

**Hidden Lake
Sockeye Salmon Enhancement
Progress Report
2006**

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This year's operation of the Hidden Lake Sockeye Salmon Enhancement Project was made possible through enhancement taxes paid by the commercial fishermen in Area H, Cook Inlet and associated waters and through a grant 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 Hidden 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

Hidden Lake, located on the Kenai Peninsula 69 Kilometers east of Soldotna, 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 1988; and, since 1991, has completed all the field activities.

On 18 May 2006, an estimated 582,000 unfed sockeye fry were released into Hidden Lake. All 582,000 fry were released at the west end of the lake and all the released fish were otolith marked.

During 2006, smolt migration monitoring began on 18 May and continued daily until 1 July. During this time an estimated 200,794 sockeye (*O. nerka*) and 25,111 coho (*O. kisutch*) smolts migrated from the lake.

Based on otolith marks, 47.4% ($\pm 3.6\%$) of the migrating sockeye smolts were enhanced. An estimated 91.0% ($\pm 2.4\%$) were age 1 and 9.0% ($\pm 2.4\%$) were age 2. The average length and weight of the age 1 sockeye smolts was 140.2 mm (± 0.89 mm) and 24.7 g (± 0.5 g). The age 2 sockeye smolts were 179 mm (± 10.31 mm) and 60.49 g (± 8.71 g).

Of the migrating coho smolts, an estimated 22.4% ($\pm 2.2\%$) were age 1 and 77.7% ($\pm 2.2\%$) were age 2. The average length and weight of the age 1 coho smolts was 133.3 mm (± 2.5 mm) and 22.5 g (± 1.30 g). The age 2 coho smolts were 142.4 mm (± 1.6 mm) and 27.1 g (± 1.12 g).

Adult sockeye salmon escapement was monitored from 7 July to 8 September 2006. During this time an estimated 38,627 adult sockeye salmon returned to Hidden Creek. The percentage of adult male and adult female fish was 54.0% and 46.0%, respectively. Male fish averaged 512 mm (20.2 in) in length and the females averaged 495 mm (19.5 in). An estimated 0.13% of the fish were age 1.1, 88.8% were age 1.2, 3.7% were age 1.3, 7.1% were age 2.2 and 0.26% were age 2.3

Otolith samples were collected from fish returning to the weir on Hidden Creek. Forty-seven percent of the otolith samples were of hatchery origin.

Between 12 September and 26 September 2006, 5.691 million eggs were collected and shipped to Trail Lakes Hatchery for fertilization and incubation. An estimated 5.232 million eggs (92.8%) have survived to the eyed stage.

Water chemistry and zooplankton samples were collected 4 times during 2006. The Alaska Department of Fish and Game provided the analysis.

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INTRODUCTION AND PURPOSE

In 1972 and 1973, the Commercial Fisheries Division of the Alaska Department of Fish and Game (ADF&G) conducted biological, chemical, and physical inventories of numerous lakes throughout the Cook Inlet basin (Bill, et al. 1972; Barton and Barrett, 1973). Based on these investigations it appeared that Hidden Lake had the potential for increased production of sockeye salmon (*Oncorhynchus nerka*).

In 1976, activities to enhance the production of sockeye salmon in Hidden Lake were initiated by the Fisheries Rehabilitation, Enhancement and Development Division (FRED) of ADF&G. Initial enhancement activities involved the collection of basic fisheries and limnological data and the gathering of a small number of sockeye salmon eggs to evaluate incubation and fry rearing procedures (Kyle, et al. 1990).

Between 1976 and 1989, ADF&G collected more information on Hidden Lake. Based on this information, ADF&G was able to conclude that at an adult escapement of 10,000 sockeye, wild smolt production leveled off because the natural spawning area was limited and/or egg to fry survival was poor (Kyle, et al. 1990). ADF&G also concluded the lake's zooplankton community was being underutilized by sockeye salmon fry rearing in the lake. Thus, more sockeye fry could rear in the lake than that produced by natural spawning

Since 1976 Hidden Lake has been enhanced by annually collecting eggs from adult sockeye returning to the lake and releasing the resulting fry back to the lake. Enhancement by collecting eggs and releasing fry back to Hidden Lake bypasses some of the critical life stages that occur in the lake and takes advantage of the lake's underutilized zooplankton community.

As the Hidden Lake enhancement project was being developed, it was feared salmon enhancement itself could be detrimental to the fry-rearing environment. The escapement of large numbers of enhanced fish may, by increasing the available nutrients, alter the level of primary productivity and shift the zooplankton community to species not utilized by rearing sockeye fry.

Based on the potential of Hidden Lake to rear sockeye fry and the limitations imposed by large adult escapements, the project objective became the maximum production of adult fish while maintaining the fry-rearing environment. An average adult sockeye escapement of 30,000 fish was considered an appropriate management objective and could be accomplished by the following goals:

1. Annually collecting up to 2.3 million eggs and releasing up to 2 million sockeye fry to the lake;
2. Monitoring lake water quality through the collection and analysis of representative samples;
3. Enumerating smolt migration from the lake, and;
4. Enumerating adult escapement to the lake.

In 1988, the Cook Inlet Aquaculture Association (CIAA) became involved in the Hidden Lake Enhancement Project by conducting the gamete collection, incubation, and fry release activities. Since 1989, CIAA, with assistance from ADF&G, also conducted the smolt migration and adult escapement monitoring; beginning in 1991, CIAA assumed responsibility for conducting the limnological sampling. For data consistency, ADF&G has completed and will continue to complete the water chemistry, plankton and adult scale analyses.

In March 1999, ADF&G conducted a technical review of the Hidden Lake Sockeye Salmon Enhancement Project (Simpson and Edmundson, 1999). Concerns arose regarding the amount of sockeye salmon entering Hidden Lake. In 2000, CIAA took steps to alleviate concern by utilizing four year floating averages of survival rates (egg to fry, fry to smolt, and smolt to adult) and ADF&G estimated harvests to calculate a stocking rate that would best allow for an annual target escapement of 30,000 sockeye salmon into Hidden Lake.

PROJECT AREA

Hidden Lake is located on the Kenai Peninsula 69 kilometers east of Soldotna, Alaska and lies entirely within the Kenai National Wildlife Refuge. The lake is accessible by the Sterling Highway and the Skilak Lake Loop Road (Figure 1).

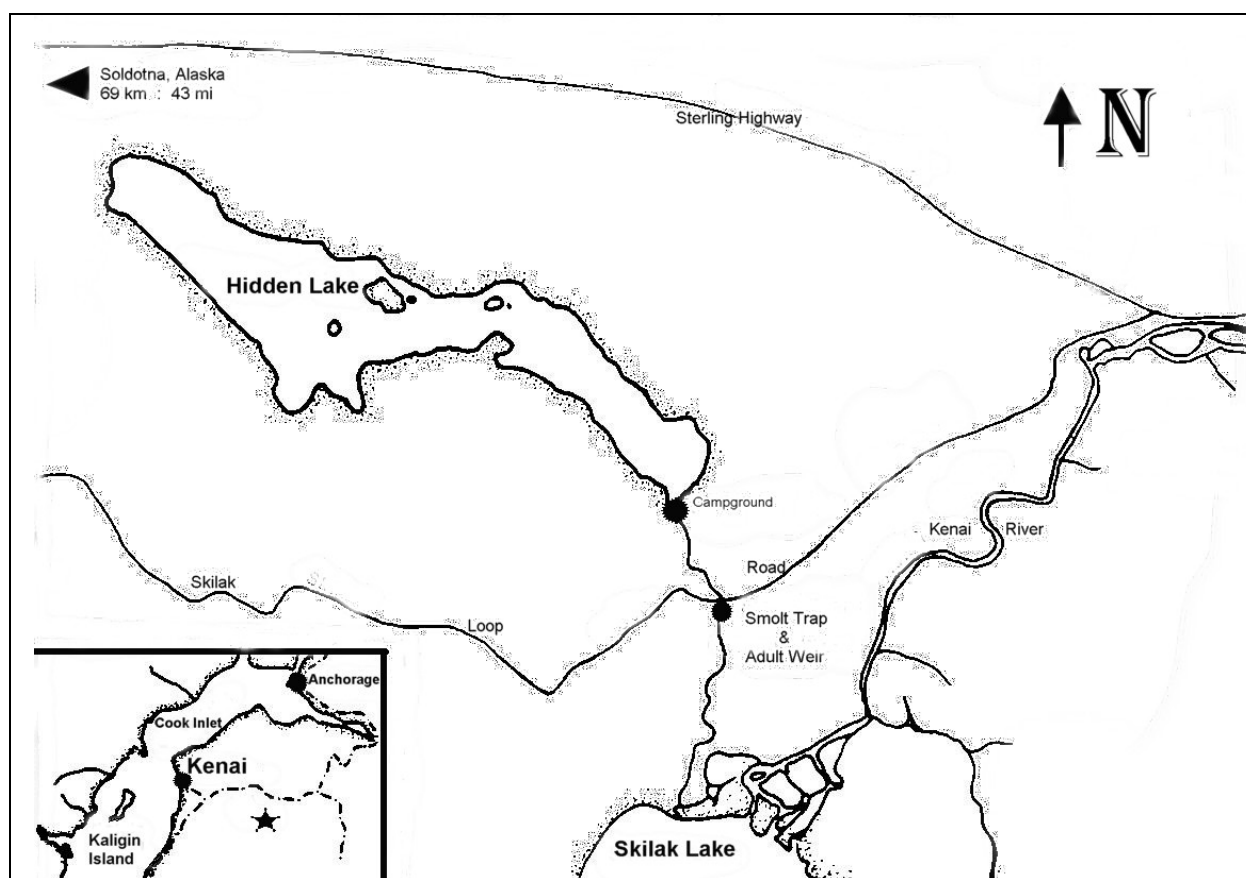


Figure 1. Area Map of Hidden Lake, Kenai Peninsula, Southcentral Alaska.

Hidden Lake (Figure 2) is steep sided with two major basins. It has a surface area of 6.8 km², a mean depth of 20.1 m, a maximum depth of 45.1 m, and a volume of 138.1 X 10⁶ m³. The mean depth of the euphotic zone is 20 m. There is one outlet, Hidden Creek, which flows 5 km to Skilak Lake, the Kenai River and Cook Inlet.

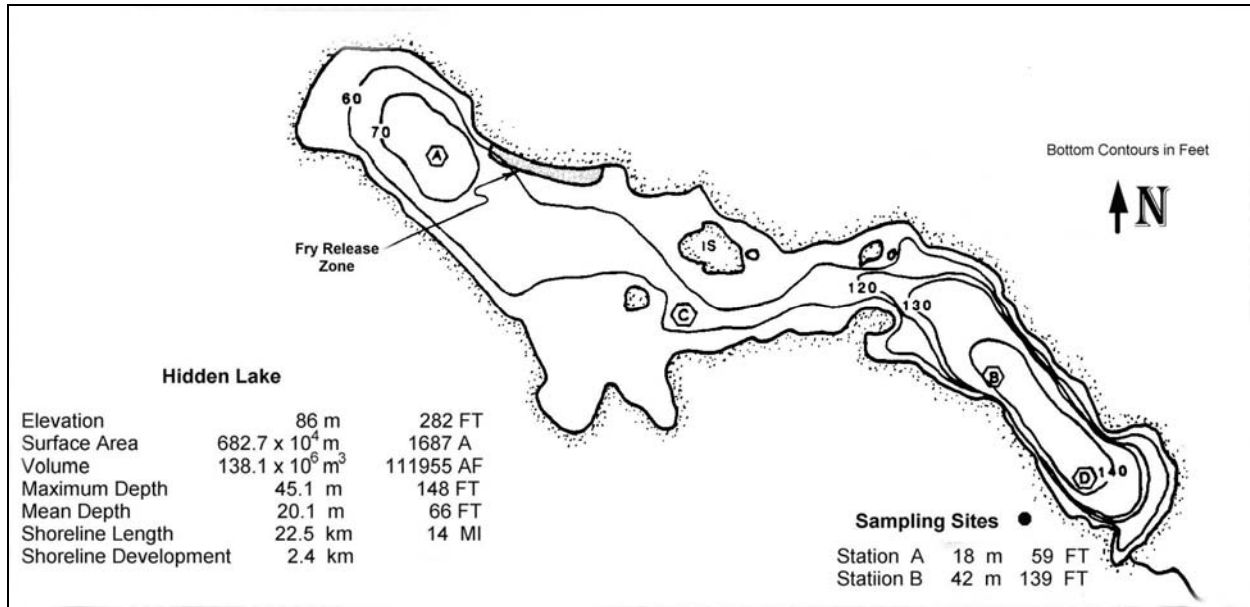


Figure 2. Morphometric map of Hidden lake showing the two major basins.

The lake's watershed area is 37.4 km^2 and has an average annual precipitation of 44 cm. The estimated water residence time is 11.7 years. During the open water season the total phosphorus concentration averages $7 \mu\text{g/l}$, the total nitrogen concentration is $178 \mu\text{g/l}$ and the chlorophyll *a* concentration is $0.6 \mu\text{g/l}$. Based on these concentrations, Hidden Lake is considered an oligotrophic-mesotrophic system (Kyle, et al. 1990).

Two cladocerans, (*Bosmina longirostris* and *Daphnia longiremus*), three copepoda (*Diaptomus pribolofensis*, *Epischura nevadensis*, and *Cyclops columbians*), and numerous species of rotifers make up the zooplankton community of Hidden Lake. Fish present in the lake include five species of Pacific salmon (*O. nerka*, *O. kisutch*, *O. tshawytscha*, *O. gorbuscha*, and *O. mykiss*), lake trout (*Salvelinus namaycush*), Dolly Varden char (*S. malma*), threespine stickleback (*Gasterosteus aculeatus*), and coastrange sculpin (*Cottus aleuticus*) (Kyle, et al. 1990).

METHODS

In general, Hidden Lake limnological sampling, salmon egg takes, hatchery incubation, fry rearing, smolt enumeration and adult escapement monitoring follow procedures recommended by ADF&G.

Limnological Sampling and Environmental Conditions

During 2006, water quality samples were collected four times during the open water season from May through September. Two primary sites (Figure 2) were sampled for dissolved oxygen, temperature and light transmission profiles, Secchi disk transparency and zooplankton densities. Samples for analysis of phosphorus, carbon, chlorophyll *a*, phaeophytin *a*, nitrogen, calcium, magnesium, iron, conductivity, pH, alkalinity, turbidity, and color were also collected with a Kemmerer sampler one meter below the surface and from the midhypolimnion. In addition to the two primary sites, two secondary sites were also sampled (Figure 2). Measurements at the secondary sites were limited to the zooplankton community and Secchi disk transparency.

Water samples were collected by CIAA. Sample collection procedures are described by Koenings, et al. (1986). Water analysis is completed by ADF&G.

In addition to the limnological samples collected from Hidden Lake, percent cloud cover was estimated, precipitation measured to the nearest millimeter and Hidden Creek water and air temperatures were recorded at 5:00 PM each day.

Smolt Enumeration

To enumerate the smolt migration, a smolt trap was temporarily placed in Hidden Creek approximately 100 meters downstream of Skilak Lake Loop road. The smolt trap consisted of a modified fyke net with nylon mesh leads 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 Hidden Lake were made until the migration of fish exceeded 1,000 to 2,000 fish per hour. At migration 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 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:

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

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

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.

In 2006, migrating smolts were enumerated from 18 May through 1 July. The 10% sub-sampling procedure was used to enumerate 30% of the sockeye smolt and 11% of the coho smolt migrating in 2006.

A detailed description of smolt enumeration procedures is available in CIAA's Hidden Lake Enhancement Project procedure manual (CIAA, 2002).

Smolt Characteristics and Enhanced Contribution

CIAA has released sockeye salmon fry to Hidden Lake since 1989. To evaluate this enhancement procedure, CIAA collects a sample of the sockeye and coho smolts migrating each year to determine age, weight, and length characteristics of the migrating populations.

Since 1991, CIAA has marked the otolith of all salmon fry released to Hidden Lake with a thermal mark². 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.

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

In 2006, smolts collected for measurement and otolith removal were sampled in proportion to the daily smolt migration. This was accomplished by collecting approximately every 750th sockeye smolt and every approximately 70th 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. Age, weight and length measurements were made on and otoliths removed from 740 sockeye smolts. Age, weight and length measurements were made on 373 coho smolts.

Each smolt collected for evaluation was first measured to the nearest millimeter for fork length³ and then weighed to the nearest 0.1 gram. Several scales were also removed from the primary growth area⁴ and mounted on a glass slide for subsequent age determination. The otoliths were then removed and placed in a labeled one-dram vial. A dilute ethanol solution was added to the vial to cover the otoliths.

After the smolt migration was complete, the otoliths were shipped to C.I.A.A headquarters. Staff at CIAA headquarters processed the otoliths and checked each for a hatchery mark following procedures described by Glick and Shields (1993). Field staff collected 740 pairs of sockeye otoliths, of which 661 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,

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.

$n_h =$ 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

Each year CIAA enumerates the escapement of adult fish to Hidden Lake. The escapement enumeration includes an assessment of the sex, age, and standard fork length⁵ of the returning population of fish. To determine the proportion of enhanced fish in the adult population, CIAA has, in the past, collected otolith samples from returning fish. However, in 2006, few fish were sacrificed for otolith collection because the lateness of the return projected fewer fish than were realized.

To enumerate returning salmon, sample and collect sex, age, and length information, a “V” shaped adult counting weir was temporarily installed in Hidden Creek. The weir was constructed of 1.9 cm galvanized pipe and 7.6 cm aluminum channel. The galvanized pipe was picketed through 1.9 cm holes in the aluminum channel spaced 2.54 cm apart.

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

In 2006, adult escapement was monitored from 7 July to 8 September. After 8 September, the adult migration appeared complete and the counting weir was removed.

In 2006, it was assumed 27,450 adult fish would return to Hidden Creek during a six week period from 15 July to 25 August. Based on this assumption, it was calculated that 120 fish needed to be collected every 6th day to secure a sample size adequate to assess the enhanced proportion, of the returning fish. To obtain an adequate sample size for determining age, sex, and size, a daily sample was taken on approximately every 30th fish counted upstream.

⁵Standard fork length was defined as the measurement from mideye to the fork of the tail.

In 2006, 92 otolith samples were collected and 946 adult sockeye salmon were sampled for age, length and weight.

A detailed description of adult escapement enumeration procedures is available in the Hidden Lake Enhancement Project procedure manual (CIAA, 2002).

Gamete Collection, Incubation and Rearing

Since 1976, the collection of sockeye gametes and the release of hatchery incubated fry have been used to enhance the sockeye population in Hidden Lake. To date, a total of 72,707,000 eggs have been collected for incubation at Crooked Creek, Big Lake and Trail Lakes Hatcheries. The annual gamete collections conducted since 1976 are summarized in Table 1.

In 2006, male and female adult sockeye salmon in spawning areas were collected by beach seine 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, 1993b).

Between 12 September and 26 September 2006, 5.691 million eggs were collected from 2,302 female 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 5.232 million eggs (92.8%) have survived to the eyed stage.

The sockeye eggs collected in 2006 are currently being incubated at Trail Lakes Hatchery. 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 and 2008.

Table 1. Summary of sockeye salmon gamete collection and fry releases at Hidden Lake, 1976 - 2006.

Brood Year	No. eggs taken	No. females used	Fecundity	Receiving hatchery	No. fry released	Egg-to-fry survival (%)	No. smolt produced in Hidden Lk	Fry-to-smolt survival (%)	No. fry Released LCI Lakes	No. fry Held for Smolt	No. Smolt Released Tutka Lagoon	Fry-to-smolt survival (%)
1976	832,880	274	3,091	Crooked Cr.	330,228	39.6	58,800	17.8				
1977	406,878	200		Big L.	308,704	75.9	40,600	13.2				
1978	311,808	100	3,118	Crooked Cr.	8,258	2.7						
1979												
1980												
1981												
1982	1,579,188	576	2,741	Trail L.	1,086,000	68.8	231,300	21.3				
1983	1,928,000	639	3,017	Trail L.	1,236,900	64.2	289,100	23.4				
1984	3,766,000	1,310	2,875	Trail L.	1,805,792	47.9						
1985	7,019,000	2,330	3,012	Trail L.	0							
1986	4,740,000	1,580	3,000	Trail L.	3,718,311	78.5						
1987	7,000,184	2,434	2,876	Trail L.	6,085,307	86.9						
1988	2,718,853	891	3,046	Trail L.	2,470,012	91.0	194,400	7.9				
1989	2,220,467	647	2,669	Trail L.	1,747,900	79.0	203,800	11.7				
1990	2,189,000	956	2,290	Trail L.	1,600,000	64.6	214,100	13.4				
1991	2,652,000	1,119	2,370	Trail L.	1,716,000	64.7	330,200	19.2				
1992	2,293,000	1,007	2,277	Trail L.	1,901,000	82.9	365,300	19.2				
1993	2,200,000	934	2,355	Trail L.	1,800,000	81.8	195,000	10.8				
1994	2,156,000	1,017	2,120	Trail L.	1,700,000	78.8	326,600	19.2				
1995	1,893,000	849	2,230	Trail L.	1,600,000	84.5	184,700	11.5				
1996	2,048,000	817	2,507	Trail L.	1,501,000	73.3	305,300	20.3				
1997	2,166,000	936	2,314	Trail L.	1,035,000	47.8	182,900	17.7				
1998	2,303,000	859	2,681	Trail L.	1,507,100	65.4	352,300	23.4				
1999	2,297,000	954	2,408	Trail L.	1,242,000	54.1	284,200	22.9				
2000	1,486,000	607	2,448	Trail L.	905,500	60.9	218,000	24.1				
2001	1,326,000	504	2,631	Trail L.	980,200	73.9	249,200	25.4				
2002	1,118,000	433	2,582	Trail L.	628,900	56.3	59,974	9.5				
2003*	893,000	371	2,407	Trail L.	646,000	89.4	264,133	40.9		152,000	92,200	60.7
2004**	5,445,000	2,045	2,663	Trail L.	573,000	89.5	202,100	35.3	4,126,000	290,000	260,000	89.7
2005***	2,027,000	1,045	1,940	Trail L.	582,000	79.0	87,182	15.0	680,000	193,000		
2006	5,691,788	2,302	2,473	Trail L.								
Total	72,707,000	27,736			38,715,000		4,286,000					
Mean			2,443		1,340,867	73.2	245,632	18.6				

The 1977 sockeye salmon were taken from anadromous and residual fish.

BY 1978 eggs suffered high mortality due to complications with the hatchery source water.

The 1985 hatchery broodstock (fry) became infected with IHN virus and were destroyed.

Egg collection data prior to 1989 is from on Kyle, et al. 1990.

Mean calculation is based on broodyear 1988 to present.

The number of smolt produced was derived from the recovery of marked fish.

*Survival from eyed egg to emergent fry was 89%. Only 646,000 fry released, 152,000 kept for smolt.

**Survival from eyed egg to emergent fry was 89%. Only 573,000 fry released to Hidden, 4,126,000 fry released to Lower Inlet Lakes, 174,000 kept for smolt

***Survival from eyed egg to emergent fry was 79%. Only 582,000 fry released to Hidden, 680,000 fry released to lower inlet lakes, 193,000 kept for smolt

 incomplete broodyear

Fish Transport and Stocking

Approximately 582,000 of the 1,593,000 sockeye salmon fry produced from gametes collected from Hidden Lake in 2005 were released to Hidden Lake on 18 May 2006. The unfed fry were transported by truck in oxygenated tanks from Trail Lakes Hatchery to Hidden Lake, transferred to oxygenated fish transport tanks on board a small skiff, motored to the west end of the lake and

released near historic spawning areas (Figure 2). All the fry appeared healthy at the time of 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: H2,2,2; Rbr 2:1.2,2.2,3.2]. Otoliths samples were processed to document the marks and are on file at CIAA Headquarters.

Approximately 680,000 fry produced from Hidden Lake gametes were released at Leisure Lake on 29 June 2006. The fish were thermally marked with the Hatch Code: H3,1; Rbr 2:1.3,2.1..

Approximately, 255,000 smolts produced from Hidden Lake games collected in 2004, were released in Tutka Bay Lagoon. The fish were thermally marked with the Hatch Code 2,2H; Rbr 1:1.2,2 .2.

Since 1977, over 38.7 million fry have been released to Hidden Lake (Table 1).

RESULTS AND DISCUSSION

Limnology and Environmental Conditions

Hidden Lake limnological characteristics have been monitored for several years. Water chemistry and zooplankton samples from 2006 are summarized in Table 2.

Environmental conditions during the Hidden Lake smolt migration were monitored from 19 May to 1 July 2006. Stream stage measurements averaged 0.71 feet and ranged from 0.67 to 0.74 feet. During the period of smolt migration, stream temperatures averaged 11.9°C and ranged from 6 to 15°C. Air temperatures averaged 16.4°C and ranged from 8 to 26°C. Twenty percent of the days were partly cloudy, 30% were completely overcast, and 14% clear days were recorded. Rain was recorded on 12 days during the smolt migration. A total of 35 mm of rain fell during this period (Appendix 2).

Environmental conditions during the Hidden Lake adult sockeye migration were monitored from 9 July to 8 September 2006. Stream stage measurements averaged 0.7 feet and ranged from 0.2 to 3.5 feet.. Stream temperatures averaged 14.4°C and ranged from 11.0 to 19.0°C and air temperatures averaged 15.8.4°C and ranged from 10.0 to 22.0°C. Seven percent of the days were clear, 18% were partly cloudy, and 32% were completely overcast. Rain was recorded on 26 of the days during the adult migration. A total of 124 mm of rain fell during this period (Appendix 2).

Table 2. Average open water season water quality characteristics of Hidden Lake

AVERAGE WATER QUALITY - 1 METER										
Year	Sp. Cond (umhos/cm)	pH (SU)	Alk (mg/l)	Turb. (NTU)	TP (ug/l)	TKN (ug/l)	Chl a (ug/l)	EZD (m)	Secchi (m)	Zooplankton (mg/m2)
1980	145	7.8	66		6.8	120	2.1			
1981	117	7.0	73		6.6	171	0.6			2,381
1982	137	8.1	70		8.6	174	0.4			1,619
1983	144	8.1	72		6.9	176	0.5			3,285
1984	146	7.9	71		6.7	172	0.7			2,248
1985	147	7.9	78	0.7	7.2	177	0.9			1,967
1986	144	7.8	72	0.4	7.5	185	0.3			2,420
1987	147	8.0	70	0.2	6.9	188	0.5			1,390
1988	146	7.8	67	0.6	6.8	197	0.6			2,466
1989	146	8.0	67	0.4	7.8	198	0.4			3,437
1990	147	8.0	73	0.4	7.8	193	0.8			2,258
1991	152	8.0	72	0.7	6.7	171	0.8	20.2	7.3	2,222
1992	145	8.0	66	0.7	7.4	231	1.3	15.2	5.0	1,030
1993	150	7.8	68	0.5	7.0	198	1.5	14.0	6.4	2,030
1994	156	7.8	70	0.5	7.4	210	1.6	19.6	6.7	847
1995	153	7.8	71	0.7	5.7	197	1.8	20.0	7.6	1,520
1996	152	7.8	71	0.7	5.6	188	0.9	19.6	8.4	1,338
1997	153	7.8	73	0.4	6.6	186	0.7	20.2	9.7	2,111
1998	150	8.0	72	0.8	6.4	205	0.8	21.0	7.2	2,358
1999	149	7.6	72	0.7	7.3	234	0.8	18.7	6.7	2,474
2000	150	7.8	69	0.8	7.2	234	1.6	20.4	8.7	3,896
2001	150	7.6	68	0.7	7.8	231	1.1	19.4	7.1	3,398
2002	147	7.7	73	0.4	8.6	257	1.1	17.9	5.9	2,447
2003	148	7.3	70	0.4	8.4	229	2.8	17.1	7.0	959
2004				NO DATA				17.1	6.6	1,450
2005	149	7.2	68	0.3	9.8	273	0.5	17.5	7.0	1,693
2006	147	7.3	67	0.1	8.2	237	0.5	23.4	8.0	1,445

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

AVERAGE WATER QUALITY - HYPOLIMNION

Year	Sp. Cond (umhos/cm)	pH (SU)	Alk (mg/l)	Turb. (NTU)	TP (ug/l)	TKN (ug/l)	Chl a (ug/l)
1980	146	7.8	69		6.1	140	1.8
1981	116	7.0	74		6.5	175	0.5
1982	136	8.0	71		7.2	172	0.5
1983	148	7.8	73		9.2	193	0.8
1984	149	7.7	72	0.6	6.3	168	0.6
1985	147	7.7	79	0.7	8.2	179	0.7
1986	146	7.7	71	0.3	7.6	180	0.3
1987	150	7.8	70	0.3	8.3	191	0.5
1988	150	7.6	67	0.4	7.0	195	0.6
1989	149	7.9	67	0.4	8.0	196	0.4
1990	148	7.8	73	0.4	8.5	187	0.7
1991	154	7.8	73	0.7	8.2	189	0.6
1992	147	7.7	69	0.6	9.5	218	1.1
1993	156	7.6	71	0.4	8.0	203	1.3
1994	157	7.6	70	0.6	7.3	188	0.9
1995	159	7.6	72	0.7	6.5	189	1.6
1996	159	7.7	73	0.7	6.3	190	2.6
1997	153	7.8	73	0.5	9.0	201	1.2
1998	153	7.8	72	0.1	6.6	194	0.6
1999	153	7.5	72	0.7	7.4	221	0.5
2000	151	7.7	70	0.7	7.9	245	1.5
2001	152	7.5	69	0.7	7.5	222	0.9
2002	150	7.6	73	0.5	9.1	239	0.7
2003	149	7.3	68	0.5	8.9	224	1.5
2004				NO DATA			
2005	149	7.2	68	0.1	11.8	277	0.5
2006	148	7.4	68	0.2	8.5	216	0.6

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

Smolt Enumeration

In general, the pattern of the 2006 Hidden Lake sockeye smolt migration seemed to have two distinct peaks – dissimilar to previous smolt migrations before 2005. It is apparent that the average is shifting into that pattern as well. The peaks of the 2006 smolt migration occurred between 3 and 7 June and again between 13 and 17 June.

Three thousand fifteen moribund or dead sockeye smolts were observed during the 2006 smolt migration. A majority of the mortality occurred prior to the fish entering the trap.

Not considering the 3,015 sockeye smolts lost during enumeration, the final 2006 Hidden Creek sockeye smolt migration was estimated at 200,794 ($\pm 17,855$). Other fish counted included 25,111 (± 901) coho smolts (Appendix 3).

Smolt Characteristics and Enhanced Contribution

In 2006, characteristics of the smolt migration were evaluated from scale samples collected throughout the migration and from measurements of length and weight. Based on these samples and measurements, an estimated 91% ($\pm 2.4\%$) of the sockeye smolts were age 1 and 8.4% ($\pm 2.4\%$) were age 2. The average length and weight of the age 1 sockeye smolts was 140.2 mm (± 0.89 mm) and 24.7 g (± 0.5 g). The age 2 sockeye smolts were 179 mm (± 10.31 mm) and 60.5 g (± 8.71 g). There were no age 3 smolts (Table 3).

Of the migrating coho smolts, an estimated 22.4% ($\pm 2.2\%$) were age 1 and 77.6% ($\pm 2.2\%$) were age 2. There were no age 3 smolts. The average length and weight of the age 1 coho smolts was 133.3 mm (± 2.5 mm) and 22.5 g (± 1.30 g) and the age 2 coho smolts were 142.4 mm (± 1.6 mm) and 27.1 g (± 1.12 g).

The age structure, average length, and weight measurements of the sockeye smolts were similar to previous sockeye smolt migrations. Although average length and weight measurements of the coho smolts were similar to previous years, the age structure showed age-2 smolts to be the dominate age class of the coho smolt migration

Table 3. Age structure, length and weight characteristics of Hidden Lake sockeye smolt, 1976 - 2006.

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	80		20		130		146		NA		NA	
1977	83		17		144		199		NA		NA	
1978	88		12		133		190		22.4		79.3	
1979	85		15		145		177		30.7		57.2	
1980	90		10		143		200		27.3		83.9	
1981	98		2		144		198		28.5		81.4	
1982	99		1		145		174		27.3		55.3	
1983	94		6		132		186		21.3		66.1	
1984	95		5		144		170		28.7		49.2	
1985	97		3		141		185		26.3		63.7	
1986	96		4		134		180		22.4		55.6	
1987	81		19		143		175		28.0		54.3	
1988	94		6		128		179		18.7		59.1	
1989	94		6		126		163		17.6		43.5	
1990	78		21		140		191		30.0		71.6	
1991	93		6		140		205		25.4		88.9	
1992	95		5		133		172		21.5		47.1	
1993	89		10		130		183		20.4		61.2	
1994	94		6		130		179		18.1		49.8	
1995	86		13		128		181		18.3		56.5	
1996	95	(±2.1)	5	(±2.1)	135	(±0.5)	190	(±4.5)	19.1	(±0.3)	59.4	(±6.5)
1997	96	(±2.7)	4	(±2.7)	123	(±0.6)	190	(±15.9)	15.9	(±0.3)	72.7	(±19.7)
1998	91	(±2.9)	9	(±2.9)	129	(±0.7)	203	(±5.8)	20.0	(±0.4)	82.3	(±6.5)
1999	86	(±3.6)	14	(±3.6)	132	(±0.6)	173	(±5.1)	23.0	(±0.3)	51.1	(±4.8)
2000	93	(±2.2)	8	(±2.2)	138	(±0.5)	182	(±7.3)	25.0	(±0.3)	64.0	(±7.8)
2001	94	(±2.6)	6	(±2.5)	134	(±0.5)	165	(±8.6)	22.3	(±0.3)	45.0	(±8.0)
2002	86	(±2.2)	13	(±2.2)	134	(±0.8)	165	(±6.0)	22.2	(±0.4)	45.0	(±4.8)
2003	94	(±2.2)	6	(±2.2)	140	(±0.5)	179	(±0.8)	24.7	(±0.2)	60.5	(±6.5)
2004	64	(±3.7)	36	(±3.7)	140	(±0.8)	179	(±3.6)	24.7	(±0.8)	60.5	(±3.7)
2005	91	(±1.8)	9	(±1.9)	140	(±0.5)	179	(±3.6)	24.7	(±2.0)	60.5	(±3.7)
2006	91	(±2.4)	9	(±2.4)	140	(±0.9)	179	(±10.31)	24.7	(±0.5)	60.4	(±8.7)
Mean	90		10		136		181		21.9		57.6	

Prior to 1990, data summary is from Kyle et al. (1990).

Prior to 1988, estimates of the enhanced contribution of sockeye to the Hidden Lake sockeye smolt migration were based on coded wire tag studies. Estimates of the proportion of hatchery fish ranged from 3 to 78% (Kyle, et al. 1990). Since 1991, the otoliths of all hatchery-incubated fry released to Hidden Lake were thermally marked. These hatchery marks have been used to apportion migrating sockeye smolts between wild and enhanced fish since 1993. In 2006, the proportion of hatchery-incubated salmon in the sockeye smolt migration was 47.4% (±3.6%) (Table 4). This proportion is lower than the average estimate of the hatchery contribution based on otolith thermal marks.

Table 4. The contribution of enhanced sockeye to the Hidden Lake smolt migrations, 1976 - 2006.

Smolt Year	Total		Wild	Hatchery	% Hatchery	
	No.	95% C.I.			%	95% C.I.
1976	29,639		29,639	0	0	
1977	17,670		17,670	0	0	
1978	111,466		52,745	58,721	53	
1979	94,347		46,828	47,519	50	
1980	81,748		79,458	2,290	3	
1981	161,522		161,522	0	0	
1982	222,673		222,673	0	0	
1983	235,233		235,233	0	0	
1984	419,376		175,876	243,500	58	
1985	396,000		98,000	298,000	75	
1986	651,889		140,965	510,924	78	
1987	68,980		68,980	0	0	
1988	471,625					
1989	719,527					
1990	231,300					
1991	208,500					
1992	191,900					
1993	388,500	(±21,100)	62,200	326,300	84	(+4.8)
1994	414,700	(±40,400)	53,900	360,800	87	(+3.9)
1995	293,700	(±33,400)	79,300	214,400	73	(+6.5)
1996	428,100	(±15,700)	94,200	333,900	78	(+3.6)
1997	228,800	(±0)	65,000	163,000	71	(+5.1)
1998	385,300	(±45,000)	85,600	299,700	78	(+3.7)
1999	313,100	(±13,390)	94,300	218,800	70	(+4.2)
2000	475,600	(± 52,609)	108,500	367,100	77	(+3.2)
2001	324,900	(±0)	94,000	230,900	71	(+4.4)
2002	369,900	(±51,400)	133,200	236,700	64	(+4.4)
2003	309,180	(±17,300)	63,800	245,400	79	(+3.1)
2004	192,800	(±0)	140,800	53,000	27	(+3.9)
2005	290,400	(±15,500)	70,300	220,100	76	(+2.6)
2006	200,794	(±17855)	106,421	94,373	47	(+3.6)
Mean	329,700		89,400	240,300	70	

Prior to 1993, estimates of smolts originating from hatchery fry releases based on CWT studies.

Since 1993, estimates of smolts originating from hatchery fry releases based on otolith thermal marks.

Mean calculated from 1993 to 2005.

Prior to 1990, data summary is from Kyle et al. (1990).

Adult Escapement

Adult sockeye salmon return was monitored from 7 July to 8 September 2006 (Appendix 4). During this time an estimated 38,535 adult sockeye salmon returned to Hidden Creek. (Table 5).

Table 5. Summary of Hidden Lake salmon escapement, age distribution and fish length. 1976 - 2006.

Year	Escapement		Major Age Classes						
	Number	Hatchery (%) (C.I.)	1.2		1.3		2.2		
			(%)	Lth(mm)	(%)	Lth(mm)	(%)	Lth(mm)	
1976	4,860		79	540	1	530	20	550	
1977	1,055		64	550	2	600	34	570	
1978	4,647		88	530	10	540	2	540	
1979	5,762		90	540	4	560	6	550	
1980	27,488		92	530	1	560	1	530	
1981	15,939		78	530	15	560	7	555	
1982	9,790		70	520	23	560	4	520	
1983	11,297		87	530	11	550	2	530	
1984	27,784		92	520	3	570	5	550	
1985	24,784		77	520	13	570	9	580	
1986	17,530		85	530	9	570	6	540	
1987	43,487		96	530	3	540	0	540	
1988	50,907		94	540	4	570	2	570	
1989	7,770		44	550	41	580	15	540	
1990	77,959		86	507	2	565	12	516	
1991	112,792		90	512	7	557	3	521	
1992	32,912		82	505	13	551	5	513	
1993	11,582		80	529	9	568	11	536	
1994	6,086		60	493	31	557	6	507	
1995	7,542		63	514	12	559	21	525	
1996	55,526		83	539	7	587	9	540	
1997	56,053		77	514	18	566	3	536	
1998	67,727		83	510	14	556	3	516	
1999	49,406	69.4	(±3.7)	89	455	6	549	5	502
2000	45,685	62.0	(±3.6)	82	519	9	560	8	530
2001	42,462	57.9	(±4.0)	63	525	20	564	12	544
2002	71,983	62.0	(±3.1)	73	537	18	582	7	544
2003	11,734	57.9	(±5.2)	70	517	24	568	6	570
2004	18,172	76.8	(±2.7)	67	521	19	568	12	540
2005*	13,000	ND		79	ND	12	ND	9	ND
2006	38,535	47		89	502	4	547	7	506
Mean	31,363	61.9		79	522	12	562	8	537
Min	1,055	47.0		44	455	1	530	0	502
Max	112,792	76.8		96	550	41	600	34	580

Data prior to 1990 from Kyle, et al. 1990.

Mean escapement from 2003 to 2006 = 20,360

Mean escapement from 1992 to 2006 = 35,227

*In 2005 a hole was detected in the weir, CIAA counted 6,745 sockeye salmon. 13,000 is based on prior counts and ADF&G fish wheel estimates

ND = No Data Collected or Calculated

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

The 2006 allocation data for commercial fishery harvest was 21,049, the personal use fishery harvest was 3,720, and sport fishery harvest was 4,030.

The percentage of adult male and adult female sockeye salmon returning to Hidden Lake in 2006 was 54.0% and 46.0%, respectively (Table 6). Male fish averaged 511 mm (20.2in) in length and the females averaged 495 mm (19.5 in). An estimated 0.13% of the fish were age 1.1, 88.8% were age 1.2, 3.7% were age 1.3, 7.1% were age 2.2 and 0.26% were age 2.3.

Table 6. Hidden Lake sockeye salmon escapement sex ratio and size data, 2006.

	Age Group						Total
	1.1	1.2	1.3	2.2	2.3	3.2	
Males	51	18,308	1,166	1,369	51	0	20,809
Percent	0.13	47.50	3.03	3.55	0.13		54
Sample Size	1	361	23	27	1		413
Mean Lth (mm)	420	509	551	511	590		511
Std. Error		1	5	5			1
Sample Size	1	361	23	27	1		413
Females		15,923	254	1,369	51	0	17,726
Percent		41.31	0.66	3.55	0.13		46
Sample Size		314	5	27	1		347
Mean Lth (mm)		494	528	502	555		496
Std. Error		1	7	5			1
Sample Size		314	5	27	1		347
Both Sexes	51	34,231	1,420	2,738	102	0	38,535
Percent	0.13	88.81	3.68	7.10	0.26		100
Sample Size	1	675	28	54	2		760
Mean Lth (mm)	420	502	547	506	573		504
Std. Error		1	5	3			1
Sample Size	1	675	28	54	2		760
* Large Freshwater		94.0%	96.0%				

* Hidden Lake sockeye typically have a very distinctive large freshwater growth pattern on their scales. Fish without this pattern may be from another population.

Special Studies – Adults

In March 1999, ADF&G conducted a technical review of the Hidden Lake Sockeye Salmon Enhancement Project (Simpson and Edmundson, 1999). Based on this review, ADF&G recommended that two special studies be conducted. One study was to determine if hatchery incubated fish released to Hidden Lake are straying into other Kenai River system spawning

populations and the other was to determine the contribution of hatchery incubated fish to the sockeye population returning to Hidden Lake.

To determine if hatchery incubated fish were straying into other Kenai River spawning populations; late run adult sockeye salmon returning to the Russian River and the Trail Lakes Hatchery discharge were checked for hatchery incubated fish. The Russian River was checked for fish from Hidden Lake because the Russian River is upstream of Hidden Lake and fish returning to the Russian River migrate up the Kenai River with fish bound for Hidden Lake. Sockeye Salmon have been sampled every year from 1999 to 2000 and no hatchery fish have been detected in the Russian River. Thus, 2002 was the last year Russian River sockeye salmon were sampled for hatchery marks.

To continue monitoring for possible straying sockeye salmon in 2003, a small creek on the southeast side of Skilak Lake was sampled for hatchery marked sockeye salmon. Over the past three years a total of 311 otolith samples have been collected from this creek and its surrounding area (none were found to be of hatchery origin). In addition, the hatchery discharge was checked for fish from Hidden Lake because it is believed returning fish may be attracted to the water they were incubated in.

Typically to determine the contribution of hatchery incubated fish to the population of adult sockeye returning to Hidden Lake, CIAA annually attempts to collect otolith samples from approximately 120 fish every sixth day throughout the migration. Because of late return in 2006, CIAA did not implement this practice. As an alternative, CIAA staff sampled 92 fish on the 5 and 6 August 2006 and found that out of the 92 samples 90 of them were readable with a result of 47% hatchery contribution.

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RECOMMENDATIONS

In order to make a statistically sound estimate of hatchery origin, CIAA staff should conceive and implement (in 2007) a strategy to collect an appropriate otolith sample during the adult sockeye salmon return to the Hidden Creek weir.

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APPENDICES

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Appendix 1. Hidden Lake 2006 – Macrozooplankton Density.

Site A - Depth 21 - 20 m						
Date	Density (No/m ²)				Mean (No/m ²)	Seasonal Mean (No/m ²)
	26-May	20-Jun	20-Aug	27-Sep		
<i>Epischura</i>		8,493	679	287	2,365	2,365
<i>Cyclops</i>	955	2,972			39,602	39,602
Ovig. <i>Cyclops</i>	19,108	9,979	4,395	892	982	982
<i>Bosmina</i>	12,420	1,062	669		8,594	8,594
Ovig. <i>Bosmina</i>	32,962	57,537	732	255	3,538	3,538
<i>Daphnia l.</i>	11,465	7,006		64	22,872	22,872
Ovig. <i>Daphnia l.</i>	478		159	64	4,634	4,634
<i>Daphnia g.</i>					175	175
Ovig. <i>Daphnia g.</i>						
Total:					82,760	82,760

Body Size - Site B - Depth 40 - 42 m						
Date	Density (No/m ²)				Mean (No/m ²)	Seasonal Mean (No/m ²)
	26-May	20-Jun	20-Aug	27-Sep		
<i>Epischura</i>	3,185	15,924	66,879	3,715	22,426	22,426
<i>Cyclops</i>	317,410	225,053	82,803	27,070	163,084	163,084
Ovig. <i>Cyclops</i>	6,369	31,847	17,516	531	14,066	14,066
<i>Bosmina</i>	2,293	198,514	1,173,567	138,004	378,095	378,095
Ovig. <i>Bosmina</i>	13,800	8,493	68,471	531	22,824	22,824
<i>Daphnia l.</i>	48,832	199,575	97,134	39,278	96,205	96,205
Ovig. <i>Daphnia l.</i>	12,739	58,386	19,108	3,715	23,487	23,487
<i>Daphnia g.</i>	1,062	2,123	44,586	108,280	39,013	39,013
Ovig. <i>Daphnia g.</i>			6,369	13,270	4,910	4,910
Total:					764,108	764,108

Site C - Depth 17- 19 m						
Date	Density (No/m ²)				Mean (No/m ²)	Seasonal Mean (No/m ²)
	26-May	20-Jun	20-Aug	27-Sep		
<i>Epischura</i>					8,416	8,416
<i>Cyclops</i>	83,227	2,548		287	21,516	21,516
Ovig. <i>Cyclops</i>	3,822	318			1,035	1,035
<i>Bosmina</i>	19,958	67,834	22,134	287	27,553	27,553
Ovig. <i>Bosmina</i>	8,493	955	955		2,601	2,601
<i>Daphnia l.</i>	30,998	106,369	2,548	382	35,074	35,074
Ovig. <i>Daphnia l.</i>	8,068	9,554		64	4,422	4,422
<i>Daphnia g.</i>		637	1,115	223	494	494
Ovig. <i>Daphnia g.</i>	425			191	154	154
Total:					101,264	101,264

Site D - Depth 40 - 43 m						
Date	Density (No/m ²)				Mean (No/m ²)	Seasonal Mean (No/m ²)
	26-May	20-Jun	20-Aug	27-Sep		
<i>Epischura</i>	9,156	38,217	49,363	14,013	27,687	27,687
<i>Cyclops</i>	109,471	202,229	35,032	59,873	101,651	101,651
Ovig. <i>Cyclops</i>	9,554	20,701	9,554	3,185	10,749	10,749
<i>Bosmina</i>	6,768	657,643	785,032	187,898	409,335	409,335
Ovig. <i>Bosmina</i>	1,194	17,516			4,678	4,678
<i>Daphnia l.</i>	22,293	257,962	84,395	31,210	98,965	98,965
Ovig. <i>Daphnia l.</i>	1,990	65,287	4,777	8,917	20,243	20,243
<i>Daphnia g.</i>		7,962	15,924	187,261	52,787	52,787
Ovig. <i>Daphnia g.</i>			15,924	38,217	13,535	13,535
Total:					739,630	739,630

Appendix 1. (cont'd) Hidden Lake 2006 – Macrozooplankton Biomass.

Site A - Depth 20 - 20.5 m

Date	Body Size (mm)				Body Size (mm)		Biomass (mg/m ²)	
	26-May	20-Jun	20-Aug	27-Sep	Mean	Seasonal	Mean	Seasonal
						Weighted		Weighted
<i>Epischura</i>		1.57	0.65	0.83	1.02	1.48	11	32
<i>Cyclops</i>	1.03	1.07	1.01	1.19	1.08	1.04	166	155
Ovig. <i>Cyclops</i>	1.27	1.24			1.26	1.25	6	6
<i>Bosmina</i>	0.50	0.44	0.50	0.52	0.49	0.48	19	19
Ovig. <i>Bosmina</i>	0.66	0.61	0.63		0.63	0.65	14	15
<i>Daphnia l.</i>	0.79	0.95	0.72	0.95	0.85	0.89	74	82
Ovig. <i>Daphnia l.</i>	1.03	1.02		0.84	0.96	1.03	20	23
<i>Daphnia g.</i>	1.12		1.20	0.77	1.03	1.11	0	1
Ovig. <i>Daphnia g.</i>								
Total:							311	331

Body Size - Site B - Depth 40 - 42 m

Date	Body Size (mm)				Body Size (mm)		Biomass (mg/m ²)	
	26-May	20-Jun	20-Aug	27-Sep	Mean	Seasonal	Mean	Seasonal
						Weighted		Weighted
<i>Epischura</i>	0.56	1.34	1.06	1.44	1.10	1.11	132	135
<i>Cyclops</i>	1.03	1.01	1.05	1.13	1.06	1.03	658	625
Ovig. <i>Cyclops</i>	1.26	1.27	1.27	1.26	1.27	1.27	84	84
<i>Bosmina</i>	0.44	0.35	0.55	0.57	0.48	0.53	811	982
Ovig. <i>Bosmina</i>	0.68	0.61	0.59	0.62	0.63	0.61	86	80
<i>Daphnia l.</i>	0.86	0.91	0.98	1.06	0.95	0.94	398	384
Ovig. <i>Daphnia l.</i>	1.13	1.08	1.26	0.94	1.10	1.12	134	138
<i>Daphnia g.</i>	0.93	1.24	1.10	1.07	1.09	1.08	128	126
Ovig. <i>Daphnia g.</i>			1.42	1.39	1.41	1.40	38	37
Total:							2,469	2,591

Body Size - Site C - Depth 17 - 19m

Date	Body Size (mm)				Body Size (mm)		Biomass (mg/m ²)	
	26-May	20-Jun	20-Aug	27-Sep	Mean	Seasonal	Mean	Seasonal
						Weighted		Weighted
<i>Epischura</i>	0.65	1.12	0.86	1.02	0.91	0.97	29	35
<i>Cyclops</i>	0.88	1.11		1.12	1.04	0.89	84	60
Ovig. <i>Cyclops</i>	1.25	1.30			1.28	1.25	6	6
<i>Bosmina</i>	0.48	0.52	0.50	0.55	0.51	0.51	69	67
Ovig. <i>Bosmina</i>	0.64	0.64	0.62		0.63	0.64	10	10
<i>Daphnia l.</i>	0.75	0.87	0.74	0.81	0.79	0.84	97	111
Ovig. <i>Daphnia l.</i>	1.07	1.10	1.20	0.78	1.04	1.09	22	24
<i>Daphnia g.</i>	0.80	1.07	1.15	0.90	0.98	1.10	1	2
Ovig. <i>Daphnia g.</i>				1.41	1.41	1.41	1	1
Total:							320	316

Body Size - Site D - Depth 40 - 43m

Date	Body Size (mm)				Body Size (mm)		Biomass (mg/m ²)	
	26-May	20-Jun	20-Aug	27-Sep	Mean	Seasonal	Mean	Seasonal
						Weighted		Weighted
<i>Epischura</i>	0.68	1.35	1.01	1.59	1.16	1.17	189	196
<i>Cyclops</i>	1.03	1.03	1.09	1.09	1.06	1.04	415	401
Ovig. <i>Cyclops</i>	1.26	1.28	1.27	1.30	1.28	1.27	65	65
<i>Bosmina</i>	0.47	0.51	0.55	0.60	0.53	0.54	1,105	1,124
Ovig. <i>Bosmina</i>	0.66	0.66			0.66	0.66	20	20
<i>Daphnia l.</i>	0.74	0.84	1.01	1.09	0.92	0.89	380	354
Ovig. <i>Daphnia l.</i>	1.03	1.02	1.29	1.18	1.13	1.05	121	104
<i>Daphnia g.</i>	1.20	0.94	1.15	1.15	1.11	1.14	186	205
Ovig. <i>Daphnia g.</i>			1.38	1.40	1.39	1.39	101	102
Total:							2,581	2,570

Appendix 1. (cont'd) Hidden Lake 2006 – Water Quality.

Date	Sta	Depth (m)	TP (ug/l)	TFP (ug/l)	FRP (ug/l)	TKN (ug/l)	NH3+NH4 (ug/l)	NO2+NO3 (ug/l)	TN:TP	RSi (ug/l)	Org C (ug/l)	Chla (ug/l)	Phaeo (ug/l)	EZD (m)
26-May	A	1	6.7	3.9	3.8	228.8	3.2	23.1	83 :1	3624	521	0.39	0.14	19.5
	A	16	6.8	4.5	3.5	212.9	4.0	19.1	76 :1	3638	581	0.42	0.16	
20-Jun	B													
	B													
	A	1	6.2	4.5	3.7	230.2	34.5	18.4	89 :1	3498	581	0.13	0.13	22.6
	A	14	8.4	4.9	3.9	204.2	3.3	18.0	59 :1	3377	584	0.43	0.30	
10-Aug	B	1	7.7	4.5	4.5	246.2	11.4	19.3	76 :1		486	0.27	0.18	31.0
	B	30	9.4			227.4			54 :1	3707				
	A	1	9.3	3.2	1.8	257.8	24.2	4.1	62 :1	3360	600	0.66	0.25	25.3
	A	16	9.4	6.1	4.2	208.8	3.8	4.1	50 :1	3356	594	0.66	0.25	
27-Sep	B	1	8.7	4.3	2.2	227.5	7.2	4.1	59 :1	3427	597	0.61	0.25	25.1
	B	26	7.5	4.3	2.8	208.9	5.7	4.1	63 :1	3470	587	0.51	0.26	
	A	1	9.3	4.0	2.5	248.8	10.0	4.1	60 :1	3725	465	0.91	0.40	19.2
	A	16	9.6	5.0	3.4	234.2	6.7	4.1	55 :1	3550	581	0.96	0.40	
	B	1	9.6	5.1	2.8	222.2	6.9	4.1	52 :1	3589	581	0.65	0.27	21.3
Mean			8.4	4.5	3.3	227.5	10.1	10.6	63 :1	3,527	563	0.55	0.25	23.4
Min			6.2	3.2	1.8	204.2	3.2	4.1	50 :1	3,356	465	0.13	0.13	19.2
Max			9.6	6.1	4.5	257.8	34.5	23.1	89 :1	3,725	600	0.96	0.40	31.0

Date	Sta	Depth (m)	Sp. Cond (umhos/cm)	pH (SU)	Alk (mg/l)	Turb (NTU)	Color (Pt)	Ca (mg/l)	Mg (mg/l)	Fe (ug/l)	Secchi (meters)
26-May	A	1	148	7.1	69.0	0.2	10	22.5	2.8	12	8.00
	A	16	149	7.3	68.8	0.3	8	22.9	2.9	10	
20-Jun	B										
	B										
	A	1	151	7.2	68.7	0.3	8	22.7	3.4	9	9.00
	A	14	150	7.3	68.7	0.2	12	23.4	3.1	8	
10-Aug	B	1					20				8.00
	B	30	154	7.2	69.0	0.1		23.2	2.9	8	
	A	1	145	7.5	67.2	0.1	8	21.9	3.1	8	7.00
	A	16	144	7.6	67.3	0.2	12	22.6	2.9	16	
27-Sep	B	1	147	7.6	67.3	0.1	9	22.8	2.9	9	7.00
	B	26	147	7.5	68.0	0.1	9	23.5	2.9	8	
	A	1	143	7.0	64.7	0.1	10	22.7	2.7	12	8.00
	A	16	146	7.3	65.9	0.1	11	23.0	2.9	11	
	B	1	147	7.2	67.4	0.0	9	22.2	3.2	8	9.00
Mean			148	7.3	67.7	0.2	11	23	3	10	8.00
Min			143	7.0	64.7	0.0	8	22	3	8	7.00
Max			154	7.6	69.0	0.3	20	24	3	16	9.00

Appendix 2. Hidden Lake 2006 – Environmental Conditions.

Smolts		Precip. (mm)	Stage (ft)	Flow	Water Temp. (°C)	Air Temp. (°C)
Date	Sky					
19-May	3	0.0	ND	ND	10.0	14.0
20-May	4	0.0	ND	ND	6.0	8.0
21-May	2	0.0	ND	ND	8.0	14.0
22-May	2	0.0	0.71	ND	11.0	20.0
23-May	2	0.0	0.71	ND	12.0	23.0
24-May	2	0.0	0.71	ND	13.0	25.0
25-May	1	0.0	0.72	ND	14.0	25.0
26-May	1	0.0	0.72	ND	15.0	26.0
27-May	1	0.0	0.72	ND	15.0	24.0
28-May	1	0.0	0.71	ND	15.0	23.0
29-May	2	0.0	0.70	ND	12.0	20.0
30-May	2	0.0	0.71	ND	13.0	19.0
31-May	4	2.5	0.70	ND	10.0	10.0
1-Jun	4	0.0	0.70	ND	10.0	13.0
2-Jun	2	0.0	0.70	ND	15.0	18.0
3-Jun	3	0.0	0.70	ND	14.0	17.0
4-Jun	1	0.0	0.71	ND	14.0	15.0
5-Jun	3	0.0	0.72	ND	14.0	16.0
6-Jun	2	0.0	0.69	ND	15.0	16.0
7-Jun	4	0.0	0.68	ND	10.0	13.0
8-Jun	4	0.0	0.68	ND	8.0	12.0
9-Jun	3	5.2	0.68	ND	10.0	13.0
10-Jun	3	0.0	0.67	ND	10.0	14.0
11-Jun	4	1.4	0.68	ND	8.0	10.0
12-Jun	3	4.2	0.69	ND	9.0	15.0
13-Jun	4	0.4	0.70	ND	11.0	16.0
14-Jun	3	0.0	0.70	ND	12.0	18.0
15-Jun	4	6.0	0.70	ND	11.0	14.0
16-Jun	3	6.5	0.72	ND	12.0	17.0
17-Jun	4	0.5	0.72	ND	13.0	15.0
18-Jun	4	0.0	0.70	ND	10.0	13.0
19-Jun	4	0.0	0.70	ND	11.0	14.0
20-Jun	4	0.0	0.70	ND	12.0	13.0
21-Jun	3	0.0	0.70	ND	13.0	17.0
22-Jun	4	6.5	0.70	ND	12.0	13.0
23-Jun	2	1.0	0.72	ND	13.0	14.0
24-Jun	2	0.4	0.72	ND	13.0	16.0
25-Jun	2	0.0	0.70	ND	13.0	19.0
26-Jun	4	0.0	0.74	ND	12.0	13.0
27-Jun	2	0.0	0.74	ND	13.0	19.0
28-Jun	1	0.0	0.74	ND	13.0	18.0
29-Jun	4	0.0	0.70	ND	11.0	13.0
30-Jun	4	0.4	0.70	ND	12.0	15.0
1-Jul	2	0.0	0.70	ND	15.0	20.0
Total	44	35.0				

		Precip.	Stage	Flow	Water	Water
					Temp	Temp
Smolts	Avg.	0.8	0.71	ND	11.9	16.4
	Min.	0.0	0.67	ND	6.0	8.0
	Max.	6.5	0.74	ND	15.0	26.0
Adults	Avg.	2.3	0.7	ND	14.4	15.8
	Min.	0.0	0.2	ND	11.0	10.0
	Max.	25.5	3.5	ND	19.0	22.0

Cloud Cover - No. of Days				
Meas.	<100%	<50%	>50%	>0%
Rain	100%	>50%	>0%	Clear
Smolts	44.0	36%	20%	30%
Adults	55.0	36%	32%	18%

ND = No Data

- 1.0 = Clear
- 2.0 = Cloud Cover <50%
- 3.0 = Cloud Cover >50%
- 4.0 = Overcast
- 5.0 = Rain
- Ice out = ND

Adults		Precip. (mm)	Stage (ft)	Flow	Water Temp. (°C)	Air Temp. (°C)
Date	Sky					
9-Jul	2	0.0	0.2	ND	15.0	20.0
10-Jul	2	0.0	0.2	ND	15.0	20.0
11-Jul	3	0.0	0.2	ND	15.0	18.0
12-Jul	1	0.0	0.2	ND	15.0	22.0
13-Jul	1	0.0	0.2	ND	15.0	21.0
14-Jul	4	0.0	0.6	ND	15.0	18.0
15-Jul	5	0.9	0.6	ND	15.0	14.0
16-Jul	2	0.0	0.5	ND	15.0	16.0
17-Jul	3	0.0	0.5	ND	16.0	16.0
18-Jul	3	0.0	0.5	ND	15.0	16.0
19-Jul	3	0.0	0.5	ND	15.0	19.0
20-Jul	3	0.0	0.5	ND	15.0	16.0
21-Jul	3	0.0	0.5	ND	15.0	15.0
22-Jul	4	0.0	0.5	ND	15.0	15.0
23-Jul	5	0.5	0.5	ND	15.0	14.0
24-Jul	4	0.0	0.5	ND	15.0	15.0
25-Jul	5	0.8	0.5	ND	15.0	15.0
26-Jul	3	0.7	0.5	ND	16.0	19.0
27-Jul	1	0.0	0.5	ND	19.0	22.0
28-Jul	1	0.0	0.5	ND	19.0	21.0
29-Jul	2	0.0	0.5	ND	16.0	16.0
30-Jul	5	11.0	0.5	ND	15.0	13.0
31-Jul	5	3.5	ND	ND	14.0	13.0
1-Aug	3	0.0	ND	ND	15.0	14.0
2-Aug	3	0.5	0.5	ND	14.0	15.0
3-Aug	5	1.0	0.5	ND	14.0	12.0
4-Aug	5	0.5	0.5	ND	13.0	14.0
5-Aug	3	0.8	0.6	ND	14.0	16.0
6-Aug	2	0.0	0.6	ND	14.0	19.0
7-Aug	2	0.0	0.6	ND	16.0	21.0
8-Aug	2	0.0	0.5	ND	17.0	22.0
9-Aug	5	0.2	0.6	ND	16.0	17.0
10-Aug	3	0.0	0.6	ND	15.0	16.0
11-Aug	5	7.0	0.6	ND	14.0	16.0
12-Aug	5	6.0	0.6	ND	14.0	17.0
13-Aug	5	ND	0.5	ND	14.0	14.0
14-Aug	5	3.0	0.5	ND	14.0	13.0
15-Aug	5	2.0	0.5	ND	13.0	13.0
16-Aug	4	16.0	0.5	ND	14.0	14.0
17-Aug	3	0.0	0.5	ND	15.0	16.0
18-Aug	5	6.0	0.5	ND	14.0	11.0
19-Aug	5	18.0	0.6	ND	14.0	12.0
20-Aug	5	2.5	0.6	ND	14.0	16.0
21-Aug	3	2.0	0.6	ND	14.0	15.0
22-Aug	ND	ND	ND	ND	ND	ND
23-Aug	4	0.0	0.52	ND	14.0	18.0
24-Aug	4	5.4	0.52	ND	12.0	11.0
25-Aug	3	25.5	0.56	ND	12.3	13.0
26-Aug	4	1.0	0.55	ND	12.0	13.0
27-Aug	2	0.2	0.54	ND	13.0	15.0
28-Aug	2	0.0	0.52	ND	13.0	16.0
29-Aug	2	0.0	0.54	ND	12.0	14.0
30-Aug	4	0.0	0.5	ND	12.0	12.0
31-Aug	ND	ND	ND	ND	ND	ND
1-Sep	ND	ND	ND	ND	ND	ND
2-Sep	ND	ND	ND	ND	ND	ND
3-Sep	ND	ND	ND	ND	ND	ND
4-Sep	ND	ND	ND	ND	ND	ND
5-Sep	3	4.0	3.47	ND	13.0	14.0
6-Sep	3	5.0	3.46	ND	11.0	10.0
7-Sep	3	0.0	3.45	ND	12.5	14.5
8-Sep	3	0.0	3.43	ND	13.0	15.0
Total	56	124.0				

Appendix 3. Hidden Lake 2006 – Smolt Migration.

Date	Sockeye			Coho			Rainbow		Dolly Varden	
	Daily	Mort.	Total	Daily	Mort.	Total	Daily	Total	Daily	Total
18-May	0	0	0	0	0	0	0	0	0	0
19-May	11	0	11	5	0	5	0	0	0	0
20-May	11	0	22	9	0	14	0	0	0	0
21-May	3	0	25	5	0	19	0	0	0	0
22-May	2	0	27	1	0	20	0	0	0	0
23-May	14	0	41	2	0	22	1	0	0	0
24-May	27	0	68	1	0	23	0	0	0	0
25-May	17	0	85	3	0	26	1	1	0	0
26-May	864	0	949	5	0	31	1	2	2	2
27-May	3,306	0	4,255	22	0	53	0	2	3	5
28-May	3,553	0	7,808	72	0	125	6	8	2	7
29-May	236	0	8,044	110	0	235	0	8	0	7
30-May	1,156	0	9,200	529	1	765	3	11	3	10
31-May	1,085	0	10,285	380	0	1145	2	13	1	11
1-Jun	1,320	2	11,607	601	1	1747	3	16	5	16
2-Jun	7,837	2	19,446	669	0	2416	1	17	2	18
3-Jun	18,981	21	38,448	1190	2	3608	1	18	0	18
4-Jun	15,442	24	53,914	1986	2	5596	0	18	0	18
5-Jun	9,753	7	63,674	2628	1	8225	2	20	0	18
6-Jun	4,529	6	68,209	1101	0	9326	2	22	1	19
7-Jun	524	4	68,737	412	1	9739	2	24	0	19
8-Jun	485	0	69,222	274	0	10013	0	24	0	19
9-Jun	626	2	69,850	168	0	10181	0	24	1	20
10-Jun	524	1	70,375	273	0	10454	1	25	0	20
11-Jun	818	1	71,194	398	0	10852	0	25	0	20
12-Jun	458	7	71,659	294	0	11146	1	26	0	20
13-Jun	455	8	72,122	432	4	11582	0	26	0	20
14-Jun	19,450	10	91,582	3618	3	15203	1	27	1	21
15-Jun	14,850	23	106,455	2132	3	17338	0	27	0	21
16-Jun	29,518	22	135,995	4582	1	21921	3	30	0	21
17-Jun	5,092	14	141,101	570	0	22491	0	30	0	21
18-Jun	5,534	14	146,649	360	1	22852	2	32	0	21
19-Jun	1,616	10	148,275	139	2	22993	1	33	1	22
20-Jun	4,138	63	152,476	361	2	23356	0	33	0	22
21-Jun	5,977	80	158,533	287	3	23646	0	33	0	22
22-Jun	3,372	1,596	163,501	108	0	23754	0	33	0	22
23-Jun	6,478	32	170,011	592	2	24348	1	34	0	22
24-Jun	8,720	114	178,845	349	1	24698	2	36	1	23
25-Jun	3,644	94	182,583	93	0	24791	1	37	0	23
26-Jun	3,686	65	186,334	72	0	24863	1	38	1	24
27-Jun	2,946	42	189,322	71	0	24934	1	39	0	24
28-Jun	6,222	322	195,866	118	0	25052	3	42	3	27
29-Jun	5,033	405	201,304	37	0	25089	0	42	0	27
30-Jun	1,744	24	203,072	21	0	25110	0	42	0	27
1-Jul	737	0	203,809	31	0	25141	0	42	0	27
Total	200,794	3,015	203,809	25,111	30	25,141	42	42	27	27

Appendix 4. Hidden Lake 2006 – Adult Migration.

Date	Sockeye		Lures	Coho Daily	Otolith	
	Daily	Total			Collection	Mortalites
7-Jul	0	0		0		
8-Jul	0	0		0		
9-Jul	0	0		0		
10-Jul	0	0		0		
11-Jul	0	0		0		
12-Jul	0	0		0		
13-Jul	0	0		0		
14-Jul	0	0		0		
15-Jul	0	0		0		
16-Jul	0	0		0		
17-Jul	0	0		0		
18-Jul	0	0		0		
19-Jul	0	0		0		
20-Jul	0	0		0		
21-Jul	1	1		0		
22-Jul	0	1		0		
23-Jul	18	19		0		
24-Jul	15	34		0		
25-Jul	0	34		0		
26-Jul	24	58		0		
27-Jul	50	108		0		
28-Jul	0	108		0		
29-Jul	0	108		0		
30-Jul	59	167		0		
31-Jul	676	843		0		
1-Aug	44	887		0		
2-Aug	13	900		0		
3-Aug	165	1,065		0		
4-Aug	4,792	5,857		0		
5-Aug	319	6,176		0		
6-Aug	91	6,267		0		
7-Aug	50	6,317		0		
8-Aug	1,102	7,419		0		
9-Aug	2,078	9,497		0		
10-Aug	3,395	12,892		0		
11-Aug	2,551	15,443		0		
12-Aug	739	16,182		0		
13-Aug	1,165	17,347		0		
14-Aug	60	17,407		0		
15-Aug	2,720	20,127		1		
16-Aug	710	20,837		0		
17-Aug	0	20,837		0		
18-Aug	1	20,838		0		
19-Aug	4,084	24,922		1		
20-Aug	1,821	26,743		3		
21-Aug	391	27,134		1		
22-Aug	0	27,134		0		
23-Aug	93	27,227		0		
24-Aug	2,910	30,137		0		
25-Aug	573	30,710		0		
26-Aug	55	30,765		0		
27-Aug	271	31,036		0		
28-Aug	2,029	33,065		0		
29-Aug	3,502	36,567		0		
30-Aug	808	37,375		1		
31-Aug	1	37,376		1		
1-Sep	102	37,478		1		
2-Sep	2	37,480		0		
3-Sep	0	37,480		0		
4-Sep	4	37,484		0		
5-Sep	238	37,722		0	40	
6-Sep	5	37,727		0		
7-Sep	807	38,534		2	52	
8-Sep	1	38,535		0		
Total	38,627			11	92	

Appendix 5. Hidden Lake 2006 - Update.

Stocking & Misc. Activities

Crew on-site:	18-May	
Ice-out:	20-Apr	(approximate date)
Crew off-site:	8-Sep	
Fry stocking:	18-May	582,000 fry
Adult Otolith Collection	5-Sep	7-Sep

Smolt Migration

Dates:	18-May to 1-Jul	
Sockeyes:		200,794
Mortalities:		3,015
Percent age 1:		91.0
Percent age 2:		8.4
Percent hatchery:		47.4
Coho:		25,141
Dolly Varden:		27
Rainbow:		42

* Commercial, sportfish and personal use harvests provided by ADF&G.

Egg Take

Dates:	12-Sep to 26-Sep	
No. of broodstock used:		2,093
Green eggs:		5,639,893
Fecundity:		2,450
Eyed eggs:		5,232,277
Survival:		92.8%

Adult Migration

Dates:	7-Jul to 8-Sep	
Sockeye total return:		67,426
Hidden Creek return:		38,627
* Commercial Harvest		21,049
* Sportfish Harvest		4,030
* Personal Use Harvest		3,720
Otolith Collection		92
Mortalities		0
Lake Escapement:		38,535
Hatchery broodstock:		4,690
Lake broodstock:		33,852
Lures:		3 (recorded)
Coho		11

