the proportion of age =  $i$  smolts in stratum  $h$ ,

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<sup>3</sup> Standard fork length was measured from the tip of the snout to the fork of the tail.

<sup>4</sup> 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.

$m_{hi} = 1 - l_{hi}$ , the proportion of other than age =  $i$  smolts in stratum  $h$ ,

$f = n / N$ , the sampling fraction (assumed equal in all strata),

$W_h = N_h / N$ , the stratum weight, and

$y =$  the weight or length of the smolt.

Then, the proportion of enhanced smolts,  $\hat{P}$ , is:

$$\hat{P} = a / n;$$

with a variance of:

$$v(\hat{P}) = (1 - f)(1/n) \sum W_h p_h q_h;$$

which, under proportional allocation, is like the usual simple random sample estimate.

And, the total number of enhanced smolts,  $\hat{A}$ , is:

$$\hat{A} = N(a / n) = N\hat{P};$$

with a variance of:

$$v(\hat{A}) = N^2(1 - f)(1/n) \sum W_h p_h q_h = N^2 v(\hat{P}).$$

Since samples sizes are large and  $\hat{P}$  is not extreme, the normal approximation without a correction for continuity, can be used to develop the relative error. Thus, the 95% confidence interval estimates for  $\hat{P}$  and  $\hat{A}$  are:

$$\hat{P} \pm 1.96\sqrt{v(\hat{P})} \quad \text{and} \quad \hat{A} \pm 1.96\sqrt{v(\hat{A})};$$

with relative errors of:

$$\left(1.96\sqrt{v(\hat{P})}/(\hat{P})\right)100 \quad \text{and} \quad \left(1.96\sqrt{v(\hat{A})}/(\hat{A})\right)100.$$

The proportion of age =  $i$  smolts in the migration was also estimated as:

$$\hat{L}_i = c_i / n;$$

with a variance of:

$$v(\hat{L}_i) = (1 - f) \frac{1}{n} \sum_h W_h l_{hi} m_{hi};$$

and, the total number of age =  $i$  smolts was estimated as:

$$\hat{C}_i = N(\hat{L}_i);$$

with a variance of:

$$v(\hat{C}_i) = N^2 v(\hat{L}_i).$$

Confidence intervals (95%) estimates for age-class proportion and abundance, assuming 2 age-classes, are:

$$\hat{L}_i \pm 2.24 \left( \sqrt{v(\hat{L}_i)} \right) \quad \text{and} \quad \hat{C}_i \pm 2.24 \left( \sqrt{v(\hat{C}_i)} \right).$$

Mean weight or length of age =  $i$  smolt was also estimated as:

$$\bar{y}_i = \frac{\sum_h \sum_j y_{hij}}{c_i};$$

with an approximate variance estimate of:

$$v(\bar{y}_i) \cong \frac{1}{\hat{C}_i^2} \sum_h \frac{N_h^2 (1-f)}{n_h (n_h - 1)} \left[ \sum_j (y_{hij} - \bar{y}_{hi})^2 + c_{hi} (1 - c_{hi}/n_h) (\bar{y}_{hi} - \bar{y}_i)^2 \right];$$

and 95% confidence interval estimates of:

$$\bar{y}_i \pm 1.96 \left( \sqrt{v(\bar{y}_i)} \right).$$

## Adult Escapement

Each year ADF&G enumerates the escapement of adult fish to Big Lake. For the results of the adult enumeration and a description of the methods used contact ADF&G

## Gamete Collection, Incubation and Rearing

Since 1993, CIAA has been involved in the collection of sockeye gametes and the release of hatchery incubated fry to enhance the sockeye population in Big Lake. To date, a total of 72.226 million eggs have been collected for incubation at Eklutna Salmon Hatchery and Trail Lakes Hatchery by CIAA. The annual gamete collections conducted since 1993 are summarized in Table 1.



In 2004, male and female adult sockeye salmon in spawning areas were collected by weir and dipnet and artificially spawned. Gametes were collected, transported and fertilized using a delayed fertilization technique. Gamete collection procedures are described in CIAA's "Egg-Take Procedures" manual (CIAA, 1993).

Table 1. Summary of sockeye salmon gamete collection and fry releases at Big Lake, 1993 - 2004.

Brood Year	No. eggs taken	No. females used	Fecundity	Receiving hatchery	No. fry released to Meadow Creek	No. fry released to Blodgett Lake	No. Smolt released to Eklutna Tail Race	No. Smolt released to Grouse Lake	Egg-to-fry survival (%)	No. smolt produced	Fry-to-smolt survival (%)
1991	Fry Transfer from Big Lake Hatchery to Eklutna						869,000				
1992	Fry Transfer from Big Lake Hatchery to Eklutna; IHN detected all fish destroyed						0				
1993	9,000,000	3,600	2,500	Eklutna	3,000,000	2,000,000	1,000,000	200,000	68.9	ND	NA
1994	7,755,000	2,674	2,900	Eklutna	3,000,000	2,000,000	0	0	64.5	ND	NA
1995	8,000,000	3,200	2,500	Eklutna	3,000,000	2,000,000	1,000,000	500,000	75.0	ND	NA
1996	8,000,000	3,200	2,500	Eklutna	2,900,000	1,118,000	1,009,000	226,000	62.8	ND	NA
1997	8,000,000	3,200	2,500	Eklutna	3,000,000	2,000,000	PNLA	0	62.5	ND	NA
1998	5,132,000	1,955	2,625	Trail Lakes	197,000	0	PNLA	0	20.3*	ND	NA
1999	1,149,000	574	2,002	Trail Lakes	846,000	0	PNLA	PNLA	73.6	ND	NA
2000	3,638,000	1,408	2,584	Trail Lakes	0	0	PNLA	PNLA	0.0	ND	NA
2001	6,574,000	2,206	2,980	Trail Lakes	4,316,000	0	PNLA	PNLA	65.7	107,359	2.49%
2002	6,342,000	2,305	2,751	Trail Lakes	3,589,000	0	PNLA	PNLA	56.6	140,720	3.92%
2003	7,046,000	2,685	2,624	Trail Lakes	5,004,000	0	PNLA	PNLA	71.0		
2004	2,590,000	1,124	2,304	Trail Lakes							
Total	73,226,000	28,131			28,852,000	9,118,000	3,878,000	926,000			
Mean	6,421,455	2,344	2,564		2,622,909	828,909	646,333	154,333	56.4		3.20%

PNLA = Project No Longer Active

\*Reflects the survival of 1.042 million fry. 197,000 were released to Meadow creek, while the remaining 845,000 of these fry were held over to be released to Grouse Lake as smolt, but were later destroyed due to IHN virus.

Brood Year Incomplete

Between 11 August and 28 August 2008, 2.590 million eggs were collected from 1,124 female sockeye salmon and shipped to Trail Lakes Hatchery for fertilization. Mixing the eggs from each female with a portion of the milt from eight to ten males and then activating the sperm with a 0.7% saline solution completed fertilization. An estimated 2.194 million eggs (84.7%) have survived to the eyed stage.

The sockeye eggs collected in 2004 are currently being incubated at Trail Lakes Hatchery and are beginning to emerge. Incubation will follow standard hatchery procedures (Wilson and Hetrick, 1992) and water temperature will be regulated to thermally mark the otoliths of fish scheduled for release in 2005.

## **Fish Transport and Stocking**

All the sockeye salmon fry produced from gametes collected from Big Lake in 2003 were released to Meadow Creek (at the old Big Lake Hatchery site) on 19 May and 20 May 2004. The 5.004 million fry were transported by truck in oxygenated tanks from Trail Lakes Hatchery to Big Lake and gravity fed via tubing into Meadow Creek. None of the released fry were externally marked or tagged; however, the otoliths of all the released fry were marked with thermal bands [Hatch Code: H4; Rbr 2:1.4]. Otoliths samples were processed to document the marks and are on file at the Kenai office. Since 1993, over 28.9 million sockeye salmon fry have been released to Big Lake by CIAA (Table 1).


## **RESULTS AND DISCUSSION**

### **Limnology and Environmental Conditions**

Environmental conditions during the Big Lake (Fish Creek) smolt emigration were monitored from 16 May to 24 June 2004. Stream stage measurements averaged 1.85 feet and ranged from 1.62 to 2.02 feet. During the period of smolt migration, stream temperatures averaged 14.8°C and ranged from 8.0 to 20.0°C. Air temperatures averaged 17.0°C and ranged from 10.0 to 26.0°C. Twenty-two percent of the days were clear, 48% partly cloudy, and 30% were completely overcast. A total of 1 mm of rain fell during this period (Appendix 1).

Environmental conditions during the Big Lake (Meadow Creek) egg collection were not in 2004

### **Smolt Enumeration**

In 2004, a total of 256,321 sockeye smolts emigrated from the lake. Other fish counted included 35,954 coho smolts (Appendix 2). The peak of the 2004 smolt migration occurred from 31 May to 3 June. 

### **Smolt Characteristics and Enhanced Contribution**

In 2004, characteristics of the smolt migration were evaluated from scale samples collected throughout the emigration and from measurements of length and weight. Based on these samples and measurements, an estimated 90.0% ( $\pm 8.1\%$ ) were age 1 and 10.0% ( $\pm 19.4\%$ ) were age 2. The average length and weight of the age 1 sockeye smolts was 124.0 mm ( $\pm 0.4$  mm) and 20.8 g ( $\pm 0.3$  g). The age 2 sockeye smolts were 153.7 mm ( $\pm 6.1$  mm) and 39.2 g ( $\pm 5.1$  g). There were no age 3 smolts (Table 2).

Of the emigrating coho smolts, an estimate, 14.2% ( $\pm 1.4\%$ ) were age 1, 76.7% ( $\pm 1.7\%$ ) were age 2 and 9.1% ( $\pm 1.2\%$ ) were age 3. The average length and weight of the age 1 coho smolts was 132.8 mm ( $\pm 0.10$  mm) and 24.6 g ( $\pm 0.10$  g). the age 2 coho smolts were 144.1 mm ( $\pm 0.04$  mm) and 30.7 g ( $\pm 0.03$  g), and the age 3 coho smolts were 177.1 mm ( $\pm 0.20$  mm) and 55.5g ( $\pm 0.02$  g).

Table 2. Age structure, length, and weight characteristics of Big Lake sockeye smolt, 2002 - 2004

Smolt Year	Age Class (%)				Mean length (mm)				Mean weight (g)			
	Age 1.0	95% C.I.	Age 2.0	95% C.I.	Age 1.0	95% C.I.	Age 2.0	95% C.I.	Age 1.0	95% C.I.	Age 2.0	95% C.I.
2002	91	( $\pm 2.2$ )	9	( $\pm 2.2$ )	123	( $\pm 2.2$ )	160	( $\pm 7.6$ )	22.3	( $\pm 0.4$ )	38.6	( $\pm 4.7$ )
2003	98	( $\pm 2.2$ )	2	( $\pm 2.9$ )	128	( $\pm 1.0$ )	163	( $\pm 5.9$ )	21.7	( $\pm 0.6$ )	43.7	( $\pm 2.9$ )
2004	90	( $\pm 8.1$ )	10	( $\pm 19.4$ )	124	( $\pm 0.4$ )	154	( $\pm 6.1$ )	20.8	( $\pm 0.3$ )	39.2	( $\pm 5.1$ )
Mean <sup>1</sup>	93		7		125		159		21.6		40.5	
Hist. Mean <sup>2</sup>	77		6		105		133		18.2		41.2	

<sup>1</sup>Mean derived from data collected by CIAA 2002 and on

<sup>2</sup>This is a historical mean comprised of data from 1976 to 1989 (Clupach and Kyle 1990)

In 2004, the proportion of hatchery-incubated fry in the sockeye smolt emigration was 61.0% ( $\pm 2.8\%$ ) (Table 3).

Table 3. The contribution of enhanced sockeye to the Big Lake smolt emigration, 2002 - 2004

Smolt Year	Number	Hatchery		95% C.I.	
		Wild	Hatchery	%	C.I.
2002*	48,865	48,547	318	0.7	( $\pm 1.4$ )
2003**	116,994	23,399	93,595	80.0	( $\pm 2.0$ )
2004	256,321	99,965	156,356	61.0	( $\pm 2.8$ )
Mean <sup>1</sup>	82,930	61,682	124,976	70.5	
Hist. Mean <sup>2</sup>	573,860	132,885	566,966	69.9	

\*CIAA did not release fish in 2001; few hatchery fish were expected

\*\*2003 otolith marks were reread and corrected from the initial reading; the samples were not ground enough by the original reader.

<sup>1</sup>From CIAA smolt counts 2003 and 2004

<sup>2</sup>These are historical means derived from Clupach and Kyle 1990 1976 to 1989 from Clupach and Kyle 1990

## **Adult Escapement**

Adult sockeye salmon escapement was monitored by ADF&G in 2004. For information on Big Lake escapement contact ADF&G

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## **RECOMMENDATIONS**

There are no recommendations for 2005.

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## **APPENDICES**

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Appendix 1. Big Lake 2004 – Environmental Conditions.

Smolts					Water	Air
Date	Sky	Precip. (mm)	Stage (ft)	Flow	Temp. (°C)	Temp. (°C)
16-May	4	0	2.00	ND	8.0	10.0
17-May	3	0	2.00	ND	10.0	15.0
18-May	4	0	2.00	ND	9.0	14.0
19-May	2	0	2.00	ND	11.0	16.0
20-May	1	0	1.98	ND	13.0	19.0
21-May	2	0	1.96	ND	15.0	20.0
22-May	3	0	1.94	ND	14.0	18.0
23-May	5	0	1.96	ND	13.0	12.0
24-May	5	0	1.98	ND	11.0	10.0
25-May	3	0	2.02	ND	12.0	13.0
26-May	2	0	2.02	ND	11.0	13.0
27-May	5	0	1.98	ND	14.0	11.0
28-May	4	0	1.98	ND	13.0	13.0
29-May	2	0	1.96	ND	13.0	15.0
30-May	2	0	1.96	ND	15.0	17.0
31-May	5	0	1.96	ND	13.0	14.0
1-Jun	2	0	1.94	ND	14.0	17.0
2-Jun	3	0	1.94	ND	14.0	15.0
3-Jun	1	0	1.90	ND	15.0	17.0
4-Jun	2	0	1.88	ND	16.0	18.0
5-Jun	3	0	1.86	ND	16.0	17.0
6-Jun	1	0	1.82	ND	17.0	21.0
7-Jun	4	0	1.78	ND	17.0	15.0
8-Jun	4	0	1.76	ND	14.0	11.0
9-Jun	3	0	1.72	ND	14.0	15.0
10-Jun	3	0	1.70	ND	15.0	17.0
11-Jun	2	0	1.70	ND	16.0	17.0
12-Jun	2	0	1.70	ND	17.0	19.0
13-Jun	3	0	1.68	ND	17.0	18.0
14-Jun	2	0	1.64	ND	17.0	22.0
15-Jun	4	0	1.64	ND	15.0	16.0
16-Jun	4	0	1.62	ND	14.0	15.0
17-Jun	5	1	1.88	ND	13.0	16.0
18-Jun	2	0	1.84	ND	18.0	24.0
19-Jun	1	0	1.8	ND	19.0	26.0
20-Jun	1	0	1.78	ND	20.0	25.0
21-Jun	1	0	1.76	ND	19.0	23.0
22-Jun	1	0	1.72	ND	19.0	22.0
23-Jun	1	0	1.7	ND	19.0	20.0
24-Jun	1	0	1.66	ND	20.0	23.0
Total	40	1				

	Meas.			Water	Air
Smolts	Avg.	Precip	Stage	Flow	Temp
		0.03	1.85	ND	14.8
	Min.	0	1.62	ND	8.0
	Max.	1	2.02	ND	20.0

	Cloud Cover - No. of Days				
	Meas.	<100%	<50%	>0%	Clear
Smolts	1	12	8	11	9

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

ND = No Data

Ice out = ND

Appendix 2. Big Lake 2004 – Smolt Emigration.

Date	Sockeye			Coho		Rainbow		Arctic Char	
	Daily	Mort.	Total	Daily	Total	Daily	Total	Daily	Total
12-May									
13-May									
14-May									
15-May									
16-May	0	0	0	463	463	0	0	0	0
17-May	3	0	3	465	928	0	0	0	0
18-May	3	0	6	450	1,378	0	0	0	0
19-May	3	0	9	628	2,006	0	0	0	0
20-May	5	0	14	828	2,834	0	0	0	0
21-May	4	0	18	1,124	3,958	0	0	0	0
22-May	1	0	19	781	4,739	0	0	0	0
23-May	6	0	25	937	5,676	0	0	0	0
24-May	16	0	41	1,487	7,163	0	0	0	0
25-May	15	0	56	1,170	8,333	0	0	0	0
26-May	3,209	0	3,265	985	9,318	0	0	0	0
27-May	66	0	3,331	605	9,923	0	0	0	0
28-May	2,039	0	5,370	1,681	11,604	0	0	0	0
29-May	874	0	6,244	2,017	13,621	0	0	0	0
30-May	1,085	0	7,329	2,374	15,995	0	0	0	0
31-May	34,512	0	41,841	3,833	19,828	0	0	0	0
1-Jun	34,550	0	76,391	3,443	23,271	0	0	0	0
2-Jun	32,176	0	108,567	2,009	25,280	0	0	0	0
3-Jun	43,720	0	152,287	2,463	27,743	0	0	0	0
4-Jun	13,345	0	165,632	1,442	29,185	0	0	0	0
5-Jun	5,101	0	170,733	3,666	32,851	0	0	0	0
6-Jun	6,488	0	177,221	1,398	34,249	0	0	0	0
7-Jun	10,545	0	187,766	698	34,947	0	0	0	0
8-Jun	7,966	0	195,732	178	35,125	0	0	0	0
9-Jun	6,509	0	202,241	224	35,349	0	0	0	0
10-Jun	23,814	0	226,055	146	35,495	0	0	0	0
11-Jun	1,222	0	227,277	32	35,527	0	0	0	0
12-Jun	12,048	0	239,325	77	35,604	0	0	0	0
13-Jun	5,450	0	244,775	47	35,651	0	0	0	0
14-Jun	6,505	0	251,280	21	35,672	0	0	0	0
15-Jun	1,225	0	252,505	26	35,698	0	0	0	0
16-Jun	226	0	252,731	14	35,712	0	0	0	0
17-Jun	2,487	0	255,218	9	35,721	0	0	0	0
18-Jun	414	0	255,632	53	35,774	0	0	0	0
19-Jun	269	0	255,901	28	35,802	0	0	0	0
20-Jun	118	0	256,019	53	35,855	0	0	0	0
21-Jun	211	0	256,230	63	35,918	0	0	0	0
22-Jun	47	0	256,277	16	35,934	0	0	0	0
23-Jun	44	0	256,321	20	35,954	0	0	0	0
Total			256,321		35,954	0	0	0	0

### Appendix 3. Big Lake 2004 - Project Update.

#### Stocking & Misc. Activities

Crew on-site (Fish Creek):	16-May
Ice-out:	No Data
Crew off-site(Fish Creek):	23-Jun
Fry stocking (Meadow Ck:	19-May to 20-May 5,004.00 fry @ .46 grams

#### Smolt Migration

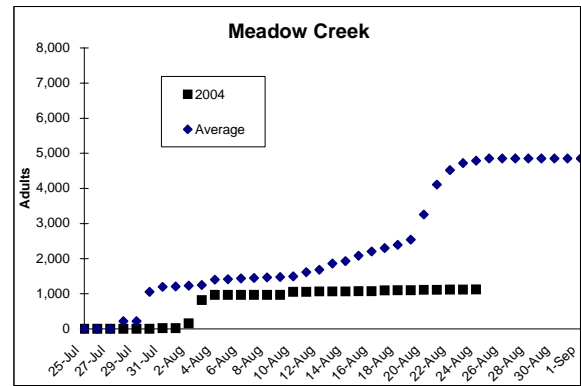
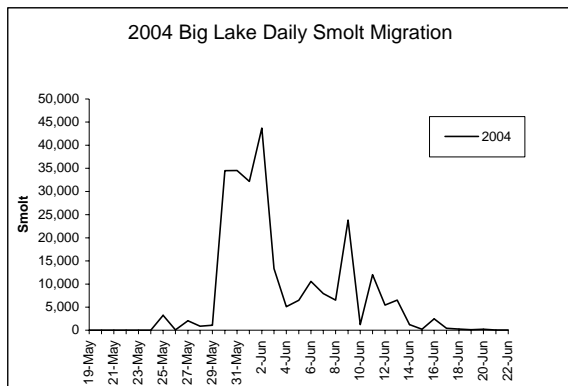
Dates:	16-May to 23-Jun
Sockeyes:	256,321
Mortalities:	0
Percent age 1:	90%
Percent age 2:	10%
Percent hatchery:	61%
Coho:	35,954
Arctic Char:	0
Rainbow:	0

#### Egg Take

Dates:	11-Aug to 28-Aug
No. of female broodstock:	1,124
Green eggs:	2,590,000
Fecundity:	2,304
Eyed eggs:	2,194,000
Survival	84.7%

#### Adult Migration

Sockeye total return:	
Fish Creek Return:	
Sport/PU Harvest:	Data Available at ADF&G
Commercial Harvest:	
Meadow Creek Return:	



3/15/2005

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