Bear Lake
Salmon Enhancement
Progress Report
2011

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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 and through the harvest and sale of surplus 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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ACKNOWLEDGEMENTS

The 2011 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. Appreciation is extended to the Alaska SeaLife Center and Icicle SeaFoods for the collection of sockeye salmon otoliths from the commercial and common property harvests in Resurrection Bay.

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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 2011, 2.488 million sockeye fry (BY10) and 437,000 coho fry (BY10) were released into Bear Lake. At the time of release, the sockeye fry averaged 0.60 grams and the coho fry averaged 1.0 grams. All released fry were of Bear Lake origin. Due to an outbreak of IHN in the raceways, all fish to be released as smolts were destroyed (BY09). No coho smolts were released.

Smolt migration monitoring began on 20 May and continued daily until 05 July. During this time a total of 477,800 (± 52,300) sockeye and 40,400 (± 3,800) coho smolts migrated from the lake.

Based on otolith marks, 96.8% (± 1.8%) of the emigrating sockeye smolts were enhanced. An estimated 92.5% smolts were age 1 and 7.5% were age 2. The average length and weight of the age 1 sockeye smolts was 94 mm (± 0.9 mm) and 7.3 g (± 0.2 g) respectively. The age 2 sockeye smolts were 126 mm (± 2.6 mm) and 17.7 g (± 1.0 g).

Due to vandalism at the weir, 74% of the coho scale and otolith samples were lost. No enhanced or age contribution as well as average length/weight can be determined.

A total of 18,116 adult sockeye returned to Bear Creek in 2011. The returning sockeye salmon were age 1.2 (36.3%) or age 1.3 (61.8%). A total of 13,220 were passed into the lake, while the remaining 4,894 were harvested at the weir for cost recovery. An additional 145,459 were harvested in Resurrection Bay in cost recovery. In the common property, 56,111 were harvested in the commercial fishery and an estimated 20,000 fish were caught in the sport fishery. Total return of sockeye to Resurrection Bay was 240,484.

A total of 850 adult coho returned to Bear Creek weir in 2011. The returning fish were age 1.1 (23.3%), age 2.1 (74.0%) or 3.1 (2.7%). Of the adult coho returning, 0 were harvested and sold for cost recovery or donated, 491 were held and used as hatchery broodstock, and 359 were passed into Bear Lake.

From 28 July to 13 August 2011, 5,984,100 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 1,806 females were fertilized with milt from 1,806 males. All female adult sockeye salmon were injected with an antibiotic (erythromycin) prior to be passed up into the lake in order to reduce the prevalence of BKD in the spawning population.

From 06 October to 14 October 2011, 577,700 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 280,700 coho salmon eggs.

A total of 870 gallons of fertilizer was applied to Bear Lake in 2011. Limnological samples were collected in June (2x), July and August.

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 species[1].

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.

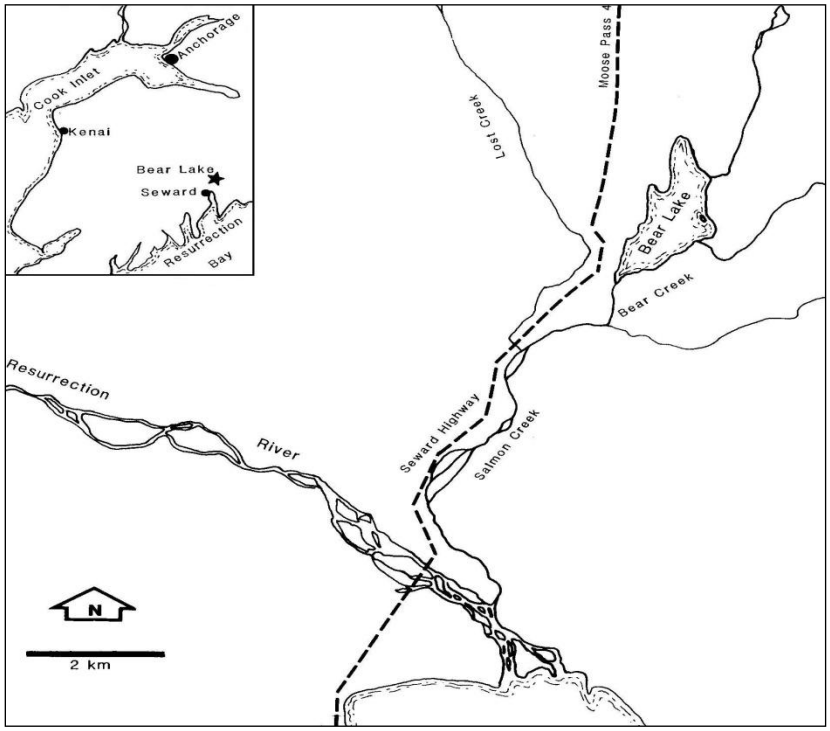

Figure 1. Map showing location of Bear Lake near Seward, Alaska.

Bear Lake has a watershed area of 15 km^2 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 X 10^6 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.

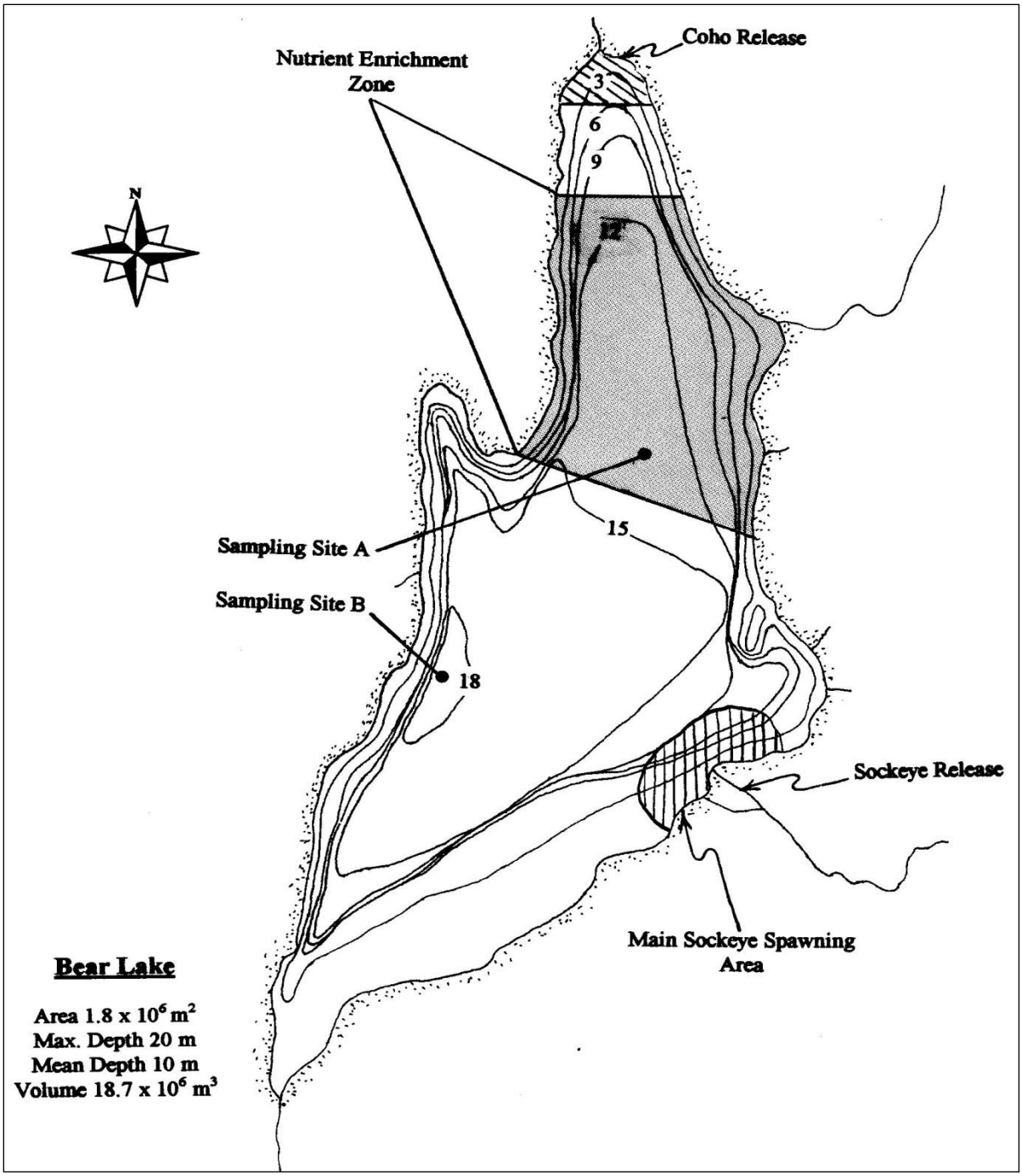

Figure 2. Bear Lake near Seward, Alaska

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 2011 were consistent with previous limnological sampling activities with the exception of the water sampler used (Kemmerer versus Van Dorn). These procedures are described by Koenings, et al. (1986).

During 2011, assessments of water quality were conducted 4 times (June (2x), July, August) throughout the open water season. 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 Kemmerer 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. Due to equipment failure, total nitrogen and carbon levels could not be analyzed.

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. Between 25 August and 03 September, no data was recorded.

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 16 June to 30 July. 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 2011 to identify, count and control the migration of all fish moving into or out of Bear Lake.

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.

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.

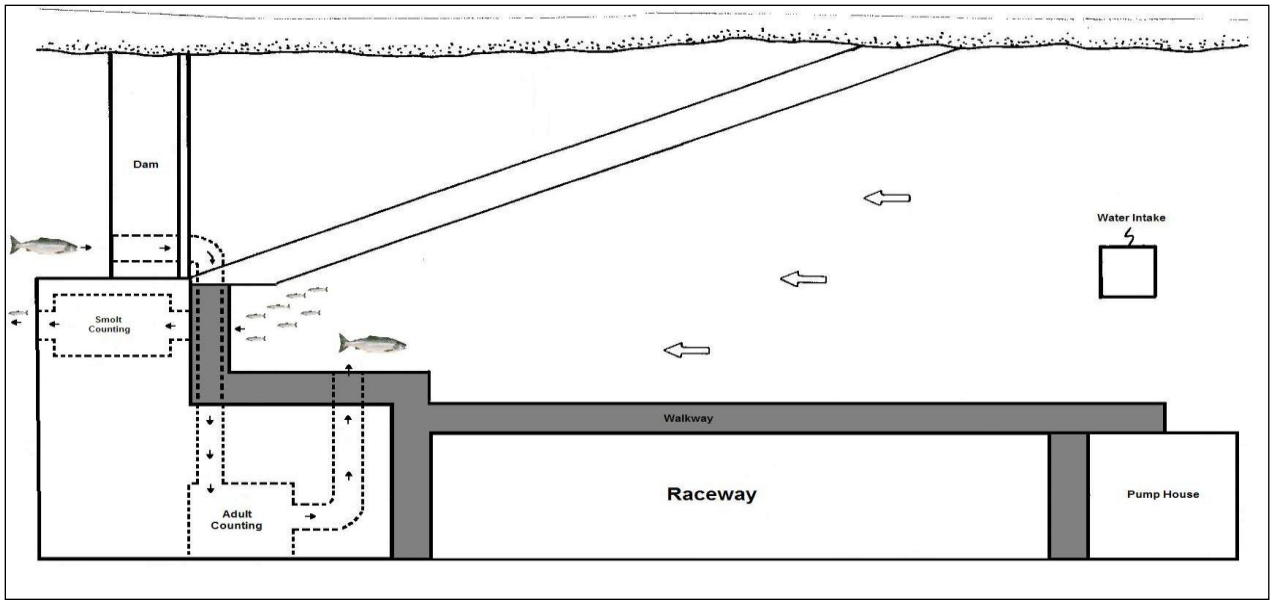

Figure 3. The Bear Creek weir, smolt trap and adult counting complex (Top View).

Assuming the two minute sub-sampling intervals were randomly distributed throughout sub-sampling[2] 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:

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

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

and the variance is,

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

And:

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

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

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 mark[3]. The purpose of this mark is to determine the contribution of released hatchery fish to the Bear Lake smolt population.

In 2011, smolts collected for measurement, age determination, and otolith removal were sampled in proportion to the daily smolt migration. This was accomplished by collecting every 1000th sockeye smolt and every 160th 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. However, due to vandalism at the weir 184/249 coho and 100/450 sockeye samples were destroyed. There were enough sockeye salmon samples to provide statistical validation to the calculations for enhanced and age contribution as well as average weight and length. However, there were insufficient samples to do the same for the migrating coho population. Age, weight and length measurements were available on 350 sockeye smolts (0.07%) and 65 coho smolts (0.16%).

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

Each smolt collected for evaluation was first measured to the nearest millimeter for fork length[4] and weighed to the nearest 0.1 gram. Several scales were then removed from the primary growth area[5] 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:

N = total number of migrating smolts,

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

n = total number of smolts sampled,

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

a = total number of enhanced smolts sampled,

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

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

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

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

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

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

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

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.

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 weight of the returning population of fish.

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). All female sockeye salmon that were passed into the lake received an erythromycin injection (0.17 - 0.20 mg/kg fish weight) to reduce the prevalence of BKD (Bacterial Kidney Disease) at the spawning ground.

Every 20th sockeye was sampled to assess sex, age and weight. For the coho adult migration, every 10th coho was sampled. In 2011, measurements were collected from 898 sockeye (5.0%) and 84 coho (9.9%).

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. 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 – 2,4H; Smolt – 3,2,3H).

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 – 4,3H). 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 2011, 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. Due to an outbreak of IHN in the raceways at the hatchery, all sockeye smolt production was destroyed. No smolts were stocked into Resurrection Bay.

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).

Otolith Collection in Resurrection Bay

With the stocking of sockeye salmon smolts into net pens in Resurrection Bay instead of Bear Lake, it became necessary to collect otoliths from fish harvested in Resurrection Bay (cost recovery and commercial harvests) in order to determine the percentage of return attributable to lake production versus net pen production (fry versus smolt production). The Alaska SeaLife Center (ASLC) performed this sampling as part of their salmon project requirements. Fish heads

were collected on a weekly basis at the fish processing plant (Icicle Seafoods) and otoliths were removed. Otoliths were sent to the ADF&G Mark Lab for analysis.

RESULTS AND DISCUSSION

Limnology, Environmental Conditions and Lake Fertilization

Bear Lake's limnological characteristics have been monitored for several years. The 2011 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 2011.

	1 meter depth											
Year	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/m2)
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
2010*	82	7.0	27	1.3	5.5	NA	4.1	NA :1	2.0	9.2	4.2	NA
2011*	85	7.6	30	1.4	15.2	NA	4.1	NA :1	3.2	8.6	4.4	NA

Averages prior to 1992 compiled by ADF&G.
EZD, Secchi and atomic ratio provided by CIAA.
Open water season only.
*2004 - 2011 - zooplankton data analysis is incomplete.
2010 data is a combination of both Site A & B
2010, 2011 TKN analysis is not complete due to equipment failure

Table 2. Water quality characteristics of Bear Lake in the hypolimnion, 1979 to 2011.

	Hypolimnion								
Year	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)
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
2010	86	6.7	28	4.1	23.0	NA	8.0	NA :1	8.9
2011	92	7.1	32	2.6	17.0	NA	5.3	NA :1	5.4

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)
2010 data is combination of both Site A and B.
2010, 2011 TKN analysis is not complete due to equipment failure.

The environmental conditions recorded in 2011 are presented in Appendix 2. Between 15 May and 30 June, the average air temperature was 9.9^{o}C (± 3.7^{o}C) while water temperature averaged 9.3^{o}C (± 3.2^{o}C). Average stage height below the weir was 1.2 ft (± 0.3 ft) and above the weir it was 1.6 ft (± 0.09 ft) for the same time period. Between 01 July and 31 October, the average air temperature was 10.4^{o}C (± 4.8^{o}C) while water temperature averaged 13.1^{o}C (± 3.9^{o}C). Average

stage height below the weir was 0.98 ft (± 0.04 ft) and above the weir it was 1.21 ft (± 0.02 ft). The environmental conditions observed in 2011 are compared to other years in Table 3.

Table 3. Environmental conditions observed at Bear Lake, 1990 to 2011.

May thru June 30

Year	Total Days	Clear	No. of Days <50% Cloud Cover	No. of Days >50% Cloud Cover	No. of Days 100% Overcast	Rain	Days Meas. Precip	Precip (mm)	Temperature (C) Air Avg	Air Range	Water Avg	Water 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)
2010	46	8	11	8	11	8	14	70	12	(7-20)	11	(4-14)
2011	47	7	2	4	23	10	23	111	10	(3-17)	9	(4-14)

July thru Sept/Oct/Nov

Year	Total Days	Clear	No. of Days <50% Cloud Cover	No. of Days >50% Cloud Cover	No. of Days 100% Overcast	Rain	Days Meas. Precip	Precip (mm)	Temperature (C) Air Avg	Air Range	Water Avg	Water 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)
2010	111	25	5	14	46	21	39	678	11	(2-18)	13	(7-16)
2011	93	18	6	16	32	21	44	671	10	(1-22)	13	(6-18)

*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 24 of the last 31 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 2011

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			1260	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			300	283	31	8/12 - 8/28	Almost daily
2010			600	566	61	6/13 - 8/22	Varied
2011			870	820	89	6/16 - 7/30	3 times/ week

Smolt Enumeration - Sockeye

Enumeration of Bear Lake sockeye smolts occurred between 20 May and 05 July. A total of 477,800 (± 52,300) sockeye smolts migrated from Bear Lake in 2011 (Appendix 3). The 10% sub-sampling procedure was used to count 79.3% of the migrating sockeye salmon.

The age 1.0 smolts averaged 94 mm (± 0.9 mm) in length and 7.3 g (± 0.2 g) in weight. The age 2.0 smolts averaged 126 mm (± 2.6 mm) in length and 17.7 g (± 1.0 g) in weight (Table 5). Based on the presence of hatchery induced thermal marks in the otoliths of 350 smolts, it was estimated that 96.8% (± 1.8%) of the sockeye smolts were of hatchery origin.

Smolt Enumeration - Coho

A total of 40,400 (± 3,800) coho salmon smolts migrated from Bear Lake in 2011 (Appendix 3) between 19 May and 30 June. The 10% sub-sampling procedure was used to count 40.3% of the migrating coho smolts.

Due to vandalism at the weir which resulted in the destruction of nearly all the coho samples (scales/otolith), no assessment on the enhanced rate, age or length/weight characteristics could be performed.

Adult Escapement - Sockeye

Adult sockeye salmon began arriving at the weir on 24 May 2011 and continued to migrate until 22 July 2011 (Appendix 4). During this time, 18,116 adults were captured and counted at the weir (Table 7). The returning major age groups for adult sockeye included ages 1.2 (36.3%), 1.3 (61.8%), 2.2 (0.8%) and 2.3 (0.8%). Of the 18,116 adult sockeye that migrated to Bear Creek in 2011, 4,894 were harvested for cost recovery and 13,220 were passed to the lake. Mortalities at the weir were 2 fish. An additional 56,111 fish were harvested in the seine fishery and an additional 145,959 fish in the saltwater cost recovery harvest. It was estimated that 20,000 fish were harvested in the sport fishery for a total return to Resurrection Bay of 240,484 sockeye salmon.

A summary of mean age and weight, by age class, for adult sockeye salmon escapement to the Bear Creek weir site for 2011 is presented in Appendix 6.

Adult Escapement - Coho

Adult coho salmon began arriving at the weir on 22 August 2011 and continued to migrate until

20 October (Appendix 5). During this time, 850 adults were captured and counted at the weir (Table 7). The returning major age groups for adult coho included ages 1.1 (23.3%), 2.1 (74.0%), and 3.1 (2.7%).

Of the 850 adult coho that were counted at the Bear Creek weir site, 0 were harvested, 491 were held for broodstock purposes and 359 were passed into the lake.

A summary of mean age and weight, by age class for adult salmon escapement to the Bear Creek weir site for 2011 is presented in Appendix 7.

Table 5. Sockeye smolt migrations: mean length and weight, by age class, for Bear Lake, 1980 to 2011.

						Age Composition								Average Length (mm)[6]					Average Weight (g)[6]				
Year	Number	95%CI	% Hatch.	95%CI	No. 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	8.0	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	96.4	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	94,000	26,600	9,400				88	0.4	96	1.1		6.2	0.2	8.3	0.5
2009	241,100	29,500	97.1	1.6	7,000			235,400	3,900	5,700	9,400				91	0.6	126	NA		6.7	0.1	17.6	NA
2010	598,900	47,500	93.9	1.8	36,500			544,800	14,000	53,300	14,100				88	0.5	124	1.4		5.9	0.2	16.7	0.8
2011[7]	477,800	52,300	96.8	1.8	15,300			442,000	13,700	35,800	13,700				94	0.9	126	2.6		7.3	0.2	17.7	1.0
Avg.[4]	543,000	60,600	82.8	3.0	45,200	11,400	5,600	495,475	21,200	36,300	9,200	3,800	2,300	119	104	0.8	131	3.6	17	10.7	0.8	24.6	3.2
Total[5]	10,186,100					157,600		9,184,200		669,350		21,923											

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

[1]In 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.

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

[3]In 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

[4]Average values calculated from smolt year 1995 to 2010.

[5]Total values calculated from 1980 to 2011.

[6]1980 thru 1992 averages are arithmetic, 1993 and later are weighted averages.

[7]Due to vandalism at the weir, some samples (68) (scales/otoliths) were missing or destroyed. For the samples that are missing length/weight as well enhanced and age characteristics were not used for calculations.

Table 6. Coho smolt migrations: mean length and weight, by age class, for Bear Lake, 1980 to 2011.

					Age Composition								Average Length (mm)[4]								Average Weight (g)[4]							
Year	Number	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				
2010	48,900	2,700	98.3	1.4	21,200	3,000	27,300	3,000					101	2.5	124	0.6					10.9	2.4	20.1	1.03				
2011[5]	40,400	3,800	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*					*NA*	*NA*	*NA*	*NA*					*NA*	*NA*	*NA*	*NA*				
Avg[2]	88,288	8,600	92.7	2.3	59,300	4,700	29,000	5,900	3,200	2,900	500	600	110		128		135		157		13.5		20.8		25.3		35.6	
Total[3]	2,825,200				1,800,600		897,400		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 rouinded to nearset 0.1 g. All other figures have been rounded to nearest 100 fish.

[1]Percent Hatchery calculated for Age 1.0 smolts only

[2]Average values calculated from smolt year 1980 to 2010.

[3]Total values calculated from 1980 to 2011.

[4]1980 thru 1992 averages are arithmetic, 1993 and later are weighted averages.

[5]Due to vandalism at the weir nearly all (184) of the 249 samples collected (scales/otoliths) were destroyed or missing therefore it is impossible to provide statistical validation to enhanced contribution, age contribution and length/weight information

Table 7. Historic returns of Coho and Sockeye Salmon to Bear Lake weir, 1980 to 2011.

	Weir	Coho Salmon			Weir	Sockeye Salmon										
	Retun	Age Composition			Retun	Age Composition										
Year	Total	1.1	2.1	3.1	Total	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
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	---11---		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
2010	1,230	805	395	30	15,864	0	18	0	12,323	0	2,095	0	1,369	59	0	0
2011	850	198	629	23	18116	0	25	0	6576	0	11187	25	151	151	0	0
Avg[1]	3,316	1,143	2,079	94	22,525	248	146	356	9,077	9	11,215	6	1,018	445	3	1
% of Avg	100%	34.5%	62.7%	2.8%	100%	1.1%	0.6%	1.6%	40.3%	0.0%	49.8%	0.02%	4.5%	2.0%	0.01%	0.1%

[1] Average calculation is based on 1994 data onward.

Hatchery Activities

Stocking

In 2011, 2.488 million sockeye fry (BY10; 4H) and 437,000 coho fry (BY10; 2,2H) were released into Bear Lake. These fish will migrate in 2012/2013 as smolts. At the time of release, the sockeye fry averaged 0.60 gm and the coho fry averaged 1.0 gm.

Due to an IHN outbreak, no sockeye smolts were stocked and released from net pens in Resurrection Bay. No coho smolts were released in 2011. A summary of releases are provide in Table 8.

Eggtake

Between 28 July and 13 August 2011, a total of 5,984,100 sockeye salmon eggs were collected. A total of 3,512 broodfish were used (1,806 females; 1,806 males) providing an average fecundity of 3,313 eggs/female. A total of 219 fish were either inviable or mortalities. Disease screening indicated that 22.6% of the samples collected were positive for *R. salmoninarum*.

From 06 October to 14 October 2011, a total of 577,700 coho eggs were collected from 144 females and fertilized with milt from 96 males. Average fecundity was 4,012 eggs/female. An additional 280,700 coho eggs were collected by ADF&G Fort Richardson Hatchery. Approximately 36,000 eggs were culled due to the incidence of BKD. Due to a number of power interruptions and delays in water recovery due to plumbing issues the survival to the eyed stage was very poor (54%).

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

Fry-to-Smolt Survival

Migrating smolts in 2011 were stocked either as fry in 2009 (BY08 - Age 2) and 2010 (BY09 - Age 1). Based on age classification from otoliths/scales, the fry-to-smolt survival for each brood year of fry stocking can be determined. Information could not be completed for the coho salmon, since scale and otolith samples were destroyed (vandalism at the weir). 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. Using otolith data collected by the ASLC in 2010 and again in 2011, the percentage of the total return attributable to the lake production (fry stocking program) and the net pen production (smolt stocking program) can be calculated (BY2006 onward). This information is summarized below in Table 11.

Table 8. Coho and sockeye salmon releases at Bear Lake, 1986 to 2011.

	Coho				Sockeye					
Release Year	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	0.60			1,600,000	10.4
2009[6]	270,000	1.3	68,000	13.5	2,543,000	0.50			1,675,000	13.2
2010[6]	435,000	1.2			2,200,000	0.65			1,650,000	13.6
2011[7]	437,000	1.0			2,488,000	0.60				
Total	10,133,800		2,675,330		36,238,000		2,009,000		8,058,200	
Ave	375,326	0.96	157,372	11.4	1,575,565	0.50	669,667	3.96	805,820	9.59

[1] Released into Bear Lake
[2] Extra Fry Released into Bear Creek
[3] sockeye fry relase, 445, 300 @ .36g & 335,300 @ .38g
[4] sockeye fry release, 1,573,000 @ (.35-.45 g) & 223,000 @2.7 g
[5]An additional 103,000 coho smolts @ 12.7g (Bear Lake brood year 2001) were released at the Homer Spit.
[6]Sockeye smolt stocking was into net pens at Resurrection Bay not Bear Lake
[7]No smolts into Resurrection Bay in 2011 due to IHN outbreak at hatchery. All smolts destroyed (BY09).

Table 9. Eggs collected for Bear Lake enhancement, 1989 to 2011.

	Coho				Sockeye			
Brood Year	Brood Stock	Green Eggs	Eyed Eggs	%	Brood Stock	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	1,414,800	1,252,800	88.5	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
2010	Bear L	647,000	501,000	77.4	Bear L	5,400,000	4,810,000	89.1
2011	Bear L	577,700	312,400	54.1	Bear L	5,984,100	5,586,600	93.4
Total		20,780,672	17,405,192			89,636,700	77,075,000	
Ave				82.1				82.6

Table 10. Bear Lake smolt production by brood years.

	Coho							Sockeye						
Brood Year	Escap.	No. Fry Stocked	Size (g)	No. Smolt	Hatch Smolt	% Hatch. Survival	Brood Year	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	60,262	59,172	16.4	2007	8,420	2,400,000	0.60	288,658	278,582	11.6
2008	368	270,000	1.3	IC	IC	IC	2008 *	8,992	2,543,000	0.50	580,600	563,655	22.2
2009 *	535	435,000	1.2	IC	IC	IC	2009 *	9,977	2,200,000	0.65	442,000	427,856	19.4
2010 *	492	437,000	1.0				2010 *	8,564	2,488,000	0.60			
2011 *	359						2011 *	9,389					
Ave[1]	469	393,100	0.96	92,432	84,647	22.1	Ave[1]	9,278	1,713,600	0.52	553,840	338,482	22.3

* Incomplete broodyear

[1]Average data is for 1993 onward. For # Smolt, Hatchery Smolt and % Survival only includes completed years only.

Smolt numbers are rounded to the nearest 100 fish.

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

IC- data can't be completed due to samples being lost/destroyed

* Incomplete broodyear

[1]Average data is for 1993 onward. For # Smolts, Hatchery Smolt and % Survival only includes includes completed years only

Smolt numbers are rounded to the nearest 100 fish.

Note: Number of Hachery 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 - BY2009 hatchery smolt is from fry stocking only. Smolt stocking went to Resurrection Bay

Table 11. Marine survival for sockeye at Bear Lake (BY1989 to BY2008)

BY	Lake (Fry) Marine Survival	NetPen (Smolt) 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	
2004	11.0	
2005	1.2	
2006	*60.1*	*0.1*
2007	*25.0*	*2.3*
2008	*0.0*	*0.0*
AVE	14.7	NA

Red/italics indicates incomplete brood year.
Average is calculated using complete brood years only.

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RECOMMENDATIONS

Greater examination is required to determine the possible reasons for the decline in coho smolt production and the adult returns to Bear Lake. In order to assess the marine survival for coho salmon, an assessment on the number of fish harvested in the sport fishery is necessary. CIAA and ADFG should collaborate on performing this assessment.

Starting in 2012, CIAA will need to collect otoliths from the fishery in Resurrection Bay (ASLC no longer performing the sampling). Based on the lake production marine survivals for BY2005 (1.2%) and for BY2006 (60%), CIAA should have the ADF&G provide us with those otoliths collected by ASLC in order to perform a secondary read to double check the marks.

An evaluation of the Trail Lakes Hatchery marking program should be performed to ensure that the different thermal marks are easily distinguishable and of high quality.

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APPENDICES

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Appendix 1. Bear Lake 2011 - 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)
6/3/2011	B	1	11.6	3.6	1.5		2.0	4.1	NA :1	2559		7.31	NA	NA
	B	12	17.5	5.3	3.7		17.5	4.1	NA :1	2835		3.65	0.21	
6/29/2011	B	1	28.6	15.4	12.9		18.7	4.1	NA :1	2487		1.54	0.34	8.1
	B	12	16.8	4.4	2.7		3.0	9.0	NA :1	2698		10.89	NA	
8/1/2011	B	1	9.2	3.8	1.9		5.2	4.1	NA :1	2079		0.86	0.23	10.9
	B	10	16.8	5.0	2.2		3.9	4.1	NA :1	2330		5.84	1.09	
9/9/2011	B	1	11.5	4.1	2.3		2.5	5.0	NA :1	2047		4.52	NA	6.9
	B	15	17.0	7.4	3.7		17.5	4.1	NA :1	2479		1.15	0.47	
Mean			16.1	6.1	3.9	NA	8.8	4.8	NA :1	2439	#DIV/0!	4.5	0.5	8.6
Min			9.2	3.6	1.5	0.0	2.0	4.1	NA :1	2047	0	0.9	0.2	6.9
Max			28.6	15.4	12.9	0.0	18.7	9.0	NA :1	2835	0	10.9	1.1	10.9
1m Ave			15.2	7.6	5.4	NA	8.6	4.1	NA :1	2375	#DIV/0!	3.2	0.3	8.6
Hypo Ave			17.0	5.5	3.1	NA	10.5	5.3	NA :1	2586	#DIV/0!	5.4	0.6	

* 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)
6/3/2011	B	1	83	7.4	29.5	1.9	6	12.5	0.7	54	3.0
	B	12	91	7.1	32.7	2.6	8	12.8	0.7	100	
6/29/2011	B	1	84	7.6	30.3	1.0	5	12.4	0.8	11	4.0
	B	12	90	7.0	31.5	3.8	8	12.8	0.9	90	
8/1/2011	B	1	90	7.7	30.8	0.4	5	13.0	0.9	13	7.5
	B	10	92	7.4	31.4	2.3	5	13.2	0.9	26	
9/9/2011	B	1	82	7.5	29.6	2.2	9	12.8	0.9	27	3.0
	B	15	93	7.0	33.9	1.6	11	13.6	1.1	154	
Mean			88	7.3	31.2	2.0	7.1	12.9	0.9	59.4	4.4
Min			82	7.0	29.5	0.4	5.0	12.4	0.7	11.0	3.0
Max			93	7.7	33.9	3.8	11.0	13.6	1.1	154	7.5
1m Ave			84.8	7.6	30.1	1.4	6.3	12.7	0.8	26.3	4.4
Hypo Ave			91.5	7.1	32.4	2.6	8.0	13.1	0.9	92.5	

Appendix 1. (continued) Bear Lake 2011 - Zooplankton Analysis

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

Appendix 2. Bear Lake 2011 - Environmental Conditions

Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-May						
2-May						
3-May						
4-May						
5-May						
6-May						
7-May						
8-May						
9-May						
10-May						
11-May						
12-May						
13-May						
14-May						
15-May	5	0		1.52	6	5
16-May	4	2.6		1.52	6	5
17-May	5	5.2		1.52	6	6
18-May	5	1		1.52	6	6
19-May	5	17.6	1	1.58	4	5
20-May	5	22.8	1.1	1.68	5	8
21-May	4	0.8	1.08	1.7	5	10
22-May	5	5	1.17	1.72	5	9
23-May	3	3	1.09	1.7	5	11
24-May	1	0	1.08	1.7	5	11
25-May	2	0	1.08	1.7	5	12
26-May	3	0	1	1.68	5	17
27-May	2	0	1.06	1.68	8	16
28-May	5	0	1.07	1.68	8	12
29-May	1	10	1.07	1.68	8	13
30-May	4	0	1.08	1.67	8	8
31-May	4	0	1.08	1.67	8	7

Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Jun	5	1	1.08	1.67	8	15
2-Jun	4	0	1.09	1.67	8	6
3-Jun	5	12.2	1.1	1.67	7	5
4-Jun	4	6	1.8	1.64	7	6
5-Jun	3	4.2	1.8	1.61	8	7
6-Jun	1	0	1.8	1.55	8	13
7-Jun	4	0	1.7	1.54	9	3
8-Jun	4	4	1.7	1.53	9	7
9-Jun	4	1	1.8	1.53	9	7
10-Jun	4	1.8	1.7	1.52	9	8
11-Jun	4	0	1.6	1.52	9	8
12-Jun	4	0	0.98	1.5	11	7
13-Jun	4	0	0.96	1.47	11	7
14-Jun	5	0.98	1.02	1.47	11	9
15-Jun	4	0.98	1	1.49	11	9
16-Jun	1	1.8	0.99	1.49	11	12
17-Jun	4	0	0.97	1.49	12	7
18-Jun	4	0.6	0.96	1.49	12	8
19-Jun	4	0.8	0.94	1.49	13	9
20-Jun	4	0	0.94	1.49	13	12
21-Jun	3	0	0.96	1.49	13	15
22-Jun	1	0	0.98	1.5	13	17
23-Jun	0	0	0.94	1.5	14	14
24-Jun	1	0	0.93	1.5	14	14
25-Jun	4	0	0.92	1.5	14	11
26-Jun	4	1.2	0.92	1.5	13	11
27-Jun	4	0	0.91	1.5	14	12
28-Jun	4	6.2	0.91	1.5	14	16
29-Jun	1	0	0.91	1.5	14	16
30-Jun	4	0	0.98	1.52	14	12

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 2011 - Environmental Conditions

Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Jul	4	0	0.96		14	8
2-Jul	3	11.6	0.96		14	13
3-Jul	1	0	0.96		15	17
4-Jul	3	0	0.96		15	15
5-Jul	1	0	0.96	1.23	16	17
6-Jul	1	0	0.96	1.23	16	17
7-Jul	4	0	0.95	1.23	16	11
8-Jul	4	0	0.96	1.23	15	11
9-Jul	4	0	0.96	1.23	15	12
10-Jul	4	0	0.96	1.23	15	16
11-Jul	4	0	0.95	1.22	15	16
12-Jul	4	3.6	0.94	1.21	16	16
13-Jul	4	0	0.96	1.21	17	17
14-Jul	2	0	0.96	1.21	18	20
15-Jul	1	0	0.95	1.2	18	22
16-Jul	2	0	0.96	1.19	18	14
17-Jul	4	0	0.94	1.18	17	16
18-Jul	3	12.5	0.94	1.18	17	17
19-Jul	1	0	0.96	1.18	18	18
20-Jul	1	0	0.96	1.18	18	16
21-Jul	2	2.6	0.96	1.18	18	16
22-Jul	1	0	0.96	1.18	18	20
23-Jul	3	2.8	0.96	1.18	18	14
24-Jul	4	11	1	1.22	14	14
25-Jul	4	2.6	1.03	1.23	14	13
26-Jul	4	5.6	1.08	1.24	14	12
27-Jul	3	1.6	1.05	1.24	16	16
28-Jul	2	0	1.04	1.23	17	16
29-Jul	1	0	1.04	1.23	17	17
30-Jul	3	0	1.03	1.22	17	17
31-Jul	3	0	1.03	1.21	16	15

Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Aug	4	2.6	1.03		16	13
2-Aug	5	29.8			16	12
3-Aug	5	26.2			16	12
4-Aug	5	21.6			15	8
5-Aug	4	7			16	8
6-Aug	4	0			16	8
7-Aug	5	22			16	9
8-Aug	5	28.2			16	10
9-Aug	4	0			16	10
10-Aug	3	0			16	12
11-Aug	3	0			16	14
12-Aug	1	0			16	12
13-Aug	3	0			16	14
14-Aug	3	0			16	12
15-Aug	4	1.2			16	12
16-Aug	2	0			16	14
17-Aug	4	6.4			16	12
18-Aug	5	5.8			16	11
19-Aug	4	4.2			16	12
20-Aug	5	12.6			16	11
21-Aug	4	6.6			16	10
22-Aug	5	6.8			16	9
23-Aug	4	1.6			16	8
24-Aug	4	0			16	8
25-Aug						
26-Aug						
27-Aug						
28-Aug						
29-Aug						
30-Aug						
31-Aug						

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 2011 - Environmental Conditions

Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Sep						
2-Sep						
3-Sep						
4-Sep						
5-Sep						
6-Sep						
7-Sep						
8-Sep						
9-Sep						
10-Sep						
11-Sep						
12-Sep						
13-Sep						
14-Sep	5	23.4			12	8
15-Sep	5	16.2			12	8
16-Sep	5	10.2			12	9
17-Sep	4	5			11	10
18-Sep	3	2.4			11	10
19-Sep	5	58.8			11	4
20-Sep	5	80			11	4
21-Sep	3	17.5			11	8
22-Sep	5	16.2			11	6
23-Sep	4	1			9	11
24-Sep	4	2.8			9	10
25-Sep	3	1.2			11	8
26-Sep	1	0			10	9
27-Sep	1	0			10	10
28-Sep	1	0			10	6
29-Sep	1	0			10	7
30-Sep	3	0			10	7

Date	Sky	Precip. (mm)	Lower Gauge (ft)	Upper Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Oct	5	63			10	6
2-Oct	5	78			8	3
3-Oct	4	0			8	4
4-Oct	4	0			8	4
5-Oct	1	0			8	6
6-Oct	5	2.6			8	8
7-Oct	5	2.1			8	5
8-Oct	3	0.9			8	7
9-Oct	4	0			7	4
10-Oct	1	0			7	4
11-Oct	1	0			7	3
12-Oct	1	0			7	6
13-Oct	4	0			7	6
14-Oct	5	27.6			7	6
15-Oct	5	10			7	5
16-Oct	4	2.8			7	4
17-Oct	4	0			7	3
18-Oct	2	0			6	1
19-Oct	1	0			6	1
20-Oct	4	0			6	6
21-Oct	5	12.5			6	2
22-Oct						
23-Oct						
24-Oct						
25-Oct						
26-Oct						
27-Oct						
28-Oct						
29-Oct						
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 2011 - Smolt Migration.

	Sockeye		Coho		Dolly Varden		Rainbow Trout	
Date	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
16-May		0		0		0		0
17-May		0		0		0		0
18-May		0		0		0		0
19-May	0	0	0	0	0	0	0	0
20-May	969	969	39	39	1	1	1	1
21-May	312	1,281	14	53	1	2	0	1
22-May	1,556	2,837	33	86	5	7	3	4
23-May	8,525	11,362	60	146	1	8	2	6
24-May	34,478	45,840	103	249	113	121	10	16
25-May	1,607	47,447	19	268	1	122	1	17
26-May	59,821	107,268	783	1,051	113	235	32	49
27-May	64,654	171,922	923	1,974	685	920	5	54
28-May	46,640	218,562	1,592	3,566	358	1,278	10	64
29-May	36,832	255,394	1,395	4,961	420	1,698	49	113
30-May	42,084	297,478	1,278	6,239	496	2,194	7	120
31-May	22,031	319,509	1,082	7,321	91	2,285	21	141
01-Jun	17,531	337,040	1,792	9,113	166	2,451	1	142
02-Jun	30,496	367,536	2,599	11,712	174	2,625	1	143
03-Jun	4,577	372,113	383	12,095	16	2,641	1	144
04-Jun	5,968	378,081	1,320	13,415	1	2,642	97	241
05-Jun	11,828	389,909	2,835	16,250	0	2,642	214	455
06-Jun	10,675	400,584	2,842	19,092	1	2,643	149	604
07-Jun	8,364	408,948	2,177	21,269	3	2,646	150	754
08-Jun	6,073	415,021	1,853	23,122	2	2,648	88	842
09-Jun	4,924	419,945	1,847	24,969	0	2,648	46	888
10-Jun	4,959	424,904	2,781	27,750	2	2,650	16	904
11-Jun	2,744	427,648	1,058	28,808	0	2,650	13	917
12-Jun	2,377	430,025	812	29,620	3	2,653	12	929
13-Jun	2,176	432,201	595	30,215	1	2,654	24	953
14-Jun	3,885	436,086	900	31,115	16	2,670	8	961
15-Jun	1,310	437,396	128	31,243	0	2,670	4	965
16-Jun	2,946	440,342	128	31,371	0	2,670	11	976
17-Jun	3,718	444,060	328	31,699	0	2,670	4	980
18-Jun	1,052	445,112	94	31,793	0	2,670	0	980
19-Jun	5,293	450,405	150	31,943	0	2,670	0	980
20-Jun	1,716	452,121	239	32,182	0	2,670	0	980
21-Jun	2,441	454,562	613	32,795	3	2,673	0	980
22-Jun	9,307	463,869	863	33,658	0	2,673	0	980
23-Jun	2,312	466,181	342	34,000	0	2,673	1	981
24-Jun	1,831	468,012	560	34,560	1	2,674	1	982
25-Jun	4,936	472,948	440	35,000	0	2,674	1	983
26-Jun	2,956	475,904	3,148	38,148	3	2,677	1	984
27-Jun	186	476,090	97	38,245	0	2,677	0	984
28-Jun	611	476,701	372	38,617	0	2,677	0	984
29-Jun	141	476,842	175	38,792	4	2,681	0	984
30-Jun	162	477,004	320	39,112	0	2,681	0	984
01-Jul	286	477,290	447	39,559	0	2,681	0	984
02-Jul	273	477,563	401	39,960	0	2,681	0	984
03-Jul	128	477,691	288	40,248	0	2,681	0	984
04-Jul	86	477,777	101	40,349	0	2,681	0	984
05-Jul	67	477,844	84	40,433	0	2,681	0	984
06-Jul		477,844		40,433		2,681		984
07-Jul		477,844		40,433		2,681		984
08-Jul		477,844		40,433		2,681		984
09-Jul		477,844		40,433		2,681		984
10-Jul		477,844		40,433		2,681		984
11-Jul		477,844		40,433		2,681		984
Totals		477,844		40,433		2,681		984

Appendix 4. Bear Lake 2011 - Adult Sockeye Salmon Migration.

Date	Lake Escapement Males	Females	Combined	Donate & Harvest	Morts	Daily Total	Cumm. Total
20-May							
21-May			0			0	0
22-May			0			0	0
23-May			0			0	0
24-May	2	0	2	0	0	2	2
25-May	0	0	0	0	0	0	2
26-May	35	0	35	0	0	35	37
27-May	24	11	35	0	0	35	72
28-May	6	2	8	0	0	8	80
29-May	29	11	40	0	0	40	120
30-May	157	34	191	0	0	191	311
31-May	42	26	68	0	0	68	379
01-Jun	137	64	201	0	0	201	580
02-Jun	302	126	428	0	0	428	1,008
03-Jun	55	8	63	0	0	63	1,071
04-Jun	282	97	379	0	0	379	1,450
05-Jun	256	129	385	0	0	385	1,835
06-Jun	262	150	412	0	0	412	2,247
07-Jun	406	186	592	0	0	592	2,839
08-Jun	295	172	467	0	0	467	3,306
09-Jun	428	311	739	0	0	739	4,045
10-Jun	372	186	558	0	0	558	4,603
11-Jun	495	325	820	0	0	820	5,423
12-Jun	555	200	755	0	0	755	6,178
13-Jun	588	205	793	1	0	794	6,972
14-Jun	731	402	1,133	2	0	1,135	8,107
15-Jun	539	269	808	0	0	808	8,915
16-Jun	591	309	900	0	0	900	9,815
17-Jun	785	240	1,025	0	2	1,027	10,842
18-Jun	0	224	224	328	0	552	11,394
19-Jun	0	255	255	439	0	694	12,088
20-Jun	0	252	252	653	0	905	12,993
21-Jun	0	121	121	937	0	1,058	14,051
22-Jun	0	100	100	0	0	100	14,151
23-Jun	0	199	199	463	0	662	14,813
24-Jun	0	114	114	286	0	400	15,213
25-Jun	0	158	158	166	0	324	15,537
26-Jun	0	94	94	19	0	113	15,650
27-Jun	0	162	162	246	0	408	16,058
28-Jun	0	158	158	17	0	175	16,233
29-Jun	0	101	101	291	0	392	16,625
30-Jun	0	44	44	28	0	72	16,697
01-Jul	0	95	95	21	0	116	16,813
02-Jul	0	80	80	210	0	290	17,103
03-Jul	0	76	76	128	0	204	17,307
04-Jul	0	30	30	22	0	52	17,359
05-Jul	0	120	120	78	0	198	17,557
06-Jul	0	0	0	49	0	49	17,606
07-Jul	0	0	0	84	0	84	17,690
08-Jul	0	0	0	81	0	81	17,771
09-Jul	0	0	0	20	0	20	17,791
10-Jul	0	0	0	82	0	82	17,873
11-Jul	0	0	0	38	0	38	17,911
12-Jul	0	0	0	19	0	19	17,930
13-Jul	0	0	0	11	0	11	17,941
14-Jul	0	0	0	18	0	18	17,959
15-Jul	0	0	0	17	0	17	17,976
16-Jul	0	0	0	0	0	0	17,976
17-Jul	0	0	0	33	0	33	18,009
18-Jul	0	0	0	0	0	0	18,009
19-Jul	0	0	0	51	0	51	18,060
20-Jul	0	0	0	0	0	0	18,060
21-Jul	0	0	0	0	0	0	18,060
22-Jul	0	0	0	56	0	56	18,116
23-Jul	0	0	0	0	0	0	18,116
24-Jul	0	0	0	0	0	0	18,116
25-Jul	0	0	0	0	0	0	18,116
26-Jul	0	0	0	0	0	0	18,116
27-Jul	0	0	0	0	0	0	18,116
28-Jul	0	0	0	0	0	0	18,116
29-Jul			0			0	18,116
30-Jul			0			0	18,116
31-Jul			0			0	18,116
01-Aug			0			0	18,116
02-Aug			0			0	18,116
03-Aug			0			0	18,116
04-Aug			0			0	18,116
05-Aug			0			0	18,116
06-Aug			0			0	18,116
07-Aug			0			0	18,116
08-Aug			0			0	18,116
Total	7,374	5,846	13,220	4,894	2	18,116	

Appendix 5. Bear Lake 2011 - Adult Coho Salmon Migration.

	Lake Escapement			Broodstock			Harvest *			Total		Raceway	Daily	Cumm
Date	Males	Females	Combined	Males	Females	Combined	Males	Females	Combined	Males	Females	Morts	Total	Total
22-Aug	2	1	3	0	0	0	0	0	0	2	1	0	3	3
23-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	3
24-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	3
25-Aug			0			0			0	0	0		0	3
26-Aug			0			0			0	0	0		0	3
27-Aug			0			0			0	0	0		0	3
28-Aug			0			0			0	0	0		0	3
29-Aug			0			0			0	0	0		0	3
30-Aug			0			0			0	0	0		0	3
31-Aug			0			0			0	0	0		0	3
1-Sep			0			0			0	0	0		0	3
2-Sep			0			0			0	0	0		0	3
3-Sep			0			0			0	0	0		0	3
4-Sep			0			0			0	0	0		0	3
5-Sep			0			0			0	0	0		0	3
6-Sep	8	3	11	0	0	0	0	0	0	8	3	0	11	14
7-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	14
8-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	14
9-Sep	9	9	18	0	0	0	0	0	0	9	9	0	18	32
10-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	32
11-Sep	33	20	53	0	0	0	0	0	0	33	20	0	53	85
12-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	85
13-Sep	36	14	50	0	0	0	0	0	0	36	14	0	50	135
14-Sep	29	13	42	0	0	0	0	0	0	29	13	0	42	177
15-Sep	7	4	11	0	0	0	0	0	0	7	4	0	11	188
16-Sep	15	5	20	0	0	0	0	0	0	15	5	0	20	208
17-Sep	10	6	16	0	0	0	0	0	0	10	6	0	16	224
18-Sep	9	7	16	0	0	0	0	0	0	9	7	0	16	240
19-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	240
20-Sep	35	15	50	0	0	0	0	0	0	35	15	0	50	290
21-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	290
22-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	290
23-Sep	7	22	29	0	0	0	0	0	0	7	22	0	29	319
24-Sep	16	10	26	7	0	7	0	0	0	23	10	0	33	352
25-Sep	5	7	12	3	6	9	0	0	0	8	13	0	21	373
26-Sep	1	1	2	0	7	7	0	0	0	1	8	0	9	382
27-Sep	0	0	0	12	13	25	0	0	0	12	13	0	25	407
28-Sep	0	0	0	13	9	22	0	0	0	13	9	0	22	429
29-Sep	0	0	0	10	10	20	0	0	0	10	10	0	20	449
30-Sep	0	0	0	4	6	10	0	0	0	4	6	0	10	459
1-Oct	0	0	0	7	6	13	0	0	0	7	6	0	13	472
2-Oct	0	0	0	3	0	3	0	0	0	3	0	0	3	475
3-Oct	0	0	0	19	16	35	0	0	0	19	16	0	35	510
4-Oct	0	0	0	26	49	75	0	0	0	26	49	0	75	585
5-Oct	0	0	0	32	70	102	0	0	0	32	70	0	102	687
6-Oct	0	0	0	28	36	64	0	0	0	28	36	0	64	751
7-Oct	0	0	0	8	22	30	0	0	0	8	22	0	30	781
8-Oct	0	0	0	9	23	32	0	0	0	9	23	0	32	813
9-Oct	0	0	0	4	12	16	0	0	0	4	12	0	16	829
10-Oct	0	0	0	1	4	5	0	0	0	1	4	0	5	834
11-Oct	0	0	0	1	0	1	0	0	0	1	0	0	1	835
12-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	835
13-Oct	0	0	0	0	1	1	0	0	0	0	1	0	1	836
14-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	836
15-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	836
16-Oct	0	0	0	2	0	2	0	0	0	2	0	0	2	838
17-Oct	0	0	0	3	7	10	0	0	0	3	7	0	10	848
18-Oct	0	0	0	0	2	2	0	0	0	0	2	0	2	850
19-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	850
20-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	850
Total	222	137	359	192	299	491	0	0	0	414	436	0	850	

Appendix 6. Bear Lake 2011 – Adult Sockeye Age and Sex Characteristics

	Age						
	1.1	1.2	1.3	2.1	2.2	2.3	Total
Sample Period:	24 May through 22 July						
Males (No.)	0	2,444	2,998	25	101	25	5,594
Percent	0.0%	43.7%	53.6%	0.5%	1.8%	0.5%	30.9%
Sample Size	0	97	119	1	4	1	222
Total Sample Size							287
Mean Length (mm)							
Std. Deviation							
Std. Error							
Mean Weight (kg)		2.33	3.02	0.80	2.73	3.60	2.73
Std. Deviation		0.45	0.46		0.59		0.58
Std. Error		0.05	0.04		0.29		0.03
Females (No.)	25	4,132	8,189	0	50	126	12,522
Percent	0.2%	33.0%	65.4%	0.0%	0.4%	1.0%	69.1%
Sample Size	1	164	325	0	2	5	497
Total Sample Size							611
Mean Length (mm)							
Std. Deviation							
Std. Error							
Mean Weight (kg)	1.90	2.17	2.80		2.70	2.88	2.61
Std. Deviation		0.34	0.37		0.42	0.54	0.47
Std. Error		0.03	0.02		0.30	0.24	0.02
Both Sexes (No.)	25	6,576	11,187	25	151	151	18,116
Percent	0.1%	36.3%	61.8%	0.1%	0.8%	0.8%	99.9%
Sample Size	1	261	444	1	6	6	719
Total Sample Size							898
Mean Length (mm)							
Std. Deviation							
Std. Error							
Mean Weight (kg)	1.90	2.23	2.86	0.80	2.72	3.00	2.65
Std. Deviation		0.39	0.40		0.49	0.57	0.51
Std. Error		0.02	0.02		0.20	0.23	0.02

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

Appendix 7. Bear Lake 2011 – Adult Coho Age and Sex Characteristics

	Age			
	1.1	2.1	3.1	Total
Sample Period:	22 August through 20 October			
Males (No.)	140	431	23	594
Percent	23.5%	72.5%	3.9%	69.9%
Sample Size	12	37	2	51
Total Sample Size				61
Mean Length (mm)	557	568	587	564
Std. Deviation	39.8	54.5	99.7	53.2
Std. Error	11.5	9.0	70.5	6.8
Mean Weight (kg)	2.39	2.83	3.45	2.71
Std. Deviation	0.59	0.87	1.91	0.87
Std. Error	0.17	0.14	1.35	0.11
Females (No.)	5	17	0	22
Percent	22.7%	77.3%	0.0%	2.6%
Sample Size	5	17	0	22
Total Sample Size				23
Mean Length (mm)	545	590		580
Std. Deviation	42.9	31.5		37.7
Std. Error	19.2	7.6		7.9
Mean Weight (kg)	2.40	3.17		2.99
Std. Deviation	0.56	0.59		0.64
Std. Error	0.25	0.14		0.13
Both Sexes (No.)	198	629	23	850
Percent	23.3%	74.0%	2.7%	100.0%
Sample Size	17	54	2	73
Total Sample Size				84
Mean Length (mm)	554	575	587	568
Std. Deviation	39.8	49.2	99.7	49.8
Std. Error	9.7	6.7	70.5	5.4
Mean Weight (kg)	2.39	2.93	3.45	2.78
Std. Deviation	0.56	0.80	1.91	0.82
Std. Error	0.14	0.11	1.35	0.09

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

Appendix 8. Bear Lake 2011 – Project Updates

Sockeye Salmon Project

Stocking & Misc. Activities

Crew on-site:	15-May		
Ice-out:	NA		
Crew off-site:	21-Oct		
Fry stocking:	22-Jun	2,488,000	0.6 g
PreSmolt stocking:			
Smolt stocking:(Res Bay)		IHN	
Fertilizer application:	16-Jun to 30-Jul	870 gallon	

Egg Take

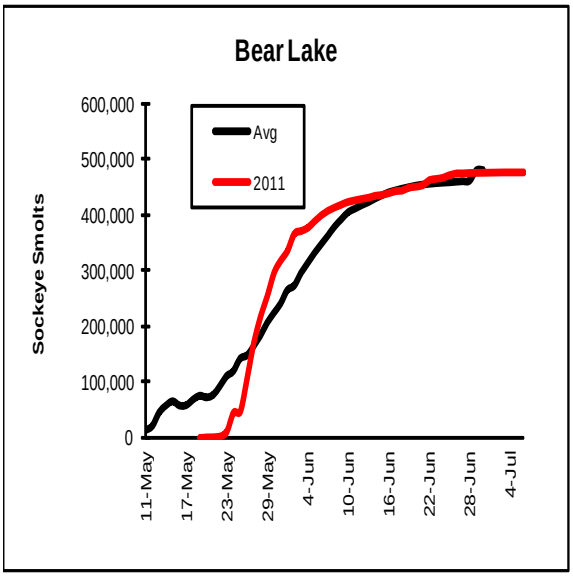
Dates:	28-Jul to 13-Aug	
No. of broodstock used:		3,512
Green eggs:		5,984,000
Fecundity:		3,313
Eyed eggs:		5,586,600
% Survival		93.4%

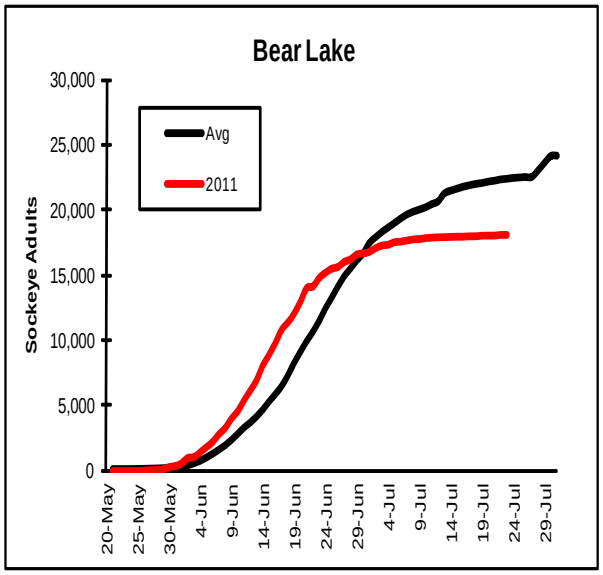
Smolt Migration

Dates:	20-May to 5-Jul	
Sockeyes:		477,800
Percent age 1:		92.5%
Percent age 2:		7.5%
Percent age 3:		0.0%
Percent hatchery:		96.8%
Dolly Varden:		2,681

Adult Migration

Dates:	24-May to 22-Jul		
Total return:		240,484	
Commercial & Sport Fish harvest:		76,411	32%
C.R. harvest(FW & SW):		150,853	63%
Lake:		13,220	5%
Mortalities		0	
Hatchery broodstock:		3,831	
Lake broodstock:		9,389	





Coho Salmon Project

Stocking & Misc. Activities

Crew on-site:	15-May		
Ice-out:	NA		
Crew off-site:	21-Oct		
Fry stocking:	21-Jun	437,000	1.01 g
Smolt stocking Bear Lake			
Fertilizer application:	16-Jun to 30-Jul	870 gallon	

Egg Take

Dates:	6-Oct to 14-Oct	
No. of females used:		144
Green eggs:		577,700
Fecundity:		4,012
Eyed eggs:		312,400
% Survival		54.1%

Smolt Migration

Dates:	20-May to 5-Jul	
Cohos:		40,400
Percent age 1:		NA (no samples)
Percent age 2:		NA (no samples)
Percent age 3:		NA (no samples)
Percent hatchery:		NA (no samples)
Dolly Varden:		2,681

Adult Migration

Dates:	22-Aug to 20-Oct		
Coho total creek return:		850	
Weir return:		850	100%
C.R. harvest:		0	0%
Lake:		359	42%
Hatchery broodstock:		491	58%
Est. Remaining in Bear Ck:		0	0%
Est. Remaining in Salmon Ck:		0	0%