Bear Lake
Salmon Enhancement
Progress Report
2015

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The 2015 operation of the Bear Lake Sockeye and Coho Salmon Enhancement Project was made possible through enhancement taxes paid by the commercial fishermen in Area H, Cook Inlet and associated waters and through Cook Inlet Aquaculture Association Special Harvest Area Access licensing fees.

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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 2015 Bear Lake limnology sampling, lake fertilization, smolt migration, fry release, adult count, and gamete collection exercises were conducted by the Cook Inlet Aquaculture Association. Appreciation is extended to the full-time and seasonal staff at Bear Lake Weir and Trail Lakes Hatchery for their assistance in conducting the field studies. Appreciation is extended to Icicle Seafoods for the collection of sockeye salmon otoliths from the cost recovery harvests in Resurrection Bay.

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ABSTRACT

The Cook Inlet Aquaculture Association has been conducting sockeye salmon (*Oncorhynchus nerka*) and coho salmon (*O. 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 2015, both sockeye (BY14; 2,415,000; 0.55 g) and coho salmon fry (BY14; 448,000; 1.14 g) were released into Bear Lake as well as sockeye salmon smolt into Resurrection Bay (BY13; 1,758,000; 15.3 g) and coho salmon smolt (BY13; 98,000; 14.5 g) to Bear Creek. Smolt migration began on 06 May and continued until 03 July. During this time period, 728,800 (± 80,200) sockeye and 91,700 (± 4,500) coho salmon smolts migrated from the lake. For the migrating sockeye smolt, 97% (± 10.8%) were of hatchery origin and the age-1 smolt was the dominant age class at 93.2% (± 10.4%). For the coho smolt, 99.0% (± 5.0%) were of hatchery origin and the age-1 smolt was the dominant age class at 61.4% (± 5.0%).

A total of 44,620 adult sockeye salmon returned to Bear Lake for escapement, broodstock, and harvest. An additional 63,537 fish were harvested in the saltwater component of the cost recovery harvest and 4,633 were harvested in the commercial seine fishery. The sport fish harvest was estimated at 12,000 fish and there were 69 mortalities at the weir, bringing the total sockeye salmon return to 124,859 fish. For the adult coho salmon return to Bear Lake, 1,979 fish were counted at the weir for escapement, broodstock, and harvest. The sport fish harvest was estimated at 5,400 fish bringing the total return of coho salmon to 7,379 fish.

Between 29 July and 04 August, 5,148,400 sockeye salmon eggs were collected and transported to Trail Lakes Hatchery for fertilization, incubation, and rearing. Between 12 October and 14 October, 575,300 coho eggs were collected and transported to Trail Lakes Hatchery for incubation and rearing.

Based on the 2015 spring water quality samples, it was determined that 1,110 gallons of fertilizer

was required to meet the desired lake nutrient goal. Limnology samples were collected in May, June, August, and September.

INTRODUCTION AND PURPOSE

Bear Lake is located on Alaska's Kenai Peninsula near the community of Seward 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 (*O. 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 target both sockeye and coho salmon with control of predator and competitor species. The objectives are to create a commercial sockeye salmon fishery and to maintain the coho salmon sport fishery enhancement program. To accomplish the objectives CIAA does the following:

1) Maintain the level of coho salmon production.
2) Maintain sockeye and coho salmon lake spawning escapement goals.
3) Annually describe the timing, abundance, size, and percent of wild and enhanced sockeye and coho salmon 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 salmon 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. It is the largest clear water lake in the Resurrection Bay drainage.

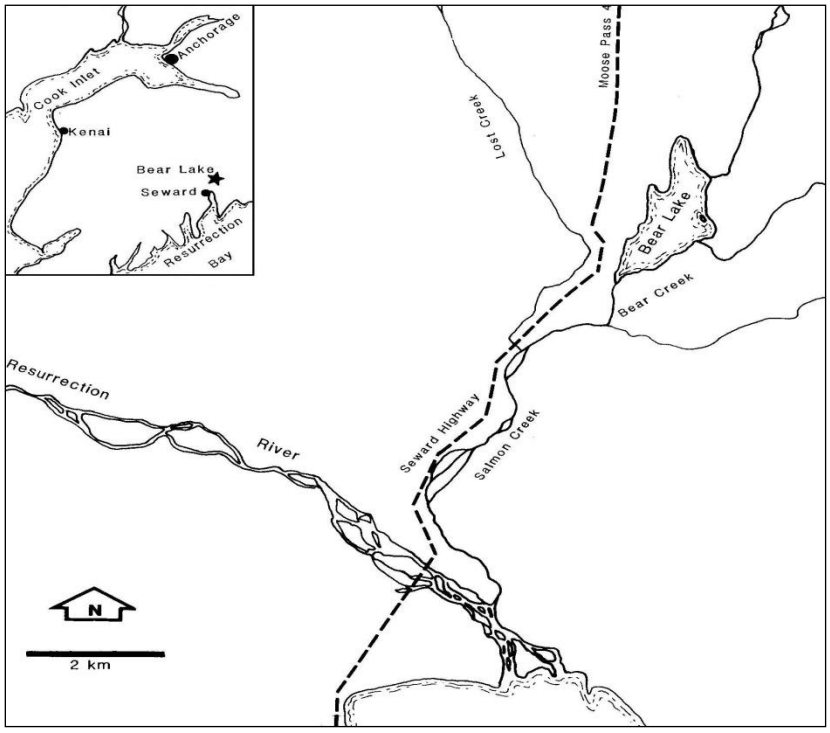

Figure 1. Map showing location of Bear Lake near Seward, Alaska.

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 (Figure 1). 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.

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 (Koenings et al., 1987). 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.

In the fall of 2012, the small tributary stream used for acclimation of sockeye salmon fry and the main spawning area changed course during a flood event. The amount of water flowing through this creek channel decreased substantially in comparison to previous years. The location now used for acclimation of fry and broodstock collection correspondingly has changed to the new stream discharge starting in 2013.

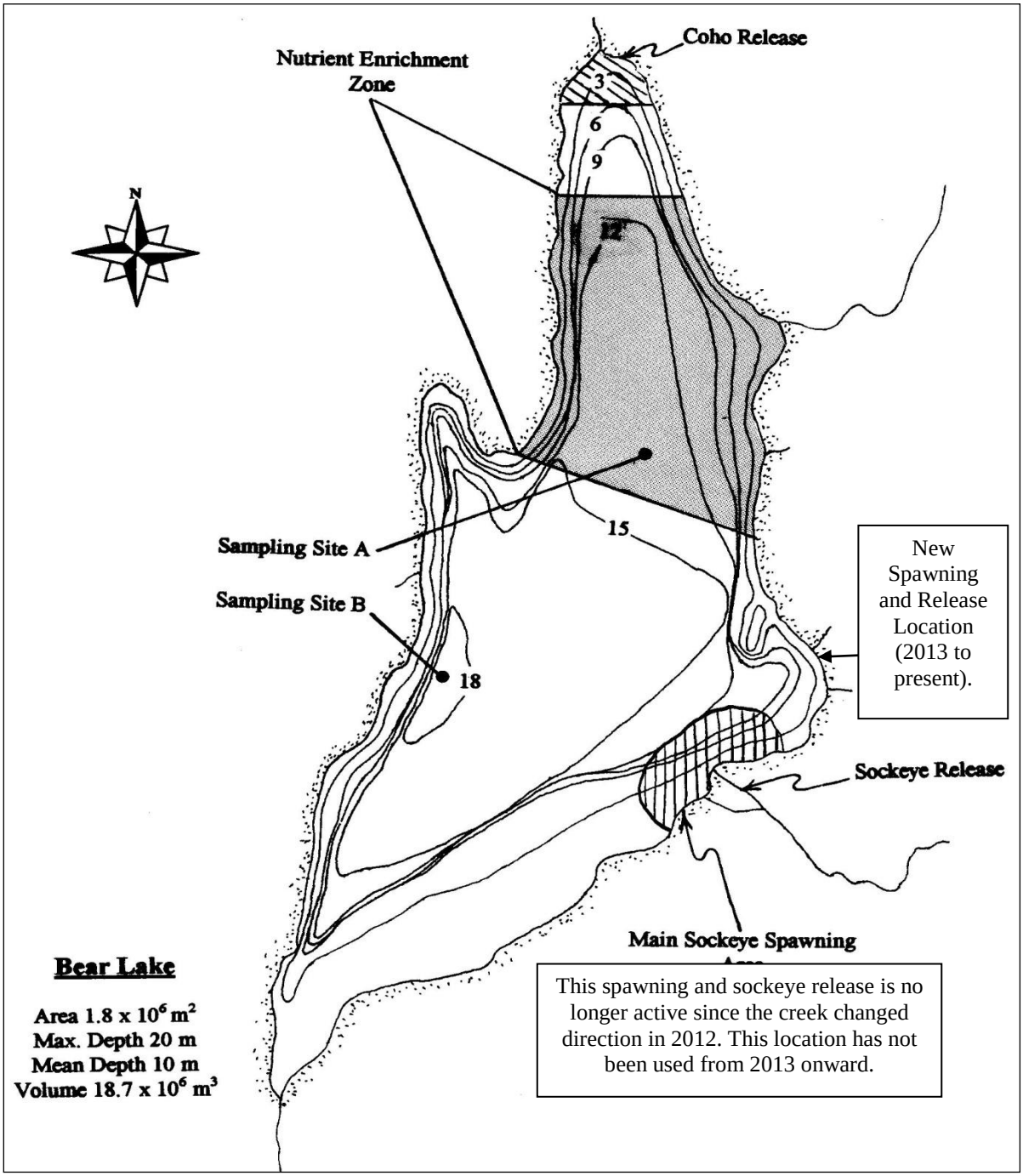

Figure 2. Bear Lake near Seward, Alaska

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. Greater detail of the methods can be found in the Smolt and Adult Procedure Manuals for Bear Lake (CIAA, 2015a and 2015b).

Limnological Sampling and Environmental Conditions

During 2015, assessments of water quality were conducted 4 times (May, June, August, September) throughout the open water season. Water samples were collected using a Van Dorn water sampler and water quality was analyzed using a YSI meter, plankton net, secchi disk and light meter. Sampling and analysis followed the procedures described by Koenings et al. (1986). A 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 1 meter below the surface and from the hypolimnion. A 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 were completed by ADF&G. Zooplankton identification and quantification was conducted by ADF&G.

In addition to the water chemistry analysis, CIAA staff made daily observations of other environmental conditions at Bear Lake. These observations, completed at 5:00 pm throughout the summer field season, included percent cloud cover, precipitation to the nearest millimeter, and Bear Creek stage. Bear Creek stage height was recorded in 2 different locations. The upper gauge was used to monitor pool height above the weir while the lower gauge monitored the water level below the weir. Both heights were dependent on the addition or removal of dam boards. Air and water temperature were recorded every hour using a Hobo® data logger. All recordings in a 24-hour period were averaged to provide a daily average air and water temperature. However, due to technical failure the data from the data loggers were incomplete. Air and water temperature data collected at 5 pm were used for 2015. Between 07 August and 08 September, staff were assisting Tutka Bay Lagoon Hatchery and were not on site. On occasions,

Trail Lakes Hatchery staff recorded water and air temperature but for the majority of the time no data were recorded during this time period.

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. Using the mean spring total phosphorus concentration recorded in 2015 and a lake nutrient model supplied by ADF&G, it was determined that 1,110 gallons of fertilizer was required for Bear Lake in 2015.

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 2014 to identify, count, and control the migration of all fish moving into or out of Bear Lake.

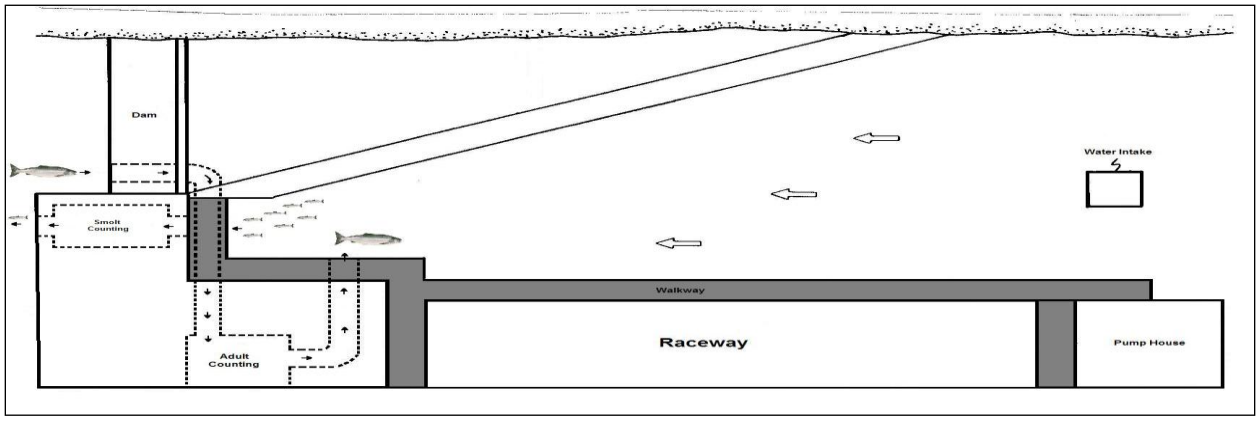

Figure 3. The Bear Creek weir, smolt trap and adult counting complex (top view).

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 2 minutes and then counted. During the remaining 18 minutes, migrating smolts were passed through the weir structure uncounted. The 2-minute smolt count was multiplied by 10 to estimate the number of smolts migrating during the 20-minute interval.

Assuming the 2-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:

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

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

Since 1990, CIAA has been releasing sockeye and coho salmon fry into Bear Lake. To evaluate this enhancement procedure, CIAA has collected a sample of sockeye and coho salmon smolts

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

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 2015, smolts collected for measurement, age determination, and otolith removal were sampled in proportion to the daily smolt migration. This was accomplished by collecting every 1,000th sockeye salmon smolt and every 150th coho salmon 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 collected from 717 sockeye salmon smolt (0.10%) and 597 coho salmon smolt (0.65%).

Each smolt collected for evaluation was first measured to the nearest millimeter for fork length[4] and weighed to the nearest 0.1 g. Otoliths were removed and placed in a labeled one dram vial filled with a 10% ethanol solution. Each otolith was checked for a hatchery mark and aged following procedures described by Glick and Shields (1993).

Sockeye salmon smolt characteristics, the proportion of enhanced sockeye smolt and the proportion of age-1 and age-2 sockeye salmon 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,

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.

$q_h = 1 - p_h$, 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.

Then the proportion of enhanced smolts, $\hat{P}$, was estimated as:

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

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:

$$v\left(\hat{A}\right) = N^2\left(1 - f\right)(1/n)\sum W_h p_h q_h = N^2 v\left(\hat{P}\right).$$

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:

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

and, the relative error is:

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

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

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

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:

$$\hat{L}_i \pm 2.24\left(\sqrt{v(\hat{L}_i)}\right) \qquad \text{and} \qquad \hat{C}_i \pm 2.24\left(\sqrt{v(\hat{C}_i)}\right).$$

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).

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 Bacterial Kidney Disease (BKD) at the spawning ground.

Every 30th sockeye salmon was sampled to assess sex, age (via scale analysis), and weight. For the coho adult migration, all fish used for the eggtake were sampled. In contrast to the adult sockeye, coho otoliths were collected for age determination and hatchery contribution. In 2015, measurements were collected from 1,934 sockeye salmon (4.3% of the adult sockeye salmon that

returned to Bear Lake) of which 1,514 were readable and 550 coho salmon (27.8% of the adult coho salmon that returned to Bear Lake) of which 516 were readable.

Gamete Collection, Incubation and Rearing – Sockeye Salmon

Since 1989, egg collection, incubation, and rearing of sockeye salmon have been done to develop a Bear Lake sockeye salmon 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 salmon 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 salmon gametes collected for the Bear Lake stocking program were collected from adults returning to Bear Lake.

Originally, it was believed returning adult sockeye salmon 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 salmon 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, CIAA has employed several methods 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 gillnetting 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. However, flood conditions in the fall of 2012 dramatically changed the flow of water in this small tributary stream. The broodstock collection area changed to where the creek was now entering the lake after the 2012 flood event and this area has been in use since 2013.

Male and female adult sockeye salmon from the spawning area were harvested and stripped of

their gametes. The gametes were shipped to Trail Lakes Hatchery for fertilization, incubation and rearing. The sockeye salmon 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 – 4,2H; smolt – 3,3,2H).

Gamete Collection, Incubation, and Rearing – Coho Salmon

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, all females used for gamete collection had a small section of kidney removed for screening of *Renibacterium. 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 that had a high prevalence of BKD were culled. The coho salmon 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 – 4,3H, smolt – 5,3H). Coho salmon eggs were also collected by ADF&G staff for their stocking programs as well as for the Salmon in the Classroom program.[5]

Fish Transport and Stocking

Sockeye salmon fry have been stocked into Bear Lake since 1990. For stocking, the fry were transported by truck in oxygenated tanks to the public access area near the lake outlet. Fish were then transferred to a 150 gallon tank placed in a boat. The boat then transported the fry to the area where the main tributary now enters the lake. From the tank, fish were released into a small holding pen for acclimation and imprinting purposes. Staff from CIAA made multiple trips throughout the day. At the end of each day, the pen was emptied into the lake. In addition to the fry stocking, sockeye salmon smolt were stocked into net pens located in Resurrection Bay for short-term rearing before release.

5 http://www.adfg.alaska.gov/index.cfm?adfg=educators.salmonclassroom

Coho salmon fry reared at Trail Lakes Hatchery have been stocked into Bear Lake since 1986. For stocking, the 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 addition to the coho salmon fry stocking, coho salmon smolts were transported to Bear Creek weir by truck where they were put into raceways for a week to acclimate and imprint before being released to Bear Creek.

Otolith Collection in Resurrection Bay and Bear Lake Weir

With the stocking of sockeye salmon smolt into net pens in Resurrection Bay, 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). In 2010 and 2011, 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. Starting in 2012, CIAA staff performed this sampling following the same procedures and the otoliths were analyzed by CIAA staff. In 2015, fish heads were collected from Icicle Seafoods processing plant in Seward for both the Resurrection Bay harvest (saltwater) and from Bear Lake weir harvest (freshwater).

For each fishery (Resurrection Bay and Bear Lake) the proportion of adult sockeye belonging to each age class/program designation (BY09; BY10; BY11; and wild, fry, smolt) were estimated using the following notations and formulas.

If:

N = total number of adults captured in fishery (from fish tickets),

n = total number of adults captured in fishery that were sampled,

a = total number of adults captured in fishery from each age class/program designation,

p = the proportion of adults captured in fishery from each age class/program designation,

Then the proportion of adults from each age class/program designation, $\hat{P}$, was estimated as:

$$\hat{P} = a / n \text{; with a variance of } v\left(\hat{P}\right) = (a/n)(1-a/n)/n-1$$

The total number of adults from each age class/program designation, $\hat{A}$, was also estimated as:

$$\hat{A} = N(a/n) = N\hat{P} \text{; with a variance of: } v\left(\hat{A}\right) = v\left(\hat{P}\right)N^2.$$

Thus the 95% confidence interval estimate for

$$\hat{A} = 1.96\sqrt{v\left(\hat{A}\right)}$$

In 2015, for the Resurrection Bay harvest, 125 fish were sampled for otolith analysis for each harvest date except for 8 harvest dates. A total of 26 different harvests (63,537 fish) occurred of which 18 were sampled (55,522 fish). In total, 2,405 samples were obtained. For statistical analysis, the samples collected were then randomly selected in proportion to the harvest number for that day. Approximately 1.48% of each day's harvest were analyzed.

In 2015, for the Bear Lake harvest, 75 fish were sampled for otolith analysis for each harvest date except for 10 harvest dates. A total of 28 different harvests (28,154 fish) occurred of which 18 were sampled (14,339 fish). In total, 1,044 samples were obtained. For statistical analysis, the samples collected were then randomly selected in proportion to the harvest number for that day. Approximately 2.67% of each day's harvest were analyzed.

RESULTS AND DISCUSSION

Limnology, Environmental Conditions and Lake Fertilization

Bear Lake's limnological characteristics have been monitored for several years. The 2015 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 2015.

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	ND	8.0	ND	8.3	ND :1		ND	ND	ND
1980	74	7.3	29	ND	7.7	138	9.8	42 :1	3.4	ND	ND	ND
1981	68	6.3	28	ND	7.2	101	14.0	35 :1	3.4	ND	ND	734
1982	77	7.6	29	ND	9.9	149	47.0	44 :1	1.9	ND	ND	704
1983	86	7.6	32	ND	8.7	175	41.6	55 :1	2.0	ND	ND	914
1984	88	7.4	32	2.5	10.6	204	24.0	48 :1	3.6	ND	ND	836
1985	87	7.2	36	1.7	11.3	177	89.7	52 :1	2.6	ND	ND	429
1986	82	7.3	32	2.3	12.3	188	12.4	36 :1	2.9	ND	ND	583
1987	81	7.4	29	1.3	9.7	135	2.1	31 :1	1.6	ND	ND	401
1988	No sampling conducted											
1989	No sampling conducted											
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	515
1999	82	7.2	30	1.2	5.6	126	9.0	53 :1	0.9	9.7	5.6	771
2000	80	7.0	28	2.2	6.8	125	3.4	42 :1	3.4	8.9	4.6	356
2001	79	7.1	27	1.2	6.0	124	4.0	35 :1	2.0	9.2	5.0	288
2002	78	7.1	29	0.7	7.0	117	12.4	42 :1	2.4	10.4	5.0	525
2003	74	6.7	26	0.6	6.7	124	6.8	44 :1	2.1	11.0	6.4	333
2004	72	6.8	27	1.0	7.3	176	26.5	38 :1	1.5	9.2	3.8	107
2005	81	6.7	27	0.4	8.6	137	22.7	41 :1	0.9	9.2	5.4	698
2006	82	6.6	28	1.2	12.3	158	8.5	30 :1	2.5	8.3	3.2	412
2007	81	6.7	30	1.2	8.1	121	9.3	37 :1	1.6	11.9	4.3	322
2008	79	7.1	28	1.5	12.7	106	4.1	16 :1	2.6	8.9	4.0	292
2009	81	7.2	30	1.0	7.6	151	4.1	35 :1	1.2	8.4	4.5	407
2010	82	7.0	27	1.3	5.5	NA	4.1	NA :1	2.0	9.2	4.2	768
2011	85	7.6	30	1.4	15.2	NA	4.1	NA :1	3.2	8.6	4.4	658
2012	82	7.3	29	1.0	6.4	NA	25.3	NA :1	1.6	11.8	5.1	222
2013	76	7.3	25	0.9	9.6	NA	4.1	NA :1	1.9	9.0	4.1	247
2014	78	7.2	29	0.3	9.1	NA	1.5	NA :1	1.1	10.6	4.3	246
2015	80	7.0	31	1.2	5.7	152	1.0	67 :1	1.5	11.0	4.8	344

Averages prior to 1992 compiled by ADF&G. EZD, Secchi and atomic ration provided by CIAA. Open water season only.
2010 data is a combination of both Site A & B
NA = TKN analysis is not complete due to equipment failure
ND = No Data

Table 2. Water quality characteristics of Bear Lake in the hypolimnion, 1979 to 2015.

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	ND	18.3	ND	16.2	ND :1	ND
1980	81	7.2	31	ND	13.9	168	14.3	29 :1	8.8
1981	69	6.3	29	ND	11.3	124	19.3	28 :1	5.5
1982	78	7.4	28	ND	16.6	177	37.6	29 :1	5.8
1983	88	7.3	32	ND	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	ND
1988	No sampling conducted								
1989	No sampling conducted								
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
2012	83	6.8	28	1.8	12.3	NA	47.3	NA :1	2.9
2013	81	6.9	25	2.5	17.3	NA	6.6	NA :1	4.2
2014	82	6.8	29	0.8	11.5	NA	2.1	NA :1	3.0
2015	81	6.7	31	1.8	15.2	189	0.7	36 :1	4.2

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.

NA = TKN analysis is not complete due to equipment failure.

ND = No Data

The environmental conditions recorded in 2015 are presented in Appendix 2. Between 06 May and 30 June, the average air temperature was 11.9°C (± 3.9°C) [mean ± standard deviation] and the water temperature averaged 13.2°C (± 3.0°C). Average stage height below the weir was 1.58 ft (± 0.10 ft) and above the weir it was 0.92 ft (± 0.04 ft) for the same time period. Between 01 July and 19 October, the average air temperature was 9.9°C (± 5.3°C) and the water temperature averaged 13.3°C (± 3.6°C). Between 01 July and 24 July and 25 August and 19 October, average stage height below the weir was 1.42 ft (± 0.09 ft) and above the weir it was 0.94 ft (± 0.08 ft). However, due to the gap in data collection (07 August to 08 September), data cannot be compared with other years (see tables 3 and 4) for total days, percent cloud cover, precipitation and temperature (air and water).

Table 3. Environmental conditions observed at Bear Lake between the start of smolt counts and 30 June, 1990 to 2015.

		No. of Days							Temperature (C)			
			<50%	>50%			Days		Air		Water	
Year	Total Days	Clear	Cloud Cover	Cloud Cover	100% Overcast	Rain	Meas. Precip	Precip (mm)	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)
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)
2012	46	11	7	7	13	8	25	149	12	(6-20)	6	(2-12)
2013	43	19	7	6	9	2	13	42	13	(3-21)	9	(2-15)
2014	49	15	13	10	6	5	20	6	12	(8-17)	11	(7-16)
2015	56	8	10	12	14	12	29	226.4	12	(4-22)	13	(8-18)

ND-no data. IC-incomplete data

Table 4. Environmental conditions observed at Bear Lake between 01 July and completion of coho counts, 1990 to 2015.

Year	Total Days	No. of Days Clear	<50% Cloud Cover	>50% Cloud Cover	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	1,084	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)
2012	102	18	7	5	40	32	51	1,083	10	(2-18)	11	(5-15)
2013	102	28	5	10	40	19	32	607	14	(5-26)	14	(9-19)
2014	75	25	11	5	16	18	40	66	14	(5-17)	12	(0-17)
2015	74	3	17	21	24	14	50	394	10	(1-21)	13	(8-18)

ND-no data. IC-incomplete data

*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.

For 2014 - staff stopped recording sky condition and rainfall from July 25 - August 25. However, water and air temperatures were recorded for the entire time period.

For 2015 - staff did not record sky condition, rainfall or temperature between August 7-September 8.

Smolt Enumeration - Sockeye

Enumeration of Bear Lake sockeye smolt occurred between 06 May and 03 July. A total of 728,800 (± 80,200) sockeye salmon smolt migrated from Bear Lake in 2015 (Appendix 3). The 10% sub-sampling procedure was used to count 64.6% of the migrating sockeye salmon.

An estimated 93.2% (± 10.4%) smolt were age-1 and 6.8% (± 2.0%) were age-2. The age-1 smolt averaged 98 mm (± 0.4 mm) [mean ± confidence interval] in length and 8.35 g(± 0.21 g) in weight. The age-2 smolt averaged 119 mm (± 2.3 mm) in length and 15.5 g (± 0.83 g) in weight (Table 5). Based on the presence of hatchery induced thermal marks, it was estimated that 97.0% (± 10.8%) of the sockeye salmon smolt were of hatchery origin.

Smolt Enumeration – Coho Salmon

A total of 91,700 (± 4,500) coho salmon smolt migrated from Bear Lake in 2015 (Appendix 3) between 13 May and 08 July. The 10% sub-sampling procedure was used to count 31.9% of the migrating coho salmon smolt.

An estimated 61.4% (± 5.0%) [mean ± confidence interval] smolt were age-1, and 38.6% (± 4.4%) were age-2. The age-1 smolt averaged 97 mm (± 1.5 mm) in length and 10.7 g (± 0.5 g) in weight. The age-2 smolt averaged 115 mm (± 1.5 mm) in length and 15.9 g (± 0.6 g)in weight (Table 6). Based on the presence of hatchery induced thermal marks, it was estimated that 99.0% (± 5.0%) of the coho salmon smolt were of hatchery origin.

Adult Escapement – Sockeye Salmon

Adult sockeye salmon began arriving at the weir on 19 May 2015 and continued to migrate until 04 August 2015 (Appendix 4). During this time, 44,893 adults were captured and counted at the weir (Table 7). The returning major age groups (via scale samples) for adult sockeye salmon included ages 1.1 (0.1%), 1.2 (43.0%), 1.3 (52.8%), 2.1 (0.1%), 2.2 (2.6%) and 2.3 (1.5%). Of the 44,620 adult sockeye that migrated to Bear Creek in 2015, 29,059 were harvested for cost recovery, 2,056 were donated and 13,505 were passed to the lake. There were 69 mortalities at the weir. In the common property seine fishery a total of 4,633 were harvested and 63,537 fish were harvested in the saltwater cost recovery harvest. The number of fish caught in sport fishery is estimated at 12,000. The total return to Resurrection Bay was estimated to be 124,859 sockeye salmon.

A summary of mean age and weight, by age class, for adult sockeye salmon escapement to the Bear Creek weir site for 2015 is presented in Appendix 6.

Adult Escapement – Coho Salmon

Adult coho salmon began arriving at the weir on 30 August 2015 and continued to migrate until 19 October (Appendix 5). During this time, 1,979 adults were captured and counted at the weir (Table 7). The returning major age groups for adult coho included ages 1.1 (80.2%), and 2.1 (19.8%).

Of the 1,979 adult coho that were counted at the Bear Creek weir site, 1,013 were harvested and donated, 705 were held for broodstock purposes and 261 were passed into the lake. Sport fish harvest is estimated at 5,400 fish, bringing the total return of adult coho salmon to 7,379.

This year, otoliths were analyzed from the adult coho used for eggtake purposes. A total of 516 otoliths were readable. Based on these analyses, 21.5% (± 3.5%) were BY 11-Fry , 2.1% (± 1.2%), BY11-Wild, 52.0% (± 4.3%) BY12-Fry, 23.4% (± 3.7%) BY12-Smolt and 1.0% (± 0.8%) BY12-Wild.

A summary of mean age and weight, by age class for adult salmon escapement to the Bear Creek weir site for 2015 is presented in Appendix 7.

Table 5. Sockeye salmon smolt migrations: mean length and weight, by age class, for Bear Lake, 1980 to 2015.

						Age Composition								Average Length (mm)[6]					Average Weight (g)[6]				
Year	Number	*CI	% Hatch.	CI	No. Wild	0.0	CI	1.0	CI	2.0	CI	3.0	CI	0.0	1.0	CI	2.0	CI	0.0	1.0	CI	2.0	CI
1980	3,400					0		3,400		20		20		-	119		187		-	NA		NA	
1981	3,500					0		2,800		700		0		-	117		158		-	16.2		41.6	
1982	46,300					0		46,100		100		0		-	110		144		-	14.0		29.7	
1983	13,000					0		11,000		2,000		40		-	112		149		-	13.5		32.9	
1984	10,500					0		7,700		2,500		300		-	116		153		-	15.4		35.8	
1985	1,600					0		1,300		300		30		-	126		176		-	20.2		51.4	
1986	1,000					0		800		100		0		-	123		167		-	18.3		47.2	
1987	18,200					0		17,800		300		100		-	112		172		-	12.8		46.5	
1988	9,100					0		7,200		1,900		30		-	120		155		-	16.0		34.9	
1989	5,100					0		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					0		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		0		115	123		152		18.1	18.7		35.3	
1994	253,900					700		228,600		21,200		0		102	121		154		11.0	17.4		37.0	
1995	73,500	1,900	70.2	8.0	21,900	0	0	68,000	1,600	5,500	1,000	0	0	-	122		156		-	17.9		37.2	
1996	156,000	9,600	64.2	3.5	55,400	0	0	149,400	9,400	6,400	2,100	0	0	-	117	0.6	120	2.1	-	11.8	*NA*	16.2	*NA*
1997	276,000	64,000	74.6	3.6	70,100	0	0	270,500	64,000	5,500	3,500	0	0	-	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	0	0	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	0	0	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	162,500	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	0	0	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	0	0	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	0	0	1,306,200	22,000	23,000	10,000	0	0	-	92	0.8	140	7.7	-	7.5	0.2	30.4	4.9
2004	123,200		96.2	2.4	4,700	0	0	76,500	7,800	46,700	7,800	0	0	-	115	1.3	139	0.8	-	14.2	1.4	26.1	1.2
2005	1,420,400	105,400	98.5	7.3	21,500	0	0	1,391,400	103,800	29,100	11,100	0	0	-	88	0.5	88	*NA*	-	6.4	*NA*	6.1	*NA*
2006	1,962,400	147,100	99.1	7.4	18,330	0	0	1,773,700	135,500	187,600	30,000	0	0	-	85	0.5	105	1.2	-	5.7	0.2	11.1	0.6
2007	1,347,900	88,300	98.4	6.5	20,900	0	0	1,265,300	20,900	82,600	18,500	0	0	-	89	0.6	92	2.3	-	6.6	0.1	7.0	0.5
2008	308,500	19,000	100.0	0.0	0	0	0	285,000	19,600	23,400	9,000	0	0	-	88	0.4	96	1.1	-	6.2	0.2	8.3	0.5
2009	241,100	29,500	98.6	12.1	3,500	0	0	235,300	29,000	5,800	3,600	0	0	-	91	0.6	126	*NA*	-	6.7	0.1	17.6	*NA*
2010	598,900	47,500	97.9	7.9	11,500	0	0	544,000	45,100	54,800	13,700	0	0	-	88	0.5	124	1.4	-	5.9	0.2	16.7	0.8
2011[7]	477,800	52,300	97.4	10.8	12,400	0	0	441,900	50,200	35,900	13,800	0	0	-	94	0.9	126	2.6	-	7.3	0.2	17.7	1.0
2012	467,000	28,700	99.8	6.1	1,000	0	0	454,700	28,800	12,300	6,900	0	0	-	93	0.8	132	6.3	-	6.9	0.2	20.7	2.4
2013	791,700	79,800	99.2	10	6,100	0	0	737,000	75,600	54,700	15,500	0	0	-	82	0.3	100	1.5	-	4.7	0.1	9.0	0.5
2014	393,500	25,300	96.7	6.5	12,800	0	0	310,900	26,300	82,700	17,900	0	0	-	87	0.7	105	0.6	-	6.3	0.5	11.2	0.9
2015	728,800	80,200	97.0	10.8	21,600	0	0	679,500	76,000	49,300	14,500	0	0	-	98	0.4	119	2.3	-	8.4	0.2	15.5	0.8
Avg.[4]	540,300	41,500	86.2	6.0	28,700	600	280	501,085	34,800	38,400	9,700	1,000	600	119	101	0.8	128	3.4	17	9.8	0.7	22.6	2.8
Total[5]	11,825,800					157,600		10,836,300		819,750		21,923											

No statistical analysis

No Thermal Marking

*CI-confidence interval = 95%. NA-not available.

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 2012.

[5]Total values calculated from 1980 to 2013.

[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 salmon smolt migrations: mean length and weight, by age class, for Bear Lake, 1980 to 2015.

					Age Composition								Average Length (mm)[4]								Average Weight (g)[4]							
Year	Number	*CI	% Hatch.	CI	1.0	CI	2.0	CI	3.0	CI	4.0	CI	1.0	CI	2.0	CI	3.0	CI	4.0	CI	1.0	CI	2.0	CI	3.0	CI	4.0	CI
1980	75,000				54,600		20,300		100		0		122		135		ND		-		19.3		24.0		-		-	
1981	72,900				10,900		61,800		200		0		122		127		ND		-		18.4		19.8		-		-	
1982	143,700				134,000		9,600		100		0		116		127		ND		-		15.0		20.4		-		-	
1983	108,400				100,400		7,900		100		0		115		129		ND		-		14.3		20.2		-		-	
1984	93,800				78,300		15,200		300		0		116		134		ND		-		15.0		22.4		-		-	
1985	105,900				104,300		1,600		0		0		125		168		-		-		18.1		41.5		-		-	
1986	72,700				60,900		11,500		300		0		126		137		ND		-		19.5		24.9		-		-	
1987	80,200				61,200		18,700		250		0		109		145		ND		-		11.6		27.9		-		-	
1988	63,800				50,500		13,300		0		0		118		133		-		-		16.4		22.3		-		-	
1989	99,400				96,200		3,200		0		0		116		134		-		-		18.8		23.0		-		-	
1990	83,400				67,500		14,800		1,000		0		119		139		ND		-		15.7		24.1		-		-	
1991	97,600				86,500		10,600		500		0		121		138		ND		-		18.0		25.5		-		-	
1992	112,900				107,500		4,700		600		0		120		137		ND		-		17.1		25.7		-		-	
1993	53,500				42,300		10,400		0		0		124		137		-		-		19.5		25.8		-		-	
1994	54,400				6,000		43,700		0		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		ND		-		11.4		18.0		-		-	
1996	154,900	15,300			16,100	4,700	137,300	14,400	1,400	1,400	0	0	95		112		ND		-		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	0	0	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	0	0	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	0	0	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	0	0	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	0	0	109		119		138		-		11.9		16.3		26.5		-	
2004	73,400	*NA*	92.4	2.6	54,200	3,500	19,200	3,500	0	0	0	0	103	1.2	128	1.6	-	-	-	-	11.5	0.8	22.1	1.2	-	-	-	-
2005	65,400	3,700	97.3	5.6	56,400	3,600	9,100	1,900	0	0	0	0	97	1.0	121	2.3	-	-	-	-	9.5	0.5	18.2	1.5	-	-	-	-
2006	50,000	4,300	97.0	8.5	36,600	4,100	13,300	2,900	0	0	0	0	93	2.2	128	2.6	-	-	-	-	8.4	0.9	21.7	1.4	-	-	-	-
2007	78,900	2,500	96.8	3.7	43,000	4,800	35,800	4,700	0	0	0	0	86	1.8	112	0.8	-	-	-	-	6.0	2.2	14.7	1.1	-	-	-	-
2008	63,900	3,800	98.2	6.0	34,800	3,600	28,900	3,400	300	400	0	0	95	1.1	117	0.4	-	-	-	-	8.6	1.3	16.9	0.8	-	-	-	-
2009	54,800	4,100	98.6	7.5	33,100	3,500	21,800	2,900	0	0	0	0	98	1.4	115	0.7	-	-	-	-	9.6	1.2	15.8	0.7	-	-	-	-
2010	48,900	2,700	98.4	5.6	20,900	2,900	27,600	3,100	300	400	0	0	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*	*NA*	*NA*	-	-	*NA*	*NA*	*NA*	*NA*	-	-	-	-
2012	45,900	1,000	98.4	2.5	16,400	2,500	29,400	2,500	0	0	0	0	101	2.4	122	0.5	-		-	-	8.1	2.7	19.6	0.9	-	-	-	-
2013	36,200	3,200	96.2	8.8	13,900	2,600	21,500	3,000	800	700	0	0	98	4.1	121	1.0	135	13.6	-	-	9.9	3.5	17.3	0.9	23.6	7.2	-	-
2014	21,100	1,100	96.2	6	9,700	2,100	11,300	2,100	200	400	0	0	81	3.9	111	1.0	-	-	-	-	6.6	2.5	15.2	0.9	-	-	-	-
2015	91,700	4,500	99.0	5.0	56,300	4,600	35,100	4,000	300	400	0	0	97	6.3	115	6.3	-	-	-	-	10.7	2.2	15.9	2.6	-	-	-	-
Avg[2]	83,889	7,000	94.8	5.0	54,200	4,500	27,500	5,300	2,400	1,500	100	100	108		127		135		157		12.9		20.5		25.1		35.6	
Total[3]	3,020,000				1,841,700		960,600		78,350		1,900																	

*CI-confidence interval=95%. NA-not available.

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 2014.

[3]Total values calculated from 1980 to 2015.

[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. Historical returns of Coho and Sockeye Salmon to Bear Lake weir, 1980 to 2015.

	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	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	18,116	0	25	0	6,576	0	11,187	25	151	151	0	0
2012	924	72	794	58	14,381	0	27	0	6,129	0	6,235	0	2,229	212	0	0
2013	3,122	1,561	1,416	145	15,820	0	62	0	7,290	0	7,103	217	1,086	62	0	0
2014	1,772	403	1,369	0	28,774	0	0	0	10,867	0	16,679	0	898	331	0	0
2015	1,979	1,503	476	0	44,893	0	30	0	19,303	0	23,692	30	1,186	652	0	0
Avg[1]	3,067	1,096	1,885	86	23,151	203	125	291	9,408	7	11,617	16	1,078	421	2	1
% of Avg	100%	35.7%	61.5%	2.8%	100%	0.9%	0.5%	1.3%	40.6%	0.0%	50.2%	0.07%	4.7%	1.8%	0.01%	0.1%

NA-not available

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

Hatchery Activities

Stocking

In 2015, 2.415 million sockeye salmon fry (BY14; Hatch Code - 3,2H) and 448,000 coho salmon fry (BY14; Hatch Code - 2,6H) were released into Bear Lake. These fish will migrate in 2016/2017 as smolts. At the time of release, the sockeye salmon fry averaged 0.55 g and the coho salmon fry averaged 1.14 g.

In addition to the fry stocking, 1.758 million sockeye salmon smolt (BY13; Hatch Code - 2,4H) were short-term reared in net pens located in Resurrection Bay before being released. At the time of release, the sockeye salmon smolts averaged 15.3 g. A summary of releases are provided in Table 8. An additional 98,000 coho smolts (BY13; Hatch Code - 2,2H) were released into Bear Creek after a 1-week acclimation in raceways located at Bear Creek weir.

Eggtake

Between 29 July and 04 August 2015, a total of 5,148,399 sockeye salmon eggs were collected. A total of 3,945 broodfish (includes broodstock, mortalities, and inviable) were used providing an average fecundity of 2,703 eggs/female.

Between 12 October and 14 October 2015, a total of 575,260 coho salmon eggs were collected from 168 females and 112 males. Average fecundity was 3,503 eggs/female. Of the 168 females sampled for disease screening, no fish was identified as being positive for *Renibacterium salmoninarum.* An additional 330,000 coho salmon eggs were collected by ADF&G.

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

Fry-to-Smolt Survival

Migrating smolts in 2015 were stocked either as fry in 2013 (BY12 - age-2) and 2014 (BY13 - age-1). Based on age classification from otoliths/scales, the fry-to-smolt survival for each brood year of fry stocking can be determined. Total smolt migration count (count plus fish sampled for otolith and mortalities) was used to determine fry to smolt survival. In 2015, the fry-to-smolt survival for sockeye salmon from BY11 was finalized at 29.8%, BY12 is at 16.3% (incomplete data), and BY13 is at 27.4% (incomplete data). For coho salmon, the fry-to-smolt survival is estimated at 11.0% for BY11, 8.6% for BY12 (incomplete data), and 11.9% for BY13 (incomplete data). This information is summarized in Table 10.

Resurrection Bay Fishery and Bear Lake Weir Otolith Analysis

Otolith analysis of adult sockeye salmon (n=822) sampled in proportion to the daily harvest during the Resurrection Bay fishery (26 May to 26 June) indicated that 0.5% (± 0.5%) [mean ± confidence interval] were from BY09-Wild, 0.4% (± 0.4%) were BY09-Fry, 21.7% (± 2.8%) were BY10-Fry, 18.0% (± 2.6%) were BY10-Smolt, 1.7% (± 0.9%) were BY10-Wild, 13.9% (± 2.4%) were BY11-Fry, 36.1% (± 3.3%) were BY11-Smolt, 0.6% (± 0.5%) were BY11-Wild and 7.2% (± 1.6%) could not be read. As expected, there were no fish identified as BY09-Smolt because these fish were culled prior to stocking due to an IHN outbreak.

Otolith analysis of adult sockeye salmon (n=372) sampled in proportion to the daily harvest during the Bear Lake Weir Fishery (12 June to 28 June) indicated that 0.8% (± 0.9%) were BY09-Fry, 0.5% (± 0.7%) were BY10-Wild, 42.2% (± 5.0%) were BY10-Fry, 4.3% (± 2.1%) were BY10-Smolt, 05% (± 0.7%) were BY11-Wild, 39.5% (± 5.0%) were BY11-Fry, 9.1% (± 2.9%) were BY11-Smolt and 3.0% (± 1.7%) could not be identified.

Summarizing, 40.1% of the Resurrection Bay Harvest (63,537) came from the fry program while the remainder (59.9%) came from the smolt program. In contrast, 86.0% of the Bear Lake weir harvest came from the fry program and 14.0% from the smolt program. Although it is not surprising to have the weir harvest be predominantly from the fry program, it is interesting to

note that despite the smolt program being released at net pens in Resurrection Bay, some adults still found their way to Bear Lake.

Marine Survival

Based on information collected from migrating sockeye salmon smolt and returning 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 (2010 and 2011) and by CIAA (2012 onward), 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 (BY06 onward). This information is summarized in Table 11. Caution should be used in interpreting the results for BY05 through BY07. Due to poor thermal marking, there are a number of different variations of the thermal mark making it very difficult to determine the program (fry or smolt) contribution to the total return. This problem has been corrected.

For the return in 2015, age composition as determined by otolith collection in the Resurrection Bay fishery is applied only to the commercial and saltwater cost recovery harvests. Age composition for escapement, broodstock, and freshwater cost recovery harvest uses the information provided by otolith analysis at the weir. Unfortunately, no analysis can be provided for the sport fish harvest because this harvest was spread across two locations—the creek mouth and near the shore where the net pens are located.

For the coho salmon, two different programs, fry and smolt, contributed to the adult return in 2015. Although data are incomplete, the fry program has an 8.5% marine survival (3,839 adult return from a 44,700 smolt count at the weir) while the smolt program experienced a 3.1% marine survival (1,727 adult return from a 55,000 smolt release).

Table 8. Coho and sockeye salmon releases at Bear Lake, 1986 to 2015.

	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	1.00	237,000	8.86	2,437,000	0.65	-	-	619,000	9.9
2008[6]	360,000	1.40	142,000	12.5	2,400,000	0.60	-	-	1,600,000	10.4
2009[6]	270,000	1.30	68,000	13.5	2,543,000	0.50	-	-	1,675,000	13.2
2010[6]	435,000	1.20	-	-	2,200,000	0.65	-	-	1,650,000	13.6
2011[7]	437,000	1.01	-	-	2,488,000	0.60	-	-	-	-
2012	222,000	1.68	93,000	12.3	2,490,000	0.61	-	-	1,305,000	10.8
2013	405,000	1.00	-	-	2,548,000	0.49	-	-	2,090,000	14.7
2014	468,000	0.95	55,000	12.2	2,405,000	0.43	-	-	1,742,000	14.5
2015	448,000	1.14	98,000	14.5	2,415,000	0.55	-	-	1,758,000	15.3
Total	11,676,800		2,823,330		46,096,000		2,009,000		14,953,200	
Ave	376,671	0.99	148,596	11.5	1,707,259	0.50	669,667	3.96	1,068,086	10.80

Table 9. Eggs collected for Bear Lake enhancement, 1989 to 2015.

	Coho				Sockeye			
Brood Year	Brood Stock	Green Eggs	Eyed Eggs	% Survival to Eyed	Brood Stock	Green Eggs	Eyed Eggs	% Survival to Eyed
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	89.4
2007	Bear L	748,000	581,000	77.7	Bear L	6,071,000	5,398,000	88.9
2008	Bear L	574,000	283,000	49.3	Bear L	6,033,000	5,531,000	91.7
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
2012	Bear L	638,600	518,300	81.2	Bear L	6,041,114	5,611,491	92.9
2013	Bear L	630,000	577,000	91.6	Bear L	5,325,100	4,774,200	89.7
2014	Bear L	581,279	547,422	94.2	Bear L	5,292,800	4,656,248	88.0
2015	Bear L	575,260	522,359	90.8	Bear L	5,148,399	4,786,569	93.0
Total		23,205,811	19,570,273			111,444,113	96,903,508	
Ave				83.2				83.6

Table 10. Bear Lake smolt production by brood years.

Brood Year		Coho Escap.	No. Fry Stocked	Size (g)	No. Smolt	Hatch Smolt	% Hatch. Survival
1985		4,421	445,700	1.64	74,520		
1986		5,115	226,300	1.46	54,700		
1987		5,653	347,200	1.00	111,570		
1988		1,640	491,300	0.75	78,680		
1989		475	333,200	1.30	91,280		
1990		919	390,600	1.42	118,000		
1991		227	203,800	0.49	86,470		
1992		332	450,000	0.30	91,950		
1993		560	335,000	0.22	62,800		
1994		475	509,000	0.75	204,100		
1995		444	350,000	0.70	84,600		
1996		380	448,700	0.63	64,500		
1997		276	409,000	0.66	57,700		
1998		350	306,000	0.82	74,827		
1999		368	316,100	0.94	100,200	83,300	26.4
2000		429	311,000	0.99	114,300	97,300	31.3
2001		495	405,000	1.04	187,000	163,600	40.4
2002		875	405,000	1.37	63,300	58,900	14.5
2003		395	406,000	1.07	69,700	67,800	16.7
2004		572	405,000	1.30	92,700	89,900	22.2
2005		546	447,000	0.84	71,900	70,000	15.7
2006		500	521,000	1.00	56,600	55,700	10.7
2007		386	360,000	1.40	60,700	59,800	16.6
2008		368	270,000	1.30	IC	IC	IC
2009		535	435,000	1.20	IC	IC	IC
2010		492	437,000	1.00	38,100	37,000	8.5
2011		359	222,000	1.68	25,200	24,200	10.9
2012		315	405,000	1.00	*44,800*	*44,000*	*10.9*
2013	*	300	468,000	0.95	*81,600*	*80,900*	*17.3*
2014	*	534	448,000	1.14	*45,900*	*45,700*	*10.2*
2015	*	253	446,600	1.00			
Ave[1]		444	394,100	1.00	84,013	73,409	19.4

No Thermal Marking

IC-incomplete data

* 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.

Table 10 continued. Bear Lake smolt production by brood years.

Brood Year		Sockeye Escap.	No. Fry Stocked	Size (g)	No. Smolt	Hatch. Smolt	% Hatch. Survival
1985		1,235	-	-	19,740	No Thermal Marking	
1986		830	-	-	8,450		
1987		212	-	-	4,320		
1988		106	-	-	4,030		
1989		185	2,260,000	0.80	345,000		
1990		1,071	1,530,000	0.35	157,800		
1991		741	1,796,000	0.72	910,600		
1992		1,925	1,813,000	0.38	288,200		
1993		5,045	170,000	0.15	74,400	51,800	30.5
1994		8,430	330,000	0.37	154,900	100,000	30.3
1995		8,334	781,000	0.37	296,500	220,600	28.2
1996		8,012	788,000	0.34	97,900	71,100	9.0
1997		7,945	265,000	0.56	84,800	64,200	24.2
1998		8,427	1,380,000	0.25	179,400	135,100	9.8
1999		7,815	1,796,400	0.80	368,700	312,800	17.4
2000		11,828	144,500	0.30	108,100	45,400	31.4
2001		12,801	3,209,000	0.49	1,352,900	917,900	28.6
2002		12,504	1,467,000	0.42	105,600	102,800	7.0
2003		13,233	3,012,000	0.63	1,579,000	1,122,900	37.3
2004		8,061	3,020,000	1.17	1,858,400	699,200	23.2
2005		10,285	2,414,000	0.52	1,288,700	623,600	25.8
2006		8,338	2,437,000	0.65	290,800	290,700	11.9
2007		8,420	2,400,000	0.60	290,100	285,700	11.9
2008		8,992	2,543,000	0.50	579,900	567,500	22.3
2009		9,977	2,200,000	0.65	454,200	442,700	20.1
2010		8,564	2,488,000	0.60	509,400	508,000	20.4
2011		9,389	2,490,000	0.61	819,700	810,700	32.6
2012		8,031	2,548,000	0.49	360,200	346,900	13.6
2013	*	8,999	2,405,000	0.43	*693,300*	*672,800*	*28.0*
2014	*	9,233	2,415,000	0.55	*890,700*	*884,500*	*36.6*
2015	*	9,560	2,374,000	0.65			
Ave[1]		9,227	1,872,900	0.53	542,700	386,000	21.8

IC-incomplete data

* Incomplete broodyear

[1]Average data is for 1993 onward. For # Smolts, Hatchery Smolt and % Survival 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, BY2005 hatchery smolt do not include the number that were stocked as smolts into Beak Lake

BY2006 - BY2015 hatchery smolt is from fry stocking only. Smolt stocking went to Resurrection Bay

Table 11. Marine survival for sockeye salmon at Bear Lake.

BY	Lake (Fry) Marine Survival	NetPen (Smolt) Marine Survival
1989	5.0	NA
1990	24.9	NA
1991	5.4	NA
1992	15.5	NA
1993	17.3	NA
1994	34.4	NA
1995	16.2	NA
1996	15.9	NA
1997	15.9	NA
1998	18.9	NA
1999	8.4	NA
2000	17.3	NA
2001	9.8	NA
2002	26.6	NA
2003	6.1	NA
2004	11.1	NA
2005[a]	*1.2*	NA
2006[b]	56.6	0.1
2007[b]	47.0	3.4
2008	12.7	0.9
2009	13.7	NA
2010	13.20	7.07
2011	*9.60*	*2.26*
2012	*2.1*	*0.94*
AVE	18.7	2.9

[a]= methodolgy changed between the 2 and 3 yr

[b]=poor thermal marking makes it difficult to ascertain which program contributed to the return

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RECOMMENDATIONS

The coho salmon program at Bear Lake saw a significant increase in smolt production in 2015 in contrast to the previous years. Reasons for the decline and the now increase in production is unknown. Further analyses of the data should be completed to determine what may be influencing the coho smolt production from the lake.

The number of fish caught in the sport fishery for both sockeye and coho salmon is an estimate. Sport fish harvest is based on the mail-in Statewide Sport Fish Survey.[6] These numbers are not available until the summer after the fish had been caught. It has been some time since a creel survey has been performed in Resurrection Bay to validate the Statewide Sport Fish Survey results. An assessment on the number of fish harvested and their age composition as well as the hatchery program contribution (fry versus smolt) in the Resurrection Bay sport fishery is necessary—CIAA and ADF&G should collaborate on performing this assessment.

The erythromycin injection project has proven to be working for the sockeye broodstock program based on the decrease in BKD incidence. In 2016, all returns (2 and 3 year old) will be from broodstock that were injected with erythromycin and should therefore have a lower incidence of BKD. However, 2016 will be the last year in which erythromycin will be available. Due to low demand, suppliers are no longer manufacturing erythromycin. Other researchers have been experimenting with a new drug called Draxxin. This new drug will need to be investigated to see if it is a suitable substitute. Without a suitable substitute, family tracking may become a necessity.

This is the second year in which no coho salmon eggs were culled due to BKD. This is a reflection of the family tracking program for BKD in the broodstock. This program should be continued.

6 https://www.adfg.alaska.gov/sf/sportfishingsurvey/.

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APPENDICES

Appendix 1. Bear Lake 2015 - 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)
5/27/2015	B	1	4.2	1.5	1.4	150.3	8.7	1.7	80 :1	2,352	310	1.28	0.49	11.5
5/27/2015	B	14	8.1	1.6	1.5	176.6	14.0	0.0	48 :1	2,582	285	4.06	0.91	
6/29/2015	B	1	9.0	4.2	1.0	138.9	14.1	0.0	34 :1	1,784	312	2.32	0.51	11.6
6/29/2015	B	14	9.3	3.8	1.4	127.7	13.5	0.0	30 :1	2,455	391	4.78	2.67	
8/5/2015	B	1	4.1	3.0	1.1	170.2	11.0	0.0	92 :1	1,890	152	0.85	0.29	10.5
8/5/2015	B	14	9.1	4.8	3.1	196.9	14.1	0.0	48 :1	2,707	348	7.03	0.47	
9/9/2015	B	1	5.5	5.0	0.1	148.0	11.9	2.3	61 :1	2,140	219	1.70	0.46	10.2
9/9/2015	B	15	34.2	6.0	2.5	253.2	45.2	2.8	17 :1	2,749	203	1.11	0.95	
Mean			10.4	3.7	1.5	170.2	17.4	0.9	51 :1	2,332	278	2.9	0.8	11.0
Min			4.1	1.5	0.1	127.7	8.7	0.0	17 :1	1,784	152	0.9	0.3	10.2
Max			34.2	6.0	3.1	253.2	45.2	2.8	92 :1	2,749	391	7.0	2.7	11.6
1m Ave			5.7	3.4	0.9	151.9	11.4	1.0	67 :1	2,042	248	1.5	0.4	11.0
Hypo Ave			15.2	4.1	2.1	188.6	21.7	0.7	36 :1	2,623	307	4.2	1.3	

NH3+NH4 average does not include highlight number. Out of range-sample contamination

NA-not available due to equipment failure.

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)
5/27/2015	B	1	69	7.4	31.7	0.9	5	12.3	0.2	16	4.0
5/27/2015	B	14	72	6.9	30.4	0.4	4	12.2	0.2	20	
6/29/2015	B	1	78	7.5	30.9	0.6	6	12.4	0.0	12	3.5
6/29/2015	B	14	78	6.6	29.9	0.6	5	12.3	0.0	10	
8/5/2015	B	1	85	7.4	30.4	0.2	8	12.4	0.0	7	6.0
8/5/2015	B	14	88	6.5	31.1	2.6	8	12.9	0.0	0	
9/9/2015	B	1	83	7.4	31.5	0.5	4	12.5	0.1	15	5.5
9/9/2015	B	15	84	6.6	33.3	3.5	4	12.6	0.0	86	
Mean			80	7.0	31.2	1.2	5.5	12.5	0.1	23.7	4.8
Min			69	6.5	29.9	0.2	4.0	12.2	0.0	0.0	3.5
Max			88	7.5	33.3	3.5	8.0	12.9	0.2	86	6.0
1m Ave			78.8	7.4	31.1	0.6	5.8	12.4	0.1	12.5	4.8
Hypo Ave			80.5	6.7	31.2	1.8	5.3	12.5	0.1	29.0	

Fe average does not include higlighted number. Out of range-sample contamination

Macrozooplankton Density - Site A - Depth 12.5m - 14m
(No/m2)

	27-May	29-Jun	5-Aug	9-Sep	Mean (No/m2)	Seasonal Mean (No/m2)
Ergasilus						
Ovig Ergasilus						
Epischura	69	2,102	4,299	159	1,657	1,657
Ovig Epischura						
Diaptomus	239				239	60
Ovig Diaptomus						
Cyclops	23,025	26,752	7,325	4,140	15,311	15,311
Ovig. Cyclops		8,217	1,274		4,746	2,373
Bosmina	1,433	61,338	139,650	10,032	53,113	53,113
Ovig. Bosmina	573	25,032	16,083	3,822	11,378	11,378
Daphnia l.	6,783	26,561	143,312	53,981	57,659	57,659
Ovig. Daphnia l.	1,338	477	24,541	22,452	12,202	12,202
Daphnia g.						
Ovig Daphnia g.						
Imm. Calanoid						
Scapholeberis						
Chydorinae	96		318		207	104
Ovig Chydorinae						
Copepod Nauplii						
Ceriodaphnia			796	1,752	1,274	637
Ovig. Ceriodaphnia				22,452	22,452	5,613
TOTAL	**33,556**	**150,479**	**337,598**	**118,790**	**180,237**	**160,106**
AVERAGE	**4,195**	**21,497**	**37,511**	**14,849**	**16,385**	**14,555**
STDEV:	**7,925**	**21,006**	**59,490**	**18,102**	**20,582**	**20,900**

Macrozooplankton Density - Site B - Depth 16m - 18m
(No/m2)

	27-May	29-Jun	5-Aug	9-Sep	Mean (No/m2)	Seasonal Mean (No/m2)
Ergasilus						
Ovig Ergasilus						
Epischura	2,389	1,274	2,452	510	1,656	1,656
Ovig Epischura						
Diaptomus						
Ovig Diaptomus				255		
Cyclops	52,452	41,401	16,274	41,274	37,850	37,850
Ovig. Cyclops		9,395	2,898		6,147	3,073
Bosmina	1,911	36,624	192,834	19,873	62,811	62,811
Ovig. Bosmina	3,344	12,898	18,726	6,879	10,462	10,462
Daphnia l.	20,064	19,268	203,758	76,943	80,008	80,008
Ovig. Daphnia l.	5,159	1,115	50,605	29,299	21,545	21,545
Daphnia g.						
Ovig Daphnia g.						
Imm. Calanoid						
Scapholeberis						
Chydorinae	96		223	510	276	207
Ovig Chydorinae						
Copepod Nauplii						
Ceriodaphnia			669	510	590	295
Ovig. Ceriodaphnia				3,057	3,057	764
TOTAL	**85,415**	**121,975**	**488,439**	**179,110**	**224,401**	**218,671**
AVERAGE	**12,202**	**17,425**	**54,271**	**17,911**	**22,440**	**21,867**
STDEV:	**18,968**	**16,118**	**83,206**	**25,225**	**28,611**	**29,029**

Appendix 1. (continued) Bear Lake 2015 - Zooplankton Analysis

	Body Size - Site A - Depth 12.5m - 14m (mm)				Seasonal Means				
	27-May	29-Jun	5-Aug	9-Sep	Mean Length (mm)	Weighted Length (mm)	Biomass (mg/m2)	Weighted Biomass (mg/m2)	% by Species
Ergasilus									
Ovig Ergasilus									
Epischura	0.81	1.46	0.95	0.69	0.98	1.10	7.0	9.9	3.8%
Ovig Epischura									
Diaptomus	0.70				0.70	0.70	0.1	0.1	0.0%
Ovig Diaptomus									
Cyclops	0.86	1.11	0.65	0.68	0.83	0.93	36.5	47.4	18.2%
Ovig. Cyclops		1.24	1.28		1.26	1.25	14.0	13.7	5.2%
Bosmina	0.38	0.38	0.34	0.31	0.35	0.35	60.0	59.3	22.7%
Ovig. Bosmina	0.40	0.43	0.38	0.37	0.40	0.41	16.3	17.4	6.7%
Daphnia l.	0.65	0.78	0.57	0.55	0.64	0.59	99.9	85.0	32.6%
Ovig. Daphnia l.	0.77	1.02	0.66	0.59	0.76	0.63	30.9	20.9	8.0%
Daphnia g.									
Ovig Daphnia g.									
imm. Calanoid									
Scapholeberis									
Chydorinae	0.32		0.34		0.33	0.34	0.1	0.1	0.0%
Ovig Chydorinae									
Copepod Nauplii									
Ceriodaphnia			0.41	0.52	0.47	0.49	0.4	0.5	0.2%
Ovig. Ceriodaphnia				0.59	0.59	0.59	6.5	6.5	2.5%
TOTAL:							**271.9**	**260.7**	**100%**

	Body Size - Site B - Depth 16m - 18m (mm)				Seasonal Means				
	27-May	29-Jun	5-Aug	9-Sep	Mean Length (mm)	Weighted Length (mm)	Biomass (mg/m2)	Weighted Biomass (mg/m2)	% by Species
Ergasilus									
Ovig Ergasilus									
Epischura	0.84	1.62	1.00	1.27	1.18	1.08	12.00	9.33	2.2%
Ovig Epischura									
Diaptomus									
Ovig Diaptomus				1.34	1.34	1.34	0.63	0.63	
Cyclops	0.88	1.05	0.85	0.81	0.90	0.90	108.11	109.84	25.7%
Ovig. Cyclops		1.24	1.29	1.23	1.25	1.25	17.94	17.89	4.2%
Bosmina	0.38	0.36	0.36	0.36	0.37	0.36	76.40	74.27	17.4%
Ovig. Bosmina	0.39	0.42	0.40	0.39	0.40	0.40	15.44	15.74	3.7%
Daphnia l.	0.62	0.83	0.64	0.61	0.68	0.64	156.85	141.15	33.0%
Ovig. Daphnia l.	0.71	0.98	0.83	0.70	0.81	0.78	61.90	57.89	13.5%
Daphnia g.									
Ovig Daphnia g.									
Imm. Calanoid									
Scapholeberis									
Chydorinae	0.32		0.34	0.27	0.31	0.29	0.18	0.16	0.0%
Ovig Chydorinae									
Copepod Nauplii									
Ceriodaphnia			0.43	0.57	0.50	0.49	0.24	0.23	0.1%
Ovig. Ceriodaphnia				0.55	0.55	0.55	0.77	0.77	0.2%
TOTAL:							**450.43**	**427.89**	**100%**

Appendix 2. Bear Lake 2015 - Environmental Conditions

Date	Sky	Precip. (mm)	Upper Gauge (ft)	Lower Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-May						
2-May						
3-May						
4-May						
5-May						
6-May	4	0.0	0.88	1.38	7.8	8.0
7-May	5	3.4	0.94	1.38	8.9	11.0
8-May	5	27.9	0.96	1.58	7.8	9.0
9-May	5	12.5	0.90	1.70	8.9	9.0
10-May	3	4.4	0.90	1.78	8.9	9.0
11-May	3	1.2	0.96	1.75	8.9	10.0
12-May	2	0.5	0.94	1.75	10.6	15.0
13-May	4	0.0	0.90	1.72	10.0	12.0
14-May	4	0.0	0.88	1.67	9.4	9.5
15-May	4	1.9	0.90	1.66	8.9	8.5
16-May	3	7.5	0.88	1.65	9.4	12.0
17-May	1	0.9	0.91	1.60	10.6	11.0
18-May	2	0.1	0.90	1.57	10.0	12.0
19-May	4	0.0	0.90	1.52	10.0	10.0
20-May	2	0.0	0.94	1.53	10.0	11.0
21-May	3	0.0	0.92	1.47	11.1	14.0
22-May	2	0.0	0.96	1.50	12.2	12.0
23-May	5	4.0	0.98	1.54	10.6	9.5
24-May	4	11.5	1.00	1.54	11.7	8.5
25-May	3	5.0	1.00	1.55	11.7	10.0
26-May	1	0.0	1.00	1.54	12.2	11.0
27-May	1	0.6	1.00	1.52	12.8	17.0
28-May	1	0.0	0.98	1.52	13.3	14.5
29-May	1	0.0	0.85	1.50	14.4	17.5
30-May	2	0.0	0.85	1.48	16.1	20.0
31-May	2	0.0	0.92	1.46	16.7	17.5

Date	Sky	Precip. (mm)	Upper Gauge (ft)	Lower Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Jun	4	0.0	0.88	1.46	14.4	10.0
2-Jun	4	9.0	0.90	1.47	14.4	8.5
3-Jun	5	6.5	0.90	1.48	15.0	8.0
4-Jun	5	23.0	0.85	1.52	12.8	8.0
5-Jun	5	33.0	0.96	1.60	12.8	6.0
6-Jun	4	9.0	0.95	1.70	12.8	4.0
7-Jun	3	0.8	0.89	1.70	13.3	11.0
8-Jun	4	3.2	0.90	1.68	12.2	7.0
9-Jun	5	19.0	0.90	1.68	12.2	6.5
10-Jun	3	8.0	0.94	1.75	12.8	8.5
11-Jun	3	0.0	0.92	1.74	12.8	10.0
12-Jun	3	0.8	0.94	1.73	13.9	13.0
13-Jun	2	0.0	0.94	1.68	15.6	18.0
14-Jun	3	0.0	0.94	1.66	16.7	19.0
15-Jun	1	0.0	0.90	1.52	17.8	22.0
16-Jun	2	0.0	0.88	1.58	17.8	20.0
17-Jun	1	0.0	0.92	1.64	16.7	17.0
18-Jun	2	0.0	0.98	1.60	17.8	15.0
19-Jun	4	0.0	0.92	1.58	16.7	13.0
20-Jun	3	0.0	0.94	1.58	16.7	13.0
21-Jun	4	0.0	0.90	1.58	16.7	13.0
22-Jun	1	0.0	0.90	1.54	17.2	16.0
23-Jun	3	0.0	0.87	1.52	15.6	12.5
24-Jun	2	0.0	0.92	1.52	17.2	16.0
25-Jun	4	0.0	0.95	1.50	16.7	13.0
26-Jun	4	0.5	0.92	1.52	15.6	11.0
27-Jun	5	3.6	0.94	1.55	15.6	11.0
28-Jun	5	14.0	0.96	1.55	15.6	10.0
29-Jun	5	8.0	0.94	1.58	16.1	10.0
30-Jun	5	6.6	0.94	1.56	16.1	9.5

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 2015 - Environmental Conditions

Date	Sky	Precip. (mm)	Upper Gauge (ft)	Lower Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Jul	2	1.0	0.94	1.52	16.7	12.5
2-Jul	3	0.0	0.94	1.55	15.6	11.0
3-Jul	2	0.0	0.92	1.52	17.2	14.0
4-Jul	5	1.8	0.90	1.50	15.6	10.0
5-Jul	4	1.0	0.90	1.50	16.1	14.0
6-Jul	4	0.6	0.88	1.55	16.7	14.0
7-Jul	3	13.5	0.90	1.53	16.4	13.5
8-Jul	3	0.0	0.90	1.54	16.4	13.0
9-Jul	2	0.5	0.90	1.50	16.4	13.0
10-Jul	4	0.0	0.89	1.50	17.5	14.5
11-Jul	3	0.0	0.90	1.48	17.5	15.0
12-Jul	4	2.8	0.98	1.52	16.7	16.0
13-Jul	4	10.4	1.00	1.50	16.7	10.0
14-Jul	4	4.0	0.94	1.50	16.1	11.0
15-Jul	4	0.9	0.94	1.50	15.6	11.5
16-Jul	5	14.0	0.96	1.52	15.6	11.0
17-Jul	3	20.0	1.00	1.53	15.6	12.0
18-Jul	3	0.0	1.03	1.55	15.8	14.5
19-Jul	2	0.0	1.02	1.55	16.1	19.0
20-Jul	2	0.0	1.00	1.50	17.2	19.0
21-Jul	3	0.0	1.00	1.50	17.2	17.0
22-Jul	5	8.0	0.98	1.52	16.1	11.0
23-Jul	3	8.0	1.00	1.52	16.1	16.0
24-Jul	2	0.0	1.00	1.52	16.7	21.0
25-Jul	4	0.0	1.00	1.50	16.1	13.0
26-Jul	4	14.0	1.00	1.50	16.1	13.0
27-Jul	3	2.0	1.00	1.50	16.1	14.0
28-Jul	4	0.0	0.98	1.50	16.1	14.0
29-Jul	4	3.1	0.96	1.50	16.1	15.0
30-Jul	2	0.0	0.96	1.50	16.7	19.0
31-Jul	2	0.0	0.96	1.48	16.7	21.0

Date	Sky	Precip. (mm)	Upper Gauge (ft)	Lower Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Aug	3	8.0	0.92	1.46	17.2	18.0
2-Aug	2	0.0	0.94	1.46	17.2	17.0
3-Aug	2	0.0	0.96	1.46	17.2	18.0
4-Aug	2	0.0	0.92	1.46	17.2	19.0
5-Aug	4	0.0	0.92	1.46	17.2	15.0
6-Aug	3	0.0	0.94	1.45	17.2	16.0
7-Aug						
8-Aug						
9-Aug						
10-Aug						
11-Aug						
12-Aug						
13-Aug						
14-Aug						
15-Aug					17.2	15.0
16-Aug					17.2	14.0
17-Aug					17.2	14.0
18-Aug					17.2	15.0
19-Aug						
20-Aug						
21-Aug						
22-Aug						
23-Aug						
24-Aug					15.6	13.0
25-Aug						
26-Aug						
27-Aug						
28-Aug					12.8	11.0
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 2015 - Environmental Conditions

Date	Sky	Precip. (mm)	Upper Gauge (ft)	Lower Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Sep						
2-Sep						
3-Sep						
4-Sep					13.9	13.0
5-Sep					13.9	9.0
6-Sep						
7-Sep						
8-Sep						
9-Sep	5	0.0	0.42	1.40	13.3	7.0
10-Sep	5	25.0	0.83	1.30	12.8	6.5
11-Sep	4	15.5	0.85	1.35	13.9	7.0
12-Sep	3	10.0	0.90	1.34	12.2	8.0
13-Sep	4	0.9	0.92	1.30	14.4	9.0
14-Sep	3	5.0	0.92	1.35	13.3	8.5
15-Sep	5	14.0	0.98	1.38	13.3	6.0
16-Sep	3	2.8	0.88	1.38	12.2	7.0
17-Sep	5	15.5	0.96	1.42	11.7	4.0
18-Sep	3	2.2	0.97	1.40	12.2	4.0
19-Sep	2	0.5	0.96	1.40	11.1	5.0
20-Sep	2	0.3	0.90	1.35	10.3	8.0
21-Sep	2	0.0	0.90	1.32	10.3	5.0
22-Sep	2	0.0	0.88	1.30	10.0	4.0
23-Sep	1	0.0	1.00	1.25	10.0	3.5
24-Sep	1	0.0	1.00	1.28	9.4	4.0
25-Sep	4	0.0	0.92	1.24	7.8	5.0
26-Sep	4	0.4	0.92	1.22	9.4	5.0
27-Sep	5	9.3	0.96	1.20	10.0	5.0
28-Sep	5	5.6	0.96	1.22	10.0	7.0
29-Sep	5	22.5	1.06	1.35	10.0	4.0
30-Sep	2	7.5	0.96	1.36	8.9	1.0

Date	Sky	Precip. (mm)	Upper Gauge (ft)	Lower Gauge (ft)	Water Temp (oC)	Air Temp (oC)
1-Oct	4	0.5	1.02	1.30	7.8	3.5
2-Oct	5	13.5	0.66	1.30	7.8	1.5
3-Oct	4	27.5	1.00	1.38	7.8	3.0
4-Oct	1	0.7	0.90	1.38	8.9	5.0
5-Oct	2	0.0	0.85	1.30	8.9	4.0
6-Oct	4	0.0	0.90	1.35	8.9	5.0
7-Oct	4	0.0	0.92	1.38	8.9	4.5
8-Oct	4	12.5	0.94	1.37	8.9	7.0
9-Oct	4	7.5	0.96	1.38	9.4	7.0
10-Oct	3	10.5	0.98	1.38	8.9	4.5
11-Oct	3	21.0	1.03	1.40	8.9	5.0
12-Oct	3	0.7	1.02	1.45	8.9	5.0
13-Oct	3	1.6	1.01	1.44	8.9	6.0
14-Oct	5	7.5	1.00	1.40	8.3	5.0
15-Oct	5	3.4	1.00	1.40	7.8	3.0
16-Oct	4	3.2	1.04	1.40	8.3	5.0
17-Oct	4	11.5	0.88	1.36	8.3	5.0
18-Oct	5	19.0	0.90	1.44	8.3	3.5
19-Oct	3	3.2	0.88	1.42	8.3	4.0
20-Oct	3	0.0	0.86	1.42	8.3	5.0
21-Oct						
22-Oct						
23-Oct						
24-Oct						
25-Oct						
26-Oct						
27-Oct						
28-Oct						
29-Oct						
30-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 2015 - Smolt Migration.

	Sockeye				Coho				Dolly Varden		Rainbow Trout	
Date	Daily	Otoliths	Cumm	% Smpl	Daily	Otoliths	Cumm	% Smpl	Daily	Cumm	Daily	Cumm
01-May	2,980	2	2,980	0.07%	57	0	57	0.00%	0	0	0	0
02-May	857	1	3,837	0.12%	21	0	78	0.00%	0	0	0	0
03-May	1,190	2	5,027	0.17%	15	0	93	0.00%	0	0	3	3
04-May	7,791	8	12,818	0.10%	177	1	270	0.56%	18	18	1	4
05-May	5,635	5	18,453	0.09%	159	1	429	0.63%	0	18	0	4
06-May	5,552	6	24,005	0.11%	162	1	591	0.62%	1	19	1	5
07-May	10,553	10	34,558	0.09%	295	3	886	1.02%	5	24	2	7
08-May	906	1	35,464	0.11%	75	1	961	1.33%	1	25	0	7
09-May	6	0	35,470	0.00%	66	1	1,027	1.52%	0	25	0	7
10-May	81	1	35,551	1.23%	74	0	1,101	0.00%	0	25	0	7
11-May	16,524	15	52,075	0.09%	630	2	1,731	0.32%	2	27	1	8
12-May	65,910	64	117,985	0.10%	2,378	16	4,109	0.67%	5	32	0	8
13-May	54,917	55	172,902	0.10%	1,146	8	5,255	0.70%	7	39	7	15
14-May	79,390	76	252,292	0.10%	3,065	14	8,320	0.46%	62	101	73	88
15-May	15,671	16	267,963	0.10%	1,187	8	9,507	0.67%	10	111	15	103
16-May	47,697	48	315,660	0.10%	3,727	20	13,234	0.54%	18	129	0	103
17-May	36,330	36	351,990	0.10%	4,607	31	17,841	0.67%	27	156	0	103
18-May	29,979	30	381,969	0.10%	3,449	23	21,290	0.67%	21	177	1	104
19-May	66,293	65	448,262	0.10%	7,828	52	29,118	0.66%	7	184	1	105
20-May	41,485	42	489,747	0.10%	5,457	37	34,575	0.68%	18	202	3	108
21-May	36,785	36	526,532	0.10%	6,146	41	40,721	0.67%	16	218	2	110
22-May	59,264	59	585,796	0.10%	6,179	41	46,900	0.66%	17	235	1	111
23-May	21,972	22	607,768	0.10%	4,809	32	51,709	0.67%	4	239	1	112
24-May	29,577	29	637,345	0.10%	3,349	22	55,058	0.66%	9	248	3	115
25-May	10,886	11	648,231	0.10%	2,162	14	57,220	0.65%	3	251	2	117
26-May	9,286	10	657,517	0.11%	2,272	16	59,492	0.70%	2	253	2	119
27-May	5,857	5	663,374	0.09%	1,827	11	61,319	0.60%	3	256	1	120
28-May	7,848	8	671,222	0.10%	1,189	9	62,508	0.76%	0	256	0	120
29-May	6,602	7	677,824	0.11%	1,415	9	63,923	0.64%	0	256	0	120
30-May	10,558	10	688,382	0.09%	1,176	8	65,099	0.68%	1	257	0	120
31-May	2,513	3	690,895	0.12%	678	4	65,777	0.59%	0	257	0	120
01-Jun	7,143	7	698,038	0.10%	2,630	18	68,407	0.68%	3	260	0	120
02-Jun	5,037	5	703,075	0.10%	1,260	8	69,667	0.63%	0	260	0	120
03-Jun	764	1	703,839	0.13%	749	5	70,416	0.67%	0	260	0	120
04-Jun	1,693	1	705,532	0.06%	1,298	8	71,714	0.62%	0	260	0	120
05-Jun	2,551	2	708,083	0.08%	1,980	14	73,694	0.71%	0	260	0	120
06-Jun	1,784	2	709,867	0.11%	2,075	13	75,769	0.63%	0	260	0	120
07-Jun	3,332	3	713,199	0.09%	1,291	8	77,060	0.62%	1	261	0	120
08-Jun	1,032	1	714,231	0.10%	527	4	77,587	0.76%	0	261	0	120
09-Jun	2,444	1	716,675	0.04%	1,050	7	78,637	0.67%	0	261	0	120
10-Jun	3,336	4	720,011	0.12%	1,080	7	79,717	0.65%	0	261	0	120
11-Jun	1,794	2	721,805	0.11%	1,840	12	81,557	0.65%	1	262	0	120
12-Jun	408	0	722,213	0.00%	1,176	8	82,733	0.68%	0	262	0	120
13-Jun	444	0	722,657	0.00%	1,589	11	84,322	0.69%	0	262	0	120
14-Jun	754	1	723,411	0.13%	1,599	10	85,921	0.63%	0	262	0	120
15-Jun	443	0	723,854	0.00%	1,515	10	87,436	0.66%	0	262	0	120
16-Jun	293	0	724,147	0.00%	963	7	88,399	0.73%	1	263	0	120
17-Jun	290	1	724,437	0.34%	559	3	88,958	0.54%	0	263	0	120
18-Jun	410	0	724,847	0.00%	442	3	89,400	0.68%	0	263	0	120
19-Jun	423	1	725,270	0.24%	414	4	89,814	0.97%	0	263	0	120
20-Jun	434	0	725,704	0.00%	349	2	90,163	0.57%	0	263	0	120
21-Jun	454	1	726,158	0.22%	316	2	90,479	0.63%	0	263	0	120
22-Jun	513	0	726,671	0.00%	235	2	90,714	0.85%	0	263	0	120
23-Jun	759	1	727,430	0.13%	304	2	91,018	0.66%	0	263	0	120
24-Jun	400	0	727,830	0.00%	319	2	91,337	0.63%	0	263	0	120
25-Jun	386	0	728,216	0.00%	123	1	91,460	0.81%	0	263	0	120
26-Jun	372	0	728,588	0.00%	127	0	91,587	0.00%	0	263	0	120
27-Jun	96	0	728,684	0.00%	45	0	91,632	0.00%	0	263	0	120
28-Jun	80	0	728,764	0.00%	25	0	91,657	0.00%	0	263	0	120
Totals	728,764	717	728,764	0.10%	91,657	597	91,657	0.65%	263	263	120	120

Appendix 4. Bear Lake 2015 - Adult Sockeye Salmon Migration.

Date	Lake Escapement			Donate &		Daily	Cumm.
	Females	Males	Combined	Harvest	Morts	Total	Total
17-May	0	0	0	0	0	0	0
18-May	0	0	0	0	0	0	0
19-May	0	1	1	0	0	1	1
20-May	0	0	0	0	0	0	1
21-May	0	0	0	0	0	0	1
22-May	16	12	28	0	0	28	29
23-May	16	41	57	0	0	57	86
24-May	18	17	35	0	0	35	121
25-May	24	17	41	0	0	41	162
26-May	25	30	55	0	0	55	217
27-May	19	35	54	0	0	54	271
28-May	30	49	79	0	1	80	351
29-May	89	96	185	0	0	185	536
30-May	109	102	211	0	0	211	747
31-May	71	91	162	0	0	162	909
01-Jun	90	155	245	0	0	245	1,154
02-Jun	119	237	356	0	0	356	1,510
03-Jun	140	321	461	0	0	461	1,971
04-Jun	190	416	606	0	0	606	2,577
05-Jun	231	476	707	0	0	707	3,284
06-Jun	150	303	453	0	0	453	3,737
07-Jun	212	359	571	0	0	571	4,308
08-Jun	255	447	702	0	0	702	5,010
09-Jun	484	845	1,329	0	0	1,329	6,339
10-Jun	520	1,192	1,712	0	0	1,712	8,051
11-Jun	446	506	952	382	5	1,339	9,390
12-Jun	575	219	794	718	0	1,512	10,902
13-Jun	587	130	717	953	1	1,671	12,573
14-Jun	696	95	791	1,056	6	1,853	14,426
15-Jun	108	83	191	2,100	11	2,302	16,728
16-Jun	142	69	211	1,868	2	2,081	18,809
17-Jun	153	5	158	1,947	2	2,107	20,916
18-Jun	203	10	213	1,528	0	1,741	22,657
19-Jun	203	10	213	797	0	1,010	23,667
20-Jun	156	7	163	446	2	611	24,278
21-Jun	124	2	126	751	0	877	25,155
22-Jun	185	14	199	1,107	1	1,307	26,462
23-Jun	0	0	0	1,194	0	1,194	27,656
24-Jun	0	0	0	768	0	768	28,424
25-Jun	0	0	0	1,553	0	1,553	29,977
26-Jun	0	0	0	944	2	946	30,923
27-Jun	0	0	0	822	0	822	31,745
28-Jun	0	0	0	715	0	715	32,460
29-Jun	0	0	0	541	1	542	33,002
30-Jun	0	0	0	567	0	567	33,569
01-Jul	0	0	0	887	1	888	34,457
02-Jul	0	0	0	1,271	1	1,272	35,729
03-Jul	0	0	0	756	1	757	36,486
04-Jul	0	0	0	771	0	771	37,257
05-Jul	0	0	0	927	1	928	38,185
06-Jul	0	0	0	693	0	693	38,878
07-Jul	0	0	0	489	1	490	39,368
08-Jul	0	0	0	281	0	281	39,649
09-Jul	0	0	0	328	0	328	39,977
10-Jul	0	0	0	1,052	0	1,052	41,029
11-Jul	0	0	0	619	0	619	41,648
12-Jul	0	0	0	322	0	322	41,970
13-Jul	0	0	0	144	0	144	42,114
14-Jul	0	0	0	211	0	211	42,325
15-Jul	0	0	0	359	0	359	42,684
16-Jul	0	0	0	370	0	370	43,054
17-Jul	0	0	0	182	0	182	43,236
18-Jul	0	0	0	30	0	30	43,266
19-Jul	0	0	0	0	0	0	43,266
20-Jul	0	0	0	0	1	1	43,267
21-Jul	0	0	0	0	0	0	43,267
22-Jul	255	286	541	0	1	542	43,809
23-Jul	54	57	111	59	0	170	43,979
24-Jul	18	57	75	106	0	181	44,160
25-Jul	0	0	0	42	4	46	44,206
26-Jul	0	0	0	172	1	173	44,379
27-Jul	0	0	0	0	0	0	44,379
28-Jul	0	0	0	0	0	0	44,379
29-Jul	0	0	0	149	3	152	44,531
30-Jul	0	0	0	27	0	27	44,558
31-Jul	0	0	0	113	0	113	44,671
01-Aug	0	0	0	88	9	97	44,768
02-Aug	0	0	0	0	0	0	44,768
03-Aug	0	0	0	66	10	76	44,844
04-Aug	0	0	0	48	1	49	44,893
05-Aug	0	0	0	0	0	0	44,893
Total	6,713	6,792	13,505	31,319	69	44,893	44,893

Appendix 5. Bear Lake 2015 - Adult Coho Salmon Migration.

	Lake Escapement			Broodstock			Harvest *			Total		Raceway	Daily	Cumm
Date	Female	Males	Combined	Female	Males	Combined	Females	Males	Combined	Females	Males	Morts	Total	Total
11-Sep	0	12	12	0	0	0	0	0	0	0	12		12	12
12-Sep	0	24	24	0	0	0	0	0	0	0	24		24	36
13-Sep	2	33	35	0	0	0	0	0	0	2	33		35	71
14-Sep	0	18	18	0	0	0	0	0	0	0	18		18	89
15-Sep	0	2	2	0	0	0	0	0	0	0	2		2	91
16-Sep	0	1	1	0	0	0	0	0	0	0	1		1	92
17-Sep	0	3	3	0	0	0	0	0	0	0	3		3	95
18-Sep	0	15	15	0	0	0	0	0	0	0	15		15	110
19-Sep	0	23	23	0	0	0	0	0	0	0	23		23	133
20-Sep	1	19	20	0	0	0	0	0	0	1	19		20	153
21-Sep	0	0	0	0	0	0	0	0	0	0	0		0	153
22-Sep	0	0	0	0	13	13	0	0	0	0	13		13	166
23-Sep	3	0	3	0	33	33	0	0	0	3	33		36	202
24-Sep	2	0	2	0	16	16	0	0	0	2	16		18	220
25-Sep	4	0	4	0	4	4	0	0	0	4	4		8	228
26-Sep	3	0	3	0	17	17	0	0	0	3	17	2	20	248
27-Sep	4	0	4	0	8	8	0	0	0	4	8	3	12	260
28-Sep	3	0	3	7	15	22	0	0	0	10	15	6	25	285
29-Sep	0	0	0	12	106	118	0	0	0	12	106	3	118	403
30-Sep	0	0	0	4	38	42	0	81	81	4	119	4	123	526
01-Oct	1	0	1	1	0	1	0	67	67	2	67	1	69	595
02-Oct	0	0	0	1	25	26	0	17	17	1	42	19	43	638
03-Oct	0	0	0	14	6	20	0	128	128	14	134	5	148	786
04-Oct	0	0	0	8	14	22	0	135	135	8	149	17	157	943
05-Oct	0	0	0	5	0	5	0	78	78	5	78	2	83	1,026
06-Oct	0	0	0	8	2	10	0	73	73	8	75	4	83	1,109
07-Oct	0	0	0	67	0	67	0	106	106	67	106	21	173	1,282
08-Oct	0	0	0	55	18	73	0	88	88	55	106	0	161	1,443
09-Oct	0	0	0	72	0	72	0	83	83	72	83	0	155	1,598
10-Oct	0	0	0	33	0	33	0	69	69	33	69	0	102	1,700
11-Oct	6	0	6	22	0	22	0	49	49	28	49	10	77	1,777
12-Oct	7	0	7	14	14	28	0	13	13	21	27	16	48	1,825
13-Oct	1	0	1	12	0	12	0	21	21	13	21	4	34	1,859
14-Oct	0	0	0	9	6	15	0	5	5	9	11	9	20	1,879
15-Oct	1	0	1	14	18	32	0	0	0	15	18	3	33	1,912
16-Oct	1	0	1	16	14	30	0	0	0	17	14	20	31	1,943
17-Oct	0	0	0	7	5	12	0	0	0	7	5	0	12	1,955
18-Oct	1	0	1	5	12	17	0	0	0	6	12	0	18	1,973
19-Oct	2	0	2	2	2	4	0	0	0	4	2	37	6	1,979
20-Oct	37	32	69	(37)	(32)	(69)	0	0	0	0	0	16	0	1,979
Total	79	182	261	351	354	705	0	1,013	1,013	430	1,549	202	1,979	

Appendix 6. Bear Lake 2015 – Adult Sockeye Age and Sex Characteristics

	Age						
	1.1	1.2	1.3	2.1	2.2	2.3	Total
Sample Period:	19 May - 04 August, 2015						
Males (No.)	30	10,497	10,171	0	771	415	21,883
Percent	0.1%	48.0%	46.5%	0.0%	3.5%	1.9%	48.7%
Sample Size	1	354	343	0	26	14	738
Total Sample Size							958
Mean Length (mm)							
Std. Deviation							
Std. Error							
Mean Weight (kg)	1.00	1.74	2.50		2.12	2.53	2.13
Std. Deviation		0.40	0.38		0.47	0.26	0.53
Std. Error		0.02	0.02		0.09	0.07	0.02
Females (No.)	0	8,807	13,521	30	415	237	23,010
Percent	0.0%	38.3%	58.8%	0.1%	1.8%	1.0%	51.3%
Sample Size	0	297	456	1	14	8	776
Total Sample Size							975
Mean Length (mm)							
Std. Deviation							
Std. Error							
Mean Weight (kg)		1.64	2.21	1.85	1.94	2.10	1.98
Std. Deviation		0.36	0.32		0.26	0.25	0.43
Std. Error		0.02	0.02		0.07	0.09	0.01
Both Sexes (No.)	30	19,303	23,692	30	1,186	652	44,893
Percent	0.1%	43.0%	52.8%	0.1%	2.6%	1.5%	100.0%
Sample Size	1	651	799	1	40	22	1,514
Total Sample Size							1,934
Mean Length (mm)							
Std. Deviation							
Std. Error							
Mean Weight (kg)	1.00	1.69	2.33	1.85	2.06	2.37	2.05
Std. Deviation		0.38	0.37		0.41	0.33	0.49
Std. Error		0.01	0.01		0.06	0.07	0.01

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

Appendix 7. Bear Lake 2015 – Adult Coho Age and Sex Characteristics

	Age			
	1.1	2.1	3.1	Total
Sample Period:	30 September - 20 October, 2015			
Males (No.)	763	188		951
Percent	80.2%	19.8%		48.1%
Sample Size	199	49		248
Total Sample Size				216
Mean Length (mm)	543	538		539
Std. Deviation	330.7	42.7		284.5
Std. Error	23.4	6.1		19.4
Mean Weight (kg)				
Std. Deviation				
Std. Error				
Females (No.)	733	288	0	1,020
Percent	71.8%	28.2%	0.0%	51.6%
Sample Size	191	75	0	266
Total Sample Size				278
Mean Length (mm)	565	581		569
Std. Deviation	36.0	27.9		34.6
Std. Error	2.6	3.2		2.1
Mean Weight (kg)				
Std. Deviation				
Std. Error				
Both Sexes (No.)	1,503	476	0	1,979
Percent	76.0%	24.0%	0.0%	100.0%
Sample Size	392	124	0	516
Total Sample Size				494
Mean Length (mm)	554	564		557
Std. Deviation	236.7	40.3		201.0
Std. Error	12.0	3.6		9.0
Mean Weight (kg)				
Std. Deviation				
Std. Error				

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

Appendix 8. Bear Lake 2015 – Project Updates

Sockeye Salmon Project

Stocking & Misc. Activities

Crew on-site:	6-May			
Ice-out:				
Crew off-site:	19-Oct			
Fry stocking:	4-Jun		2,415,000	0.55
PreSmolt stocking:				
Smolt stocking:(Res Bay)	2-Jun		1,758,000	15.3
Fertilizer application:	3-Jun	to 10-Jul	1,110	

Egg Take

Dates:	29-Jul to 4-Aug		
No. of broodstock used*:		3,945	
Green eggs:		5,148,399	
Fecundity:		2,703	
Eyed eggs:		4,786,569	
% Survival		93.0%	

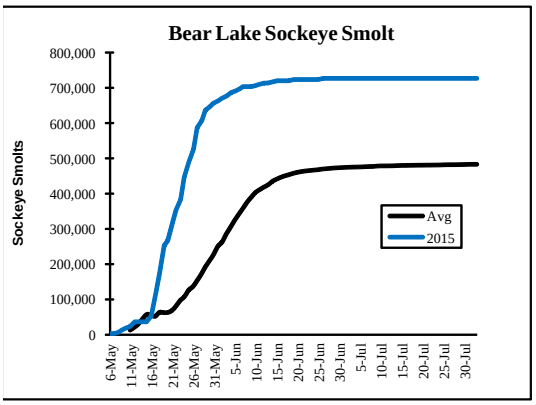
Smolt Migration

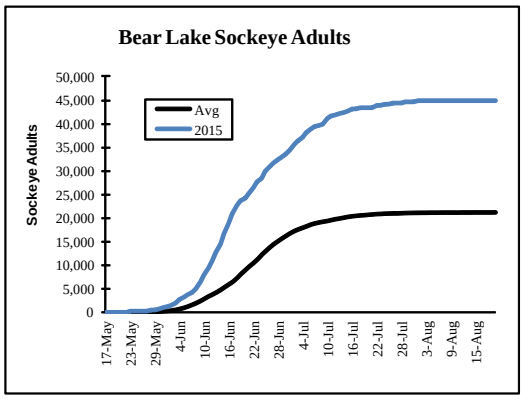
Dates:	6-May to 3-Jul		
Sockeyes:		**728,764**	
Percent age 1:		679,495	93.2%
Percent age 2:		49,269	6.8%
Percent age 3:		0	0.0%
Percent hatchery:		707,209	97.0%
Dolly Varden:		263	

Adult Migration

Dates:	22-May to 24-Jul		
Total return:		**124,859**	
Commercial & Sport Fish harvest:		16,633	13.3%
C.R. harvest(FW & SW):		94,652	75.8%
Lake:		**13,574**	10.9%
Mortalities		69	
Hatchery broodstock*:		3,945	
Lake broodstock:		9,560	

*Includes mortalities and inviables





Appendix 8 (continued). Bear Lake 2015 – Project Updates

Coho Salmon Project

Stocking & Misc. Activities

Crew on-site:	6-May			
Ice-out:				
Crew off-site:	19-Oct			
Fry stocking:	19-Jun		450,000	1.14
PreSmolt stocking:				
Smolt stocking:(Bear Creek)	21-May		75,000	15.3
Fertilizer application:	3-Jun	to 10-Jul	1,110	

Egg Take

Dates:	12-Oct to 14-Oct	
No. of broodstock used:		683
Green eggs:		575,260
Fecundity:		3,503
Eyed eggs:		522,359
% Survival		90.8%

Broodstock for CIAA and ADFG but green egg number is CIAA only.

Smolt Migration

Dates:	6-May to 3-Jul		
Cohos:		**91,657**	
Percent age 1:		56,283	61.4%
Percent age 2:		35,059	38.3%
Percent age 3:		314	0.3%
Percent hatchery:		90,713	99.0%

Adult Migration

Dates:	30-Aug to 10-Oct		
Coho total creek return:		**1,979**	
Weir return:		1,979	100%
Donated		1,013	51%
Lake:		261	13%
Hatchery broodstock:		705	36%
Est. Remaining in Bear Ck:		0	0%
Est. Remaining in Salmon Ck:		0	0%

CR Harvest = donations