

**Big Lake
Sockeye Salmon Enhancement
Final Report
2007-2008**

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The 2007 and 2008 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 an Alaskan Sustainable Salmon Fund grant received from the Alaska Department of Fish & Game and 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.

The Big Lake Sockeye Salmon Enhancement Progress Report was prepared by Cook Inlet Aquaculture Association under award AKSSF 45608 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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ABSTRACT

Big Lake, located in the Matanuska-Susitna Valley, has been managed for sockeye salmon (*Oncorhynchus nerka*) population enhancement since 1976. Initial salmon population enhancement activities were conducted by the Alaska Department of Fish and Game (ADF&G). The Cook Inlet Aquaculture Association (CIAA) began assisting ADF&G in the enhancement project in 1991; and, since 1993, has completed all field activities. In 2006, the release of various sockeye life stages was being conducted to ascertain which strategy would produce the best survival rate. After several years, one or two releases (fry, fall fry, or smolt) would be withdrawn, leaving one release with the best survival rate in operation. Due to weak survival of enhanced sockeye at Big Lake, CIAA concluded to cease all sockeye releases after 2008. All salmon population enhancement activities will be discontinued after 2008.

To facilitate in the enhancement of sockeye salmon population of Big Lake, on 22 May 2007 an estimated 316,000 sockeye smolts (16.9 g) were released. From 28 May to 30 May, an estimated 3,812,000 sockeye fry (0.62 g) were released. From 16 October to 18 October, an estimated 703,000 sockeye presmolts (3.0 g) were released. All fish were released into Meadow Creek, the main tributary of Big Lake. All released sockeye fry, presmolts, and smolts were otolith marked.

In order to enhance the sockeye salmon population of Big Lake, 4.931 million eggs were collected and shipped to Trail Lakes Hatchery for fertilization, incubation, and rearing from 11 August to 20 August 2007. An estimated 80% (3.955 million) fertilized eggs survived to the eyed stage. The survival rate to the eyed stage was less than 90% due to poor quality broodstock.

The Big Lake smolt migration was enumerated from 15 May to 23 June 2007. During this time an estimated 309,300 ($\pm 29,300$) sockeye (*O. nerka*) and 26,300 ($\pm 9,000$) coho (*O. kisutch*) smolts migrated from the lake.

Based on otolith marks, an estimated 40% ($\pm 2.3\%$) of the emigrating sockeye smolts were incubated and reared at Trail Lakes Hatchery. An estimated 90% ($\pm 1.8\%$) were age 1 and 10% ($\pm 1.8\%$) were age 2. Age 1 sockeye salmon average length and weight were 126 mm (± 0.9 mm) and 19.8 g (± 0.5 g). Age 2 sockeye average length and weight were 137 mm (± 5.8 mm) and 27.0 g (± 3.9 g).

In order to enhance the sockeye salmon population of Big Lake, from 28 May to 1 June 2008 an estimated 3,610,000 sockeye fry (0.7 g) were released. From 28 May to 29 May 2008 an estimated 433,000 sockeye smolts (10.1 g) were released. All fish were released into Meadow Creek (Big Lake). All fry and smolt were otolith marked.

The Big Lake smolt migration was enumerated from 23 May to 1 July 2008. During this time an estimated 631,700 ($\pm 35,300$) sockeye and 112,000 ($\pm 3,000$) coho smolts migrated from the lake.

Salmon population enhancement activities will be discontinued for Big Lake, therefore no gamete collection, incubation, or rearing was undergone in 2008.

Based on otolith marks, an estimated 70% ($\pm 2.4\%$) of the emigrating sockeye smolts were incubated and reared at Trail Lakes Hatchery. An estimated 94% ($\pm 1.3\%$) were age 1 and 6% ($\pm 1.3\%$) were age 2. Age 1 sockeye salmon average length and weight were 126 mm (± 0.7 mm) and 22.0 g (± 0.4 g). Age 2 sockeye salmon were 145 mm (± 6.1 mm) and 32.8 g (± 3.5 g).

Based on scale readings, an estimated 24% ($\pm 1.9\%$) of the emigrating coho smolts were age 1 and 68% ($\pm 2.1\%$) were age 2. An estimated 8% ($\pm 1.2\%$) were age 3 and 0.4% ($\pm 0.3\%$) were age 4. The average length and weight of the age 1 coho smolts were 115 mm (± 0.5 mm) and 13.0 g (± 0.02 g) and the age 2 coho smolts were 128 mm (± 0.04 mm) and 21.8 g (± 0.02 g). The average length and weight of the age 3 coho smolts were 152 mm (± 0.1 mm) and 35.3 g (± 0.06 g) and the age 4 coho smolts were 172 mm (± 0.1 mm) and 49.6 g (± 0.2 g).

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, CIAA has conducted smolt migration enumeration activities from 2002 to 2008.

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 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).

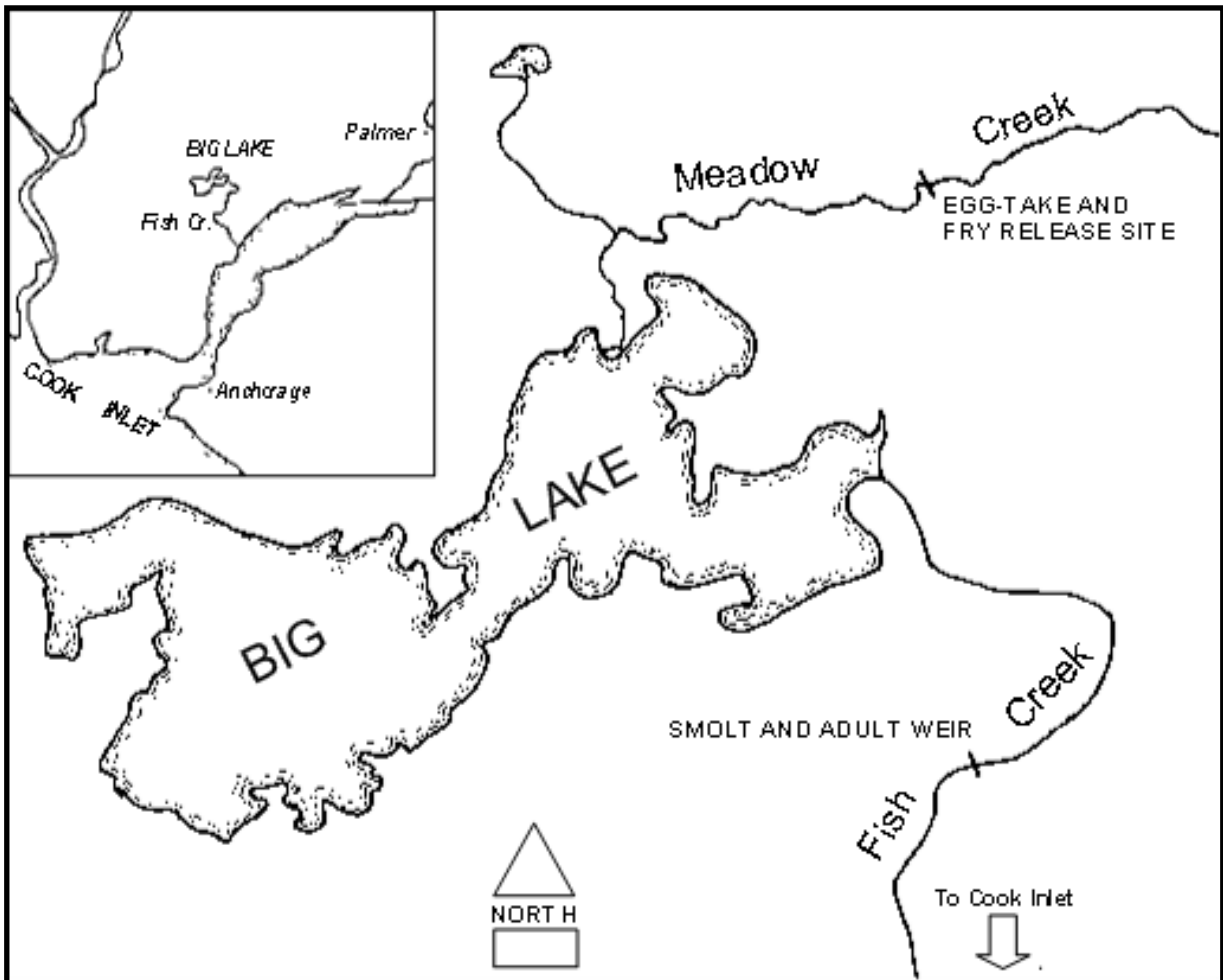


Figure 1. Area Map of Big Lake, Mat-Su Borough, South Central Alaska.

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.

Linnological Sampling and Environmental Conditions

During 2007 and 2008, there was no assessment of water quality conducted by 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 Vexar® netting leads and a double compartment live-box. The leads and fyke net funneled migrating smolts into the live-box. A swing gate 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-sampling¹ 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:

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

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.

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

The 2007 Big Lake smolt migration was enumerated from 15 May through 23 June. The 10% sub-sampling procedure was used to enumerate an estimated 156,700 ($\pm 28,300$) sockeye smolt and 18,500 ($\pm 9,000$) of coho smolt.

The 2008 Big Lake smolt migration was enumerated from 23 May through 1 July. The 10% sub-sampling procedure was used to enumerate an estimated 213,600 ($\pm 35,500$) of the sockeye smolt and 8,200 ($\pm 2,800$) 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 juvenile sockeye salmon to Big Lake since 1993. CIAA has monitored enumeration at Big Lake from 2002 to 2008. The smolt characteristics were assessed by collecting a sample of the migrating sockeye smolts to determine length and weight characteristics of the population. Hatchery contribution was assessed by collecting otoliths from this sample of migrating sockeye smolts to determine age structure and hatchery induced thermal band.

Since 1993, CIAA has marked the otolith of all sockeye fry, presmolts, and smolts released to Big Lake with a thermal band. The otolith mark is a hatchery induced thermal band produced by controlled temperature changes during incubation. The purpose of the otolith mark is to determine the contribution of hatchery fish to the smolt population. Otoliths were not collected from migrating coho smolts.

During the 2007 and 2008 smolt enumerations, 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 20 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.

Each smolt collected for evaluation was first measured to the nearest millimeter for fork length² and then weighed to the nearest 0.1 gram. Several scales were also removed from the primary growth area³ 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 the CIAA Otolith Lab. Staff at the CIAA headquarters processed the otoliths and checked each for a hatchery mark following procedures described by Glick and Shields (1993).

During the 2007 smolt migration, 1,450 sockeye smolts were sampled for age, length and weight measurements. Of the 1,450 pairs of otoliths collected, 1,447 samples were readable. Also from the migration, 994 coho smolts were sampled for length and weight measurements. Scales from these coho smolts were collected for age analysis. However, all coho scales were lost during the transition from Big Lake to CIAA headquarters and therefore not analyzed.

During the 2008 smolt migration, 1,380 sockeye smolts were sampled for age, weight and length measurements. Of the 1,380 pairs of otoliths collected, 1,303 samples were readable. Also from the migration, 675 coho smolts were sampled for length and weight measurements. Scales from these coho smolts were collected for age analysis. Of the 675 coho smolt scales collected, 624 samples 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.

² Standard fork length was measured from the tip of the snout to the fork of the tail.

³ 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.

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 ,

$m_{hi} = 1 - l_{hi}$, 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

Alaska Department of Fish & Game conducts the enumeration of the adult escapement 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, presmolts, and smolts to enhance the sockeye population in Big Lake. To date, a total of 86.825 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. Since 1993, over 40 million sockeye salmon fry, fall fry, and smolts have been released to Big Lake by CIAA (Table 1).

During the 2007 gamete collection at Big Lake, 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). Gamete collection was not conducted in 2008 due to the discontinued enhancement activities at Big Lake.

Table 1. Summary of sockeye salmon gamete collection and fry releases at Big Lake, 1993 - 2008.

Brood Year	No. eggs taken	No. females used	Receiving hatchery	No. fry released to Meadow Creek	No. fall-fry released to Meadow Creek	No. Smolt 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 (%)	Fry Release		
											Fecundity	No. smolt produced	Fry to smolt survival (%)
1991													
1992			Fry Transfer from Big Lake Hatchery to Eklutna					869,000					
			Fry Transfer from Big Lake Hatchery to Eklutna: IHN virus 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	165,547	4.61%	
2003	7,046,000	2,685	2,624	Trail Lakes	5,004,000		0	PNLA	PNLA	71.0	139,309	2.78%	
2004	2,590,000	1,124	2,304	Trail Lakes	1,742,300		0	PNLA	PNLA	67.3	114,898	6.59%	
2005	2,185,000	1,088	2,008	Trail Lakes	444,000	426,000	316,000	0	PNLA	PNLA	74.0 ¹	409,000	92%
2006	6,483,000	2,864	2,284	Trail Lakes	3,812,000	703,000	433,000	0	PNLA	PNLA	88.2	523,000	14%
2007	4,931,000	1,865	2,644	Trail Lakes	3,610,000	ND	ND	ND	PNLA	PNLA	77.8	ND	NA
Total	86,825,000	33,948			38,460,000	1,129,000	749,000	9,118,000	3,878,000	926,000		1,459,113	
Mean	5,788,333	2,263	2,514		2,564,020	564,500	374,500	651,286	646,333	154,333	61.9	243,186	20.39%

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.

¹ Survival rate is for 1,612,000. These fry were divided into three groups for release: fry (2006), fall fry (2006), and smolt (for release in 2007);

Between 11 August and 20 August 2007, 4.931 million eggs were collected from 1,865 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 3.955 million eggs (80 %) survived to the eyed stage. Survival to the eyed stage was less than 90% due to poor broodstock quality.

The sockeye eggs collected in 2007 were incubated at Trail Lakes Hatchery. Incubation followed standard hatchery procedures (Wilson and Hetrick, 1992) and water temperature was regulated to thermally mark the otoliths of fish which were released into Meadow Creek. CIAA conducted its final gamete collection, incubation, and rearing for the Big Lake enhancement project in 2007.

Fish Transport and Stocking

From 28 May to 30 May 2007, an estimated 3.812 million sockeye unfed fry were released into Meadow Creek (at the old Big Lake Hatchery site). These fry were produced from gametes collected at Big Lake in 2006. The sockeye 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: 2,3H; Rbr 1:1.2, 2.3]. Otoliths samples were processed to document the marks and are on file at CIAA headquarters.

From 16 October to 18 October 2007, an estimated 703,000 presmolt were released into Meadow Creek (same location as the fry release). The presmolts were produced from gametes collected at Big Lake in 2006. The sockeye presmolts were transported by truck in oxygenated tanks from Trail Lakes Hatchery to Big Lake and gravity fed via tubing into. 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: 6,1H; Rbr 1:1.6, 2.1]. Otoliths samples were processed to document the marks and are on file at CIAA headquarters.

On 22 May 2007, an estimated 316,000 sockeye smolts were released into Meadow Creek (same location as the fry release). These smolts were produced from gametes collected at big Lake in 2005. The sockeye smolts 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: 2,4H; Rbr 2:1.2, 2.4]. Otoliths samples were processed to document the marks and are on file at CIAA headquarters.

An estimated 3.61 million sockeye fry from brood year 2007 were released in Meadow Creek from 28 May to 1 June 2008. The sockeye 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 bands⁴ [Hatch Codes: 5H; 1,2,1H; 3,3H; Rbr 2:1.5; 1:1.1,2.2, 3.1; 1:1.3, 2.3]. Otoliths samples were processed to document the marks and are on file at CIAA headquarters.

⁴ The second and third fry hatch codes originally were to be presmolt and smolt marks, but the program was discontinued and all were stocked as fry.

An estimated 433,000 sockeye smolt from brood year 2006 were released in Meadow Creek from 28 May to 29 May 2008. Due to depleted water source at Trail Lakes Hatchery the sockeye smolt were transferred to Eklutna Salmon Hatchery. From the Eklutna Salmon Hatchery the sockeye smolt were transported by truck in oxygenated tanks 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: 1,5H; Rbr 1:1.1, 2.5]. Otoliths samples were processed to document the marks and are on file at CIAA headquarters.

In 2006, the release of various sockeye life stages was being conducted to ascertain which strategy would produce the best survival rate. After several years, one or two releases (fry, fall fry, or smolt) would be discontinued, leaving one release with the best survival rate in operation. Due to weak survival of enhanced sockeye at Big Lake, CIAA concluded to cease all sockeye releases after 2008.

RESULTS AND DISCUSSION

Limnology and Environmental Conditions

Environmental conditions during the 2007 Big Lake smolt emigration were monitored from 15 May to 22 June. Stream stage measurements averaged 1.53 feet and ranged from 1.26 to 1.87 feet. During the period of smolt migration, stream temperatures averaged 15°C and ranged from 9 to 22°C. Air temperatures averaged 18°C and ranged from 10 to 27°C. Thirteen percent of the days were partly cloudy and 31% were completely overcast. Measureable rain was recorded on 7 days during the smolt migration. A total of 10 mm of rain fell during this period (Appendix 1).

Environmental conditions during the 2007 Big Lake (Meadow Creek) egg collection were not recorded.

Environmental conditions during the 2008 Big Lake smolt emigration were monitored from 23 May to 1 July. Stream stage measurements averaged 0.87 feet and ranged from 0.7 feet to 1.00 feet. During the period of smolt migration, stream temperatures averaged 14°C and ranged from 10 to 18°C. Air temperatures averaged 15°C and ranged from 8 to 21°C. Forty-five percent of the days were partly cloudy and 50% were completely overcast. Measureable rain was recorded on 13 days during the smolt migration. A total of 25 mm of rain fell during this period (Appendix 2).

Smolt Enumeration

The 2007 Big Lake smolt migration was enumerated from 15 May to 23 June. During this time an estimated 309,300 ($\pm 29,300$) sockeye and 26,300 ($\pm 9,000$) coho smolts migrated from the lake. Other fish counted were 179 rainbow trout and 9 arctic char. The peak of the 2007 smolt migration occurred from 31 May to 8 June (Appendix 3).

The 2008 Big Lake smolt migration was enumerated from 23 May to 1 July. During this time an estimated 631,700 ($\pm 35,300$) sockeye and 112,000 ($\pm 3,000$) coho smolts migrated from the lake. Other fish counted were 197 rainbow trout. The peak of the 2008 smolt migration occurred from 4 June to 14 June (Appendix 4).

Smolt Characteristics and Enhanced Contribution

In 2007, sockeye smolt characteristics were evaluated from otolith samples and length and weight measurements collected throughout the migration. Based on these samples, an estimated 90% ($\pm 1.8\%$) were age 1 and 10% ($\pm 1.8\%$) were age 2. The average length and weight of the age 1 sockeye smolts was 126 mm (± 0.9 mm) and 19.8 g (± 0.5 g). The average length and weight of the age 2 sockeye smolts was 137 mm (± 5.8 mm) and 27.0 g (± 3.9 g).

In 2008, sockeye smolt characteristics were evaluated from otolith samples and length and weight measurements collected throughout the migration. Based on these samples, an estimated 94% ($\pm 1.3\%$) were age 1 and 6% ($\pm 1.3\%$) were age 2. The average length and weight of the age 1 sockeye smolts was 126 mm (± 0.7 mm) and 22.0 g (± 0.4 g). The average length and weight of the age 2 sockeye smolts was 145 mm (± 6.1 mm) and 32.8 g (± 3.5 g) (Table 2).

Table 2. Age structure, length and weight characteristics of Big Lake sockeye smolt 1976 – 2008.

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.
1976	64%		36%		135	(±7)	185	(±11)	26.5	(±3.7)	67.3	(±8.7)
1977	99%		1%		134	(±7)	150	(±17)	26	(±2.9)	34.1	(±15.3)
1978	95%		5%		118	(±7)	161	(±14)	15.7	(±3.8)	40.3	(±10.2)
1979	92%		8%		123	(±6)	159	(±21)	17.1	(±3.1)	39.8	(±19.1)
1980	94%		6%		129	(±6)	166	(±11)	21.6	(±2.9)	42.4	(±10.6)
1981	93%		7%		123	(±6)	118	(±5)	18.8	(±3.0)	16.2	(±2.4)
1982	87%		13%		126	(±6)	143	(±5)	19.3	(±2.7)	29.9	(±4.3)
1983	95%		5%		137	(±5)	172	(±13)	26.5	(±4.3)	51.5	(±14)
1984	92%		8%		135	(±5)	175	(±12)	27.5	(±4.1)	55.3	(±9.1)
1985	84%		16%		134	(±6)	178	(±11)	30.5	(±3.9)	56.5	(±10.1)
1986	96%		4%		133	(±5)	180	(±12)	23.9	(±2.5)	61.9	(±11.5)
1987	91%		9%		121	(±5)	162	(±15)	16.7	(±2.3)	40	(±9.1)
1988	98%		2%		127	(±6)	162	(±11)	19.9	(±3.0)	41.4	(±9.9)
1989	88%		12%		125	(±5)	163	(±8)	18.7	(±2.5)	39.2	(±8.9)
1990												
1991												
1992												
1993												
1994												
1995												
1996												
1997												
1998												
1999												
2000												
2001												
2002	91%	(±2.2)	9%	(±2.2)	123	(±2.2)	160	(±7.6)	22.3	(±0.4)	38.6	(±4.7)
2003	98%	(±2.2)	2%	(±2.9)	128	(±1.0)	163	(±5.9)	21.7	(±0.6)	43.7	(±2.9)
2004	90%	(±8.1)	10%	(±19.4)	124	(±0.4)	154	(±6.1)	20.8	(±0.3)	39.2	(±5.1)
2005	85%	(±4.5)	15%	(±2.1)	124	(±0.8)	154	(±7.1)	20.8	(±0.3)	39.2	(±6.9)
2006	92%	(±7.5)	8%	(±18.6)	124	(±0.7)	154	(±4.8)	20.8	(±0.4)	39.2	(±3.0)
2007	90%	(±1.8)	10%	(±1.8)	126	(±0.9)	137	(±5.8)	19.8	(±0.5)	27.0	(±3.9)
2008	94%	(±1.3)	6%	(±1.3)	126	(±0.7)	145	(±6.1)	22.0	(±0.4)	32.8	(±3.5)
Mean ¹	92%		8%		125		152		21.2		37.1	
Hist. Mean ²	91%		9%		129		162		22.1		44.0	

¹Mean derived from data collected by CIAA from 2002-2008.

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

In 2007, coho smolt characteristics were not completed because scale samples were not collected. Based on length and weight measurements only, the total average lengths and weights of coho smolts were normal in relation to historical runs.

In 2008, coho smolt characteristics were evaluated from length and weight measurements and scale samples collected throughout the migration. Based on these samples, an estimated 24% ($\pm 1.9\%$) were age 1, 68% ($\pm 1.9\%$) were age 2, 8% ($\pm 1.2\%$) were age 3, and 0.4% ($\pm 0.3\%$) were age 4. The average length and weight of the age 1 coho smolts was 114mm (± 0.5 mm) and 13.0 g (± 0.02 g), age 2 coho smolts were 128 mm (± 0.04 mm) and 21.8 g (± 0.02 g), age 3 coho smolts were 152 mm (± 0.1 mm) and 35.3 g (± 0.06 g), and age 4 coho smolts were 172 mm (± 0.1 mm) and 49.6 g (± 0.2 g) (Table 3).

Table 3. Age structure, length, and weight characteristics of Big Lake coho smolt 2002-2008.

Smolt Year	Age Class (%)								Mean length (mm)								Mean weight (g)							
	Age 1.0	95% C.I.	Age 2.0	95% C.I.	Age 3.0	95% C.I.	Age 4.0	95% C.I.	Age 1.0	95% C.I.	Age 2.0	95% C.I.	Age 3.0	95% C.I.	Age 4.0	95% C.I.	Age 1.0	95% C.I.	Age 2.0	95% C.I.	Age 3.0	95% C.I.	Age 4.0	95% C.I.
2002	5%	($\pm 1.9\%$)	92%	($\pm 2.3\%$)	3%	($\pm 1.4\%$)			122	(± 1.1)	135	(± 0.2)	143	(± 1.2)			17.6	(± 0.05)	23.3	(± 0.05)	29.1	(± 0.5)		
2003	8%	($\pm 1.2\%$)	90%	($\pm 1.3\%$)	2%	($\pm 0.6\%$)			117	(± 0.04)	135	(± 0.03)	166	(± 0.08)			15.4	(± 0.01)	23.4	(± 0.01)	41.3	(± 0.08)		
2004	14%	($\pm 1.4\%$)	77%	($\pm 1.7\%$)	9%	($\pm 1.2\%$)			133	(± 0.08)	144	(± 0.04)	177	(± 0.2)			24.6	(± 0.05)	30.7	(± 0.03)	55.5	(± 0.2)		
2005	3%	($\pm 1.1\%$)	98%	($\pm 1.1\%$)	ND				89	(± 0.4)	118	(± 0.06)					7.0	(± 0.07)	16.4	(± 0.02)				
2006	28%	($\pm 6.3\%$)	73%	($\pm 6.3\%$)	ND				90	(± 0.1)	105	(± 0.07)					7.5	(± 0.02)	11.7	(± 0.02)				
2007*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2008	24%	($\pm 1.9\%$)	70%	($\pm 2.1\%$)	8%	($\pm 1.2\%$)	0.4%	($\pm 0.3\%$)	115	(± 0.5)	128	(± 0.04)	152	(± 0.1)	172	(± 0.1)	13.0	(± 0.02)	21.8	(± 0.02)	35.3	(± 0.06)	49.6	(± 0.2)
Mean	14%		83%		6%		0.4%		111		128		160		172		14.2		21.2		40.3		49.6	

*Coho scale samples were not collected in 2007. Measurements were only made on length & weight, therefore data can not be analyzed for average age structure.

The proportion of hatchery-incubated sockeye of the 2007 smolt migration was 40% ($\pm 2.3\%$). The proportion of hatchery-incubated sockeye of the 2008 smolt migration was 70% ($\pm 2.4\%$) (Table 4).

Table 4. The contribution of enhanced sockeye to the Big Lake smolt emigration, 1976 - 2008

Year	Number	Wild	Hatchery	Hatchery	
				%	95% C.I.
1976	53,278	53,278	0	0	
1977	197,902	140,504	57,398	29	
1978	673,020	390,352	282,668	42	
1979	234,659	89,171	145,488	62	
1980	40,660	40,660	0	0	
1981	429,790	ND	ND	ND	
1982	660,150	ND	ND	ND	
1983	291,020	ND	ND	ND	
1984	124,167	ND	ND	ND	
1985	568,740	ND	ND	ND	
1986	921,401	156,637	764,764	83	
1987	1,383,220	248,981	1,134,239	82	
1988	592,257	23,690	568,567	96	
1989	1,068,339	53,417	1,014,922	95	
1990	ND	ND	ND	ND	
1991	ND	ND	ND	ND	
1992	ND	ND	ND	ND	
1993	ND	ND	ND	ND	
1994	ND	ND	ND	ND	
1995	ND	ND	ND	ND	
1996	ND	ND	ND	ND	
1997	ND	ND	ND	ND	
1998	ND	ND	ND	ND	
1999	ND	ND	ND	ND	
2000	ND	ND	ND	ND	
2001	ND	ND	ND	ND	
2002*	48,865	48,547	318	0.7	(±1.4)
2003**	116,994	23,399	93,595	80	(±2.0)
2004	256,321	99,965	156,356	61	(±2.8)
2005	150,821	39,364	111,457	74	(±0.2)
2006	241,335	116,364	124,971	53	(±2.8)
2007	309,337	185,602	123,735	40	(±2.3)
2008	631,704	190,143	441,561	70	(±2.4)
Mean ¹	250,768	100,483	150,285	54	
Hist. Mean ²	573,860	132,885	566,966	54	

*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.

¹From CIAA smolt counts 2002-2008

²These 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 2007 and 2008. For information on Big Lake escapement contact ADF&G.

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RECOMMENDATIONS

Future Big Lake sockeye enhancement projects should assess and mitigate problems associated with declining survival rates of enhanced sockeye.

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APPENDICES

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Appendix 1. Big Lake 2007 – Environmental Conditions.

Date	Sky	Precip. (mm)	Stage (ft)	Flow	Water Temp. (°C)	Air Temp. (°C)
15-May	3	0	1.87	ND	12	18
16-May	4	0	1.8	ND	12	15
17-May	4	5	1.8	ND	9	11
18-May	3	0	1.78	ND	11	13
19-May	1	0	1.72	ND	12	18
20-May	1	0	1.71	ND	13	20
21-May	1	0	1.70	ND	13	19
22-May	4	0	1.68	ND	14	16
23-May	5	4	1.71	ND	11	10
24-May	2	0	1.70	ND	13	18
25-May	3	0	1.69	ND	15	20
26-May	5	1	1.68	ND	12	13
27-May	3	0	1.68	ND	12	15
28-May	4	0	1.67	ND	12	14
29-May	4	0	1.67	ND	11	14
30-May	4	0	1.60	ND	12	16
31-May	3	0	1.60	ND	14	15
1-Jun	3	0	1.58	ND	11	17
2-Jun	4	0	1.56	ND	14	15
3-Jun	2	0	1.52	ND	15	19
4-Jun	3	0	1.54	ND	16	21
5-Jun	1	0	1.50	ND	17	20
6-Jun	3	0	1.48	ND	15	20
7-Jun	4	0	1.46	ND	15	16
8-Jun	4	0	1.42	ND	15	15
9-Jun	2	0	1.42	ND	15	20
10-Jun	1	0	1.40	ND	17	24
11-Jun	1	0	1.38	ND	17	21
12-Jun	2	0	1.36	ND	16	16
13-Jun	3	0	1.32	ND	15	16
14-Jun	2	0	1.32	ND	17	20
15-Jun	1	0	1.3	ND	18	23
16-Jun	1	0	1.3	ND	19	25
17-Jun	3	0	1.29	ND	18	19
18-Jun	1	0	1.28	ND	18	20
19-Jun	1	0	1.28	ND	20	23
20-Jun	1	0	1.26	ND	21	27
21-Jun	1	0	1.3	ND	22	26
22-Jun	4	0	1.28	ND	17	16
Total		10				
Avg.		0.3	1.53	ND	15	18
Min.		0	1.26	ND	9	10
Max.		5	1.87	ND	22	27

Summary of Cloud Cover - Percent of Days

	No.	Meas.	Partly		
	Days	Rain	Overcast	Cloudy	Clear
Smolts	39	18%	31%	13%	31%

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

Ice out = ND

ND = No Data

Appendix 2. Big Lake 2008 - Environmental Conditions.

Date	Sky	Precip. (mm)	Stage (ft)	Flow	Water Temp. (°C)	Air Temp. (°C)
23-May	2	0	1.00	ND	12	16
24-May	5	5	1.00	ND	10	8
25-May	2	1	1.00	ND	11	15
26-May	2	0	1.00	ND	13	14
27-May	1	0	1.00	ND	14	18
28-May	3	0	1.00	ND	14	18
29-May	2	0	1.00	ND	14	16
30-May	4	0	1.00	ND	12	15
31-May	5	0	1.00	ND	12	13
1-Jun	4	0	1.00	ND	15	16
2-Jun	4	0	1.00	ND	14	13
3-Jun	4	0	1.00	ND	13	15
4-Jun	4	0	1.00	ND	14	14
5-Jun	5	0	1.00	ND	14	13
6-Jun	5	2	1.00	ND	14	9
7-Jun	5	0	0.90	ND	13	13
8-Jun	4	0	0.90	ND	12	12
9-Jun	2	0	0.80	ND	16	18
10-Jun	4	0	0.80	ND	14	14
11-Jun	4	0	0.80	ND	13	12
12-Jun	3	0	0.80	ND	14	15
13-Jun	3	0	0.80	ND	17	20
14-Jun	4	4	0.80	ND	14	13
15-Jun	2	0	0.80	ND	14	15
16-Jun	3	0	0.80	ND	14	17
17-Jun	2	0	0.80	ND	18	21
18-Jun	1	0	0.80	ND	17	19
19-Jun	3	0	0.75	ND	17	17
20-Jun	3	0	0.75	ND	17	18
21-Jun	3	2	0.75	ND	16	16
22-Jun	4	9	0.80	ND	13	15
23-Jun	4	2	0.80	ND	13	12
24-Jun	2	0	0.80	ND	16	18
25-Jun	2	0	0.80	ND	17	18
26-Jun	4	0	0.80	ND	16	16
27-Jun	5	0	0.77	ND	15	15
28-Jun	4	0	0.75	ND	15	14
29-Jun	4	0	0.75	ND	15	16
30-Jun	3	0	0.75	ND	16	16
1-Jul	3	0	0.70	ND	16	18
Total		25				
Avg.		0.62	0.87	ND	14	15
Min.		0.0	0.70	ND	10	8
Max.		9.0	1.00	ND	18	21

Summary of Cloud Cover - Percent of Days

	No. Days	Meas. Rain	Partly Overcast	Cloudy	Clear
Smolts	40	30%	50%	45%	5%

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

Ice out = ND

ND = No Data

Appendix 3. Big Lake 2007 - Smolt Migration.

Date	Sockeye			Coho			Rainbow		Arctic Char	
	Daily	Mort.	Total	Daily	Mort.	Total	Daily	Total	Daily	Total
15-May	1	0	1	2	0	2	1	1	0	0
16-May	3	0	4	5	0	7	2	3	0	0
17-May	31	0	35	23	0	30	8	11	0	0
18-May	214	0	249	2	0	32	4	15	0	0
19-May	64	0	313	19	0	51	4	19	0	0
20-May	182	0	495	36	0	87	22	41	0	0
21-May	297	0	792	62	0	149	7	48	0	0
22-May	10	0	802	29	0	178	0	48	0	0
23-May	794	0	1,596	147	0	325	12	60	1	1
24-May	4,094	0	5,690	279	0	604	22	82	0	1
25-May	5,715	0	11,405	271	0	875	9	91	1	2
26-May	5,154	0	16,559	515	0	1,390	10	101	0	2
27-May	3,446	0	20,005	974	0	2,364	3	104	2	4
28-May	2,197	0	22,202	436	0	2,800	6	110	1	5
29-May	7,941	0	30,143	539	0	3,339	10	120	1	6
30-May	3,462	0	33,605	296	0	3,635	5	125	0	6
31-May	21,635	0	55,240	1,254	0	4,889	11	136	1	7
1-Jun	5,911	0	61,151	247	0	5,136	7	143	0	7
2-Jun	45,768	0	106,919	1,821	0	6,957	9	152	1	8
3-Jun	14,688	0	121,607	1,858	0	8,815	2	154	0	8
4-Jun	34,822	0	156,429	5,075	0	13,890	13	167	0	8
5-Jun	50,402	0	206,831	3,998	0	17,888	1	168	0	8
6-Jun	14,058	0	220,889	1,431	0	19,319	0	168	0	8
7-Jun	1,776	0	222,665	115	0	19,434	0	168	0	8
8-Jun	25,359	0	248,024	2,285	0	21,719	0	168	0	8
9-Jun	7,410	0	255,434	206	0	21,925	0	168	0	8
10-Jun	7,202	0	262,636	1,399	0	23,324	0	168	0	8
11-Jun	4,367	0	267,003	171	0	23,495	3	171	0	8
12-Jun	8,830	0	275,833	1,219	0	24,714	3	174	0	8
13-Jun	6,738	0	282,571	125	0	24,839	1	175	1	9
14-Jun	4,226	0	286,797	790	0	25,629	1	176	0	9
15-Jun	5,392	0	292,189	87	0	25,716	0	176	0	9
16-Jun	2,065	0	294,254	136	0	25,852	0	176	0	9
17-Jun	1,881	0	296,135	112	0	25,964	2	178	0	9
18-Jun	2,507	0	298,642	133	0	26,097	0	178	0	9
19-Jun	3,394	0	302,036	33	0	26,130	0	178	0	9
20-Jun	728	0	302,764	30	0	26,160	0	178	0	9
21-Jun	2,392	0	305,156	47	0	26,207	0	178	0	9
22-Jun	2,900	0	308,056	68	0	26,275	1	179	0	9
23-Jun	1,281	0	309,337	46	0	26,321	0	179	0	9
Total	309,300	0	309,300	26,300	0	26,300		179		9

Appendix 4. Big Lake 2008 – Smolt Migration.

Date	Sockeye			Coho			Rainbow		Arctic Char	
	Daily	Mort.	Total	Daily	Mort.	Total	Daily	Total	Daily	Total
23-May	248	0	248	39	0	39	3	3	0	0
24-May	127	0	375	24	0	63	2	5	0	0
25-May	85	0	460	691	0	754	9	14	0	0
26-May	18	0	478	556	0	1,310	6	20	0	0
27-May	75	0	553	1,430	0	2,740	5	25	0	0
28-May	100	0	653	1,711	0	4,451	8	33	0	0
29-May	770	0	1,423	1,677	0	6,128	13	46	0	0
30-May	1,200	0	2,623	1,904	0	8,032	7	53	0	0
31-May	3,549	0	6,172	6,184	0	14,216	14	67	0	0
1-Jun	3,064	0	9,236	3,408	0	17,624	3	70	0	0
2-Jun	18,679	0	27,915	3,167	0	20,791	4	74	0	0
3-Jun	1,703	0	29,618	3,508	0	24,299	1	75	0	0
4-Jun	18,928	0	48,546	9,674	0	33,973	6	81	0	0
5-Jun	23,064	0	71,610	6,841	0	40,814	5	86	0	0
6-Jun	37,163	0	108,773	7,048	0	47,862	6	92	0	0
7-Jun	121,365	0	230,138	10,707	0	58,569	12	104	0	0
8-Jun	89,775	0	319,913	1,036	0	59,605	23	127	0	0
9-Jun	84,771	0	404,684	2,000	0	61,605	38	165	0	0
10-Jun	25,780	0	430,464	6,100	0	67,705	5	170	0	0
11-Jun	5,894	0	436,358	8,796	0	76,501	1	171	0	0
12-Jun	33,286	0	469,644	5,153	0	81,654	1	172	0	0
13-Jun	39,088	0	508,732	4,848	0	86,502	5	177	0	0
14-Jun	8,170	0	516,902	2,947	0	89,449	2	179	0	0
15-Jun	7,712	0	524,614	2,578	0	92,027	4	183	0	0
16-Jun	16,822	0	541,436	4,894	0	96,921	4	187	0	0
17-Jun	12,193	0	553,629	4,491	0	101,412	2	189	0	0
18-Jun	12,356	0	565,985	3,106	0	104,518	0	189	0	0
19-Jun	3,048	0	569,033	626	0	105,144	0	189	0	0
20-Jun	3,138	0	572,171	336	0	105,480	2	191	0	0
21-Jun	1,436	0	573,607	441	0	105,921	1	192	0	0
22-Jun	9,117	0	582,724	63	0	105,984	0	192	0	0
23-Jun	32,948	0	615,672	4,862	0	110,846	2	194	0	0
24-Jun	11,512	0	627,184	1,121	0	111,967	1	195	0	0
25-Jun	538	0	627,722	20	0	111,987	0	195	0	0
26-Jun	1,931	1,500	631,153	50	0	112,037	1	196	0	0
27-Jun	56	45	631,254	29	0	112,066	0	196	0	0
28-Jun	43	61	631,358	5	0	112,071	1	197	0	0
29-Jun	9	123	631,490	1	0	112,072	0	197	0	0
30-Jun	17	183	631,690	6	0	112,078	0	197	0	0
1-Jul	14	0	631,704	2	0	112,080	0	197	0	0
Total	629,788	1,912	631,700	112,000	0	112,000		197		0

Appendix 5. Big Lake 2007 - Update.

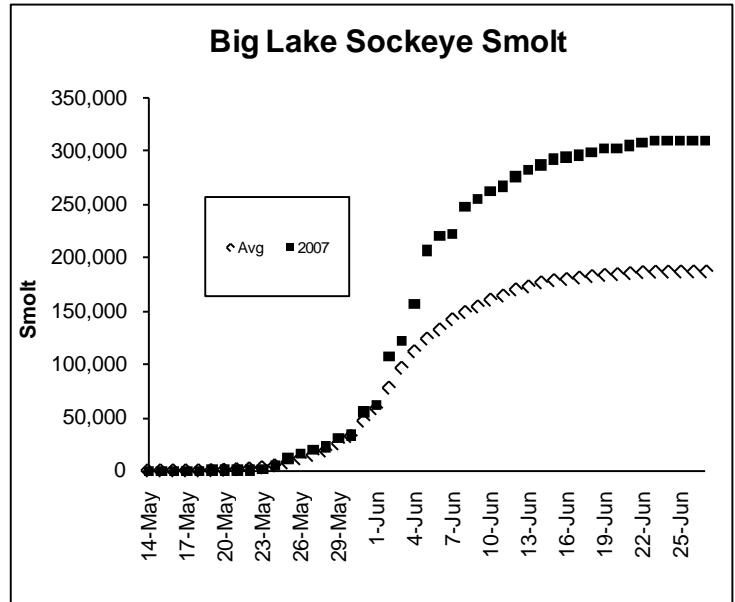
Stocking & Misc. Activities			
Crew on-site (Fish Creek):	15-May		
Ice-out:	No Data		
Crew off-site (Fish Creek):	23-Jun		
Fry stocking (Meadow Ck):	28-May to 30-May	3,812,000 fry @ 0.62 grams	
Presmolt Stocking (Meadow	16-Oct to 18-Oct	703,000 @ 3.0 grams	
Smolt Stocking (Meadow Ck):	22-May	316,000 @ 16.9 grams	

Egg Take		
Dates:	11-Aug to 20-Aug	
No. of female broodstock:		1,865
Green eggs:		4,931,000
Fecundity:		2,644
Eyed eggs:		3,955,000
Survival		80%

Smolt Migration		
Dates:	15-May to 23-Jun	
Sockeyes:		309,300
Mortalities:		0
Percent age 1:		92%
Percent age 2:		8%
Percent fry mark		17%
Percent presmolt mark		4%
Percent smolt mark		19%
Percent wild		60%
Percent hatchery:		40%
Coho:		26,300
Arctic Char:		9
Rainbow:		179

Adult Migration		
Sockeye total return:*	36,014	
Fish Creek Return:*	21,514	60%
Sport/PU Harvest:*	500	1%
Commercial Harvest:*	14,000	39%
Meadow Creek Return:*	14,225	

*Adult migration numbers provided by ADF&G



Appendix 6. Big Lake 2008 - Update

Stocking & Misc. Activities

Crew on-site (Fish Creek):	23-May	
Ice-out:	No Data	
Crew off-site (Fish Creek):	2-Jun	
Fry stocking (Meadow Ck):	28-May to 1-Jun	3,610,000 fry @ 0.7 grams
Smolt Stocking (Meadow Ck):	28-May to 29-May	433,000 @ 10.1 grams

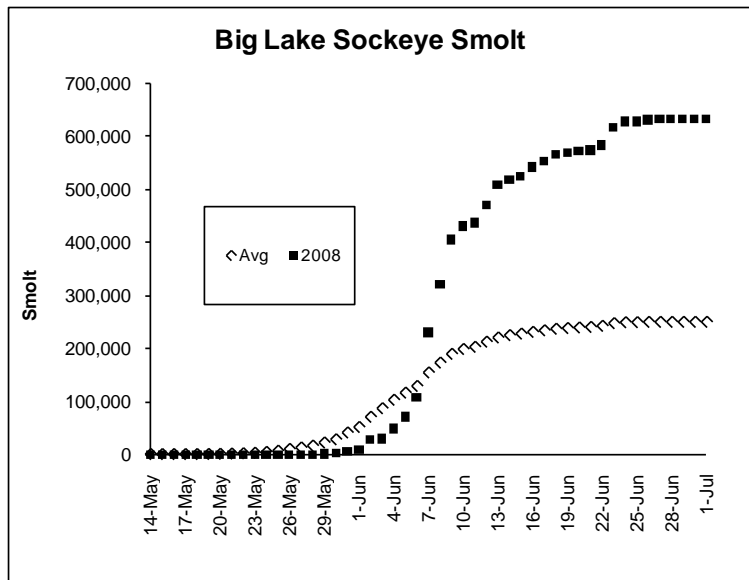
Adult Migration

Sockeye total return:*	18,079	
Fish Creek Return:*	12,900	71%
Sport/PU Harvest:*	179	1%
Commercial Harvest:*	5,000	28%
Meadow Creek Return:*	12,900	

*Adult migration numbers provided by ADF&G.

Smolt Migration

Dates:	23-May to 2-Jun
Sockeyes:	631,700
Mortalities:	1,912
Percent age 1:	94%
Percent age 2:	6%
Percent fry mark	45%
Percent presmolt mark	3%
Percent smolt mark	22%
Percent wild	30%
Percent hatchery:	70%
Coho:	112,000
Arctic Char:	0
Rainbow:	197



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