

**Bear Lake
Salmon Enhancement
Progress Report
2009**

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This year's operation of the Bear Lake Sockeye and Coho 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, through a grant from the Seward Chamber of Commerce and a grant administered by the National Oceanic and Atmospheric Administration and the Alaska Department of Fish.

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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 Bear Lake 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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Our equal employment opportunity philosophy applies to all aspects of employment with CIAA including recruiting, hiring, training, transfer, promotion, job benefits, pay, dismissal, and educational assistance.

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ACKNOWLEDGEMENTS

The 2009 Bear Lake smolt migration, fry release, adult count, and gamete collection exercise were conducted by the Cook Inlet Aquaculture Association (CIAA). Appreciation is extended to the full-time and seasonal staff at Bear Lake Weir and Trail Lakes Hatchery.

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ABSTRACT

The Cook Inlet Aquaculture Association (CIAA) has been conducting sockeye salmon (*Oncorhynchus nerka*) and coho salmon (*Oncorhynchus kisutch*) enhancement activities at Bear Lake since 1988. Enhancement efforts have focused on sockeye and coho fry stocking and improvements to the fry rearing environment through nutrient enrichment. Associated assessment activities have involved smolt and adult enumeration and limnological sampling.

In 2009, 2.543 million sockeye fry (BY08) and 270,000 coho fry (BY08) were released into Bear Lake. At the time of release, the sockeye fry averaged 0.50 grams and the coho fry averaged 1.3 grams. All released fry were of Bear Lake origin. Approximately 1.675 million sockeye smolts (BY07) were released into Resurrection Bay at an average of 13.2 grams. For the coho smolts approximately 68,000 coho smolts (BY07) were released into Bear Lake/Creek at an average of 13.5 grams.

Smolt migration monitoring began on 23 May and continued daily until 05 July. During this time a total of 241,100 ($\pm 29,500$) sockeye and 54,800 ($\pm 4,100$) coho smolts migrated from the lake.

Based on otolith marks, 97.1% ($\pm 1.6\%$) of the emigrating sockeye smolts were enhanced. An estimated 97.6% smolts were age 1 and 2.4% were age 2. The average length and weight of the age 1 sockeye smolts was 91 mm (± 0.6 mm) and 6.7 g (± 0.1 g) respectively. The age 2 sockeye smolts were 126 mm and 17.6 g. Sample size for age 2 sockeye was insufficient to provide statistical validation of the confidence interval for the average length and weight.

Based on otolith marks, 98.1% ($\pm 1.2\%$) of the emigrating coho smolts were enhanced. An estimated 60.1% of coho smolt were age 1 and 39.9% were age 2. The average length and weight of the age 1 coho smolts was 98 mm (± 1.4 mm) and 9.6 g (± 1.2 g) and the age 2 coho smolts were 115 mm (± 0.7 mm) and 15.8 g (± 0.7 g).

A total of 45,859 adult sockeye returned to Bear Creek in 2009. The returning sockeye salmon were age 1.2 (3.6%) or age 1.3 (93.8%). A total of 13,318 were passed into the lake, while the remaining 32,515 were harvested at the weir for cost recovery. An additional 110,778 were harvested in Resurrection Bay in cost recovery. In the common property, 0 were harvested in the commercial fishery and an estimated 10,787 fish were caught in the sport fishery. Total return of sockeye to Resurrection Bay was 168,345 (an estimated 947 were thought to have been illegally harvested (poached).

A total of 1,245 adult coho returned to Bear Creek weir in 2009. The returning fish were age 1.1 (31.5%), age 2.1 (65.8%) or 3.1 (2.7%). Of the adult coho returning, 0 were harvested and sold for cost recovery or donated, 529 were held and used as hatchery broodstock, and 535 were passed into Bear Lake. Approximately 181 fish were estimated to be below the weir in Bear Creek.

From 27 July to 26 August 2009, 5,009,000 sockeye salmon eggs were collected for incubation,

rearing, and release to Bear Lake. The eggs were obtained from Bear Lake broodstock, shipped to CIAA's Trail Lakes Hatchery, and fertilized using a delayed fertilization technique. Eggs from 1,476 females were fertilized with milt from 1,478 males.

From 9 October to 13 October 2009, 545,000 coho eggs were collected from 144 females and fertilized with milt from 96 males. In addition, the Alaska Department of Fish and Game (ADF&G) collected 406,500 coho salmon eggs.

A total of 310 gallons of fertilizer was applied to Bear Lake in 2009. Limnological samples were collected monthly throughout the open-water season.

INTRODUCTION AND PURPOSE

Bear Lake is located on Alaska's Kenai Peninsula near the community of Seward, Alaska and has been the site of salmon enhancement activities since 1962. Initial enhancement activities, conducted by the Alaska Department of Fish and Game (ADF&G) Sport Fish Division, focused on coho salmon (*Oncorhynchus kisutch*) and the control of predator and competitor species¹.

In 1988, the Alaska Board of Fisheries revised the management plan for Bear Lake. The revision allowed for the enhancement of sockeye salmon (*Oncorhynchus nerka*).

The revised Bear Lake management plan developed in 1988 was soon followed by a cooperative agreement between ADF&G, Sport Fish Division, ADF&G Fisheries Rehabilitation, Enhancement and Development (FRED) Division, and the Cook Inlet Aquaculture Association (CIAA). The cooperative agreement, which became effective in August 1989, allowed CIAA to operate and maintain the Bear Lake coho salmon enhancement project and to begin sockeye enhancement activities in the lake. The agreement also provided CIAA with the responsibility of operating and maintaining the Bear Creek weir site.

Current enhancement activities at Bear Lake now target both sockeye and coho salmon with control of predator and competitor species. The objectives are to create a commercial sockeye fishery and to maintain the coho sport fishery enhancement program. To accomplish the objectives CIAA will:

- 1) Maintain the level of coho salmon production;
- 2) Maintain sockeye and coho lake spawning escapement goals;
- 3) Annually describe the timing, abundance, size, and percent of wild and enhanced sockeye and coho in smolt migrations;
- 4) Annually describe the timing, abundance, and size of sockeye and coho salmon in adult migrations;
- 5) Monitor the number of marked fish resulting from fry, pre-smolt, and smolt releases in sockeye and coho adult migrations and evaluate the success of enhancement through the recovery of marked fish.

¹ ADF&G enhancement activities conducted prior to 1987 are reported by Vincent-Lang (1987).

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PROJECT AREA

Bear Lake is located on Alaska's Kenai Peninsula 9 km north of Seward, Alaska. It is the largest clear water lake in the Resurrection Bay drainage.

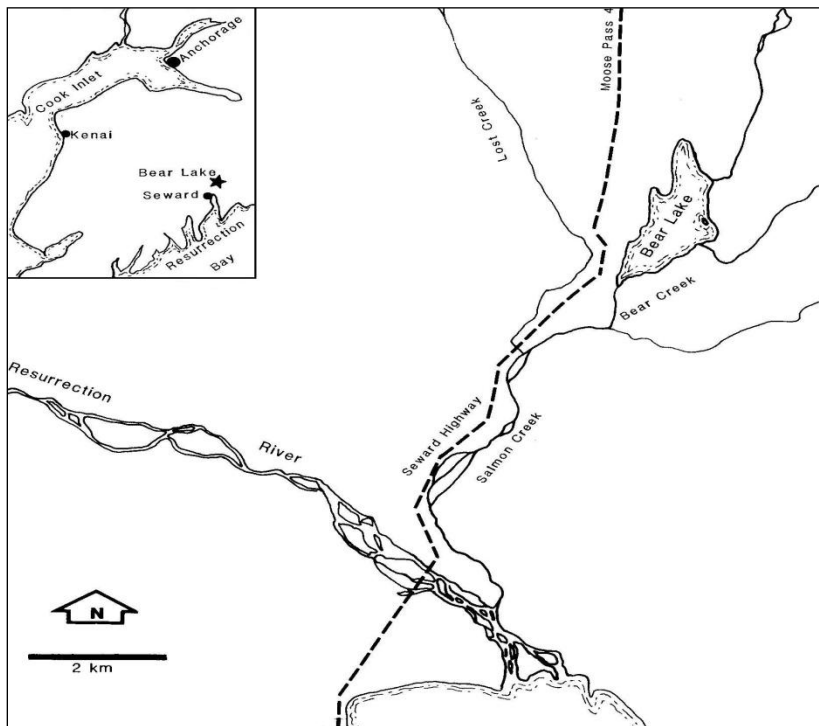


Figure 1. Map showing location of Bear Lake near Seward, Alaska.

Bear Lake has a watershed area of 15 km² and one outlet, which drains into Resurrection Bay through Bear Creek, Salmon Creek and the Resurrection River. A weir and fish passage complex, located 0.5 km downstream of the lake, provide a barrier to fish migration and allow for complete control of fish movements into or out of the lake (Figure 1).

Bear Lake (Figure 2) is oligotrophic with a surface area of 180 hectares. It has a mean depth of 10 meters, a maximum depth of 20 meters, a lake volume of $18.7 \times 10^6 \text{ m}^3$ and a water residence time of 0.75 years. There is one small island located along the east shore. The shoreline is heavily wooded and shoreline substrates vary from exposed bedrock, to large cobble, sand and organic muck.

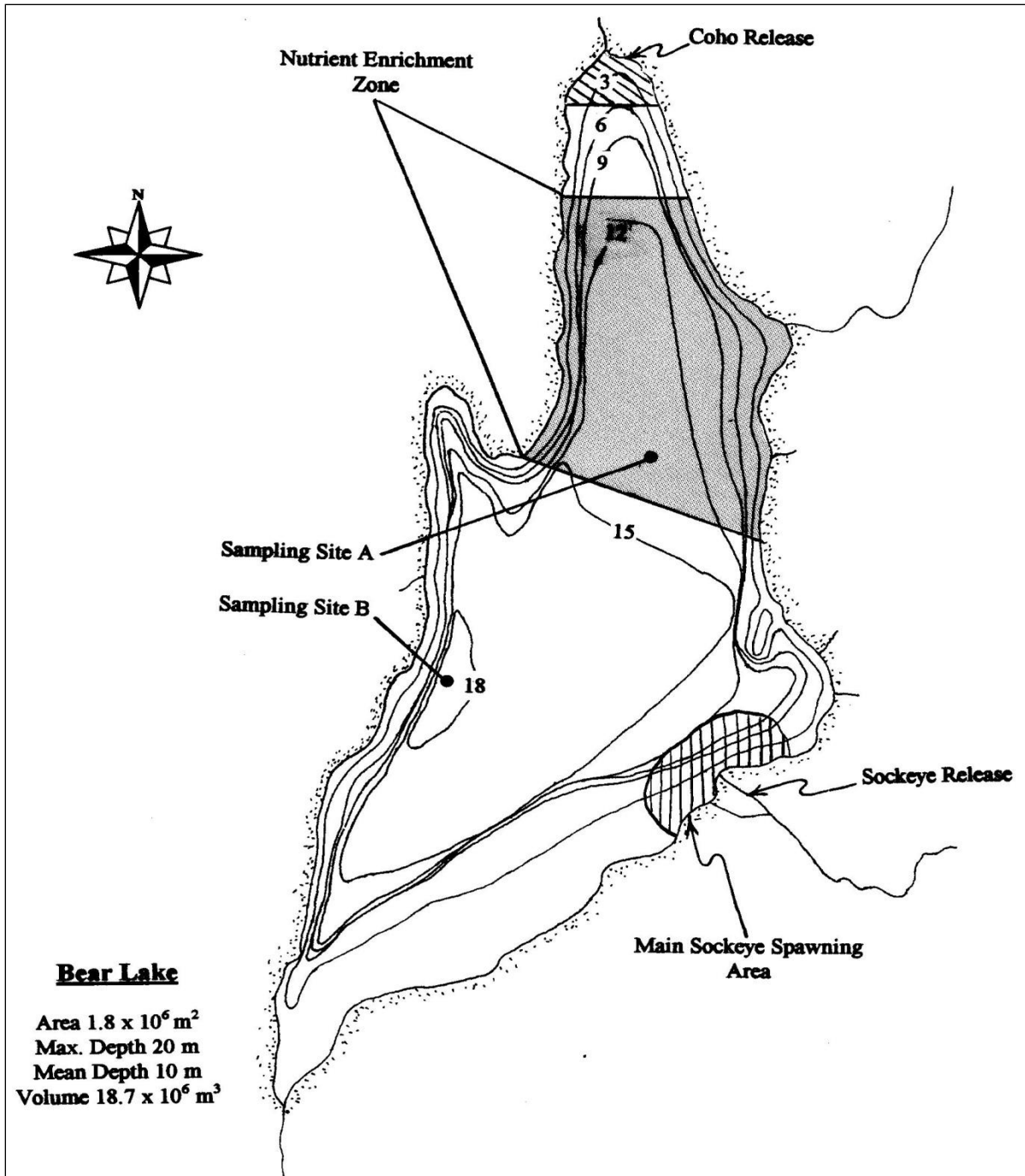


Figure 2. Bear Lake near Seward, Alaska

METHODS

In general, Bear 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

The limnological sampling and analysis procedures used in 2009 were consistent with previous limnological sampling activities with the exception of the type of water sampler used (Kemmerer versus Van Dorn). These procedures are described by Koenings, et al. (1986).

During 2009, assessments of water quality were conducted 4 times (June, July, August, September) throughout the open water season of May through October. One primary site, site B (Figure 2) was 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 Van Dorn water sampler (horizontal configuration) 1 meter below the surface and from the hypolimnion. One secondary site, site A, (Figure 2) was also sampled for Secchi disk transparency and zooplankton densities. All water samples were collected by CIAA and analyses completed by ADF&G.

In addition to the water chemistry analysis, daily observations of other environmental conditions at Bear Lake were made. These observations, completed at 5:00 P.M. throughout the summer field season, included percent cloud cover, precipitation to the nearest millimeter, air temperature, Bear Creek water temperature and Bear Creek stage.

Lake Nutrient Enrichment

The purpose of fertilizer application, applied throughout the growing season to the pelagic area

of the lake, is to stimulate algae growth and increase the zooplankton community. Fertilizer was applied from 03 July to 13 August. Fertilizer is mixed with lake water and sprayed onto the lake surface from the back of a boat.

Smolt Enumeration

A permanently installed weir, located approximately 0.5 km downstream of Bear Lake prevents the uncontrolled migration of fish into or out of Bear Lake. This structure (Figure 3) was used in 2009 to identify, count and control the migration of all fish moving into or out of Bear Lake. In 2009, maintenance and improvements were made to the buildings, electrical and mechanical system at the weir. These tasks did not change the fish migrations.

For smolt enumeration, fish migrating downstream were directed by the weir into a live box where they were captured, temporarily held, identified to species, counted and released downstream. Total counts of smolts migrating from the lake were made until the migration of fish exceeded 2,000 to 3,000 fish per hour. When this occurred, a 10% sub-sampling procedure was used to enumerate the migrating smolts.

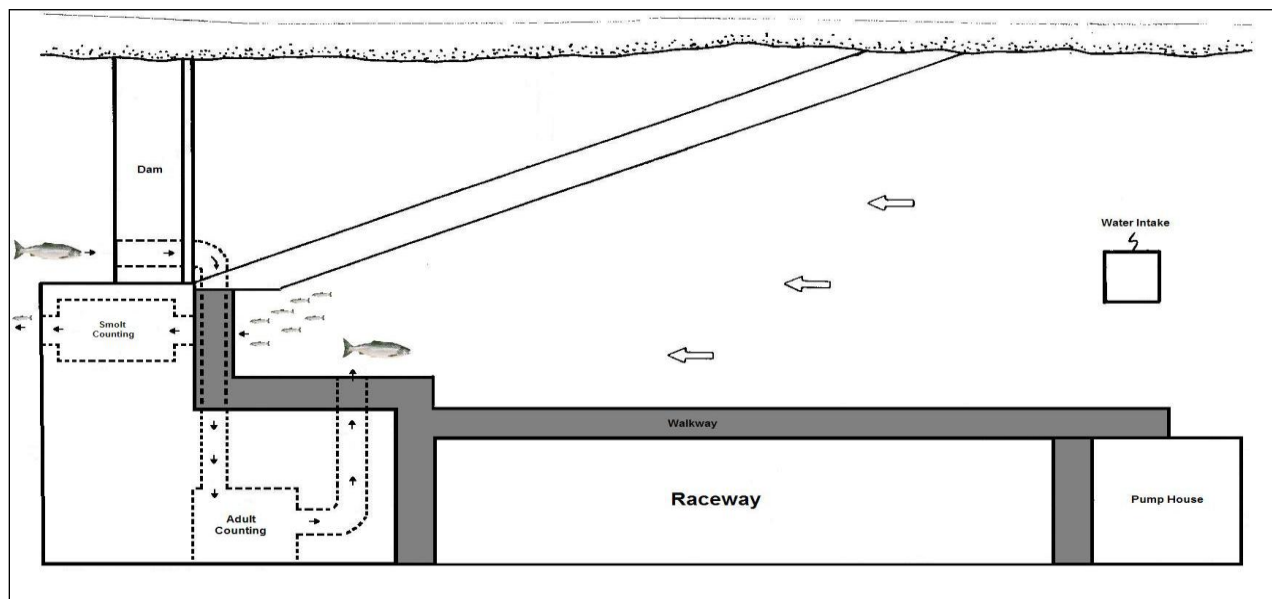


Figure 3. The Bear Creek weir, smolt trap and adult counting complex (Top View).

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 were passed through the weir structure uncounted. The two-minute smolt count was multiplied by 10 to estimate the number of smolts migrating during the twenty minute interval.

Assuming the two minute sub-sampling intervals were randomly distributed throughout sub-sampling² and smolt 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:

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

and the variance is,

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

And:

$$C.I._{\alpha=95\%} \text{ for } \hat{T}_s = \pm 2\sqrt{v(\hat{T}_s)}$$

The variance about the estimated smolt migration, \hat{T} , is equal to the variance about \hat{T}_s , because

² Predetermined randomly selected 2 minute subsampling intervals assured random distribution within each 20 minute period.

T_c is a total count with 0 variance.

Smolt Characteristics and Enhanced Contribution

CIAA has released sockeye and coho salmon fry to Bear Lake since 1990. To evaluate this enhancement procedure, CIAA has collected a sample of sockeye and coho smolts migrating each year to determine age, weight, and length characteristics of the migrating populations. Since 1993, CIAA has also marked the otolith of all salmon fry released to Bear Lake with a thermal mark³. The purpose of this mark is to determine the contribution of released hatchery fish to the Bear Lake smolt population.

In 2009, smolts collected for measurement, age determination, and otolith removal were sampled in proportion to the daily smolt migration. This was accomplished by collecting every 570th sockeye smolt and every 110th coho smolt that 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 taken on 420 sockeye smolts (0.17%) and 469 coho smolts (0.87%).

Each smolt collected for evaluation was first measured to the nearest millimeter for fork length⁴ and weighed to the nearest 0.1 gram. Several scales were then removed from the primary growth area⁵ and mounted on a glass slide for subsequent age determination. Finally, otoliths were removed and placed in a labeled one dram vial filled with a 10% ethanol solution. At CIAA office, each otolith was checked for a hatchery mark following procedures described by Glick and Shields (1993).

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:

³ The otolith mark is a hatchery induced thermal band produced by controlled temperature changes during incubation.

⁴ Standard fork length was measured from the tip of the snout to the fork of the tail.

⁵ 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 = 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} , was estimated as:

$$\hat{P} = a / n; \quad \text{with a variance of} \quad v(\hat{P}) = (1 - f)(1 / n) \sum W_h p_h q_h;$$

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

The total number of enhanced smolts, \hat{A} , was also estimated as:

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

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 were fairly large and \hat{P} was not extreme, the normal approximation, without a correction for continuity, could be used to develop the relative error. Thus, the 95% confidence interval estimate for \hat{P} and \hat{A} is:

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

and, the relative error is:

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

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

$$\hat{L}_i = c_i/n; \quad \text{with a variance of} \quad v(\hat{L}_i) = (1-f)\frac{1}{n}\sum_h W_h l_{hi} m_{hi};$$

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

$$\hat{C}_i = N(\hat{L}_i); \quad \text{with a variance of} \quad v(\hat{C}_i) = N^2 v(\hat{L}_i).$$

Confidence interval (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:

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

The confidence interval (95%) estimate for the mean weight and length is:

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

Adult Escapement

The weir structure that was used for enumerating the smolt migration was also used to identify, count, and control the migration of adult fish returning to Bear Lake. The escapement enumeration included the assessment of the sex, age, and standard fork length⁶ of the returning population of fish.

⁶ Standard fork length was defined as the measurement from mid-eye to the fork of the tail.

To enumerate the adult migration, fish attempting to migrate upstream were directed by the weir into a live box attached to a mechanical lift. Once in the live box, the fish were lifted above the weir, identified, and counted. Counted fish were either passed into the Bear Lake system or collected for other uses (harvest; hatchery broodstock).

To assess the sex, age and length of the returning populations, every 25th adult sockeye and 15th adult coho were sampled. In 2009, measurements were collected from 1,827 sockeye (3.98%) and 80 coho (6.43%).

Gamete Collection, Incubation and Rearing - Sockeye

Since 1989, egg collection, incubation and rearing of sockeye salmon have been done to develop a Bear Lake sockeye fishery. Prior to 1993, sockeye salmon returning to the Big River Lakes area on the west side of Cook Inlet or to Upper Russian Lake on the Kenai Peninsula served as broodstock for the Bear Lake sockeye stocking program. Fry from eggs collected from one or both of these broodstocks were released into Bear Lake each spring from 1990 through 1993. In 1993, adults resulting from the Bear Lake stocking program returned to Bear Lake in numbers large enough (>5,000) to provide broodstock for the hatchery. Since 1993, all sockeye gametes collected for the Bear Lake stocking program were collected from adults returning to Bear Lake.

Originally, it was believed returning adult sockeye would congregate in the spawning area identified on Figure 2 and be susceptible to capture by beach seine. In 1993, fish were captured here; but, most of the returning sockeye were found spawning at a depth of 40 feet or greater and were not susceptible to beach seining. In 1993, the egg collection goal was not met primarily because of the difficulty in capturing broodstock.

Since 1993, several methods have been employed to collect fish for hatchery broodstock. Efforts included capturing fish at the weir and holding them in raceways or deepwater net pens for ripening and purse seining or gill netting the fish from the deepwater spawning areas. Although the number of eggs collected has increased, none of the fish capture methods has worked well.

In 1995, fry were released directly to a small tributary stream where it was expected returning adults could be easily captured. Since 1999, adults have returned to this area and broodstock collections have improved.

Male and female adult sockeye salmon from the spawning areas were killed and stripped of their gametes. The gametes were shipped to Trail Lakes Hatchery for fertilization, incubation and rearing. At the time of stripping a selected number of females (677 samples total) had a small section of kidney removed for the screening of *Renibacterium salmoninarum*, the causative pathogen for Bacterial Kidney Disease (BKD). Eggs were fertilized and mating crosses were recorded.. The sockeye eggs were incubated at ambient Trail Lakes Hatchery water temperature in 2 different lots. Incubation followed standard hatchery procedures and water temperature was regulated to thermally mark the 2 different lots (Fry – 5,2H; Smolt – NA).

Gamete Collection, Incubation, and Rearing - Coho

Coho salmon eggs were collected by capturing adult fish as they attempted to migrate past the weir. The fish were held in the raceways at the weir (Figure 3) until the females' eggs matured. Gametes were collected and transported to Trail Lakes Hatchery. At the weir both males and females had a small section of kidney removed for screening of *R. salmoninarum*, the causative pathogen for BKD. Eggs were fertilized and mating crosses were recorded. Each mating cross was placed into a vertical heath stack incubator. Once the eggs reached the eyed stage and the BKD pathology results were received any crosses which had a high prevalence of BKD were culled. The coho eggs were incubated at ambient Trail Lakes Hatchery water temperature in 1 distinct lot for fry stocking only. Incubation followed standard hatchery procedures and water temperature was regulated to thermally mark the 1 lot (Fry – 4,H3). Coho salmon eggs were also collected by ADF&G Ft. Richardson Hatchery staff.

Fish Transport and Stocking

Sockeye fry have been stocked into Bear Lake since 1990. For stocking, all fry were transported

by truck from Trail Lakes Hatchery to Bear Lake in oxygenated transport tanks. In 2009, fry were transported by truck in oxygenated tanks to a small tributary stream, 0.5 kilometers from Bear Lake (Figure 2). Fry were held in large containers and supplied with creek water for four hours to imprint them to the stream. After imprinting the fry were released into the tributary. Sockeye smolts were transferred to 2 net pens located in Resurrection Bay where they were reared for an additional 2-3 weeks before being released.

Coho fry have been stocked into Bear Lake since 1986. For stocking, all coho fry were transported by truck in oxygenated transport tanks, transferred to a boat and motored to the north end of the lake where they were released in the littoral zone (Figure 2). In contrast, all coho smolts were transported by truck in oxygenated tanks and placed into raceways at the weir for imprinting.

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RESULTS AND DISCUSSION

Limnology, Environmental Conditions and Lake Fertilization

Bear Lake's limnological characteristics have been monitored for several years. The 2009 limnological data are presented in Appendix 1. This information has been summarized and is presented as open water seasonal average concentrations in Table 1 (1 meter) and Table 2 (hypolimnion).

Table 1. Water quality characteristics of Bear Lake at 1 meter, 1979 to 2009.

Year	1 meter depth											
	Sp. Cond (umhos/cm)	pH (SU)	Alk (mg/l)	Turb. (NTU)	TP (ug/l)	TKN (ug/l)	NO2+NO3 (ug/l)	TN:TP	Chl a (ug/l)	EZD (m)	Secchi (m)	Zooplankton (mg/m ²)
1979	76	7.4	30		8.0		8.3					
1980	74	7.3	29		7.7	138	9.8	42 :1	3.4			
1981	68	6.3	28		7.2	101	14.0	35 :1	3.4			734
1982	77	7.6	29		9.9	149	47.0	44 :1	1.9			704
1983	86	7.6	32		8.7	175	41.6	55 :1	2.0			914
1984	88	7.4	32	2.5	10.6	204	24.0	48 :1	3.6			836
1985	87	7.2	36	1.7	11.3	177	89.7	52 :1	2.6			429
1986	82	7.3	32	2.3	12.3	188	12.4	36 :1	2.9			583
1987	81	7.4	29	1.3	9.7	135	2.1	31 :1	1.6			401
1988												
1989												
1990	78	7.4	29	1.6	6.5	170	54.1	76 :1	1.9	11.2	3.6	1,134
1991	84	7.6	28	2.4	8.5	183	52.1	67 :1	2.8	7.4	3.2	467
1992	80	7.2	26	1.7	7.5	166	89.1	85 :1	1.7	9.0	3.8	395
1993	82	7.1	27	1.2	7.3	134	37.4	58 :1	1.9	8.7	4.4	804
1994	88	6.9	27	1.8	7.8	132	14.9	45 :1	2.1	11.4	5.0	743
1995	80	7.2	27	1.9	7.6	116	12.0	37 :1	2.7	10.1	4.4	377
1996	86	7.3	30	2.3	6.3	191	7.5	70 :1	3.1	9.0	3.8	949
1997	89	7.5	33	2.3	7.4	161	17.8	56 :1	3.0	8.2	4.4	556
1998	79	7.2	29	1.2	7.6	176	18.7	66 :1	0.6	8.5	5.3	485
1999	82	7.2	30	1.2	5.6	126	9.0	53 :1	0.9	9.7	5.6	698
2000	80	7.0	28	2.2	6.8	125	3.4	42 :1	3.4	8.9	4.6	711
2001	79	7.1	27	1.2	6.0	124	4.0	35 :1	2.0	9.2	5.0	896
2002	78	7.1	29	0.7	7.0	117	12.4	42 :1	2.4	10.4	5.0	1,271
2003	74	6.7	26	0.6	6.7	124	6.8	44 :1	2.1	11.0	6.4	345
2004*	72	6.8	27	1.0	7.3	176	26.5	38 :1	1.5	9.2	3.8	NA
2005*	81	6.7	27	0.4	8.6	137	22.7	41 :1	0.9	9.2	5.4	NA
2006*	82	6.6	28	1.2	12.3	158	8.5	30 :1	2.5	8.3	3.2	NA
2007*	81	6.7	30	1.2	8.1	121	9.3	37 :1	1.6	11.9	4.3	NA
2008*	79	7.1	28	1.5	12.7	106	4.1	16 :1	2.6	8.9	4.0	NA
2009*	81	7.2	30	1	7.6	151	4.1	35 :1	1.2	8.4	4.5	NA

Averages prior to 1992 compiled by ADF&G.

EZD, Secchi and atomic ratio provided by CIAA.

Open water season only.

*2004 - 2009 - zooplankton data analysis is incomplete.

Table 2. Water quality characteristics of Bear Lake in the hypolimnion, 1979 to 2009.

Year	Sp. Cond (umhos/cm)	pH (SU)	Alk (mg/l)	Hypolimnion		TKN (ug/l)	NO ₂ +NO ₃ (ug/l)		Chl a (ug/l)
				Turb. (NTU)	TP (ug/l)		TN:TP	TN:TP	
1979	79	7.3	30		18.3		16.2		
1980	81	7.2	31		13.9	168	14.3	29 :1	8.8
1981	69	6.3	29		11.3	124	19.3	28 :1	5.5
1982	78	7.4	28		16.6	177	37.6	29 :1	5.8
1983	88	7.3	32		14.7	259	43.1	46 :1	6.8
1984	96	7.1	34	6.3	13.9	269	29.9	48 :1	7.7
1985	90	6.9	36	2.8	11.6	253	76.6	63 :1	4.1
1986	89	6.7	32	4.1	14.4	244	34.1	43 :1	3.9
1987	85	7.1	29	2.1	15.2	222	20.8	35 :1	
1988									
1989									
1990	83	7.1	29	2.9	11.2	248	47.4	58 :1	5.4
1991	88	7.1	29	3.3	10.6	203	55.9	55 :1	3.4
1992	84	7.0	26	2.9	8.1	194	82.7	83 :1	3.2
1993	88	7.0	29	1.9	8.8	140	65.6	62 :1	1.1
1994	88	6.9	29	1.9	13.6	185	17.7	34 :1	5.6
1995	83	7.0	28	4.7	12.8	202	8.3	36 :1	8.1
1996	87	7.0	30	4.6	12.4	273	1.9	49 :1	7.6
1997	93	7.3	34	8.3	17.1	332	4.3	44 :1	9.7
1998	89	7.1	32	2.9	8.5	188	34.5	63 :1	1.6
1999	86	6.9	30	4.2	14.7	222	12.2	38 :1	3.8
2000	81	7.2	28	1.9	6.9	127	3.0	41 :1	4.6
2001	80	7.0	27	1.9	5.8	137	3.9	37 :1	3.2
2002	80	7.0	31	0.9	10.1	127	15.2	32 :1	2.4
2003	73	6.8	26	0.7	6.7	116	7.1	41 :1	2.2
2004*	74	6.7	27	0.9	28.1	275	78.9	32 :1	1.7
2005	79	6.7	27	0.2	8.9	135	16.3	38 :1	0.9
2006	83	6.7	28	2.1	12.5	149	6.8	28 :1	2.4
2007	82	6.5	29	1.8	15.0	169	21.5	29 :1	3.2
2008	81	6.7	28	3.0	13.0	148	23.4	31 :1	2.2
2009	84	6.8	29	4.0	17.2	222	5.2	29 :1	4.8

Averages prior to 1992 compiled by ADF&G.

EZD, Secchi and atomic ratio provided by CIAA

Open water season only

*2004 - possible contamination of hypolimnion sample (7/14/2004)

The environmental conditions recorded in 2009 are presented in Appendix 2. Between 01 May and 30 June, the average air temperature was 12.2°C (± 4.2°C) while water temperature averaged 9.0°C (± 3.9°C). Average stage height below the weir was 1.05 ft (± 0.2 ft) and above the weir it was 1.33 ft (± 0.2 ft) for the same time period. Between 01 July and 31 October, the average air temperature was 11.8°C (± 4.0°C) while water temperature averaged 12.9°C (± 3.2°C). Average stage height below the weir was 0.81 ft (± 0.2 ft) and above the weir it was 1.50 ft (± 0.2 ft). The environmental conditions observed in 2009 are compared to other years in Table 3.

Table 3. Environmental conditions observed at Bear Lake, 1990 to 2009.

Year	May thru June 30											
	Total Days	Clear	No. of Days			Rain	Days Meas. Precip	Precip (mm)	Temperature (C)			
			<50% Cloud Cover	>50% Cloud Cover	100% Overcast				Avg	Range	Avg	Range
1990	44	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	(3-15)
1991	47	ND	ND	ND	ND	ND	ND	ND	ND	ND	7	(2-15)
1992	44	13	11	7	13	11	11	48	IC	IC	9	(3-14)
1993	42	5	13	11	7	6	16	ND	14	(8-20)	13	(7-17)
1994	47	8	8	11	5	15	18	38	12	(5-22)	11	(5-16)
1995	38	5	5	17	6	5	19	185	12	(6-22)	10	(6-14)
1996	45	9	7	11	6	12	17	102	11	(5-16)	12	(8-15)
1997	42	28	1	5	2	6	11	40	15	(9-22)	12	(5-20)
1998	29	6	11	3	3	6	14	5	15	(8-24)	7	(4-14)
1999	44	12	5	4	18	5	13	35	11	(4-20)	7	(0-14)
2000	46	15	5	6	17	3	8	44	11	(2-16)	7	(2-12)
2001	58	14	9	11	20	4	11	15	10	(1-18)	8	(0-15)
2002	54	18	2	7	9	18	27	58	12	(6-24)	8	(1-16)
2003	61	12	3	9	17	20	27	172	13	(6-23)	11	(1-16)
2004	61	19	2	12	14	14	17	218	15	(8-22)	9	(2-17)
2005	53	5	13	16	10	9	19	133	15	(10-23)	13	(7-17)
2006	61	12	3	10	28	8	26	105	13	(3-26)	9	(4-14)
2007	61	9	12	10	13	17	28	157	11	(5-22)	7	(1-15)
2008	61	7	8	11	11	9	19	64	12	(4-18)	8	(3-13)
2009	61	21	6	8	19	7	14	102	12	(2-18)	9	(2-14)

Year	July thru Sept/Oct/Nov											
	Total Days	Clear	No. of Days			Rain	Days Meas. Precip	Precip (mm)	Temperature (C)			
			<50% Cloud Cover	>50% Cloud Cover	100% Overcast				Avg	Range	Avg	Range
1990	119	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	(3-15)
1991	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	7	(2-15)
1992	92	17	22	16	48	38	38	345	IC	IC	IC	IC
1993	109	15	25	12	17	30	38	ND	14	(6-24)	15	(8-20)
1994	68	IC	IC	IC	IC	IC	IC	IC	IC	IC	IC	IC
1995	105	24	17	26	12	26	65	728	13	(3-20)	13	(6-16)
1996	101	17	11	31	23	19	50	308	10	(4-16)	14	(6-16)
1997	107	32	13	25	6	31	48	616	14	(5-21)	15	(6-20)
1998	117	24	19	13	39	31	72	627	12	(3-30)	11	(3-21)
1999	113	25	13	10	38	27	44	509	12	(3-25)	10	(2-16)
2000	125	19	25	14	36	31	56	443	9	(0-18)	10	(1-16)
2001	121	8	18	18	34	43	79	718	11	(-3-19)	12	(1-18)
2002	130	12	14	25	34	45	75	1084	12	(3-26)	11	(6-18)
2003	123	19	21	22	30	30	56	661	14	(3-28)	13	(5-19)
2004	122	26	20	18	30	27	40	427	15	(3-32)	14	(6-19)
2005	123	25	16	19	36	27	65	416	13	(-1-25)	14	(4-19)
2006	122	7	18	20	38	39	75	864	11	(2-30)	12	(5-17)
2007	131	17	11	25	39	39	77	601	12	(-4-28)	12	(3-17)
2008	123	22	4	12	53	32	57	813	9	(0-22)	11	(3-15)
2009	110	23	5	16	42	24	55	761	12	(6-27)	13	(7-18)

*Sky condition data is calculated differently from 1997 onward. Rain days are counted as days with measurable precipitation and 100% overcast is measured as those days indicated as 100% overcast with or without measurable precipitation.

Liquid fertilizer has been applied to Bear Lake in 22 of the last 29 years. It was not applied in 1987-1989, 1994, 1995, and 2001. Application levels are presented in Table 4.

Table 4. Fertilizer application at Bear Lake, 1981 to 2009

Year	32-0-0 (gal)	27-7-0 (gal)	20-5-0 (gal)	N (Kg)	P (Kg)	Dates	Comments
1981	2,760			4,441		9/01 - 10/31	Every 10 days
1982	3,240			5,213		7/15 - 10/31	Every 10 days
1983	4,080			6,565		6/01 - 10/04	Every 3 days
1984	1,960	1,120		4,760	181	6/01 - 9/15	Every 3 days
1985	2,800			4,505		6/01 - 9/15	Every 3 days
1986	1,680	1,120		4,309	181	7/01 - 9/15	Every 3 days
1987							No application
1988							No application
1989							No application
1990	2,640		420	4,644	43	6/05 - 8/28	Every 2 days, 20-5-0 first
1991	2,340		390	4,133	40	5/30 - 8/14	Daily, 20-5-0 first
1992	3,264		390	5,620	40	6/04 - 8/09	4 to 6 times/week
1993			960	905	98	5/25 - 8/07	3 times/week
1994							No application
1995							No Application
1996	2,280		600	4,234	61	6/03 - 9/01	Daily, 20-5-0 mid-summer
1997	1,620		540	3,116	55	6/01 - 8/4	2 bbl. a day 4 times a wk.
1998			990	934	101	6/24 - 8/10	Every day
1999			1,050	990	107	6/17 - 8/25	Every other day
2000			840	792	86	6/12 - 8/26	Every other day
2001							No application
2002			900	849	92	6/27 - 8/18	Every other day
2003			1,050	990	107	6/26 - 8/8	Mon, Wed, Fri
2004			1,260	1,188	129	6/22 - 8/20	Every other day
2005			1,050	990	107	6/16 - 8/6	3 times/ week
2006			1,200	1,132	122	7/1 - 8/21	2 to 3 times/ week
2007			330	311	34	7/7 - 8/29	1 time/ week
2008			810	764	83	7/3 - 8/13	Varied
2009			310	292	32	8/12 - 8/28	Almost daily

Smolt Enumeration - Sockeye

Enumeration of Bear Lake sockeye smolts occurred between 23 May and 05 July. A total of 241,100 ($\pm 29,500$) sockeye smolts migrated from Bear Lake in 2009 (Appendix 3). The 10% sub-sampling procedure was used to count 58.3% of the migrating sockeye salmon.

The age 1.0 smolts averaged 91 mm (± 0.6 mm) in length and 6.7 g (± 0.1 g) in weight. The age 2.0 smolts averaged 126 mm in length and 17.6 g in weight (Table 5). Sample size for age 2 sockeye was insufficient to provide statistical validation of the confidence interval for the average length and weight. Based on the presence of hatchery induced thermal marks in the

otoliths of 420 smolts, it was estimated that 97.1% ($\pm 1.6\%$) of the sockeye smolts were of hatchery origin.

Table 5. Sockeye smolt migrations: mean length and weight, by age class, for Bear Lake, 1980 to 2009.

Year	Number		% Hatch.			Age Composition						Average Length (mm) ⁶				Average Weight (g) ⁶									
	95%CI	No.	95%CI	95%CI	Wild	0.0	95%CI	1.0	95%CI	2.0	95%CI	3.0	95%CI	0.0	1.0	CI	2.0	CI	0.0	1.0	CI	2.0	CI		
1980	3,400							3,400		20		20			119		187			NA		NA			
1981	3,500							2,800		700		0			117		158			16.2		41.6			
1982	46,300							46,100		100		0			110		144			14.0		29.7			
1983	13,000							11,000		2,000		40			112		149			13.5		32.9			
1984	10,500							7,700		2,500		300			116		153			15.4		35.8			
1985	1,600							1,300		300		30			126		176			20.2		51.4			
1986	1,000							800		100		0			123		167			18.3		47.2			
1987	18,200							17,800		300		100			112		172			12.8		46.5			
1988	9,100							7,200		1,900		30			120		155			16.0		34.9			
1989	5,100							3,700		1,300		200			122		152			18.8		35.6			
1990 ¹	53,400					52,500		800		30		3		NA	113		125		NA	15.2		28.4			
1991 ²	122,000							119,900		1,600		600			125		164			18.7		40.4			
1992 ³	133,800					38,400		78,000		15,800		1,600		110	118		170		15.4	16.7		49.4			
1993	345,800					54,600		285,500		4,900				115	123		152		18.1	18.7		35.3			
1994	253,900					700		228,600		21,200				102	121		154		11.0	17.4		37.0			
1995	73,500	1,900	70.2	8	21,900			6,800	1,600	4,800	1,000				122		156			17.9		37.2			
1996	156,000	9,600	64.2	3.5	55,400			149,400	9,400	6,400	2,100				117	0.6	120	2.1		11.8		16.2			
1997	276,000	64,000	74.6	3.6	70,100			270,500	64,000	5,500	3,500				104	0.5	143	7.6		10.1	0.2	26.7	4.4		
1998	107,800	15,500	72.2	5.8	30,000			81,800	13,600	25,500	7,200	500	1,400		115	1.1	151	3.6		13.1	0.5	35.2	2.5		
1999	75,800	6,800	74.5	5.5	19,300			59,800	5,400	15,400	4,000	700	900		132	1.2	163	6.3		20.3	0.6	31.4	2.1		
2000	175,000	20,600	76.8	5.2	40,600	11,400	5,600	138,600	18,000	20,700	7,500	4,300	3,400	119	114	1.6	172	11.1	16.8	14.0	0.7	59.0	9.8		
2001	387,500	15,700	88.2	2.2	45,700			346,600	12,900	28,600	7,400	12,200	4,900		103	0.8	131	0.4		10.1	6.5	28.9	11.9		
2002	107,200	7,100	28.4	3.2	76,800			85,100	6,300	20,800	3,300	1,300	800		115	0.6	146	1.5		15.1	0.7	35.1	1.0		
2003	1,326,500	24,100	92.4	1.7	100,800			1,306,200	22,000	23,000	10,000				92	0.8	140	7.7		7.5	0.2	30.4	4.9		
2004	123,200		96.2	2.4	4,700			76,500	7,800	46,700	7,800				115	1.3	139	0.8		14.2	1.4	26.1	1.2		
2005	1,420,400	412,100	97.4	0.9	36,900			1,388,400	12,500	29,900	12,000				88	0.5	88			6.4	0.0	6.1			
2006	1,962,400	147,000	94.3	1.0	111,900			1,692,900	34,500	183,000	28,900				85	0.5	105	1.2		5.7	0.2	11.1	0.6		
2007	1,347,900	88,300	96	1.0	48,500			1,262,900	20,000	84,900	20,000				89	0.6	92	2.3		6.6	0.1	7.0	0.5		
2008	308,500	19,000	94.5	2.4	17,000			281,900	9,400	26,600	9,400				88	0.4	96	1.1		6.2	0.2	8.3	0.5		
2009	241,100	29,500	97	2	7,000			235,400	3,900	5,700	3,900				91	0.6	126	NA		6.7	0.1	17.6	NA		
Avg. ⁴	560,600	64,000	80.0	3.3	48,500	11,400	5,600	510,529	17,000	37,300	8,900	3,800	2,300	119	106	0.8	132	3.8	17	11.4	0.9	25.6	3.6		
Total ⁵	9,109,400					157,600		8,197,400		580,250		21,923													

Average Length rounded to nearest mm, Average Weight rounded to nearest 0.1 g. All other figures have been rounded to nearest 100 fish.

¹In 1990, the migration of juvenile sockeye salmon consisted of three groups of fish: 870 wild smolts of age 1.0 or older, 227,906 age 0.0 fingerlings and 52, 491 age 0.0 smolts.

Age, length and weight data for age 0.0 smolts have been lost. Summary statistics are based on the wild smolt migration.

²In 1991 smolt migration monitoring may have terminated before age 0.0 smolt migration.

³In 1992, an additional 68,505 sockeye fingerlings migrated from Bear Lake. These small fingerlings were expected to have low survivals and AWL data was not collected

⁴Average values calculated from smolt year 1995 to 2008.

⁵Total values calculated from 1980 to 2009.

⁶1980 thru 1992 averages are arithmetic, 1993 and later are weighted averages.

Smolt Enumeration - Coho

A total of 54,800 ($\pm 4,100$) coho salmon smolts migrated from Bear Lake in 2009 (Appendix 3) between 23 May and 05 July. The 10% sub-sampling procedure was used to count 26.5% of the

migrating coho smolts.

The average size (Table 6) of the age 1.0 coho smolts was 98 mm (± 1.4 mm) and 9.6 g (± 1.2 g). Age 2.0 smolts were 115 mm (± 0.7 mm) and 15.8 g (± 0.7 g). Based on the presence of hatchery induced thermal marks in the otoliths of 469 coho smolt, it was estimated that 98.1% ($\pm 1.2\%$) of the coho smolts were of hatchery origin.

Table 6. Coho smolt migrations: mean length and weight, by age class, for Bear Lake, 1980 to 2009.

Year	Number		%	Age Composition								Average Length (mm) ⁴						Average Weight (g) ⁴									
	95% CI	Hatch. 95% CI		1.0	95% CI	2.0	95% CI	3.0	95% CI	4.0	95% CI	1.0	95% CI	2.0	95% CI	3.0	95% CI	4.0	95% CI	1.0	95% CI	2.0	95% CI	3.0	95% CI	4.0	95% CI
1980	75,000			54,600		20,300		100				122	135						19.3	24.0							
1981	72,900			10,900		61,800		200				122	127						18.4	19.8							
1982	143,700			134,000		9,600		100				116	127						15.0	20.4							
1983	108,400			100,400		7,900		100				115	129						14.3	20.2							
1984	93,800			78,300		15,200		300				116	134						15.0	22.4							
1985	105,900			104,300		1,600		0				125	168						18.1	41.5							
1986	72,700			60,900		11,500		300				126	137						19.5	24.9							
1987	80,200			61,200		18,700		250				109	145						11.6	27.9							
1988	63,800			50,500		13,300		0				118	133						16.4	22.3							
1989	99,400			96,200		3,200		0				116	134						18.8	23.0							
1990	83,400			67,500		14,800		1,000				119	139						15.7	24.1							
1991	97,600			86,500		10,600		500				121	138						18.0	25.5							
1992	112,900			107,500		4,700		600				120	137						17.1	25.7							
1993	53,500			42,300		10,400		0				124	137						19.5	25.8							
1994	54,400			6,000		43,700		0				115	128						14.4	20.7							
1995	89,200	4,000		3,500	1,000	85,000	3,800	500	400	100	150	103	121						11.4	18.0							
1996	154,900	15,300		16,100	4,700	137,300	14,400	1,400	1,400	0	95	112							8.4	13.5							
1997	114,100	24,100		3,500	1,900	68,800	20,500	40,600	12,600	1,200	1,000	100	109	124	146				9.7	12.9	19.2			30.7			
1998	92,200	7,200		8,200	2,500	73,000	6,000	10,900	2,800	600	700	100	114	140	168				8.4	13.6	26.2			40.5			
1999	106,800	11,700		44,300	7,400	54,500	8,600	8,000	2,600			113	123	128					13.5	18.3	19.4						
2000	70,900	4,600		55,600	3,300	13,500	2,900	1,800	1,200			109	128	144					13.0	20.4	28.9						
2001 ¹	101,400	12,600	91.8	2.2	80,200	11,800	19,900	4,100	1,300	900		104	117	125					11.6	17.0	20.5						
2002	94,200	11,700	84.5	3.0	82,400	11,300	11,500	3,000	300	500		109	119	148					11.9	16.2	36.5						
2003	208,100	10,900	86.9	3.1	167,800	7,700	31,900	6,700	8,500	3,700		109	119	137.6					11.9	16.3	26.5						
2004	73,400		92.2	2.6	54,000	3,500	19,100	3,500				103	1.2	128	1.6				11.5	0.8	22.1	1.2					
2005	65,400	3,700	96.6	1.5	56,500	2,000	8,900	2,000				97	1.0	121	2.3				9.5	0.5	18.2	1.5					
2006	50,000	4,300	88.3	3.7	36,200	2,900	11,900	2,600				93	2.2	128	2.6				8.4	0.9	21.7	1.4					
2007	79,000	2,500	92.8	3.0	42,100	5,200	36,900	5,200				86	1.8	112	0.8				6.0	2.2	14.7	1.1					
2008	63,900	3,800	97.3	1.5	34,900	3,400	28,700	3,400				95	1.1	117	0.4				8.6	1.3	16.9	0.8					
2009	54,800	4,100	98.1	1.2	33,000	2,500	21,900	2,500				98	1.4	115	0.7				9.6	1.2	15.8	0.7					
Avg ²	91,197	9,000	92.1	2.4	60,200	4,900	29,200	6,200	3,200	2,900	500	600	110	128	135	157			13.6	21.0	25.3			35.6			
Total ³	2,735,900				1,779,400		870,100		76,750		1,900																

Note: Averages for age 3.0 and 4.0 smolts are based on a small sample size.

Average Length rounded to nearest mm, Average Weight rounded to nearest 0.1 g. All other figures have been rounded to nearest 100 fish.

¹Percent Hatchery calculated for Age 1.0 smolts only

²Average values calculated from smolt year 1980 to 2008.

³Total values calculated from 1980 to 2009.

⁴1980 thru 1992 averages are arithmetic, 1993 and later are weighted averages.

Adult Escapement - Sockeye

Adult sockeye salmon began arriving at the weir on 24 May 2009 and continued to migrate until 31 July 2009 (Appendix 4). During this time, 45,859 adults were captured and counted at the weir (Table 7). The returning major age groups for adult sockeye included ages 1.2 (3.6%), 1.3 (93.8%), 2.2 (0.3%) and 2.3 (2.2%). Of the 45,859 adult sockeye that migrated to Bear Creek in 2009, 32,515 were harvested for cost recovery and 13,318 were passed to the lake. Mortalities at the weir were 26 fish. An additional 0 fish were harvested in the seine fishery and an additional 110,778 fish in the saltwater cost recovery harvest. It was estimated that 10,787 fish were harvested in the sport fishery for a total return to Resurrection Bay of 168,395 sockeye salmon (an additional 947 fish were estimated to have been illegally caught (poached) in the sport fishery).

A summary of mean age and weight, by age class, for adult sockeye salmon escapement to the Bear Creek weir site for 2009 is presented in Appendix 6.

Adult Escapement - Coho

Adult coho salmon began arriving at the weir on 11 August 2009 and continued to migrate until 19 October (Appendix 5). During this time, 1,245 adults were captured and counted at the weir (Table 7). The returning major age groups for adult coho included ages 1.1 (31.5%), 2.1 (65.8%), and 3.1 (2.7%).

Of the 1,245 adult coho that were counted at the Bear Creek weir site, 0 were harvested, 529 were held for broodstock purposes and 535 were passed into the lake. Approximately, 181 fish remained below the weir.

A summary of mean age and weight, by age class for adult salmon escapement to the Bear Creek weir site for 2009 is presented in Appendix 7.

Table 7. Historic returns of Coho and Sockeye Salmon to Bear Lake weir, 1980 to 2009.

Year	Coho Salmon				Sockeye Salmon												
	Weir Return Total	Age Composition			Weir Return Total	Age Composition											
		1.1	2.1	3.1		0.2	1.1	0.3	1.2	0.4	1.3	2.1	2.2	2.3	3.2	3.3	
1980	4,520	NA	NA	NA	1,462	0	0	0	1,447	0	0	15	0	0	0	0	
1981	3,924	2,252	1,627	45	704	0	0	0	5	0	631	0	63	5	0	0	
1982	2,122	NA	NA	NA	472	0	0	0	407	0	26	0	6	28	0	0	
1983	5,797	5,261	510	25	627	0	0	0	275	0	316	0	25	11	0	0	
1984	3,375	3,969	401	5	3,552	0	0	0	3,432	0	74	0	31	10	0	0	
1985	4,825	4,222	603	0	1,235	0	0	0	245	0	935	0	52	3	0	0	
1986	5,479	5,384	95	0	830	0	0	0	356	0	425	0	44	6	0	0	
1987	6,021	5,888	133	0	212	0	0	0	75	0	102	0	26	5	0	0	
1988	2,174	1,818	356	0	106	0	0	0	51	0	44	0	3	8	0	0	
1989	5,106	4,174	932	0	185	0	0	0	174	0	11	0	0	0	0	0	
1990	7,525	7,179	346	0	1,071	0	0	0	390	0	627	0	---	---	0	0	
1991	7,331	6,328	1,003	0	741	0	0	0	232	0	409	0	90	5	0	0	
1992	3,055	2,444	611	0	1,925	1,398	33	0	246	0	225	0	17	6	0	0	
1993	8,671	8,136	535	0	6,708	84	17	4,068	2,336	0	135	0	17	17	0	0	
1994	5,995	4,643	1,352	0	16,752	4,399	149	196	4,813	44	6,198	0	802	129	20	0	
1995	3,295	883	2,346	66	29,203	29	380	4,877	4,877	117	17,317	29	876	672	0	0	
1996	1,711	495	1,216	0	15,957	34	101	1,280	7,002	0	5,555	0	1,919	67	0	0	
1997	3,569	618	2,883	68	17,965	0	663	26	4,849	0	10,080	0	1,123	1,174	26	26	
1998	11,023	935	9,531	557	29,447	0	49	25	24,613	0	4,245	0	344	172	0	0	
1999	3,811	529	2,991	291	17,439	0	0	0	9,004	0	6,802	25	1,534	74	0	0	
2000	6,765	1,172	5,465	129	13,716	0	136	0	2,139	0	10,253	0	917	272	0	0	
2001	2,913	1,515	1,265	133	16,364	0	0	0	5,187	0	9,705	0	736	736	0	0	
2002	3,484	1,475	1,884	124	15,227	0	0	0	11,235	0	3,064	0	859	70	0	0	
2003	3,506	2,727	752	27	16,010	0	58	0	7,219	0	6,404	0	1,921	408	0	0	
2004	2,672	1,255	1,369	49	11,923	0	992	0	2,639	0	6,904	20	1,131	238	0	0	
2005	2,947	795	2,095	58	45,312	0	0	0	37,729	0	5,898	0	1,026	659	0	0	
2006	2,089	1,058	952	79	43,069	0	0	0	5,153	0	35,000	0	2,236	681	0	0	
2007	1,113	596	517	0	20,090	0	0	0	10,472	0	8,121	0	321	1,175	0	0	
2008	1,467	489	960	18	17,142	0	61	0	5,896	0	10,030	0	912	243	0	0	
2009	1,245	392	819	34	45,859	0	0	0	1,663	0	43,017	0	151	1,028	0	0	
Avg ¹	3,600	1,224	2,275	102	23,217	279	162	400	9,031	10	11,787	5	1,050	487	3	2	
% of Avg	100%	34.0%	63.2%	2.8%	100%	1.2%	0.7%	1.7%	38.9%	0.0%	50.8%	0.02%	4.5%	2.1%	0.01%	0.1%	

¹ Average calculation is based on 1994 data onward.

Hatchery Activities

Stocking

In 2009, 2.543 million sockeye fry (BY08; H4) and 270,000 coho fry (BY08; H5) were released into Bear Lake. These fish will migrate in 2010/2011 as smolts. At the time of release, the sockeye fry averaged 0.50 gm and the coho fry averaged 1.3 gm.

Approximately, 1.675 million sockeye smolts (BY07; 2,4H) averaging 13.2 gm were released into Resurrection Bay. For the coho, approximately 68,000 coho smolts (BY07: H4) averaging 13.5 gm were released into Bear Lake/Bear Creek. A summary of releases are provide in Table 8.

Eggtake

Between 27 July and 26 August 2009, a total of 5,009,000 sockeye salmon eggs were collected. A total of 2,954 broodfish were used (1,476 females; 1,478 males) providing an average fecundity of 3,390 eggs/female. A total of 387 fish were either inviable or mortalities. Pathology results indicated a very high prevalence of BKD in the population (72.5%). Due to this high prevalence it was not feasible to cull all family crosses.

From 09 October to 13 October 2009, a total of 545,000 coho eggs were collected from 144 females and fertilized with milt from 96 males. Average fecundity was 3,775 eggs/female. An additional 406,500 coho eggs were collected by ADF&G Fort Richardson Hatchery. Pathology results indicated that BKD was prevalent in 3 mating crosses. These eggs were culled (36,000).

Table 9 provides an overview of egg collection activities for enhancement at Bear Lake since 1989.

Fry-to-Smolt Survival

Migrating smolts in 2009 were stocked either as fry in 2007 (BY06 - Age 2) and 2008 (BY07 - Age 1). Based on age classification from otoliths/scales, the fry-to-smolt survival for each brood year of fry stocking can be determined. This information is summarized in Table 10.

Marine Survival

Based on information collected from migrating sockeye smolts and returning sockeye adults (total return), it is possible to provide an estimate of the survival of hatchery fish in the marine environment. This information is summarized below in Table 11.

Table 8. Coho and sockeye salmon releases at Bear Lake, 1986 to 2009.

Release Year	Coho				Sockeye					
	Fry	Size (g)	Smolt	Size (g)	Fry	Size (g)	Pre-Smolt	Size (g)	Smolt	Size (g)
1986	445,700	1.64								
1987	226,300	1.46								
1988	347,200	1.00								
1989	491,300	0.75								
1990	333,200	1.30	93,700	20.0	2,260,200	0.80			158,800	7.1
1991	390,000	1.42			1,533,800	0.35			74,900	3.9
1992	203,800	0.49	51,730	10.1	1,795,500	0.72			565,500	4.4
1993 ¹	450,000	0.30			47,000	0.15				
1993 ²	170,600	0.30			1,765,900	0.38				
1994	335,000	0.22			170,000	0.35				
1995	509,000	0.75	7,400	6.5	330,000	0.37				
1996 ³	350,000	0.70	75,000	11.2	780,600	0.37				
1997	448,700	0.63	153,000	8.0	788,000	0.34				
1998	409,000	0.66	117,000	8.3	265,000	0.56				
1999	306,000	0.82	51,000	7.8	1,380,000	0.26				
2000 ⁴	316,000	0.94	102,000	12.8	1,796,000	0.69				
2001	311,000	0.99	120,500	12.8	145,000	0.30				
2002	405,000	1.04	124,000	13.6	2,407,000	0.49	802,000	4.50		
2003 ⁵	405,000	1.37	253,000	13.7	1,467,000	0.42			334,000	11.8
2004	406,000	1.07	477,000	11.51	2,409,000	0.63	603,000	4.50		
2005	405,000	1.30	488,000	12.40	2,416,000	0.74	604,000	2.87	402,000	11.6
2006	447,000	0.84	115,000	10.8	2,414,000	0.52			979,000	10.0
2007	521,000	1.0	237,000	8.86	2,437,000	0.65			619,000	9.9
2008 ⁶	360,000	1.4	142,000	12.5	2,400,000	0.6			1,600,000	10.4
2009 ⁶	270,000	1.3	68,000	13.5	2,543,000	0.5			1,675,000	13.2
Total	9,261,800		2,675,330		31,550,000		2,009,000		6,408,200	
Ave	370,472	0.93	157,372	11.4	1,502,381	0.49	669,667	3.96	712,022	8.64

¹ Released into Bear Lake

² Extra Fry Released into Bear Creek

³ sockeye fry release, 445, 300 @ .36g & 335,300 @ .38g

⁴ sockeye fry release, 1,573,000 @ (.35-.45 g) & 223,000 @2.7 g

⁵An additional 103,000 coho smolts @ 12.7g (Bear Lake brood year 2001) were released at the Homer Spit.

⁶Sockeye smolt stocking was into net pens at Resurrection Bay not Bear Lake

Table 9. Eggs collected for Bear Lake enhancement, 1989 to 2009.

Brood Year	Brood Stock	Coho			%	Brood Stock	Sockeye			%
		Green Eggs	Eyed Eggs				Green Eggs	Eyed Eggs		
1989	Bear L	932,300	711,800	76.3	SF Big R	3,119,300	2,713,700	87.0		
					U Russian L	57,400	47,700	83.1		
1990	Bear L	798,200	669,300	83.9	SF Big R	134,000	100,700	75.1		
					U Russian L	2,602,800	1,721,500	66.1		
1991	Bear L	695,600	533,400	76.7	SF Big R	2,534,500	1,794,500	70.8		
					U Russian L	1,441,800	974,400	67.6		
1992	Bear L	802,700	749,900	93.4	SF Big R	3,428,100	2,976,000	86.8		
					Bear L	47,000	45,100	96.0		
1993	Bear L	735,500	696,000	94.6	Bear L	276,700	172,800	62.5		
1994	Bear L	847,000	739,600	87.3	Bear L	530,000	420,000	79.2		
1995	Bear L	867,500	737,600	85.0	Bear L	2,040,000	1,672,000	82.0		
1996	Bear L	968,000	829,000	85.6	Bear L	1,481,000	1,039,000	70.2		
1997	Bear L	687,000	606,000	88.2	Bear L	502,000	363,000	72.3		
1998	Bear L	805,000	727,000	90.3	Bear L	2,645,000	2,377,000	89.9		
1999	Bear L	867,000	637,000	73.5	Bear L	2,436,000	1,902,000	78.1		
2000	Bear L	972,300	785,800	80.8	Bear L	5,093,000	4,402,000	86.4		
2001	Bear L	1,052,000	864,000	82.1	Bear L	6,017,000	5,127,000	85.2		
2002	Bear L	1,237,500	1,085,700	87.7	Bear L	6,004,000	4,921,000	82.0		
2003	Bear L	1,249,572	1,093,892	87.5	Bear L	5,000,000	4,398,000	88.0		
2004	Bear L	1,673,000	1,557,000	93.1	Bear L	5,661,000	4,989,000	88.1		
2005	Bear L	1,414,791	1,252,814	88.6	Bear L	4,002,000	3,618,000	90.4		
2006	Bear L	1,084,000	990,000	91.3	Bear L	6,087,000	5,444,000	89.44		
2007	Bear L	748,000	581,000	77.7	Bear L	6,071,000	5,398,000	88.91		
2008	Bear L	574,000	283,000	49.3	Bear L	6,033,000	5,531,000	91.68		
2009	Bear L	545,000	462,000	84.8	Bear L	5,009,000	4,531,000	90.5		
Total Ave		19,555,963	16,591,806	83.7		78,252,600	66,678,400	81.9		

Table 10. Bear Lake smolt production by brood years.

Brood Year	Coho						Brood Year	Sockeye					
	Escap.	No. Fry Stocked	Size (g)	No. Smolt	Hatch Smolt	% Hatch. Survival		Escap.	No. Fry Stocked	Size (g)	No. Smolt	Hatch. Smolt	% Hatch. Survival
1985	4,421	445,700	1.64	74,520			1985				1,235		19,740
1986	5,115	226,300	1.46	54,700			1986				830		8,450
1987	5,653	347,200	1.00	111,570			1987				212		4,320
1988	1,640	491,300	0.75	78,680			1988				106		4,030
1989	475	333,200	1.30	91,280			1989	185	2,260,000	0.80	345,000		
1990	919	390,600	1.42	118,000			1990	1,071	1,530,000	0.35	157,800		
1991	227	203,800	0.49	86,470			1991	741	1,796,000	0.72	910,600		
1992	332	450,000	0.30	91,950			1992	1,925	1,813,000	0.38	288,200		
1993	560	335,000	0.22	62,800			1993	5,045	170,000	0.15	69,100	47,600	28.0
1994	475	509,000	0.75	204,100			1994	8,430	330,000	0.37	155,400	100,400	30.4
1995	444	350,000	0.70	84,600			1995	8,334	781,000	0.37	296,700	220,700	28.3
1996	380	448,700	0.63	64,500			1996	8,012	788,000	0.34	101,400	73,800	9.4
1997	276	409,000	0.66	57,700			1997	7,945	265,000	0.56	92,500	71,100	26.8
1998	350	306,000	0.82	74,827			1998	8,427	1,380,000	0.25	168,500	132,014	9.6
1999	368	316,100	0.94	100,200	90,700	28.7	1999	7,815	1,796,400	0.80	378,900	311,700	17.4
2000	429	311,000	0.99	114,300	97,300	31.3	2000	11,828	144,500	0.30	105,400	42,923	29.7
2001	495	405,000	1.04	186,900	163,400	40.3	2001	12,801	3,209,000	0.49	1,352,800	917,788	28.6
2002	875	405,000	1.37	62,900	58,400	14.4	2002	12,504	1,467,000	0.42	106,450	102,800	7.0
2003	395	406,000	1.07	86,100	80,716	19.9	2003	13,233	3,012,000	0.63	1,571,350	1,122,823	37.3
2004	572	405,000	1.30	99,715	89,710	22.2	2004	8,061	3,020,000	1.17	1,777,836	699,283	23.2
2005	546	447,000	0.84	70,760	66,957	15.0	2005	10,285	2,414,000	0.52	1,289,819	623,875	25.8
2006	500	521,000	1.0	56,818	55,469	10.6	2006 *	8,338	2,437,000	0.65	287,609	271,940	11.2
2007 *	386	360,000	1.4	32,968	32,342		2007 *	8,420	2,400,000	0.6	235,365	228,539	
2008 *	368	270,000	1.3				2008 *	8,992	2,543,000	0.5			
2009 *	535						2009 *	9,977					
Ave ¹	468	387,700	0.94	94,730	87,832	22.8	Ave ¹	9,320	1,634,800	0.51	574,320	343,600	23.2

* Incomplete broodyear

¹Average data is for 1993 onward.

Smolt numbers are rounded to the nearest 100 fish.

Note: Number of Hatchery Smolt is based on otolith mark data..

* Incomplete broodyear

¹Average data is for 1993 onward

Smolt numbers are rounded to the nearest 100 fish.

Note: Number of Hatchery Smolt is based on otolith mark data.

BY2001, 2003,2004 fry stocked includes those stocked as fry and as presmolts
 BY2001, BY2003 ,BY2004, B 2005 hatchery smolt do not include the number that were stocked as smolts into Beak Lake

BY2006 - BY2007 hatchery smolt is from fry stocking only. Smolt stocking went to Resurrection Bay

Table 11. Marine survival for sockeye at Bear Lake (BY1989 to BY2007)

BY	Marine Survival
1989	5.0
1990	24.9
1991	5.4
1992	15.5
1993	18.6
1994	34.2
1995	16.1
1996	15.4
1997	14.5
1998	20.1
1999	8.1
2000	17.6
2001	9.8
2002	26.6
2003	6.1
<i>2004</i>	<i>11.0</i>
<i>2005</i>	<i>0.5</i>
<i>2006</i>	<i>0.0</i>
<i>2007</i>	<i>0.0</i>
AVE	15.9

Red/italics indicates incomplete brood year.

RECOMMENDATIONS

Family tracking for BKD should continue for both sockeye and coho during eggtake. Due to the extremely high incidence of BKD in the population, CIAA will perform a research trial to assess the effectiveness of erythromycin injections to adult sockeye in reducing the incidence of BKD at the spawning grounds in 2010. A selected number of fish will be injected with erythromycin and another group with the placebo. BKD samples will be collected at the spawning ground and the two groups will be compared for the prevalence of BKD. CIAA should continue to stock smolts in Resurrection Bay after a short-term rearing in net pens.

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APPENDICES

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Appendix 1. Bear Lake 2009 - Water Chemistry Analysis

Nutrients and Primary Productivity

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)	Carbon (ug/l)	Chla (ug/l)	Phaeo (ug/l)	EZD (m)
6/13/2009	B	1	12.0	6.6	1.5	167	1.6	4.1	32 :1	2819	547	1.54	0.38	6.6
	B	15	14.1	4.4	1.9	162	9.3	7.4	27 :1	2853	446	2.81	0.20	
7/17/2009	B	1	9.3	6.8	1.5	125	7.0	4.1	31 :1	2740	246	0.42	0.14	9.9
	B	13	19.0	5.7	1.2	239	2.2	4.1	28 :1	2819	562	4.33	0.57	
8/27/2009	B	1	8.9	3.8	1.6	161	2.1	4.1	41 :1	2447	342	1.67	0.31	8.8
	B	10	18.4	4.1	2.2	265	2.9	4.1	32 :1	2501	544	7.11	0.32	
9/22/2009	B	1	10.8	3.7	2.3	111	7.9	4.1	24 :1	2713	378	2.59	0.23	7.2
	B	12	11.2	4.2	2.4	134	0.8	4.1	27 :1	2560	568	3.01	0.12	
Mean			13.0	4.9	1.8	170.6	4.2	4.5	32 :1	2682	454	2.9	0.3	8.4
Min			8.9	3.7	1.2	110.8	0.8	4.1	27 :1	2447	246	0.4	0.1	6.6
Max			19.0	6.8	2.4	265.2	9.3	7.4	41 :1	2853	568	7.1	0.6	9.9
1m Ave			7.6	5.7	1.5	151.1	3.6	4.1	34.5 :1	2669	378.3	1.2	0.3	8.4
Hypo Ave			17.2	4.7	1.8	222.1	4.8	5.2	29.1 :1	2724	517.3	4.8	0.4	

* Possible contamination of hypolimnion sample.

General Tests and Metals

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)
6/13/2009	B	1	79	7.2	29.4	1.7	5	12.4	0.9	20	3.0
	B	15	83	6.7	29.6	2.4	5	12.5	0.7	30	
7/17/2009	B	1	80	7.1	30.3	0.4	3	12.7	0.9	18	5.5
	B	13	85	6.7	28.6	4.9	4	12.6	0.8	18	
8/27/2009	B	1	83	7.2	28.8	0.8	6	12.7	0.6	19	5.0
	B	10	85	7.1	28.8	4.6	6	12.3	0.9	22	
9/22/2009	B	1	81	6.7	28.9	2.9	5	12.7	1.1	26	3.0
	B	12	83	6.8	29.0	2.9	5	12.8	0.8	22	
Mean			82	6.9	29.2	2.6	4.9	12.6	0.8	21.9	4.5
Min			79	6.7	28.6	0.4	3.0	12.3	0.6	18.0	3.0
Max			85	7.2	30.3	4.9	6.0	12.8	1.1	30.0	5.5
1m Ave			80.7	7.2	29.5	1.0	4.7	12.6	0.8	19.0	4.5
Hypo Ave			84.3	6.8	29.0	4.0	5.0	12.5	0.8	23.3	

Appendix 1. (continued) Bear Lake 2009 - Zooplankton Analysis

Zooplankton data analysis is incomplete. This section will need to be completed at a later date.

Appendix 2. Bear Lake 2009 - Environmental Conditions

Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)	Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-May	1	0			2	13	1-Jun	4	0	0.94	1.34	9	10
2-May	1	0			2	16	2-Jun	3	0	0.94	1.34	9	13
3-May	1	0			2	16	3-Jun	1	0	0.94	1.3	11	17
4-May	1	0			2	11	4-Jun	1	0	0.96	1.3	11	17
5-May	4	0			2	11	5-Jun	1	0	0.96	1.3	11	17
6-May	5	10		1.36	2	3	6-Jun	1	0	0.98	1.3	11	17
7-May	4	16		1.36	2	10	7-Jun	1	0	0.98	1.3	14	15
8-May	4	0		1.36	3	10	8-Jun	1	0	1.1	1.3	14	17
9-May	4	0		1.38	3	9	9-Jun	1	0	1.3	1.3	13	16
10-May	2	0		1.4	4	11	10-Jun	4	0	1.04	1.3	12	12
11-May	1	0		1.44	5	17	11-Jun	4	0	1.04	1.3	12	11
12-May	1	0		1.46	5	17	12-Jun	4	0	1.04	1.28	12	10
13-May	5	10		1.64	6	4	13-Jun	3	0	1.04	1.28	12	10
14-May	5	24		1.72	6	2	14-Jun	4	0	0.96	1.28	12	9
15-May	1	0		1.38	8	18	15-Jun	1	0	0.96	1.26	12	14
16-May	1	0		1.38	8	18	16-Jun	4	0	0.99	1.26	13	6
17-May	1	0	0.46	1.42	8	18	17-Jun	4	0	1	1.26	13	12
18-May	1	0	0.48	0.42	8	18	18-Jun	4	0	1	1.26	13	12
19-May	2	0	0.8	1.42	8	16	19-Jun	4	0	0.98	1.27	13	16
20-May	3	0	0.78	1.42	7	10	20-Jun	4	0	0.96	1.28	13	12
21-May	3	0	1.08	1.38	7	9	21-Jun	5	11	0.94	1.28	12	11
22-May	3	0	1.08	1.38	7	10	22-Jun	5	4	0.94	1.28	12	7
23-May	5	0.5	1.08	1.38	7	10	23-Jun	4	3.5	0.94	1.28	12	7
24-May	3	0.4	1.06	1.38	8	14	24-Jun	4	0	0.98	1.28	13	7
25-May	2	0	1.02	1.38	8	16	25-Jun	3	3.5	1.04	1.28	13	13
26-May	1	0	1	1.38	8	16	26-Jun	1	7	1.6	1.28	14	12
27-May	4	0	1	1.38	8	7	27-Jun	2	0	1.6	1.26	14	18
28-May	4	10	1.06	1.42	8	8	28-Jun	2	0	1.6	1.26	14	17
29-May	3	0.5	1.08	1.38	8	8	29-Jun	2	0	1.6	1.26	14	12
30-May	5	1.5	1.1	1.38	8	7	30-Jun	1	0	1.6	1.26	14	16
31-May	4	0	1.1	1.38	8	7							

Sky Conditions

- 1 = clear
- 2 = less than 50% cloud cover
- 3 = more than 50% cloud cover
- 4 = 100% overcast
- 5 = rain

Appendix 2 (continued). Bear Lake 2009 - Environmental Conditions

Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)	Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Jul	3	0	1.4	1.4	14	14	1-Aug	1	0		1.98	14	14
2-Jul	3	0	1.4	1.4	14	15	2-Aug	1	0		1.98	14	14
3-Jul	1	0	1.01	1.4	16	17	3-Aug	1	0		1.98	14	13
4-Jul	1	0	1.01	1.4	18	23	4-Aug	5	2.5		1.97	14	9
5-Jul	1	0	1.01	1.4	18	27	5-Aug	4	10		1.93	15	14
6-Jul	1	0	1.02	1.4	18	26	6-Aug	1	0		1.96	16	14
7-Jul	1	0	1.02	1.4	18	26	7-Aug	1	0		1.92	16	14
8-Jul	1	0	1.02	1.39	17	20	8-Aug	4	0		1.9	16	12
9-Jul	1	0	1.04	1.31	17	20	9-Aug	4	0		1.88	16	10
10-Jul	4	0	0.98	1.31	16	14	10-Aug	3	0		1.88	16	10
11-Jul	1	0	1.08	1.31	16	16	11-Aug	3	0	0.89	1.86	16	12
12-Jul	1	0	1.08	1.31	16	17	12-Aug	4	0.9	0.82	1.86	16	12
13-Jul	1	0	1.07	1.3	16	16	13-Aug	4	1	0.76	1.82	14	11
14-Jul	1	0	1.08	1.3	16	16	14-Aug	5	6	0.72	1.8	14	11
15-Jul	1	0	1.08	1.3	16	16	15-Aug	4	17.6	0.76	1.81	14	11
16-Jul	4	0	1.09	1.3	16	12	16-Aug	4	14.5	0.82	1.8	14	12
17-Jul	4	0	1.08	1.3	17	17	17-Aug	3	0	0.81	1.78	14	15
18-Jul	4	1	1.08	1.3	17	16	18-Aug	4	0	0.81	1.77	14	15
19-Jul	5	0	1.08	1.3	16	12	19-Aug	2	0	0.81	1.75	14	16
20-Jul	5	4	1.09	1.33	16	11	20-Aug	1	0	0.81	1.71	14	19
21-Jul	5	8.4	1.09	1.34	16	9	21-Aug	2	0	0.6	1.7	14	9
22-Jul	5	28.5	2.02	1.39	16	8	22-Aug	5	6.2	0.6	1.69	14	9
23-Jul	5	32.4		1.44	15	9	23-Aug	4	4	0.6	1.68	14	9
24-Jul	4	9.2		1.44	15	10	24-Aug	4	4.2	0.6	1.67	14	13
25-Jul	5	15		1.49	15	8	25-Aug	4	0	0.59	1.65	14	12
26-Jul	5	50		1.56	14	14	26-Aug	4	2.2	0.56	1.63	14	12
27-Jul	5	55		1.59	14	12	27-Aug	4	60	0.54	1.62	14	11
28-Jul	5	60		1.66	14	9	28-Aug	5	37	0.86	1.6	14	10
29-Jul	5	72		1.98	14	8	29-Aug	4	0	0.86	1.6	14	10
30-Jul	5	60		1.98	14	9	30-Aug	1	0	0.85	1.59	14	13
31-Jul	3	17.5		1.98	14	11	31-Aug	4	0	0.84	1.58	14	11

Sky Conditions

- 1 = clear
- 2 = less than 50% cloud cover
- 3 = more than 50% cloud cover
- 4 = 100% overcast
- 5 = rain

Appendix 2 (continued). Bear Lake 2009 - Environmental Conditions

Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)	Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Sep	4	0	0.7	1.58	14	8	1-Oct	4	0	0.74	1.26	8	10
2-Sep	5	6.2	0.72	1.58	14	8	2-Oct	4	1.5	0.74	1.26	8	8
3-Sep	5	13	0.74	1.52	14	9	3-Oct	4	10	0.72	1.26	8	9
4-Sep	3	0	0.74	1.42	14	11	4-Oct	4	0	0.71	1.26	8	8
5-Sep	1	0	0.76	1.38	14	12	5-Oct	4	0	0.7	1.26	8	7
6-Sep	1	0	0.79	1.38	14	13	6-Oct	4	12.5	0.7	1.26	8	8
7-Sep	4	0	0.72	1.39	14	12	7-Oct	4	3.5	0.68	1.26	8	8
8-Sep	4	3	0.66	1.4	14	10	8-Oct	4	17.5	0.42	1.28	8	8
9-Sep	4	7.2	0.67	1.41	13	11	9-Oct	5	7.6	0.66	1.28	8	8
10-Sep	3	2.5	0.68	1.44	12	12	10-Oct	5	17.6	0.6	1.2	8	8
11-Sep	4	10.4	0.67	1.44	11	15	11-Oct	4	10	0.52	1.38	8	8
12-Sep	5	3.6	0.68	1.44	11	9	12-Oct	3	7	0.52	1.42	9	10
13-Sep	4	4.2	0.7	1.4	11	10	13-Oct	3	0	0.52	1.4	9	10
14-Sep	5	3	0.7	1.4	11	10	14-Oct	4	0	0.48	1.4	8	12
15-Sep	4	0.5	0.66	1.38	11	12	15-Oct	4	0	0.48	1.38	8	14
16-Sep	5	7.5	0.8	1.4	11	12	16-Oct	3	0	0.48	1.34	7	13
17-Sep	4	7	0.88	1.4	11	12	17-Oct	3	0	0.48	1.3	7	7
18-Sep	1	2	0.78	1.4	11	10	18-Oct	2	0.5	0.48	1.28	7	7
19-Sep	2	0	0.78	1.4	11	10	19-Oct						
20-Sep	5	8	0.82	1.4	10	9	20-Oct						
21-Sep	4	3.2	0.85	1.4	10	9	21-Oct						
22-Sep	1	0	0.88	1.4	10	8	22-Oct						
23-Sep	3	0	0.78	1.38	9	8	23-Oct						
24-Sep	5	2	0.76	1.38	9	8	24-Oct						
25-Sep	3	0	0.76	1.38	9	8	25-Oct						
26-Sep	2	0	0.76	1.38	9	7	26-Oct						
27-Sep	3	0	0.76	1.28	8	8	27-Oct						
28-Sep	3	1.2	0.76	1.28	8	8	28-Oct						
29-Sep	4	0.5	0.76	1.28	8	6	29-Oct						
30-Sep	4	8.8	0.76	1.28	8	10	20-Oct						
							31-Oct						

Sky Conditions

- 1 = clear
- 2 = less than 50% cloud cover
- 3 = more than 50% cloud cover
- 4 = 100% overcast
- 5 = rain

Appendix 3. Bear Lake 2009 - Smolt Migration.

Date	Sockeye		Coho		Dolly Varden		Rainbow Trout	
	Daily	Cumm	Daily	Cumm	Daily	Cumm	Daily	Cumm
01-May		0		0		0		0
02-May		0		0		0		0
03-May		0		0		0		0
04-May		0		0		0		0
05-May		0		0		0		0
06-May		0		0		0		0
07-May		0		0		0		0
08-May		0		0		0		0
09-May		0		0		0		0
10-May		0		0		0		0
11-May		0		0		0		0
12-May		0		0		0		0
13-May		0		0		0		0
14-May		0		0		0		0
15-May	0	0	0	0	0	0		0
16-May	0	0	0	0	0	0	0	0
17-May	0	0	0	0	0	0	0	0
18-May	0	0	0	0	0	0	0	0
19-May	0	0	0	0	0	0	0	0
20-May	0	0	0	0	0	0	0	0
21-May	0	0	0	0	0	0	0	0
22-May	0	0	0	0	0	0	0	0
23-May	8,750	8,750	300	300	0	0	0	0
24-May	0	8,750	0	300	0	0	0	0
25-May	0	8,750	0	300	0	0	0	0
26-May	14,180	22,930	1,258	1,558	0	0	1	1
27-May	7,501	30,431	464	2,022	0	0	0	1
28-May	30,743	61,174	1,981	4,003	0	0	0	1
29-May	32,600	93,774	3,353	7,356	20	20	0	1
30-May	2,190	95,964	880	8,236	0	20	0	1
31-May	2,853	98,817	912	9,148	1	21	0	1
01-Jun	10,540	109,357	2,143	11,291	0	21	1	2
02-Jun	6,052	115,409	2,169	13,460	3	24	0	2
03-Jun	14,610	130,019	5,962	19,422	2	26	0	2
04-Jun	16,642	146,661	2,720	22,142	1	27	0	2
05-Jun	20,665	167,326	6,003	28,145	2	29	0	2
06-Jun	21,083	188,409	3,237	31,382	11	40	0	2
07-Jun	2,953	191,362	1,901	33,283	0	40	0	2
08-Jun	4,439	195,801	3,467	36,750	0	40	0	2
09-Jun	10,043	205,844	2,269	39,019	2	42	0	2
10-Jun	5,437	211,281	3,080	42,099	0	42	0	2
11-Jun	2,720	214,001	405	42,504	0	42	0	2
12-Jun	2,583	216,584	476	42,980	0	42	0	2
13-Jun	1,248	217,832	173	43,153	0	42	0	2
14-Jun	4,231	222,063	481	43,634	0	42	0	2
15-Jun	3,042	225,105	934	44,568	0	42	0	2
16-Jun	4,016	229,121	1,133	45,701	0	42	0	2
17-Jun	1,004	230,125	680	46,381	0	42	0	2
18-Jun	2,450	232,575	879	47,260	0	42	0	2
19-Jun	1,744	234,319	939	48,199	0	42	0	2
20-Jun	858	235,177	772	48,971	0	42	0	2
21-Jun	561	235,738	409	49,380	0	42	0	2
22-Jun	621	236,359	976	50,356	0	42	0	2
23-Jun	914	237,273	1,265	51,621	0	42	0	2
24-Jun	481	237,754	320	51,941	0	42	0	2
25-Jun	230	237,984	326	52,267	0	42	0	2
26-Jun	485	238,469	185	52,452	0	42	0	2
27-Jun	149	238,618	52	52,504	0	42	0	2
28-Jun	498	239,116	262	52,766	0	42	0	2
29-Jun	493	239,609	681	53,447	1	43	0	2
30-Jun	287	239,896	541	53,988	0	43	0	2
01-Jul	212	240,108	235	54,223	0	43	0	2
02-Jul	366	240,474	239	54,462	0	43	0	2
03-Jul	67	240,541	107	54,569	0	43	0	2
04-Jul	186	240,727	102	54,671	0	43	0	2
05-Jul	379	241,106	158	54,829	1	44	0	2
06-Jul		241,106		54,829		44	0	2
07-Jul		241,106		54,829		44	0	2
08-Jul		241,106		54,829		44		2
09-Jul		241,106		54,829		44		2
10-Jul		241,106		54,829		44		2
11-Jul		241,106		54,829		44		2
Totals		241,106		54,829		44		2

Appendix 4. Bear Lake 2009 - Adult Sockeye Salmon Migration.

Date	Lake Escapement			Donate & Harvest	Morts	Daily Total	Cumm. Total
	Males	Females	Combined				
20-May							
21-May			0			0	0
22-May			0			0	0
23-May			0			0	0
24-May	0	1	1	0	0	1	1
25-May	1	0	1	0	0	1	2
26-May	0	2	2	0	0	2	4
27-May	2	0	2	0	0	2	6
28-May	1	1	2	0	0	2	8
29-May	85	30	115	0	0	115	123
30-May	13	14	27	0	0	27	150
31-May	27	12	39	0	0	39	189
01-Jun	400	81	481	0	0	481	670
02-Jun	260	146	406	0	0	406	1,076
03-Jun	337	274	611	0	0	611	1,687
04-Jun	123	70	193	0	0	193	1,880
05-Jun	260	290	550	0	0	550	2,430
06-Jun	846	723	1,569	0	2	1,571	4,001
07-Jun	484	408	892	0	0	892	4,893
08-Jun	666	534	1,200	0	0	1,200	6,093
09-Jun	512	502	1,014	0	0	1,014	7,107
10-Jun	364	384	748	0	3	751	7,858
11-Jun	231	221	452	150	0	602	8,460
12-Jun	93	77	170	424	0	594	9,054
13-Jun	306	222	528	234	2	764	9,818
14-Jun	0	0	0	1,132	0	1,132	10,950
15-Jun	149	150	299	2,275	0	2,574	13,524
16-Jun	276	374	650	1,156	0	1,806	15,330
17-Jun	142	110	252	580	3	835	16,165
18-Jun	0	0	0	979	0	979	17,144
19-Jun	267	278	545	972	0	1,517	18,661
20-Jun	132	222	354	846	0	1,200	19,861
21-Jun	33	43	76	784	2	862	20,723
22-Jun	0	0	0	1,073	1	1,074	21,797
23-Jun	160	132	292	1,708	2	2,002	23,799
24-Jun	144	117	261	1,575	5	1,841	25,640
25-Jun	243	300	543	1,498	0	2,041	27,681
26-Jun	87	129	216	1,015	3	1,234	28,915
27-Jun	81	80	161	2,003	2	2,166	31,081
28-Jun	0	0	0	1,717	0	1,717	32,798
29-Jun	0	0	0	1,656	0	1,656	34,454
30-Jun	0	0	0	255	0	255	34,709
01-Jul	0	0	0	946	1	947	35,656
02-Jul	0	0	0	742	0	742	36,398
03-Jul	0	0	0	985	0	985	37,383
04-Jul	18	32	50	466	0	516	37,899
05-Jul	156	174	330	648	0	978	38,877
06-Jul	0	0	0	565	0	565	39,442
07-Jul	0	0	0	632	0	632	40,074
08-Jul	35	30	65	217	0	282	40,356
09-Jul	0	0	0	257	0	257	40,613
10-Jul	0	0	0	196	0	196	40,809
11-Jul	0	0	0	213	0	213	41,022
12-Jul	0	0	0	427	0	427	41,449
13-Jul	0	0	0	565	0	565	42,014
14-Jul	0	0	0	957	0	957	42,971
15-Jul	0	0	0	602	0	602	43,573
16-Jul	0	0	0	299	0	299	43,872
17-Jul	0	0	0	297	0	297	44,169
18-Jul	0	0	0	317	0	317	44,486
19-Jul	0	0	0	86	0	86	44,572
20-Jul	0	0	0	186	0	186	44,758
21-Jul	0	0	0	262	0	262	45,020
22-Jul	49	172	221	205	0	426	45,446
23-Jul	0	0	0	4	0	4	45,450
24-Jul	0	0	0	244	0	244	45,694
25-Jul	0	0	0	3	0	3	45,697
26-Jul	0	0	0	0	0	0	45,697
27-Jul	0	0	0	0	0	0	45,697
28-Jul	0	0	0	0	0	0	45,697
29-Jul	0	0	0	0	0	0	45,697
30-Jul	0	0	0	162	0	162	45,859
31-Jul	0	0	0	0	0	0	45,859
01-Aug			0			0	
02-Aug			0			0	
03-Aug			0			0	
04-Aug			0			0	
05-Aug			0			0	
06-Aug			0			0	
07-Aug			0			0	
08-Aug			0			0	
Total	6,983	6,335	13,318	32,515	26	45,859	

Appendix 5. Bear Lake 2009 - Adult Coho Salmon Migration.

Date	Lake Escapement			Broodstock			Harvest *			Total		Raceway Morts	Daily Total	Cumm Total
	Males	Females	Combined	Males	Females	Combined	Males	Females	Combined	Males	Females			
11-Aug	2	2	4	0	0	0	0	0	0	2	2	0	4	4
12-Aug	0	3	3	0	0	0	0	0	0	0	3	0	3	7
13-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	7
14-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	7
15-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	7
16-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	7
17-Aug	1	1	2	0	0	0	0	0	0	1	1	0	2	9
18-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	9
19-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	9
20-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	9
21-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	9
22-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	9
23-Aug	1	0	1	0	0	0	0	0	0	1	0	0	1	10
24-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	10
25-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	10
26-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	10
27-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	10
28-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	10
29-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	10
30-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	10
31-Aug	0	3	3	0	0	0	0	0	0	0	3	0	3	13
01-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	13
02-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	13
03-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	13
04-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	13
05-Sep	1	0	1	0	0	0	0	0	0	1	0	0	1	14
06-Sep	1	2	3	0	0	0	0	0	0	1	2	0	3	17
07-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	17
08-Sep	10	0	10	0	0	0	0	0	0	10	0	0	10	27
09-Sep	3	2	5	0	0	0	0	0	0	3	2	0	5	32
10-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	32
11-Sep	5	4	9	0	0	0	0	0	0	5	4	0	9	41
12-Sep	3	1	4	0	0	0	0	0	0	3	1	0	4	45
13-Sep	4	1	5	0	0	0	0	0	0	4	1	0	5	50
14-Sep	2	1	3	0	0	0	0	0	0	2	1	0	3	53
15-Sep	9	15	24	0	0	0	0	0	0	9	15	0	24	77
16-Sep	5	8	13	0	0	0	0	0	0	5	8	0	13	90
17-Sep	5	19	24	0	0	0	0	0	0	5	19	0	24	114
18-Sep	18	4	22	0	0	0	0	0	0	18	4	0	22	136
19-Sep	21	10	31	0	0	0	0	0	0	21	10	0	31	167
20-Sep	18	8	26	0	0	0	0	0	0	18	8	0	26	193
21-Sep	27	19	46	0	0	0	0	0	0	27	19	0	46	239
22-Sep	10	9	19	0	0	0	0	0	0	10	9	0	19	258
23-Sep	10	5	15	0	0	0	0	0	0	10	5	0	15	273
24-Sep	7	3	10	0	0	0	0	0	0	7	3	0	10	283
25-Sep	2	10	12	0	0	0	0	0	0	2	10	0	12	295
26-Sep	1	0	1	0	0	0	0	0	0	1	0	0	1	296
27-Sep	15	12	27	0	0	0	0	0	0	15	12	0	27	323
28-Sep	5	3	8	0	0	0	0	0	0	5	3	0	8	331
29-Sep	9	5	14	0	0	0	0	0	0	9	5	0	14	345
30-Sep	3	7	10	0	0	0	0	0	0	3	7	0	10	355
01-Oct	2	0	2	0	3	3	0	0	0	2	3	0	5	360
02-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	360
03-Oct	0	0	0	7	8	15	0	0	0	7	8	0	15	375
04-Oct	0	0	0	9	2	11	0	0	0	9	2	0	11	386
05-Oct	0	0	0	0	1	1	0	0	0	0	1	0	1	387
06-Oct	0	0	0	21	0	21	0	0	0	21	0	0	21	408
07-Oct	0	0	0	8	2	10	0	0	0	8	2	0	10	418
08-Oct	0	0	0	33	9	42	0	0	0	33	9	0	42	460
09-Oct	0	0	0	42	64	106	0	0	0	42	64	2	108	568
10-Oct	5	3	8	83	73	156	0	0	0	88	76	0	164	732
11-Oct	2	72	74	7	28	35	0	0	0	9	100	0	109	841
12-Oct	0	0	0	17	93	110	NOT SEXED		138	17	93	0	248	1,089
13-Oct	0	0	0	0	20	20			0	0	20	0	20	1,109
14-Oct	0	0	0	0	0	0			0	0	0	0	0	1,109
15-Oct	0	0	0	10	31	41			0	10	30	0	40	1,149
16-Oct	13	28	41	0	0	0			0	13	28	0	41	1,190
17-Oct	10	12	22	0	0	0			0	10	12	0	22	1,212
18-Oct	6	10	16	0	0	0			0	6	10	0	16	1,228
19-Oct	9	8	17	0	0	0			0	9	8	0	17	1,245
Total	245	290	535	237	334	571	0	0	138	482	623	2	1,245	

Appendix 6. Bear Lake 2009 – Adult Sockeye Age and Sex Characteristics

	Age						Total
	1.1	1.2	1.3	2.1	2.2	2.3	
Sample Period:	24 May through 31 July						
Males (No.)	0	907	20,436	0	30	423	21,796
Percent	0.0%	4.2%	93.8%	0.0%	0.1%	1.9%	47.5%
Sample Size	0	30	676	0	1	14	721
Total Sample Size							853
Mean Length (mm)		469	570		460	568	566
Std. Deviation		31.2	30.0			41.6	36.8
Std. Error		5.7	1.2			11.1	1.3
Mean Weight (kg)		1.59	2.87		1.54	2.76	2.81
Std. Deviation		0.28	0.46			0.56	0.53
Std. Error		0.05	0.02			0.15	0.02
Females (No.)	0	756	22,582	0	121	605	24,063
Percent	0.0%	3.1%	93.8%	0.0%	0.5%	2.5%	52.5%
Sample Size	0	25	747	0	4	20	796
Total Sample Size							963
Mean Length (mm)		491	551		526	538	548
Std. Deviation		33.3	28.4		27.8	26.4	30.1
Std. Error		6.7	1.0		13.9	5.9	1.0
Mean Weight (kg)		1.88	2.52		2.01	2.39	2.49
Std. Deviation		0.35	0.37		0.27	0.42	0.38
Std. Error		0.07	0.01		0.14	0.09	0.01
Both Sexes (No.)	0	1,663	43,017	0	151	1,028	45,859
Percent	0.0%	3.6%	93.8%	0.0%	0.3%	2.2%	100.0%
Sample Size	0	55	1423	0	5	34	1517
Total Sample Size							1816
Mean Length (mm)		479	560		513	550	556
Std. Deviation		33.7	30.6		38.0	36.2	34.5
Std. Error		4.5	0.8		17.0	6.2	0.8
Mean Weight (kg)		1.72	2.69		1.91	2.54	2.64
Std. Deviation		0.34	0.45		0.32	0.50	0.49
Std. Error		0.05	0.01		0.14	0.09	0.01

Total means for males, females and both sexes are generated from the total sample size

Appendix 7. Bear Lake 2009 – Adult Coho Age and Sex Characteristics

	Age			Total
	1.1	2.1	3.1	
Sample Period:	04 September through 21 October			
Males (No.)	171	375	34	580
Percent	29.4%	64.7%	5.9%	46.6%
Sample Size	10	22	2	34
Total Sample Size				37
Mean Length (mm)	560	565	630	568
Std. Deviation	53.2	48.9	38.2	49.0
Std. Error	16.8	10.4	27.0	8.1
Mean Weight (kg)	2.71	2.68	3.79	2.76
Std. Deviation	0.89	0.78	0.94	0.81
Std. Error	0.28	0.17	0.67	0.13
Females (No.)	13	26	0	39
Percent	33.3%	66.7%	0.0%	3.1%
Sample Size	13	26	0	39
Total Sample Size				43
Mean Length (mm)	582	588		587
Std. Deviation	26.9	45.6		38.6
Std. Error	7.5	8.9		5.9
Mean Weight (kg)	3.35	3.45		3.43
Std. Deviation	0.44	0.67		0.58
Std. Error	0.12	0.13		0.09
Both Sexes (No.)	392	819	34	1,245
Percent	31.5%	65.8%	2.7%	100.0%
Sample Size	23	48	2	73
Total Sample Size				80
Mean Length (mm)	572	578	630	578
Std. Deviation	40.9	48.0	38.2	44.4
Std. Error	8.5	6.9	27.0	5.0
Mean Weight (kg)	3.07	3.10	3.79	3.12
Std. Deviation	0.73	0.81	0.94	0.77
Std. Error	0.15	0.12	0.67	0.09

Total means for males, females and both sexes are generated from the total sample size

Appendix 8. Bear Lake 2009 – Project Updates

Sockeye Salmon Project

Stocking & Misc. Activities

Crew on-site:	15-May		
Ice-out:	NA		
Crew off-site:	20-Oct		
Fry stocking:	25-Jun	2,543,000	0.5 g
PreSmolt stocking:			
Smolt stocking:(Res Bay)	17-Jun	1,675,000	13.2 gm
Fertilizer application:	12-Aug to 28-Aug	310 gallon	

Smolt Migration

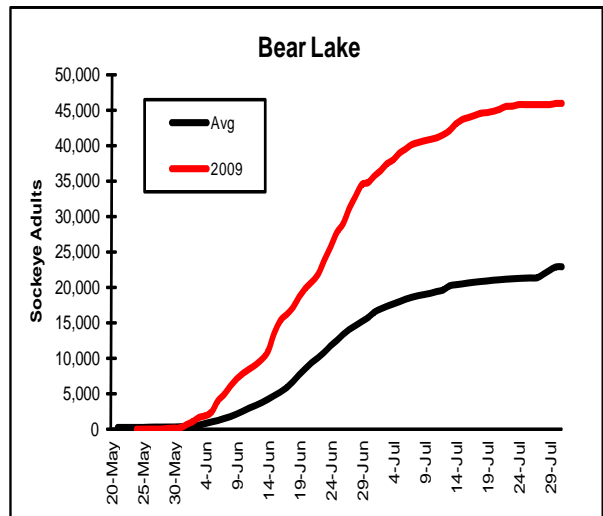
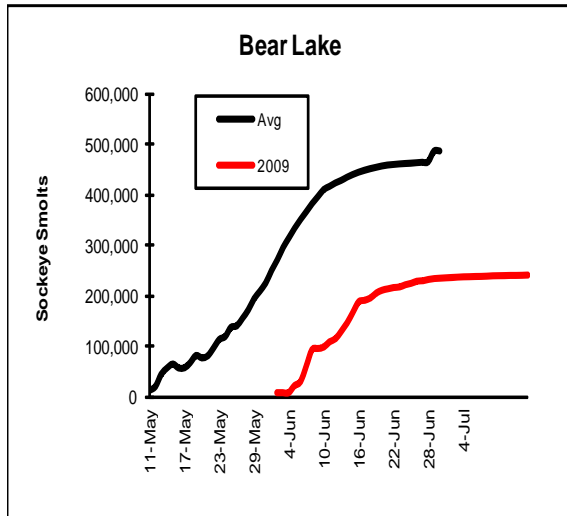
Dates:	23-May to 5-Jul	
Sockeyes:		241,106
Percent age 1:		97.6%
Percent age 2:		2.4%
Percent age 3:		0.0%
Percent hatchery:		97.1%
Dolly Varden:		44

Egg Take

Dates:	27-Jul to 26-Aug	
No. of broodstock used:		2,954
Green eggs:		5,009,000
Fecundity:		3,390
Eyed eggs:		4,531,000
% Survival		90.5%

Adult Migration

Dates:	24-May to 31-Jul	
Total return:		168,345
Commercial & Sport Fish harvest:		11,734 7%
C.R. harvest(FW & SW):		143,293 85%
Lake:		13,318 8%
Mortalities		0
Hatchery broodstock:		3,341
Lake broodstock:		9,977



Appendix 8 (continued). Bear Lake 2009 – Project Updates

Coho Salmon Project

Stocking & Misc. Activities

Crew on-site:	15-May		
Ice-out:	NA		
Crew off-site:	20-Oct		
Fry stocking:	26-Jun	270,000	1.3 g
Smolt stocking Bear Lake	2-Jun	68,000	13.5 g
Fertilizer application:	12-Aug to 28-Aug	300 gallon	

Egg Take

Dates:	9-Oct to 13-Oct	
No. of females used:	240	
Green eggs:	545,000	
Fecundity:	3,775	
Eyed eggs:	462,000	
% Survival	84.8%	

Smolt Migration

Dates:	23-May to 5-Jul	
Cohos:	54,829	
Percent age 1:	60.1%	
Percent age 2:	39.9%	
Percent age 3:	0.0%	
Percent hatchery:	98.1%	
Dolly Varden:	44	

Adult Migration

Dates:	11-Aug to 19-Oct	
Coho total creek return:	1,245	
Weir return:	1,245	100%
C.R. harvest:	0	0%
Lake:	535	43%
Hatchery broodstock:	529	42%
Est. Remaining in Bear Ck:	181	15%
Est. Remaining in Salmon Ck:	0	0%

