Big Lake
Sockeye Salmon Enhancement
Progress Report
2006

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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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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 13 June 2006, an estimated 444,000 sockeye fry (0.85 g) were released into Meadow Creek (Big Lake); all fry were otolith marked. Between 22 and 29 November 2006 426,000 sockeye fall fry (4.7 g) were released into Meadow Creek all were otolith marked differently from the fry release.

In 2006, smolt emigration monitoring began on 18 May and continued daily until 22 June. During this time, a total of 241,335 sockeye salmon (*O. nerka*) and 2,832 coho salmon (*O. kisutch*) smolts migrated from the lake.

Based on otolith marks, 51.8% (±2.8%) of the emigrating sockeye smolts were enhanced. An estimated 91.3% (±7.3%) were age 1 and 8.7% (±18.6%) were age 2. The average length and weight of the age 1 sockeye smolts was 124.0 mm (±0.7 mm) and 20.8 g (±0.4 g). The age 2 sockeye smolts were 153.7 mm (±4.8 mm) and 39.2 g (±3.0 g).

Of the emigrating coho smolts, an estimated, 27.5% (±6.3%) were age 1 and 72.5% (±6.3%) were age 2. The average length and weight of the age 1 coho smolts was 89.8 mm (±0.10 mm) and 7.5 g (±0.02 g) and the age 2 coho smolts were 104.6 mm (±0.07 mm) and 11.7 g (±0.02 g).

Adult sockeye salmon escapement was monitored in 2006 by ADF&G.

Between 8 August and 18 August 2006, 6.483 million eggs were collected and shipped to Trail Lakes Hatchery for fertilization and incubation. An estimated 90.9% (8.895 million) have survived to the eyed stage.

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INTRODUCTION AND PURPOSE

The Alaska Department of Fish and Game began sockeye salmon (*Oncorhychus 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 fifth 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 (*Oncorhychus 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).

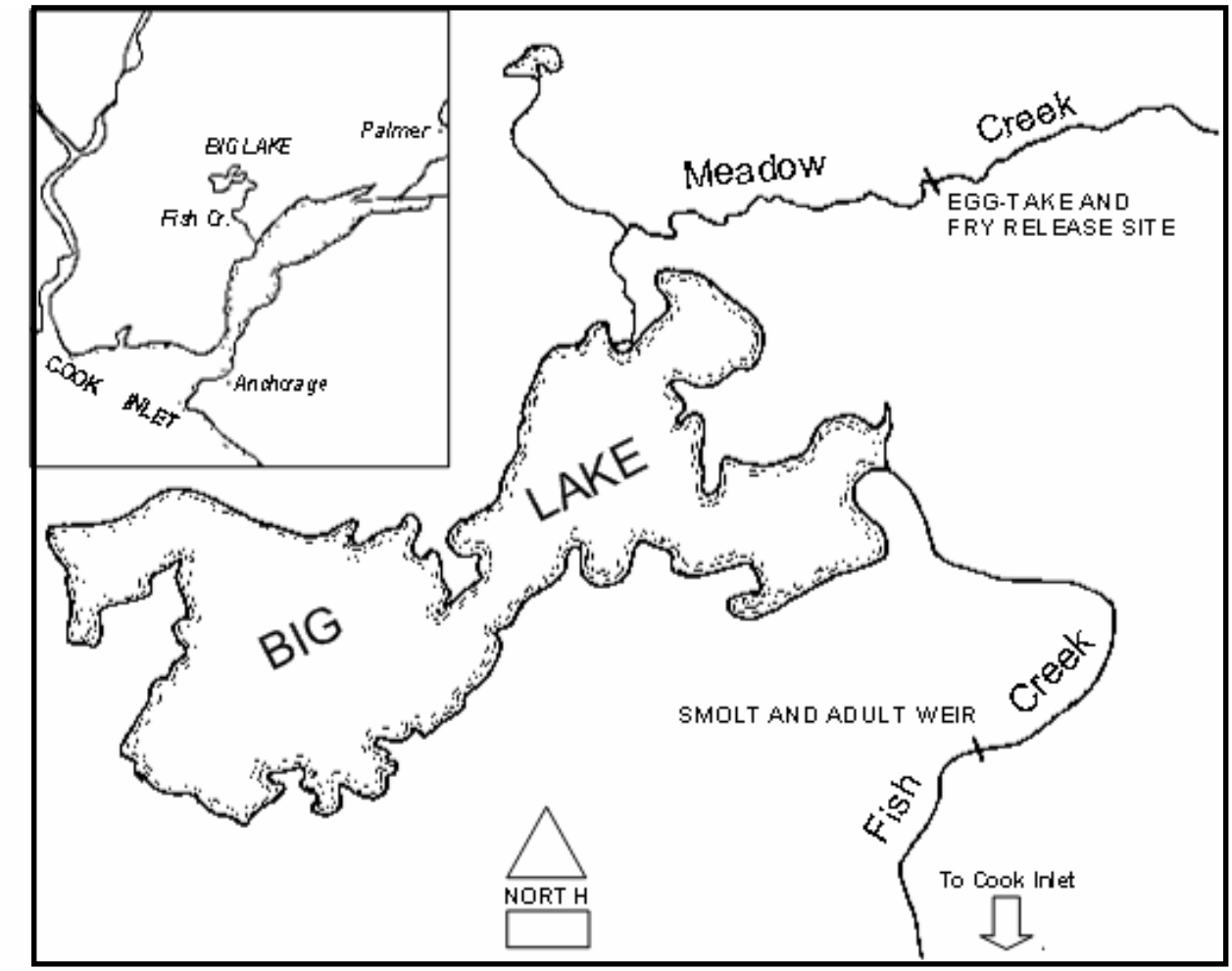

Figure 1. Area Map of Big Lake, Mat-Su Borough, South Central Alaska.

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.

Limnological Sampling and Environmental Conditions

During 2006, 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 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-sampling[1] 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:

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

and 95% confidence limits of:

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

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.

In 2006, migrating smolts were enumerated from 18 May through 22 June. The 10% sub-sampling procedure was used to enumerate 21% of the sockeye smolt and 0.4% 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 fifth 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[2]. The purpose of this mark is to determine the contribution of released fish to the smolt population. In 2006, 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 2006, 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 50th 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 1,440 sockeye smolts. Age, weight and length measurements were made on 54 coho smolts.

2 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[3] and then weighed to the nearest 0.1 gram. Several scales were also removed from the primary growth area[4] 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 Kenai office processed the otoliths and checked each for a hatchery mark following procedures described by Glick and Shields (1993). Of the 1,440 sockeye smolts sampled, 1,396 pairs of otoliths were collected and 1,395 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, $\left(N = \sum N_h\right)$,

n = total number of smolts sampled,

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

a = total number of enhanced smolts sampled,

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

$p_h = a_h / n_h$, 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, $\left(c_i = \sum c_{hi}\right)$,

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

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

4 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 81.894 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 2006, 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 - 2006.

Brood Year	No. eggs taken	No. females used	Fecundity	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 (%)	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 Elklutna; IHNV 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	Trial Lakes	197,000			0	PNLA	0	20.3 *	ND	NA
1999	1,149,000	574	2,002	Trial Lakes	846,000			0	PNLA	PNLA	73.6	ND	NA
2000	3,638,000	1,408	2,584	Trial 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		0	PNLA	PNLA	74.0 [1]		
2006	6,483,000	2,864	2,284	Trail Lakes									
Total	81,894,000	32,083			31,038,000			9,118,000	3,878,000	926,000		527,113	
Mean	5,849,571	2,292	2,504		2,549,525			759,833	646,333	154,333	58.6	137,405	3.29%

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 destoryed 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);

Brood Year Incomplete

Between 8 August and 18 August 2006, 6.483 million eggs were collected from 2,864 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 5.895 million eggs (90.9%) have survived to the eyed stage.

The sockeye eggs collected in 2006 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 2007.

Fish Transport and Stocking

Sockeye salmon fry produced from gametes collected from Big Lake in 2005 were released to Meadow Creek (at the old Big Lake Hatchery site) on 23 June 2006. The 444,000 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: H3; Rbr 2:1.3]. Otoliths samples were processed to document the marks and are on file at the Kenai office. Between 22 and 29 November 426,000 fall fry were transported by truck in oxygenated tanks from Trail Lakes Hatchery to Big Lake and gravity fed via tubing into Meadow Creek (same location as the fry release). 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: H5; Rbr 2:1.5]. Otoliths samples were processed to document the marks and are on file at the Kenai office. Approximately 409,000 fish have been held over to be released as smolt in the spring of 2007. These fish are mark with thermal bands [Hatch Code: H2,4; Rbr 2:1.2,2.4]. The release of various life stages is being conduced to ascertain which strategy will produce the best results. After several years, one or two releases (fry, fall fry, or smolt) will be dropped and the one with the best survival will be continued. Since 1993, over 40.5 million sockeye salmon fry and fall 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 18 May to 22 June 2006. Stream stage measurements averaged 0.78 feet and ranged from 0.64 to 0.90 feet. During the period of smolt migration, stream temperatures averaged 15.5°C and ranged from 9.0 to 18.0°C. Air temperatures averaged 16.5°C and ranged from 9.0 to 26.0°C. Sixty-four percent of the days were partly cloudy and 36% 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 recorded in 2006.

Smolt Enumeration

In 2006, a total of 241,335 sockeye smolts emigrated from the lake. CIAA collected and sacrificed 1,440 smolts for age, weight, and length. Therefore, 239,895 sockeye smolts passed through the trap. Other fish counted included 2,832 coho smolts (Appendix 2). The peak of the 2006 smolt migration occurred from 31 May to 7 June.

Smolt Characteristics and Enhanced Contribution

In 2006, 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 91.3% (±7.5%) were age 1 and 8.7% (±18.6%) were age 2. The average length and weight of the age 1 sockeye smolts was 124.0 mm (±0.7 mm) and

20.8 g (±0.4 g). The age 2 sockeye smolts were 153.7 mm (±4.8 mm) and 39.2 g (±3.0 g). The length and weight of the smolts were nearly identical to those from 2005 (Table 2).

Of the emigrating coho smolts, an estimated, 27.5% (±6.3%) were age 1 and 72.5% (±6.3%) were age 2. The average length and weight of the age 1 coho smolts was 89.8 mm (±0.10 mm) and 7.5 g (±0.02 g) and the age 2 coho smolts were 104.6 mm (±0.07 mm) and 11.7 g (±0.02 g).

Table 2. Age structure, length, and weight characteristics of Big Lake sockeye smolt, 2002 - 2006

	Age Class (%)				Mean length (mm)				Mean weight (g)			
Smolt Year	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	(±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)
Mean[1]	91		9		125		157		21.3		40.0	
Hist. Mean[2]	80		8		110		138		18.8		40.6	

[1]Mean dirived from data collected by CIAA 2002 and on

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

In 2006, the proportion of hatchery-incubated fry in the sockeye smolt emigration was 52.8% (±2.8%) (Table 3).

Table 3. The contribution of enhanced sockeye to the Big Lake smolt emigration, 2002 - 2006

Smolt Year	Number	Wild	Hatchery	Hatchery %	95% C.I.
2002*	48,865	48,547	318	0.7	(+1.4)
2003**	116,994	23,399	93,595	80.0	(+2.0)
2004	256,321	99,965	156,356	61.0	(+2.8)
2005	150,821	39,364	111,457	73.9	(+0.2)
2006	241,335	116,364	124,971	52.8	(+2.8)
Mean[1]	191,368	69,773	121,595	66.9	
Hist. Mean[2]	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 intial reading: the samples were not ground engough by the original reader.

[1]From CIAA smolt counts 2003 and 2005

[2]These are historical means dirived from Clupach and Kyle 1990

1976 to1989 from Clupach and Kyle 1990

Adult Escapement

Adult sockeye salmon escapement was monitored by ADF&G in 2006. For information on Big Lake escapement contact ADF&G

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RECOMMENDATIONS

In 2007, steps should be taken to increase the number of coho samples.

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APPENDICES

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Appendix 1. Big Lake 2006 – Environmental Conditions.

Smolts Date	Sky	Precip. (mm)	Stage (ft)	Flow	Water Temp. (^{o}C)	Air Temp. (^{o}C)
18-May	2	0	0.82	ND	10.0	16.0
19-May	3	0	0.82	ND	11.0	14.0
20-May	4	0	0.86	ND	9.0	10.0
21-May	3	0	0.90	ND	12.0	16.0
22-May	2	0	0.88	ND	13.0	21.0
23-May	2	0	0.82	ND	16.0	23.0
24-May	3	0	0.82	ND	16.0	24.0
25-May	2	0	0.80	ND	16.0	26.0
26-May	3	0	0.78	ND	17.0	25.0
27-May	2	0	0.78	ND	18.0	25.0
28-May	2	0	0.78	ND	16.0	23.0
29-May	4	0	0.74	ND	16.0	17.0
30-May	3	0	0.72	ND	15.0	16.5
31-May	5	0	0.72	ND	13.0	9.0
1-Jun	3	0	0.82	ND	13.0	14.0
2-Jun	3	0	0.82	ND	16.0	18.0
3-Jun	3	0	0.82	ND	15.0	17.0
4-Jun	2	0	0.76	ND	15.0	15.0
5-Jun	2	0	0.72	ND	15.0	15.0
6-Jun	4	0	0.68	ND	15.0	16.0
7-Jun	4	0	0.66	ND	14.0	15.0
8-Jun	4	0	0.64	ND	15.0	14.0
9-Jun	4	0	0.68	ND	13.0	13.0
10-Jun	5	0	0.68	ND	13.0	17.0
11-Jun	4	0	0.68	ND	14.0	14.0
12-Jun	5	0	0.68	ND	14.0	14.0
13-Jun	3	0	0.66	ND	16.0	18.0
14-Jun	2	0	0.68	ND	16.0	19.0
15-Jun	5	0	0.74	ND	15.0	12.0
16-Jun	2	1	0.86	ND	15.0	15.0
17-Jun	4	0	0.88	ND	14.0	14.0
18-Jun	3	0	0.90	ND	17.0	16.0
19-Jun	3	0	0.90	ND	16.0	15.0
20-Jun	3	0	0.86	ND	15.0	13.0
21-Jun	3	0	0.87	ND	15.0	15.0
22-Jun	5	0	0.78	ND	14.0	10.0
Total	36	1				

ND = No Data Ice out = ND

		Meas. Precip	Stage	Flow	Water Temp	Air Temp
Smolts	Avg.	0.02	0.78	ND	14.5	16.5
	Min.	0	0.64	ND	9.0	9.0
	Max.	1	0.90	ND	18.0	26.0

Appendix 2. Big Lake 2006 – Smolt Emigration.

	Sockeye			Coho		
Date	Daily	Mort.	Total	Daily	Mort.	Total
18-May	242		242	31		31
19-May	638		880	33		64
20-May	1,216		2,096	46		110
21-May	1,844		3,940	72		182
22-May	2,315		6,255	144		326
23-May	3,327		9,582	250		576
24-May	3,293		12,875	186		762
25-May	2,666		15,541	184		946
26-May	6,115		21,656	296		1,242
27-May	10,466		32,122	442		1,684
28-May	8,897		41,019	167		1,851
29-May	12,436		53,455	170		2,021
30-May	12,972		66,427	192		2,213
31-May	6,785		73,212	105		2,318
1-Jun	18,154		91,366	125		2,443
2-Jun	14,805		106,171	53		2,496
3-Jun	25,824		131,995	62		2,558
4-Jun	13,841		145,836	27		2,585
5-Jun	9,706		155,542	21		2,606
6-Jun	18,704		174,246	31		2,637
7-Jun	22,421		196,667	21		2,658
8-Jun	2,654		199,321	12		2,670
9-Jun	4,551		203,872	19		2,689
10-Jun	2,403		206,275	15		2,704
11-Jun	10,299		216,574	20		2,724
12-Jun	8,973		225,547	22		2,746
13-Jun	187		225,734	8		2,754
14-Jun	2,880		228,614	17		2,771
15-Jun	889		229,503	3		2,774
16-Jun	1,895		231,398	13		2,787
17-Jun	1,970		233,368	11		2,798
18-Jun	4,109		237,477	4		2,802
19-Jun	1,251		238,728	4		2,806
20-Jun	983		239,711	12		2,818
21-Jun	967		240,678	5		2,823
22-Jun	657		241,335	9		2,832
23-Jun			241,335			2,832
Total		0	241,335		0	2,832

Appendix 3. Big Lake 2006 - Project Update.

Stocking & Misc. Activities

Crew on-site (Fish Creek):	17-May		
Ice-out:	No Data		
Crew off-site(Fish Creek):	23-Jun		
Fry stocking (Meadow Ck):	13-Jun		444,000 fry @ 0.85 grams
Fall Fry Stocking (Meadow Ck):	22-Nov to	29-Nov	426,000 @ 4.7 grams

Smolt Migration

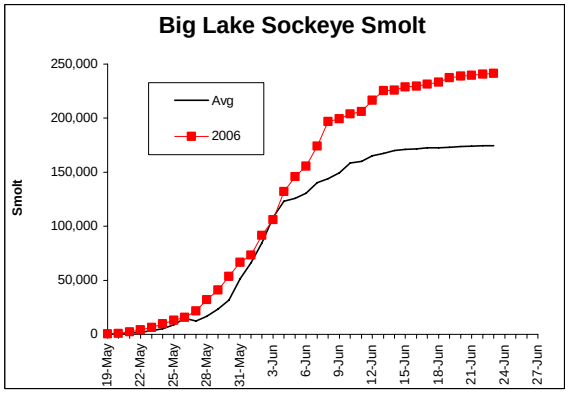
Dates:	18-May to 22-Jun	
Sockeyes:		241,335
Mortalities:		0
Percent age 1:		92%
Percent age 2:		8%
Percent hatchery:		52%
Coho:		2,832
Arctic Char:		0
Rainbow:		0

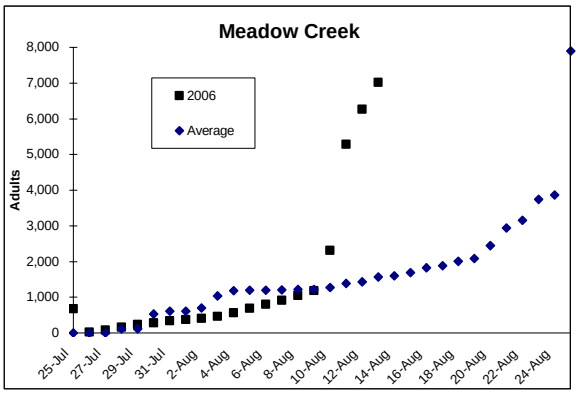
Egg Take

Dates:	13-Aug to 26-Aug	
No. of female broodstock:		2,864
Green eggs:		6,483,000
Fecundity:		2,264
Eyed eggs:		5,895,000
Survival		90.9%

Adult Migration

Sockeye total return:	36,276	
Fish Creek Return:	32,562	90%
Sport/PU Harvest:	347	1%
Commercial Harvest	3,367	9%
Meadow Creek Return:	13,616	





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