Fishery Data Series No. 14-07

Escapement and Harvest of Chilkoot River Sockeye Salmon, 2007–2012

by

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Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye to fork	MEF
mideye to tail fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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ABSTRACT

The Alaska Department of Fish and Game, Division of Commercial Fisheries, conducted a stock assessment program to estimate escapements and harvests of adult Chilkoot Lake sockeye salmon (*Oncorhynchus nerka*) for 2007–2012. This program began in 1976. Adult sockeye salmon were counted through a weir near the outlet of Chilkoot Lake, and age, length, and sex data were collected and analyzed each year. Visual scale pattern analysis was conducted to determine the proportion of Chilkoot sockeye salmon harvested annually in the District 15 commercial drift gillnet fishery. In addition, zooplankton and hydroacoustic surveys were conducted in Chilkoot Lake and analyzed each year. Visual escapement estimates of sockeye salmon at the weir were 72,678 fish in 2007, 33,117 fish in 2008, 33,705 fish in 2009, 71,657 fish in 2010, 65,915 fish in 2011, and 118,166 fish in 2012. Estimated commercial drift gillnet harvests of Chilkoot sockeye salmon ranged from 7,491 fish (2008) to 125,199 fish (2007), and estimated exploitation rates ranged from 23% (2008) to 64% (2007). Mark-recapture studies were conducted in 2007, 2010, and 2011 to estimate the sockeye salmon spawning population in the Chilkoot drainage to compare to visual weir counts. The 2007 mark-recapture estimate of 103,000 fish (CV = 6%) was 1.4 times the weir count. The 2010 mark-recapture estimate of 82,600 fish (CV = 8%) was 1.15 times the weir count. The 2011 mark-recapture estimate of 100,200 fish (CV = 8%) was 1.52 times the weir count. Over the twelve years in which mark-recapture studies were conducted since 1996, resulting escapement estimates averaged 1.73 times greater than weir counts and weir counts fell within the 95% CI of the estimates in only three years. Estimated rearing sockeye salmon fry populations have generally been stable since 2007.

Key words: abundance estimate, Chilkoot Lake, Chilkoot River, commercial harvest, enumeration weir, hydroacoustic survey, mark-recapture, *Oncorhynchus nerka*, scale pattern analysis, sockeye salmon, zooplankton.

INTRODUCTION

The Chilkoot and Chilkat river watersheds, located in northern Southeast Alaska, near the town of Haines, support two of the largest sockeye salmon (*Oncorhynchus nerka*) runs in Southeast Alaska. Between 1900 and 1920, the annual commercial harvest of sockeye salmon in northern Southeast Alaska averaged 1.5 million fish, the majority of which were believed to originate from Chilkat and Chilkoot (Rich and Ball 1933). Over the past two decades, the average sockeye salmon harvest in northern Southeast Alaska was 0.5 million fish, of which an average 65,000 fish originated from Chilkoot Lake and 96,000 fish originated from Chilkat Lake (Eggers et al. 2010). Historically, Chilkoot Lake sockeye salmon were harvested in the large fish trap and purse seine fisheries in Icy and northern Chatham straits as well as in terminal drift gillnet areas of Lynn Canal. Fish traps were eliminated with Alaska statehood in 1959 and Lynn Canal developed into a designated drift gillnet fishing area (Alaska Department of Fish and Game [ADF&G] District 15; Figure 1) where most of the commercial harvest of Chilkoot sockeye salmon takes place. A smaller portion of the Chilkoot run is intercepted in commercial purse seine fisheries that target pink salmon (*O. gorbuscha*) in Icy and northern Chatham straits. Annual contributions to those fisheries are not known and likely vary annually depending on fishing effort and the strength of pink salmon runs. Chilkoot sockeye salmon are also harvested annually in subsistence and sport fisheries, which average about 2,500 fish per year (Eggers et al. 2010).

The Alaska Department of Fish and Game (ADF&G) initiated a scale pattern analysis program in 1980 to estimate contributions of sockeye salmon stocks to the District 15 commercial drift gillnet fishery. Bergander (1974) first developed a dichotomous key to classify sockeye salmon scale samples from the Lynn Canal fishery as Chilkoot or Chilkat fish, based on distinct differences in their freshwater scale patterns (Stockley 1950). Marshall et al. (1982) improved the sample design and estimated stock contributions using linear discriminant function analysis. McPherson and Marshall (1986) showed that all age classes of the two stocks could be identified accurately using a visual classification technique and blind testing procedure. That technique was expanded to include a third stock group, a combination of Chilkat River mainstem and Berners Bay stocks that contribute to early-season catches in Lynn Canal (McPherson 1987b). Blind tests to verify accuracy and correct for misclassification have not been conducted since the early 1990s; however, historical stock-specific harvest estimates based solely on visual classification were highly accurate and the difference between initial and corrected estimates varied by only 2% or less (McPherson and Marshall 1986; McPherson 1987a, 1987b; McPherson and Jones 1987; McPherson 1989; McPherson et al. 1992; McPherson and Olsen 1992). The consistent differences in freshwater scale patterns makes visual scale pattern analysis highly accurate, and it is more cost effective and requires less time than other stock-identification methods (McPherson 1990; McPherson and Olsen 1992).

Chilkoot sockeye salmon escapements have been counted annually through an adult counting weir on the Chilkoot River since 1976 (Bachman and Sogge 2006; Bachman et al. 2013; Appendix A). The run has two components, an early and a late run, which were managed as separate units through 2005 (Geiger et al. 2005). Total annual weir counts averaged 80,000 sockeye salmon through 1993, but declined to an average of only 30,000 fish from 1994 to 2000 (Appendix B). An extremely low escapement in 1995 (7,177) prompted ADF&G to conduct mark-recapture studies to verify weir counts, and mark-recapture studies were conducted annually from 1996 to 2004, and in 2007, 2010, and 2011 (Kelley and Bachman 1999; Bachman and Sogge 2006; Appendix C). In addition to salmon counts, biological data have been collected annually at the weir to estimate age, size, and sex composition of the escapement and for use in scale pattern analysis. Basic information about lake productivity and rearing sockeye salmon fry populations has been collected through limnological and hydroacoustic sampling conducted most years from 1987 to 2006 (Barto 1996; Riffe 2006). Those studies have been used to assess potential sockeye salmon production from the lake (Barto 1996).

The Chilkoot Lake run has been managed for at least five different escapement goals since 1976 (Appendix B). Informal goals of 80,000–100,000 (1976–1980) and 60,000–80,000 (1981–1989; Bergander et al. 1988) were replaced in 1990 by a *biological* escapement goal of 50,500–91,500 sockeye salmon (McPherson 1990). The goal was divided into separate goals for early (16,500–31,500) and late runs (34,000–60,000). In 2006, the escapement goal was rounded to 50,000–90,000 sockeye salmon and classified as a *sustainable* escapement goal due to uncertainty in escapement levels based on weir counts (Geiger et al. 2005). Early- and late-run goals were eliminated and replaced with weekly cumulative escapement targets based on historical run timing. The current *sustainable* escapement goal of 38,000–86,000 sockeye salmon was established in 2009 based on an updated stock-recruit analysis by Eggers et al. (2009).

The primary purpose of sockeye salmon stock assessment studies conducted from 2007 to 2012 was to estimate the escapement and commercial harvest of Chilkoot Lake sockeye salmon. This information was used to determine if escapement goals were met, provide information for inseason management of commercial fisheries, and to reconstruct brood-year returns for use in future escapement goal evaluation. We conducted hydroacoustic and limnological surveys of the lake to estimate populations of rearing sockeye salmon fry and collect information on zooplankton abundance, light penetration, and water temperature profiles. In addition, we conducted mark-recapture studies in 2007, 2010, and 2011 to estimate the sockeye salmon population in the Chilkoot drainage for comparison to weir counts.

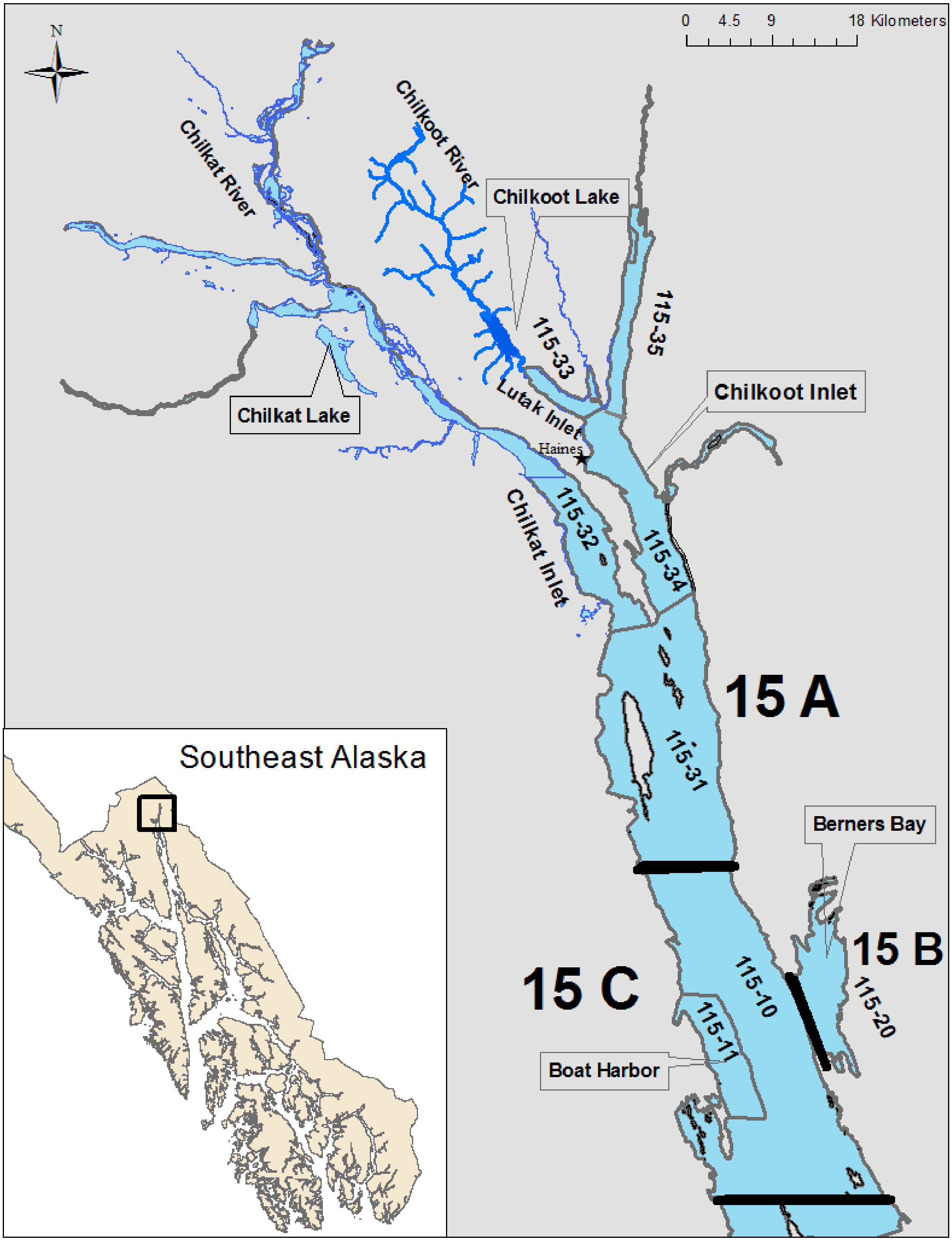

Figure 1.–Commercial fishing sub districts, with management boundary lines in the Haines area, District115.

STUDY AREA DESCRIPTION

Chilkoot Lake (ADF&G Anadromous Waters Catalogue No. 115-33-10200-0010; 59°21′16” N, 135°35′42” W) is located at the head of Lutak Inlet, approximately 16 km northeast of the city of Haines, Alaska (Figures 1 and 2). It is glacially turbid, has a surface area of 7.2 km^2 (1,734 acres), a mean depth of 55 m, a maximum depth of 89 m, and a total volume of 382.4 × 106 m^3. The Chilkoot River begins at glacier terminuses east of the Takshunak Mountains and west of the Ferebee Glacier. The glacial river flows approximately 26 km southeast into Chilkoot Lake, then flows approximately 2 km into Lutak Inlet. Early-run sockeye salmon spawn in small lake and river tributaries and late-run fish spawn in the main channel of the Chilkoot River and along lake beaches where upwelling water occurs (McPherson 1990). Chilkoot Lake is located within the northern temperate rainforest that dominates the Pacific Northwest coast of North America. The climate is characterized by cold winters and cool, wet summers. Average precipitation for the study area is approximately 165 cm/yr (Bugliosi 1988). Sitka spruce, western hemlock, and Sitka alder dominate the forested watershed. The lake is set in a transitional zone, with warmer and drier summers and cooler winters than the rest of Southeast Alaska.

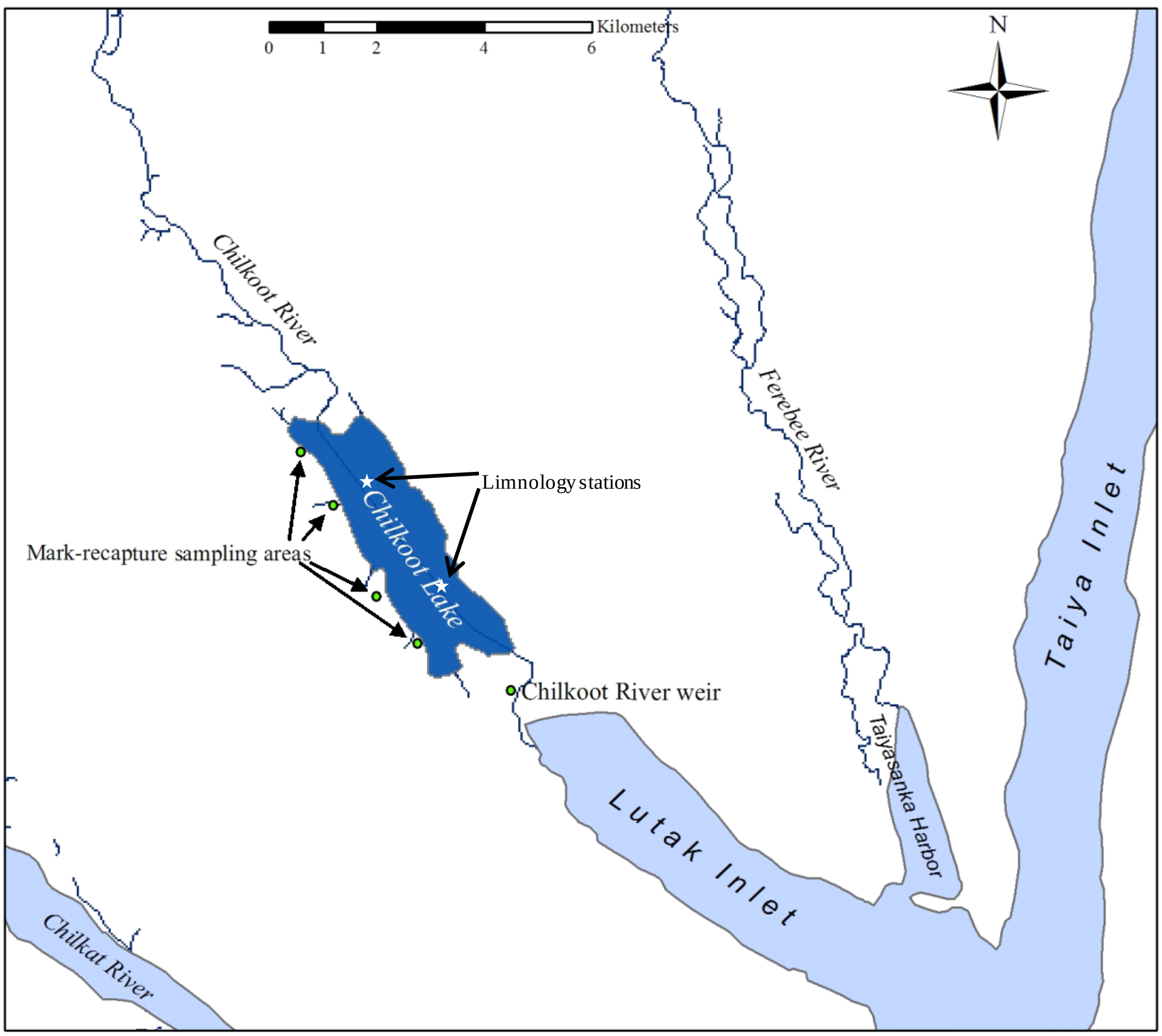

Figure 2.–Map showing Lutak Inlet, Chilkoot Lake, and locations of the salmon counting weir and recovery locations within Chilkoot Lake.

OBJECTIVES

1. Enumerate sockeye, pink, chum, and coho salmon as they migrate upstream through the Chilkoot River weir, 2007–2012.
2. Estimate the age, sex, and length composition of the sockeye salmon escapement, 2007–2012.
3. Estimate the Chilkoot Lake sockeye salmon escapement using mark-recapture techniques such that the coefficient of variation is no greater than 15% of the point estimate, 2007, 2010, and 2011.
4. Estimate the annual commercial harvest of Chilkoot Lake sockeye salmon in the Lynn Canal drift gillnet fishery, 2007–2012.
5. Estimate the abundance and density of sockeye salmon fry and other pelagic fish species in Chilkoot Lake such that the coefficient of variation is no greater than 15% of the point estimate, 2007–2012.
6. Measure water column temperature, record light penetration profiles, and estimate zooplankton species composition, size, density, and biomass in Chilkoot Lake on a monthly basis, April–October, 2007–2012.

METHODS

ESCAPEMENT

The Chilkoot River adult salmon counting weir is located 1 km downstream from Chilkoot Lake. The weir is supported by a 110-m long permanent steel structure, anchored with 20-cm steel pilings driven approximately 7 m into the bottom of the Chilkoot River channel. Pickets were installed into the support structure to form a fence across the river channel. Pickets were black iron pipe, 2- to 3-m long, 2.5 cm outside diameter, spaced 3.8 cm apart. The weir was regularly inspected, and gaps or small openings were blocked with sandbags or plastic coated wire mesh to prevent fish from passing undetected. Fish traps, recovery pens, and sampling stations were installed near mid-channel of the weir structure.

In order to minimize handling, most fish were passed by temporarily removing two to three pickets at a counting station near the center of the weir. Fish were counted by species as they passed through the opening. A panel of plywood painted white was placed in front of and below the opening to facilitate enumeration and identification of fish. Jack sockeye salmon (fish ≤360 mm mideye to tail fork) were not counted separately (most jacks were able to swim through the weir pickets undetected). Fish were trapped as well as caught with a dip net from the face of the weir for age, sex, and length sampling and marking. Fish that were sampled or marked were released into a 2×2 m plywood recovery box on the upstream side of the weir to recover from handling. Fish exited through a large hole in the side of the box once recuperated.

Stream height and water temperature were recorded at approximately 0630 hours each day. Stream height (cm) was measured on a stadia rod, and water temperature (°C) was measured with a permanently installed thermometer near the east end of the weir.

Passage estimates

Brief periods of flooding in some years required removal of pickets to prevent structural damage to the weir, and upstream salmon passage had to be estimated for days the weir was inoperable. Estimates were assumed to be zero if passage was likely negligible based on historical or inseason data. Otherwise, estimates for missed passage were calculated following methods used at the Kogrukluk River weir in western Alaska (Hansen and Blain 2011). When the weir was not in operation for all of one day, an estimate for that day ($\hat{n}_i$) was calculated as the average of the number of fish counted on the two days before (n_b and n_{b-1}) and the two days after (n_a and n_{a+1}) the missing day:

$$\hat{n}_i = \left(\frac{(n_b+n_{b-1}+n_a+n_{a+1})}{4}\right). \tag{1}$$

When the weir was not in operation for a period of two or more days, passage estimates for the missing days were calculated using linear interpolation. This method was appropriate for short periods of inoperability when fish passage was reasonably assumed to have a linear relationship with time. Average fish counts from the two days before and two days after the inoperable period were used to estimate the counts during the period of missed passage. The estimated fish count ($\hat{n}$) on day (i) of the inoperable period, where D is the total number of inoperable days, was estimated as:

$$\hat{n}_i = \left(\frac{n_b+n_{b-1}}{2}\right) + i\left(\frac{(n_a+n_{a+1})-(n_b+n_{b-1})}{2(D+1)}\right) \tag{2}$$

MARK–RECAPTURE ESTIMATE

In 2007, 2010, and 2011, the total sockeye salmon population was estimated with a stratified, two-event mark-recapture study (Seber 1982). The mark-recapture study allowed us to determine if sockeye salmon passed through the weir undetected, and served as a back-up estimate in case the weir was breached or damaged. In Event 1, adult sockeye salmon (fish >360 mm mid eye to tail fork) were marked with a finclip at a rate of 10% of the fish enumerated at the Chilkoot River weir. Marking was stratified through time by applying a primary mark (adipose finclip) and a secondary finclip in different combinations over eight two-week periods (Table 1). Fish that did not appear healthy were released unmarked.

In Event 2, recapture surveys were conducted weekly, beginning in mid-July, on inlet tributaries and spawning areas along the Chilkoot Lake shoreline. Lake spawners were typically concentrated on beaches along the western shore of the Lake. Sockeye salmon were recaptured with a 20×3 m beach seine, and each examined fish was recorded as unmarked (no finclip) or marked (by the appropriate finclip). All sampled fish were marked with a left operculum punch to prevent repeated sampling of the same fish. Scheduling of recapture surveys varied depending on fish abundance and the percentage of fish that had already been examined in a given area. Sockeye salmon carcasses found on stream surveys or floating in the lake were also examined for marks.

Table 1.–Temporal marking strata for sockeye salmon at the Chilkoot River weir, 2007, 2010, and 2011.

Year	Date	Statistical week	Primary mark	Secondary mark
2007	3–16 June	23–24	Adipose fin	None
	17–30 June	25–26	Adipose fin	Right ventral fin
	1 July–14 July	27–28	Adipose fin	Left ventral fin
	15–28 July	29–30	Adipose fin	Right axillary process
	29 July–11 August	31–32	Adipose fin	Left axillary process
	12–25 August	33–34	Adipose fin	Dorsal fin (last 4 rays)
	26 August–8 September	35–36	Adipose fin	Right pectoral fin
	9–22 September	37–38	Adipose fin	Left pectoral fin
2010	30 May–12 June	23–24	Adipose fin	None
	13–26 June	25–26	Adipose fin	Right axillary process
	27 June–10 July	27–28	Adipose fin	Left axillary process
	11–24 July	29–30	Adipose fin	Right ventral fin
	25 July–7 August	31–32	Adipose fin	Left ventral fin
	8–21 August	33–34	Adipose fin	Right pectoral fin
	22 August–4 September	35–36	Adipose fin	Left pectoral fin
2011	29 May–11 June	23–24	Adipose fin	None
	12–25 June	25–26	Adipose fin	Right ventral fin
	26 June–09 July	27–28	Adipose fin	Left ventral fin
	10–23 July	29–30	Adipose fin	Right axillary process
	24 July–6 August	31–32	Adipose fin	Left axillary process
	7–20 August	33–34	Adipose fin	Right pectoral fin
	21 August–3 September	35–36	Adipose fin	Left pectoral fin

We used Stratified Population Analysis System (SPAS) software (Arnason et al. 1996; http://www.cs.umanitoba.ca/~popan/) to analyze mark-recapture data. SPAS was designed for analysis of two-sample mark-recapture data where Event 1 (marking) and Event 2 (recapture) samples are collected over a number of strata. This software was used to calculate the maximum likelihood Darroch and pooled-Petersen (Chapman's modified) estimates and their standard errors. The general assumptions that must hold for a two-event mark-recapture estimate to be consistent were listed by Seber (1982) and Schwarz and Taylor (1998): "(1) either or both of the samples are a simple random sample, i.e., all fish in the population have the same probability of being tagged or all fish have the same probability of being captured in the second sample; or tagged fish mix uniformly with untagged fish, (2) the population is closed, (3) there is no tag loss, (4) the tagging status of each fish is determined without error, and (5) tagging has no effect on the subsequent behavior of the fish."

Assumption (1) could be violated if size- or gender-selective sampling occurred during the study. To test the hypothesis that fish of different sizes were captured with equal probability during Event 1 and Event 2, we compared the length distributions of fish for groups of marked (M), captured (C), and recaptured (R) sockeye salmon using the Kolmogorov-Smirnov (K-S) two-sample test (Conover 1999; Appendix D). The test hypothesis for each comparison was that there were no differences in MEF lengths between the data sets being tested ($P < 0.05$). Similarly, we conducted two chi-square consistency tests to check for gender-selective sampling, with the test hypothesis that there were no differences in the ratio of males to females between the data sets being tested ($P < 0.05$). Gear selectivity in Event 1 was examined by comparing the number of fish of each gender marked in Event 1, and the number of fish of each gender sampled for marks in Event 2. Sampling bias in Event 2 was examined by comparing the number of fish of each gender marked in Event 1 and recaptured during Event 2, to the number of each gender that were marked but not recaptured.

In addition, we conducted two chi-square consistency tests for temporal violations of assumption (1): a test for complete mixing, or the probability that the time of recapture of a marked fish in Event 2 was independent of when it was marked in Event 1; and a test of equal proportions of marked fish recaptured in Event 2. A test statistic with $P < 0.05$ was considered "significant," but serious bias was indicated in the pooled-Petersen estimate only if both test statistics were significant. If neither test statistic or only one of them was significant, we accepted the pooled-Petersen estimate (Schwarz and Taylor 1998); if both tests were significant, a temporally-stratified estimate was generated using the SPAS software. We evaluated the stratified Darroch estimate and attempted to find a reasonable partial pooling scheme in order to reduce the number of parameters that needed to be estimated. We used two additional goodness-of-fit tests for the Darroch estimate provided in the SPAS software, along with the guidelines and suggestions in Arnason et al. (1996) and Schwarz and Taylor (1998), to evaluate the estimate and partial pooling schemes.

We assumed the population at Chilkoot Lake was closed to emigration and recruitment, assumption (2), because sampling activities were conducted over the entire migration and spawning periods. We addressed loss of marks, assumption (3), through the use of finclips, rather than tags. Careful inspection of all fish sampled on the spawning grounds helped ensure that mark status, assumption (4), was determined without error during Event 2. Finally, substantial stress from capture and handling in Event 1 could lead to a reduction of marked fish in the recapture sample, assumption (5), and a positive bias in the mark-recapture estimate, either through direct mortality or through change in behavior of marked fish. Marked fish found dead at the weir were counted and subtracted from the number of marked fish released, but we assumed that handling mortality was minimal.

ESCAPEMENT AGE, SEX, AND LENGTH COMPOSITION

Scales were collected at the weir from a daily sample of 40 healthy sockeye salmon for use in scale pattern and age composition analyses. Samples included jacks (age 1.0 fish ≤360 mm in length); however, very few jacks (<15) have been sampled in the past (1982–2012), because most of them are small enough to swim through the weir. Approximately 20 fish were sampled during the morning shift and 20 more in the afternoon or evening shift. The length of each fish was measured from mideye to tail fork to the nearest 5 mm. Sex was determined by examining external dimorphic sexual maturation characteristics, such as kype development, belly shape, and trunk depth. One scale per fish was taken from the preferred area above the lateral line on the left side of the fish on a diagonal downward from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (INPFC 1963) and placed on a gum card. Date of sample, sex, length, and data regarding the condition of each fish were recorded on standard optical scan forms.

Scale samples were analyzed at the ADF&G salmon-aging laboratory in Douglas, Alaska. Scale impressions were made in cellulose acetate and prepared for analysis as described by Clutter and

Whitesel (1956). Scales were examined under moderate (70×) magnification to determine age. Age classes were designated by the European aging system where freshwater and saltwater years are separated by a period (e.g., 1.3 denotes a fish with one freshwater and three ocean years; Koo 1962). The weekly age distribution, the seasonal age distribution weighted by week, and SE of mean length by age and SE of sex by week were calculated using equations from Cochran (1977; Appendix D).

COMMERCIAL HARVEST ESTIMATE

Visual scale pattern analysis was used to determine stock composition of sockeye salmon harvested in the Lynn Canal (District 15) commercial drift gillnet fishery. The general methods have remained unchanged since the mid-1980s: escapement scale samples from three stocks of known origin, Chilkoot, Chilkat, and "other" (Chilkat mainstem and Berners Bay stocks), were aged and compared to scale samples from the commercial fisheries.

Commercial Harvest Information

Commercial catch data for the District 15 drift gillnet fishery were obtained from the ADF&G Southeast Alaska Integrated Fisheries Database. Catches were summarized by statistical weeks, which began on Sunday at 12:01 a.m. and ended the following Saturday at midnight. Statistical weeks were numbered sequentially starting from the beginning of the calendar year (Appendix E).

Scale samples from District 15 commercial drift gillnet landings of sockeye salmon were collected weekly through the season by ADF&G personnel at fish processing facilities at Excursion Inlet and Juneau. The sampling goal of 520 fish per week was sufficient to describe the estimated sockeye salmon age composition with a precision of ±5% and a probability of 0.10 (Thompson 1987). Sampling protocols ensured that samples were as representative of catches as possible: deliveries with catches mixed from more than one gear type or fishing district were not sampled, no more than 40 samples were taken from a single delivery, and, whenever possible, samples were systematically taken from the entire hold as it was offloaded to ensure they were representative of the entire delivery. Sampled fish were identified to sex and one scale per fish was taken from the preferred area (INPFC 1963). Length was measured from mideye to tail fork for 20% of fish sampled in the commercial fishery. Samples were processed and aged at the ADF&G salmon-aging laboratory following procedures described above for Chilkoot River escapement samples.

Scale Pattern Analysis

Known-origin scale samples were collected weekly at the Chilkoot River weir (this study), at Chilkat Lake, and from a fishwheel project conducted on the Chilkat River, which included both Chilkat Lake and Chilkat River mainstem spawners (Bachman 2010). Samples were also collected annually from spawning populations in Berners Bay (Berners and Lace rivers) and along the mainstem of the Chilkat River where sockeye salmon were concentrated in clear tributaries. These samples were temporally and spatially limited and may not be representative of the entire Berners and Chilkat mainstem populations. Samples were processed and aged at the ADF&G salmon-aging laboratory following procedures described above for Chilkoot River escapement samples.

Known-origin scale samples were processed inseason on a weekly basis, after which commercial fishery samples were analyzed and assigned to one of three stocks: Chilkoot, Chilkat, and "other" based on scale characteristics. The size of the freshwater annulus and the number of circuli in the freshwater growth zones were the principle scale characteristics used to distinguish between runs; however, the total size of the freshwater growth zone, size of the freshwater-plus growth zone, and completeness of circuli and spacing between circuli in the freshwater growth zone were also considered. Differences in age composition between stocks and migratory timing by age were also accounted for inseason. The weekly proportions of classified scale samples were applied to the District 15 commercial harvest to provide weekly estimates of stock contribution for inseason management and postseason estimates of total harvest by stock, weighted by statistical week.

FRY POPULATION ESTIMATE

Hydroacoustic and mid-water trawl sampling methods were used to estimate abundance and age-size distributions of sockeye salmon fry and other small pelagic fish in Chilkoot Lake. To control year-to-year variation in our estimates, acoustic surveys were conducted annually along the same 12 transects (two from each of six sampling sections of the lake) that were randomly chosen in 2002 as permanent transects (Riffe 2006). Hydroacoustic surveys were conducted annually in either October or November 2007–2012.

Hydroacoustic sampling of each transect was conducted during post-sunset darkness in one night. A Biosonics DT-X™ scientific echosounder (430 kHz, 7.3° split-beam transducer) with Biosonics Visual Acquisition © version 5.0 software was used to collect data. Ping rate was set at five pings sec^{-1}, pulse width at 0.3 ms, and a constant boat speed of about 2.0 m sec^{-1} was maintained. Target strength of -40 dB to -70 dB was used to represent fish within the size range of juvenile sockeye salmon and other small pelagic fish.

Fish-target density (targets/m^2) was estimated using Biosonics software (User Guide, Visual AnalyserTM 4.1, BioSonics, Inc.), using echo integration methods (MacLennan and Simmonds 1992). Mean target density for each sampling area was calculated as the average of the two replicate transects. A total-target estimate for each of the sampling areas was calculated as the product of the mean target density and the surface area of each of the sampling areas. The sum of the area estimates provided an estimate of total targets for the entire lake. The variance of the total-target estimate within an area was calculated based on 1-degree-of-freedom estimates for each group of transects. Because the estimate of total targets in each section was essentially independent (neglecting any movement of fry from one section to the other during surveys), an estimate of the sample variance of the estimate of the total targets in the entire lake was formed by summing the 1-degree-of-freedom sample variances across the six sections. Sampling error for the estimate of total targets for the entire lake was measured and reported with the coefficient of variation (Sokal and Rohlf 1995).

In conjunction with the hydroacoustic surveys, midwater trawl sampling was conducted to estimate species composition of pelagic fish. We collected pelagic fish samples using a 2×2 m trawl net (Riffe 2006), and conducted between four and six nighttime trawls at various depths during each survey.

LIMNOLOGICAL ASSESSMENT

Basic limnological data, including zooplankton, light, and temperature sampling, were collected monthly between April and October, 2007–2012. In 2007, zooplankton samples were collected at four stations marked by anchored buoys in the lake as described by Riffe (2006). Zooplankton samples and light and temperature data were collected at the two primary stations, stations 1A and 2A, located at opposite ends of the lake in depths >70 m, and additional zooplankton samples were collected at two secondary stations located between stations 1A and 2A. Since 2008, however, all sampling has been conducted at stations 1A and 2A (Figure 2).

Light and Temperature Profiles

Light and temperature profiles were collected at stations 1A and 2A. Underwater light intensity was recorded at 0.5-m intervals, from just below the surface to the depth at which ambient light level equaled 1% of the light level just below the surface, using an electronic light meter (Protomatic). Measurements of underwater light intensity were used to determine vertical light extinction coefficients and algal compensation depths. The natural log (ln) of the ratio of light intensity (I) just below the surface to light intensity at depth z, I_0/I_z, was calculated for each depth. The vertical light extinction coefficient (K_d) was estimated as the slope of ln(I_0/I_z) versus depth. The euphotic zone depth (EZD) was defined as the depth at which light (photosynthetically available radiation at 400–700 nm) was attenuated to 1% of the intensity just below the lake surface (Schindler 1971) and calculated with the equation EZD = 4.6502/K_d (Kirk 1994). Temperature (ºC) was measured with a Yellow Springs Instruments (YSI) Model 57 meter. Measurements were made at 1-m intervals from the surface to a depth of 20 m, then continued in 5-m increments to a depth of 50 m.

Secondary Production

Zooplankton samples were collected at each sampling station using a 0.5 m diameter, 153 μm mesh conical net. Vertical zooplankton tows were pulled from a depth of 50 m to the surface at a constant speed of 0.5 m sec^{-1}. The net was rinsed prior to removing the organisms, and all specimens were preserved in buffered 10% formalin. Samples were analyzed at the ADF&G Kodiak Limnology Lab, using methods detailed in the ADF&G Limnology Field and Laboratory Manual (Koenings et al. 1987). Results were averaged between stations by month and season.

RESULTS

ESCAPEMENT

2007

In 2007, 72,561 sockeye, 13 coho, 61,469 pink, 252 chum, and 39 Chinook salmon were enumerated through the Chilkoot River weir between 4 June and 12 September (Table 2; Figure 3; Appendix F). One high water event required the removal of every other picket to prevent damage to the weir and scouring of the riverbed. The event occurred on 16 July (week 29), pickets were removed at 2100 hrs, and the weir was not fish tight until 1100 hrs on 18 July. Estimated unobserved passage of fish during this time was 117 fish. The total sockeye salmon escapement, including estimated passage, was 72,678 fish. Sockeye salmon escapement exceeded the lower bound of the escapement goal range (Table 2; Figure 4) and pink salmon escapement was above the historical average (Appendix A).

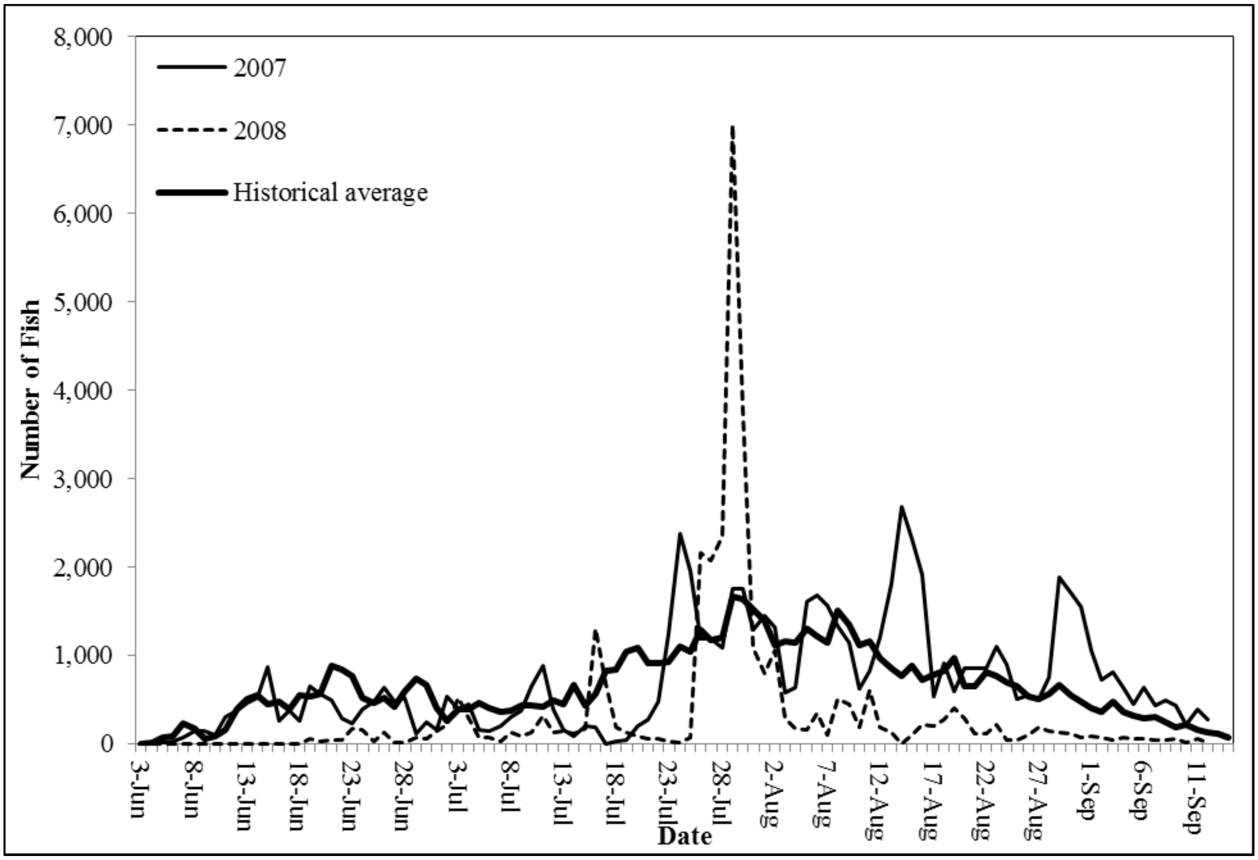

Figure 3.–Daily sockeye salmon counts at the Chilkoot River weir in 2007 and 2008 compared to the long-term average (1976–2006).

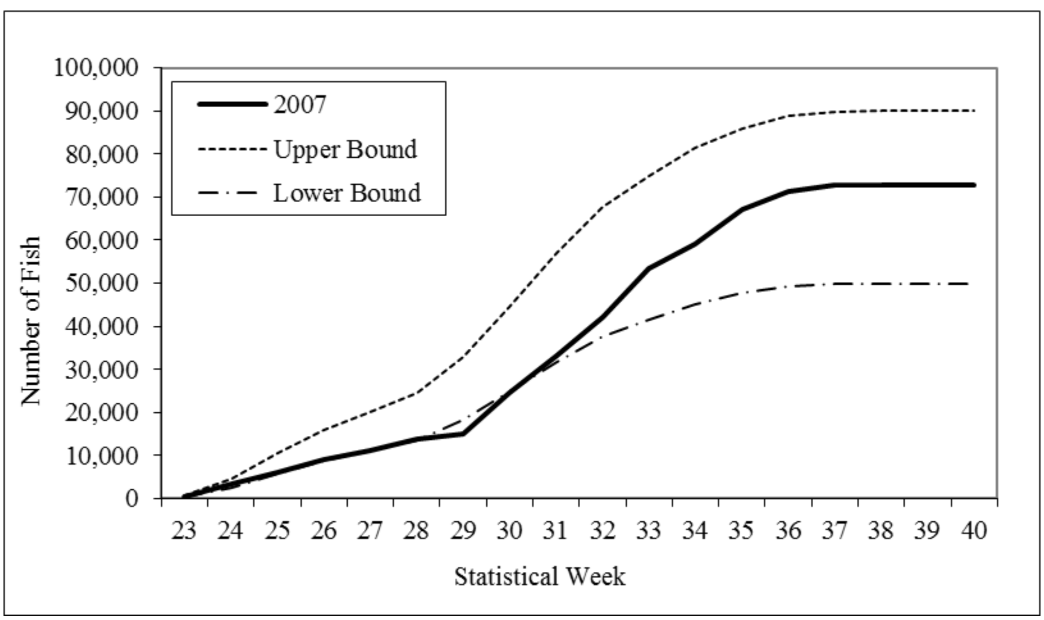

Figure 4.–Cumulative weekly escapement of sockeye salmon through the Chilkoot River weir compared to the upper and lower bounds of the *sustainable* escapement goal range, 2007.

Table 2.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and *sustainable* escapement goal range, 2007.

Statistical Week	Observed escapement		Escapement goal	
	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
23	418	418	461	830
24	2,905	3,323	2,525	4,545
25	2,860	6,183	5,926	10,666
26	2,859	9,042	8,888	15,998
27	2,046	11,088	11,094	19,969
28	2,856	13,944	13,620	24,516
29	1,073	15,017	18,284	32,912
30	9,509	24,526	24,775	44,594
31	8,796	33,322	31,731	57,116
32	8,778	42,100	37,540	67,572
33	11,385	53,485	41,619	74,914
34	5,670	59,155	45,152	81,274
35	8,009	67,164	47,733	85,920
36	4,186	71,350	49,404	88,927
37	1,328	72,678	49,863	89,753
38	–	72,678	49,948	89,907
39	–	72,678	49,983	89,969
40	–	72,678	50,000	90,000
Total	72,678	72,678	50,000	90,000

2008

In 2008, 32,957 sockeye, 50 coho, 15,105 pink, 327 chum, and 50 Chinook salmon were enumerated through the Chilkoot River weir between 4 June and 12 September (Table 3; Figure 3; Appendix G). One high water event required the removal of every other picket on 14 August to prevent damage to the weir. Estimated unobserved passage of fish during this time was 160 fish. The total sockeye salmon escapement, including estimated passage on 14 August, was 33,117 fish. Sockeye salmon escapement was below the lower bound of the escapement goal range (Table 3; Figure 5) and pink salmon escapement was below the historical average (Appendix A).

Table 3.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and *sustainable* escapement goal range, 2008.

Statistical Week	Observed escapement: Weekly	Observed escapement: Cumulative	Escapement goal: Cumulative lower bound	Escapement goal: Cumulative upper bound
23	5	5	461	830
24	12	17	2,525	4,545
25	147	164	5,926	10,666
26	590	754	8,888	15,998
27	1,375	2,129	11,094	19,969
28	888	3,017	13,620	24,516
29	2,748	5,765	18,284	32,912
30	2,485	8,250	24,775	44,594
31	18,137	26,387	31,731	57,116
32	2,028	28,415	37,540	67,572
33	1,596	30,011	41,619	74,914
34	1,623	31,643	45,152	81,274
35	782	32,416	47,733	85,920
36	455	32,871	49,404	88,927
37	246	33,117	49,863	89,753
38	–	33,117	49,948	89,907
39	–	33,117	49,983	89,969
40	–	33,117	50,000	90,000
Total	33,117	33,117	50,000	90,000

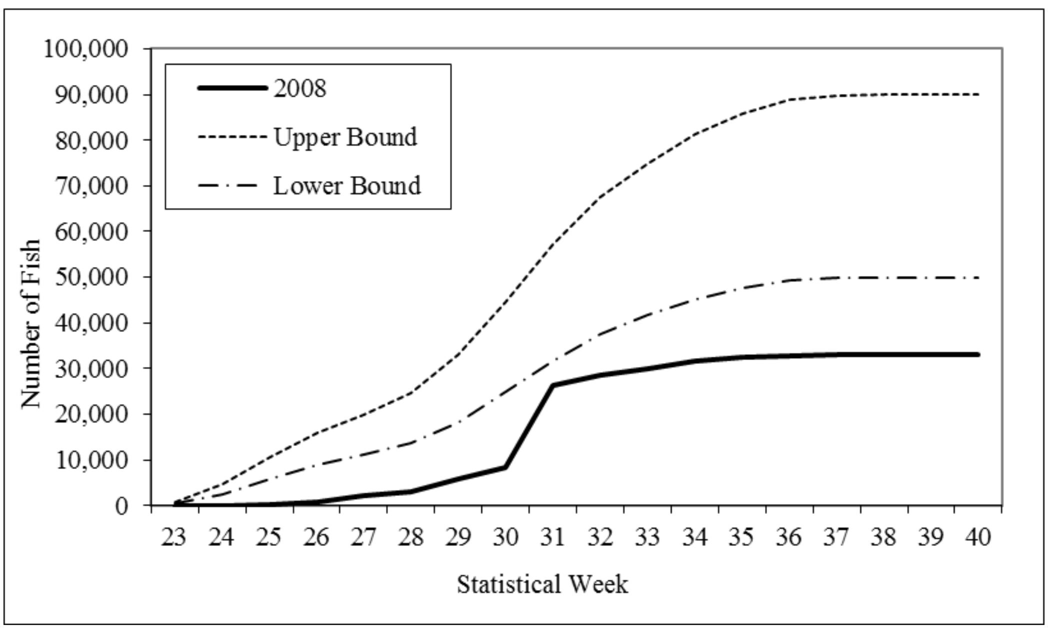

Figure 5.–Cumulative weekly escapement of sockeye salmon through the Chilkoot River weir compared to upper and lower bounds of the *sustainable* escapement goal range, 2008.

2009

In 2009, 33,545 sockeye, 11 coho, 34,483 pink, 171 chum, and 12 Chinook salmon were enumerated through the Chilkoot River weir between 3 June and 10 September (Table 4; Figure 6; Appendix H). One high water event required the removal of every other picket 29–31 August to prevent damage to the weir. Estimated unobserved passage of fish during this time was 160 fish. The total sockeye salmon escapement, including estimated passage, was 33,705 fish. Sockeye salmon escapement was below the lower bound of the escapement goal range (Table 4; Figure 7) and pink salmon escapement was near the historical average (Appendix A).

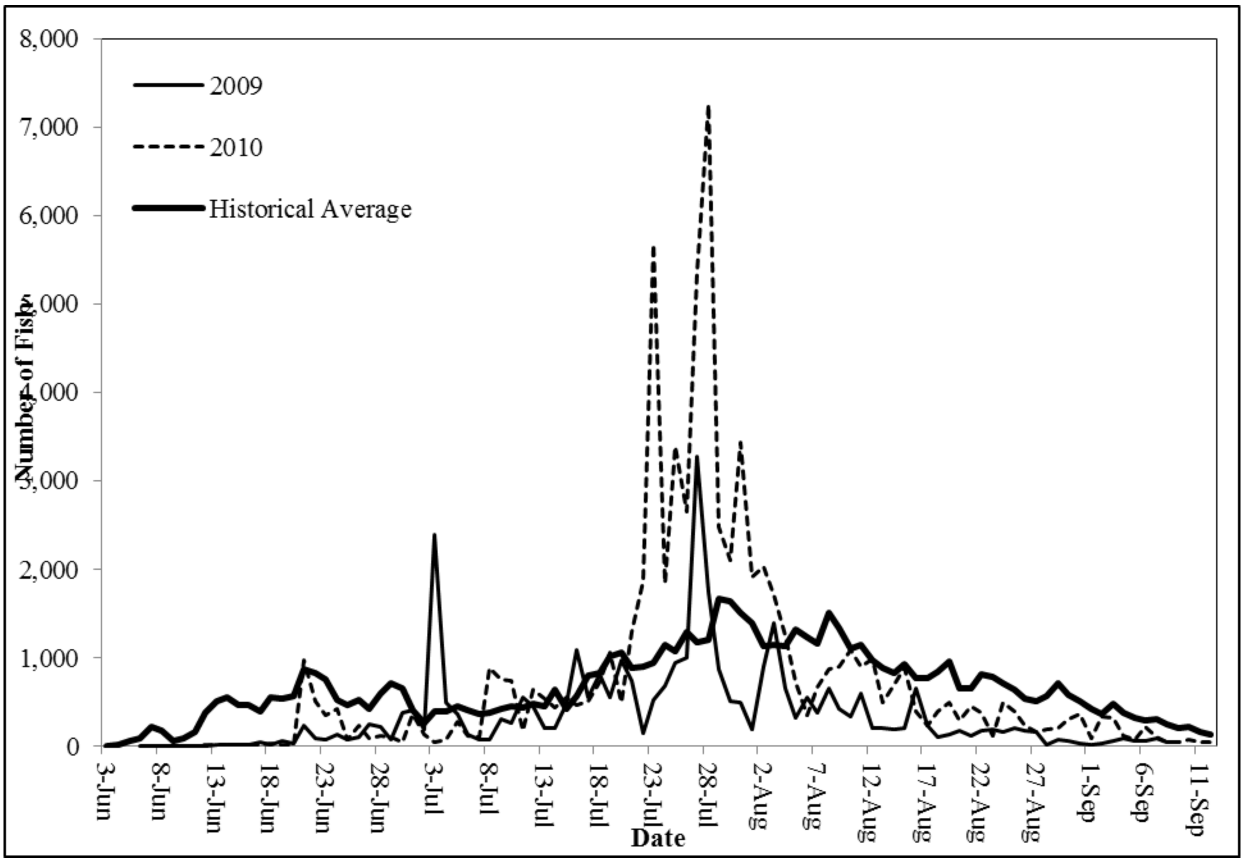

Figure 6.–Daily sockeye salmon counts at the Chilkoot River weir in 2009 and 2010 compared to the long-term average (1976–2008).

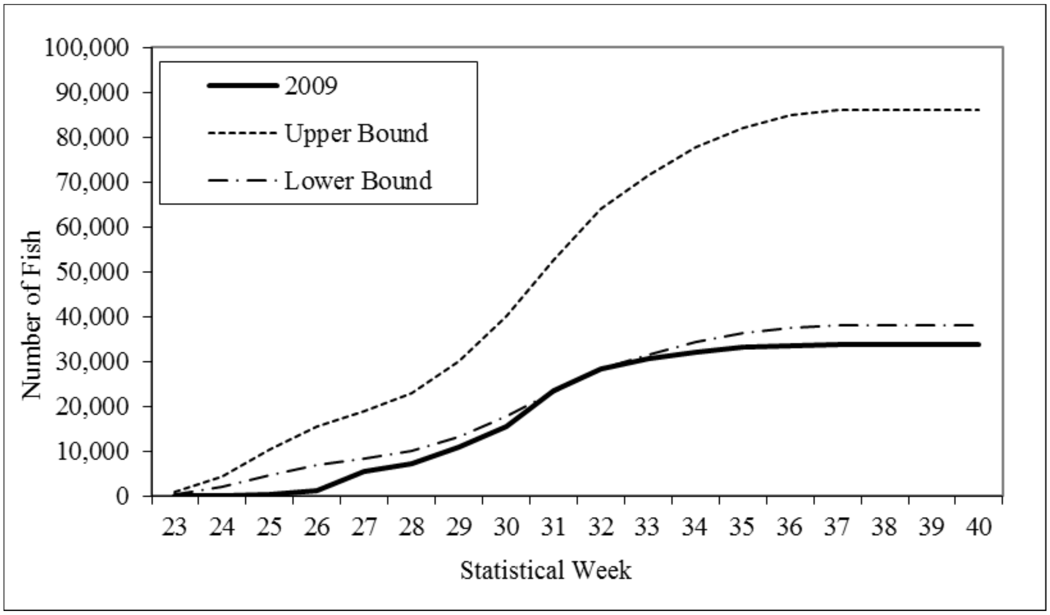

Figure 7.–Cumulative weekly escapement of sockeye salmon through the Chilkoot River weir upper and lower bounds of the *sustainable* escapement goal range, 2009. (A revised *sustainable* escapement goal was adopted in 2009; Eggers et al. 2009).

Table 4.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and *sustainable* escapement goal range, 2009.

Statistical	Observed escapement		Escapement goal[a]	
Week	Weekly	Cumulative	Lower bound	Upper bound
23	1	1	378	856
24	25	26	1,924	4,354
25	179	205	4,593	10,396
26	969	1,174	6,852	15,508
27	4,167	5,341	8,333	18,858
28	1,761	7,102	10,102	22,863
29	3,807	10,909	13,286	30,069
30	4,544	15,453	17,689	40,032
31	8,077	23,530	23,236	52,587
32	4,839	28,369	28,267	63,973
33	2,152	30,521	31,565	71,437
34	1,596	32,117	34,371	77,787
35	999	33,116	36,275	82,096
36	333	33,449	37,524	84,923
37	256	33,705	38,000	86,000
Total	33,705	33,705	38,000	86,000

[a] A revised *sustainable* escapement goal was adopted in 2009 (Eggers et al. 2009).

2010

In 2010, 71,657 sockeye, 90 coho, 30,830 pink, 410 chum, and 6 Chinook salmon were enumerated through the Chilkoot River weir between 6 June and 14 September (Table 5; Figure 6; Appendix I). Sockeye salmon total escapement exceeded the lower bound of the escapement goal range (Table 5; Figure 8) and pink salmon escapement was near the historical average (Appendix A).

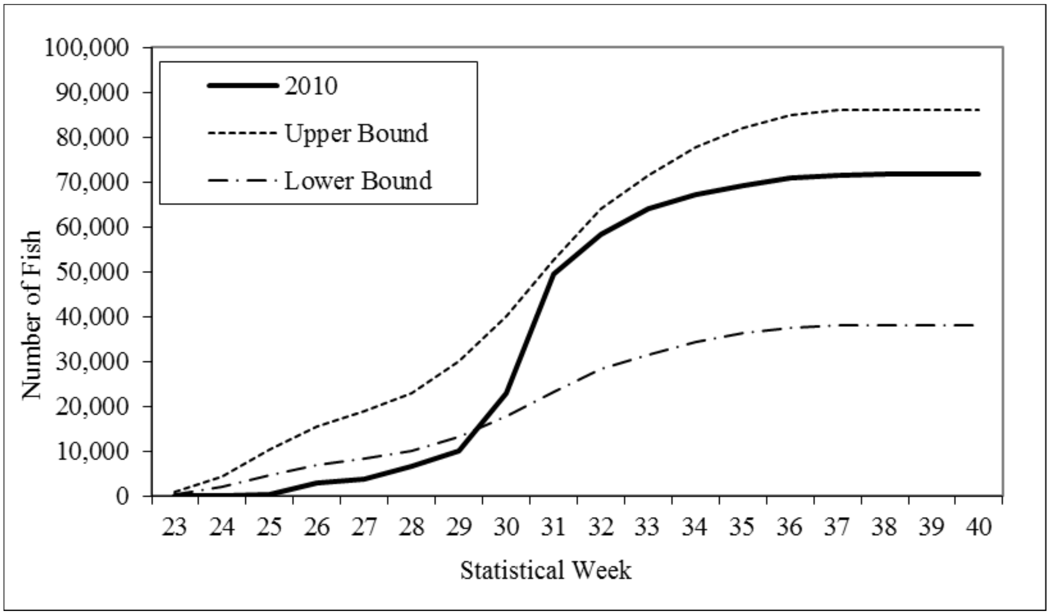

Figure 8.–Cumulative weekly escapement of sockeye salmon through the Chilkoot River weir compared to the upper and lower bounds of the *sustainable* escapement goal range, 2010.

Table 5.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and *sustainable* escapement goal range, 2010.

Statistical Week	Observed escapement		Escapement goal	
	Weekly	**Cumulative**	**Lower bound**	**Upper bound**
23	0	0	378	856
24	35	35	1,924	4,354
25	118	153	4,593	10,396
26	2,566	2,719	6,852	15,508
27	898	3,617	8,333	18,858
28	2,962	6,579	10,102	22,863
29	3,331	9,910	13,286	30,069
30	12,955	22,865	17,689	40,032
31	26,690	49,555	23,236	52,587
32	8,648	58,203	28,267	63,973
33	5,918	64,121	31,565	71,437
34	3,150	67,271	34,371	77,787
35	1,971	69,242	36,275	82,096
36	1,722	70,964	37,524	84,923
37	600	71,564	38,000	86,000
38	93	71,657	38,000	86,000
Total	**71,657**	**71,657**	**38,000**	**86,000**

2011

In 2011, 65,915 sockeye, 18 coho, 76,244 pink, 118 chum, and 43 Chinook salmon were enumerated through the Chilkoot River weir between 5 June and 5 September (Table 6; Figure 9; Appendix J). Sockeye salmon total escapement was above the lower bound of the escapement goal range (Table 6; Figure 10) and pink salmon escapement was well above the historical average (Appendix A).

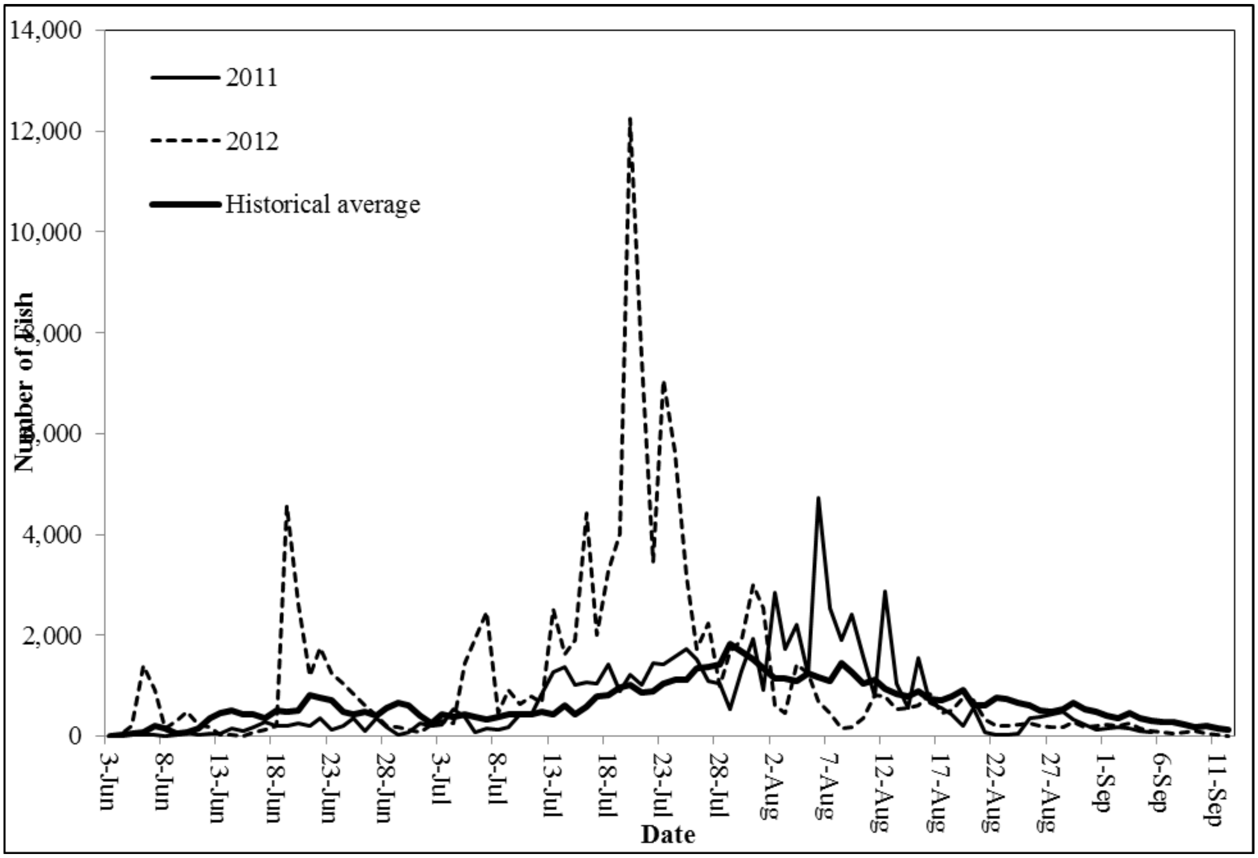

Figure 9.–Daily sockeye salmon counts at the Chilkoot River weir in 2011 and 2012 compared to the long-term average (1976–2010).

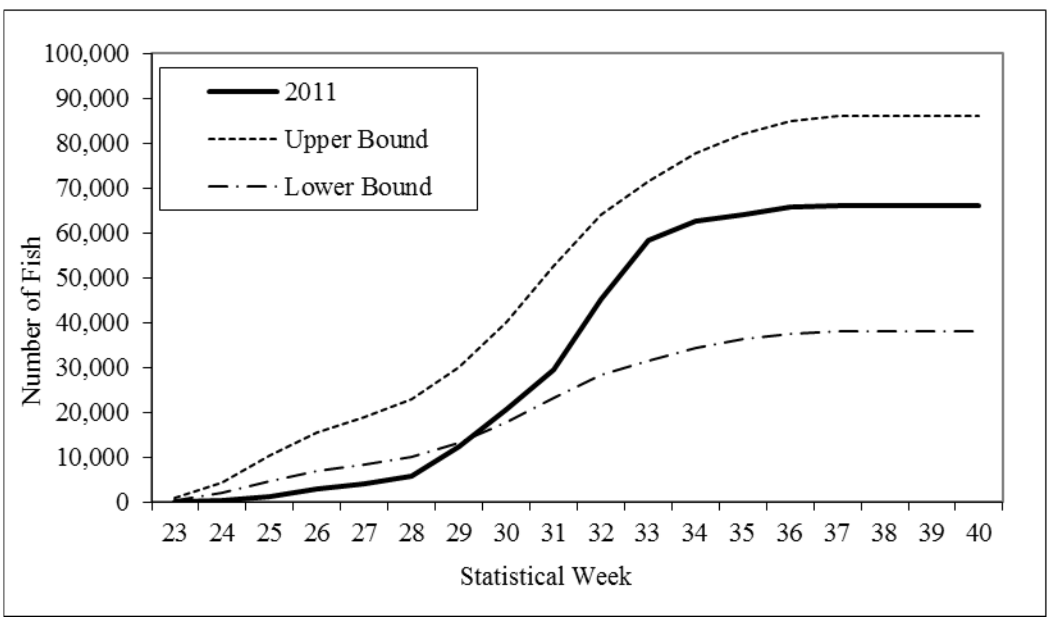

Figure 10.–Cumulative weekly escapement of sockeye salmon through the Chilkoot River weir compared to the upper and lower bounds of the *sustainable* escapement goal range, 2011.

Table 6.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and *sustainable* escapement goal range, 2011.

Statistical Week	Observed escapement		Escapement goal	
	Weekly	Cumulative	Lower bound	Upper bound
23	0	0	378	856
24	216	216	1,924	4,354
25	991	1,207	4,593	10,396
26	1,708	2,915	6,852	15,508
27	1,187	4,102	8,333	18,858
28	1,685	5,787	10,102	22,863
29	6,439	12,226	13,286	30,069
30	8,455	20,681	17,689	40,032
31	8,788	29,469	23,236	52,587
32	15,577	45,046	28,267	63,973
33	13,166	58,212	31,565	71,437
34	4,514	62,726	34,371	77,787
35	1,360	64,086	36,275	82,096
36	1,658	65,744	37,524	84,923
37	171	65,915	38,000	86,000
Total	**65,915**	**65,915**	**38,000**	**86,000**

2012

In 2012, 114,025 sockeye, 139 coho, 40,753 pink, 494 chum, and 47 Chinook salmon were enumerated through the Chilkoot River weir between 3 June and 12 September (Table 7; Figure 9; Appendix K). A high water event required the removal of every other picket 24–28 June to prevent damage to the weir. The estimated unobserved passage of fish during this time was 4,141 fish. The total sockeye salmon escapement, including estimated passage, was 118,166 fish. Sockeye salmon total escapement was well above the upper bound of the escapement goal range (Table 7; Figure 11) and pink salmon escapement was well above the historical average (Appendix A).

Table 7.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and *sustainable* escapement goal range, 2012.

Statistical week	Observed Escapement		Escapement goal	
	Weekly	**Cumulative**	**Lower bound**	**Upper bound**
23	3,013	3,013	378	856
24	1,032	4,045	1,924	4,354
25	10,448	14,493	4,593	10,396
26	4,634	19,127	6,852	15,508
27	6,704	25,831	8,333	18,858
28	7,613	33,444	10,102	22,863
29	35,354	68,798	13,286	30,069
30	24,309	93,107	17,689	40,032
31	11,568	104,675	23,236	52,587
32	3,869	108,544	28,267	63,973
33	4,319	112,863	31,565	71,437
34	2,704	115,567	34,371	77,787
35	1,468	117,035	36,275	82,096
36	931	117,966	37,524	84,923
37	200	118,166	38,000	86,000
Total	**118,166**	**118,166**	**38,000**	**86,000**

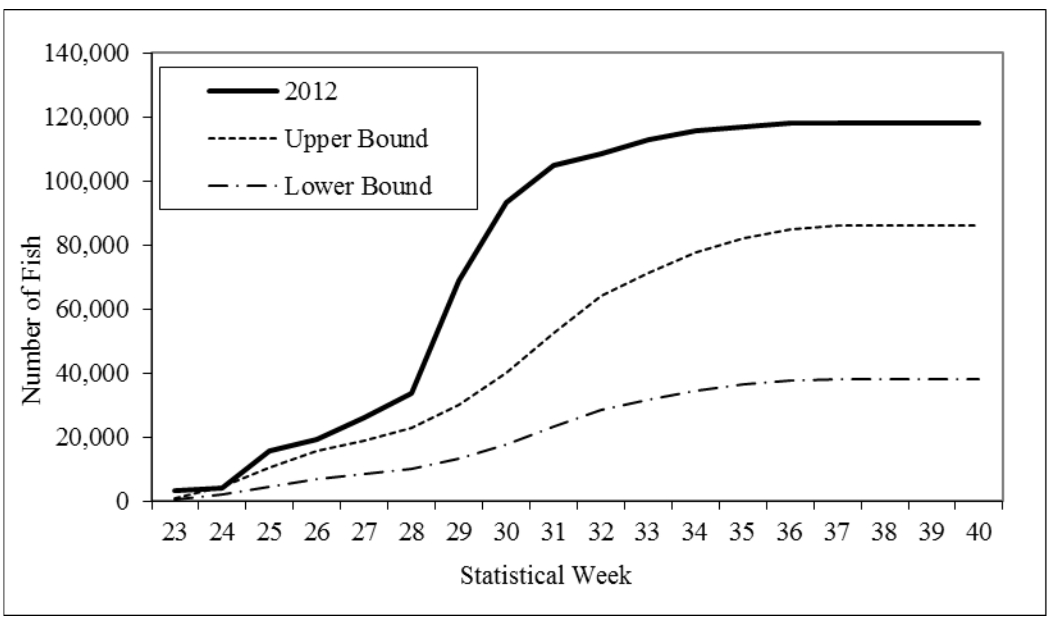

Figure 11.–Cumulative weekly escapement of sockeye salmon through the Chilkoot River weir compared to the upper and lower bounds of the *sustainable* escapement goal range, 2012.

2007 Mark-Recapture Escapement Estimate

In 2007, 7,255 sockeye salmon were marked and released at the Chilkoot River weir (Table 8). A total of 16 marked fish were found dead at the weir, a mortality rate of less than 1%. We subtracted observed mortalities and reduced the number of marked sockeye salmon to 7,239 (10% of the total escapement). Recapture surveys were conducted in Chilkoot Lake and its inlet tributaries on 18 dates between 9 July and 25 October 2007 (Table 9). A total of 1,565 sockeye salmon were examined for marks, of which 109 marked fish were recaptured, or about 7% of the total sample. We combined recapture surveys into 14 one-week periods that resulted in an 8 × 19 matrix of mark-recapture data (Appendix L). Analysis of the full mark-recapture data set in SPAS yielded a significant chi-square test statistic for complete mixing of marked fish between the marking (Event 1) and recapture (Event 2) events (χ^2 = 75.9, P < 0.01, df = 5); however, the result of the test for equal proportions of marked fish on the spawning grounds was not significant (χ^2 = 13.9, P = 0.53, df = 15). A non-significant result for one of these diagnostic tests indicated the pooled estimator was appropriate for estimating abundance in this study.

In addition, no size- or gender-selective sampling was detected. There was no significant difference in size of all fish sampled in Event 2 and fish marked in Event 1 and recaptured in Event 2 (D = 0.11, P = 0.40). There was also no significant difference in size of fish marked in Event 1 and marked fish recaptured in Event 2 (D = 0.10, P =0.43). No difference was detected in the proportions of males and females marked in Event 1 and sampled in Event 2 (χ^2 = 0.05, P = 0.82, df = 1) or in the frequency of marked males and females recaptured compared to those not recaptured in Event 2 (χ^2 = 11, P = 0.74, df = 1). These results further suggested abundance could be estimated using a pooled-Petersen model without stratification (*Case I* situation; Appendix O).

We pooled the mark-recapture data and calculated a Petersen estimate of 103,070 (SE=9,361) sockeye salmon, with a 95% confidence interval of approximately 84,722 to 121,418 fish. The coefficient of variation (9%) met our objective for a coefficient of variation less than 15%. We also explored stratified estimates using the same 8 × 19 matrix of mark-recapture data. The initial analysis failed to produce a valid Darroch estimate due to negative capture probability estimates for two release strata (Right axillary and left pectoral finclips) and three recapture strata (statistical weeks 36, 37 and 43). We then manipulated strata to yield non-negative estimates and minimize lack of fit. The Darroch estimates with the best fit (e.g., χ^2 = 0.26; P = 0.26, df = 10) resulted from pooling data into six release and sixteen recapture strata, all of which yielded estimates of about 108,000 (SE = 14,000) sockeye salmon, very similar to the pooled-Petersen estimate. The sockeye escapement (72,678) was below the confidence interval ranges of both the pooled-Peterson and stratified Darroch estimates.

Table 8.–Number of sockeye salmon counted and marked at the Chilkoot River weir by marking stratum, 2007.

Statistical week	Date[a,b]	Weir count	Secondary clip	Total marked	Observed mortality	Marks released	Percent marked
23–24	3-Jun–16-Jun	3,323	None	336	0	336	10%
25–26	17-Jun–30-Jun	5,719	Right ventral	569	1	568	10%
27–28	1-Jul–14-Jul	4,902	Left ventral	494	2	492	10%
29–30	15-Jul–28-Jul	10,465	Right axillary	935	2	933	9%
31–32	29-Jul–11-Aug	17,574	Left axillary	1,831	4	1,827	10%
33–34	12-Aug–25-Aug	17,055	Dorsal	1,607	3	1,604	9%
35–36	26-Aug–8-Sep	12,195	Right pectoral	1,322	4	1,318	11%
37–38	9-Sep–22-Sep	1,328	Left pectoral	161	0	161	12%
Total		72,561		7,255	16	7,239	10%

[a] First day of marking was 4-June.
[b] Last day of marking was 12-September.
[c] Number of marked fish released after subtracting observed mortalities.

Table 9.–Number of fish sampled and number of marked fish recaptured by sampling date at Chilkoot Lake, 2007.

	Recaptures by marking stratum									
Recapture date	Adipose Only	Right ventral	Left ventral	Right axillary	Left axillary	Dorsal	Right pectoral	Left pectoral	Total recaps.	Total sampled
9-Jul	4	5	0	0	0	0	0	0	9	93
16-Jul	4	2	0	0	0	0	0	0	6	104
20-Jul	1	0	0	0	0	0	0	0	1	68
23-Jul	5	5	0	0	0	0	0	0	10	137
30-Jul	0	7	2	0	0	0	0	0	9	95
6-Aug	0	3	1	1	0	0	0	0	5	112
13-Aug	0	1	4	2	0	0	0	0	7	78
20-Aug	0	1	2	2	1	0	1	0	7	90
27-Aug	0	2	1	0	0	3	0	0	6	100
6-Sep	0	0	0	0	0	0	0	0	0	4
10-Sep	0	0	0	0	0	0	0	0	0	10
27-Sep	0	0	0	0	2	1	1	0	4	70
8-Oct	2	0	0	3	3	6	3	0	17	169
9-Oct	0	0	0	1	4	0	1	0	6	102
16-Oct	1	0	0	1	2	3	5	0	12	120
19-Oct	0	0	0	0	1	0	0	0	1	28
23-Oct[a]	0	0	0	0	0	0	0	0	0	23
25-Oct[a]	1	0	0	2	2	3	1	0	9	162
Total	18	26	10	12	15	16	12	0	109	1,565

[a] All Event 2 samples were collected in Chilkoot Lake with the exception of 16-Oct, 19-Oct, 23-Oct, and 25-Oct samples, which were collected the inlet stream (Chilkoot River).

2010 Mark-Recapture Escapement Estimate

In 2010, 6,552 sockeye salmon were marked and released at the Chilkoot River weir (Table 10). A total of 17 marked fish were found dead at the weir, a mortality rate of less than 1%. We subtracted observed mortalities and reduced the number of marked sockeye salmon to 6,535 (9% of the total escapement). Recapture surveys were conducted in Chilkoot Lake and its inlet tributaries on 14 dates between 2 July and 19 October 2010 (Table 11). A total of 1,962 sockeye salmon were examined for marks, of which 153 marked fish were recaptured, or about 8% of the total sample. We combined recapture surveys into 16 one-week periods that resulted in an 8 × 16 matrix of mark-recapture data (Appendix M). Analysis of the full mark-recapture data set in SPAS yielded a non-significant chi-square test statistic for complete mixing of marked fish between the marking (Event 1) and recapture (Event 2) events ($\chi^2 = 2.45$, $P = 0.65$, df = 4); Results of the test for equal proportions of marked fish on the spawning grounds was also not significant ($\chi^2 = 13.66$, $P = 0.32$, df = 12). A non-significant result for one or both of these diagnostic tests indicated the pooled estimator was appropriate for estimating abundance in this study.

In addition, no size- or gender-selective sampling was detected. There was no significant difference in size of all fish sampled in Event 2 and fish marked in Event 1 and recaptured in Event 2 (D = 0.28, $P = 0.07$). There was also no significant difference in size of fish marked in Event 1 and marked fish recaptured in Event 2 (D = 0.12, P =0.91). No difference was detected in the proportions of males and females marked in Event 1 and sampled in Event 2 ($\chi^2 = 2.31$, $P = 0.13$, df = 1) or in the frequency of marked males and females recaptured compared to those not recaptured in Event 2 ($\chi^2 = 2.75$, $P = 0.10$, df = 1). These results further suggested abundance could be estimated using a pooled-Petersen model without stratification (*Case I* situation; Appendix O).

Table 10.–Number of sockeye salmon counted and marked at the Chilkoot River weir by marking stratum, 2010.

Statistical week	Date[a,b]	Weir count	Secondary clip	Total marked	Observed mortality	Marks released[c]	Percent marked
23–24	30-May–12-Jun	35	Adipose only	3	0	3	9%
25–26	13-Jun–26-Jun	2,684	Right Axillary	273	1	272	10%
27–28	27-Jun–10-Jul	3,860	Left Axillary	384	4	380	10%
29–30	11-Jul–24-Jul	16,286	Right Ventral	1,399	2	1,397	9%
31–32	25-Jul–7-Aug	35,338	Left Ventral	2,903	3	2,900	8%
33–34	8-Aug–21-Aug	9,068	Right Pectoral	1,003	2	1,001	11%
35–36	22-Aug–4-Sep	3,693	Left Pectoral	512	4	508	14%
37–38	5-Sep–18-Sep	693	Dorsal Clip	75	1	74	11%
Total		71,657		6,552	17	6,535	9%

[a] First day of marking was 9 June.
[b] Last day of marking was 14 September.
[c] Number of marked fish released after subtracting observed mortality.

Table 11.–Number of fish sampled and number of marked fish recaptured by sampling date at Chilkoot Lake, 2010.

	Recaptures by marking stratum									
Recapture date	Adipose Only	Right axillary	Left axillary	Right ventral	Left ventral	Right pectoral	Left pectoral	Dorsal	Total recaps	Total sampled
2-Jul	0	0	0	0	0	0	0	0	0	1
7-Jul	0	0	0	0	0	0	0	0	0	1
17-Jul	0	0	1	0	0	0	0	0	1	29
23-Jul	0	0	1	0	0	0	0	0	1	17
31-Jul	0	0	0	0	0	0	0	0	0	5
4-Aug	0	2	3	0	0	0	0	0	5	101
12-Aug	0	2	2	3	0	0	0	0	7	110
18-Aug	0	1	0	1	0	0	0	0	2	68
19-Aug	0	0	3	3	0	0	0	0	6	52
25-Aug	0	0	1	3	0	0	0	0	4	56
31-Aug	0	0	0	1	3	0	0	0	4	62
16-Sep	0	0	0	5	2	2	0	0	9	88
17-Sep	0	0	0	1	4	5	1	0	11	83
22-Sep	0	0	1	3	3	1	0	0	8	114
23-Sep	0	0	0	3	4	2	0	0	9	131
23-Sep	0	0	1	2	7	4	1	0	15	163
27-Sep	0	0	0	3	7	1	0	0	11	142
28-Sep	0	0	0	0	3	0	1	0	4	99
30-Sep	0	0	0	4	9	1	0	0	14	143
1-Oct	0	0	0	0	6	0	0	0	6	79
4-Oct	0	0	0	0	5	1	2	0	8	92
6-Oct	0	0	0	2	3	1	2	0	8	153
11-Oct[a]	0	0	0	0	6	3	1	0	10	106
19-Oct[a]	0	0	0	0	6	2	1	1	10	67
Total	0	5	13	34	68	23	5	0	153	1,962

[a] All Event 2 samples were collected in Chilkoot Lake with the exception of 11-Oct and 19-Oct samples, which were collected the inlet stream (Chilkoot River).

We pooled the mark-recapture data and calculated a Petersen estimate of 82,651 (SE=6,316) sockeye salmon, with a 95% confidence interval of approximately 70,271 to 95,030 fish. The coefficient of variation (8%) met our objective for a coefficient of variation less than 15%. We also explored stratified estimates using the same 8 × 16 matrix of mark-recapture data. The initial analysis failed to produce a valid Darroch estimate due to negative capture probability estimates for three release strata (adipose, left ventral and dorsal finclips) and three recapture strata (statistical weeks 27, 28 and 31). We then manipulated strata to yield non-negative estimates and minimize lack of fit. The Darroch estimates with the best fit (e.g., $\chi^2 = 8.34$; $P = 0.40$, df = 8) resulted from pooling data into four release and thirteen recapture strata, all of which yielded estimates of about 84,000 (SE = 7,000) sockeye salmon, very similar to the pooled-Petersen estimate. The weir count (71,657) fell within the confidence interval ranges of the stratified Darroch estimates and just under the pooled-Petersen estimate.

2011 Mark-Recapture Escapement Estimate

In 2011, 6,549 sockeye salmon were marked and released at the Chilkoot River weir (Table 12). A total of 27 marked fish were found dead at the weir, a mortality rate of less than 1%. We subtracted observed mortalities and reduced the number of marked sockeye salmon to 6,522 (10% of the total escapement). Recapture surveys were conducted in Chilkoot Lake and its inlet tributaries on 22 dates between 13 July and 9 October 2011 (Table 13). A total of 1,950 sockeye salmon were examined for marks, of which 126 marked fish were recaptured, or about 6.5% of the total sample. We combined recapture surveys into 11 one-week periods that resulted in an 8 × 11 matrix of mark-recapture data (Appendix N). Analysis of the full mark-recapture data set in SPAS yielded a significant chi-square test statistic for complete mixing of marked fish between the marking (Event 1) and recapture (Event 2) events (χ^2 = 71.1, P = 0.00, df = 5); however, the result of the test for equal proportions of marked fish on the spawning grounds was not significant (χ^2 = 4.39, P = 0.88, df = 9). A non-significant result for one of these diagnostic tests indicated the pooled estimator was appropriate for estimating abundance in this study.

In addition, only size-selective sampling was detected in Event 1 and there was no gender selective sampling detected in either event. There was a significant difference in size of all fish sampled in Event 2 and fish marked in Event 1 and recaptured in Event 2 (D = 0.23, P = 0.02). There was no significant difference in size of fish marked in Event 1 and marked fish recaptured in Event 2 (D = 0.20, P =0.07). No difference was detected in the proportions of males and females marked in Event 1 and sampled in Event 2 (χ^2 = 0.73, P = 0.39, df = 1) or in the frequency of marked males and females recaptured compared to those not recaptured in Event 2 (χ^2 = 064, P = 0.42, df = 1). These results further suggested abundance could be estimated using a pooled-Petersen model without stratification (Case III situation; Appendix O).

We pooled the mark-recapture data and calculated a Petersen estimate of 100,206 (SE=8,480) sockeye salmon, with a 95% confidence interval of approximately 83,585 to 116,828 fish. The coefficient of variation (8%) met our objective for a coefficient of variation less than 15%. We also explored stratified estimates using the same 8 × 13 matrix of mark-recapture data. The initial analysis failed to produce a valid Darroch estimate, however, due to negative capture probability estimates for two release strata (adipose and left pectoral finclips) and one recapture stratum (statistical week 31). We then manipulated strata to yield non-negative estimates and minimize lack of fit. The Darroch estimates with the best fit (e.g., χ^2 = 2.22; P = 0.70, df = 4) resulted from pooling data into six release and ten recapture strata, all of which yielded estimates of about 120,000 (SE = 63,000) sockeye salmon, very similar to the pooled-Petersen estimate. The weir count (65,915) was well below of confidence interval ranges of both the pooled-Peterson and stratified Darroch estimates.

Table 12.–Number of sockeye salmon counted and marked at the Chilkoot River weir by marking stratum, 2011.

Statistical week	Date[a,b]	Weir count	Secondary clip	Total marked	Observed mortality[c]	Marks released	Percent marked
23–24	29-May–11-Jun	216	None	23	0	23	11%
25–26	12-Jun–25-Jun	2,699	Right Ventral	270	2	268	10%
27–28	26-Jun–9-Jul	2,872	Left Ventral	301	2	299	10%
29–30	10-Jul–23-Jul	14,894	Right Axillary	1,521	8	1,513	10%
31–32	24-Jul–6-Aug	24,365	Left Axillary	2,312	6	2,306	9%
33–34	7-Aug–20-Aug	17,680	Right Pectoral	1,694	7	1,687	10%
35–36	21-Aug–3-Sep	3,018	Left Pectoral	398	2	396	13%
37–38	4-Sep–17-Sep	171	Dorsal Clip	30	0	30	18%
Total		65,915		6,549	27	6,522	10%

[a]First day of marking was 5 June.
[b]Last day of marking was 5 September.
[c] Number of marked fish released after subtracting observed mortality.

Table 13.–Number of fish sampled and number of marked fish recaptured by sampling date at Chilkoot Lake, 2011.

Recapture date	Recaptures by marking stratum								All recaps	Total sampled
	Adipose Only	Right ventral	Left ventral	Right axillary	Left axillary	Right pectoral	Left pectoral	Dorsal		
13-Jul	0	1	0	0	0	0	0	0	1	10
19-Jul	0	3	1	0	0	0	0	0	4	74
27-Jul	0	0	0	0	0	0	0	0	0	8
7-Aug	0	2	3	0	0	0	0	0	5	62
12-Aug	0	1	1	0	0	0	0	0	2	27
24-Aug	0	1	3	10	0	0	0	0	14	147
2-Sep	0	0	0	3	0	0	0	0	3	34
12-Sep	0	0	0	5	0	0	0	0	5	80
13-Sep	0	1	0	1	2	0	0	0	4	86
14-Sep	0	0	0	1	0	0	0	0	1	14
15-Sep	0	1	0	9	1	0	1	0	12	175
16-Sep	0	0	2	5	2	0	1	0	10	135
20-Sep	0	0	0	2	2	0	0	0	4	45
23-Sep	0	0	0	4	3	1	0	0	8	134
26-Sep	0	0	0	1	2	0	0	0	3	76
26-Sep	0	0	0	2	0	1	0	0	3	34
27-Sep	0	0	1	4	2	0	0	0	7	142
29-Sep	0	0	0	2	1	1	0	0	4	114
30-Sep	0	0	0	2	3	1	0	0	6	80
3-Oct	0	0	0	5	3	0	0	0	8	96
8-Oct	0	0	0	2	2	2	1	0	7	129
9-Oct[a]	0	0	0	4	8	2	1	0	15	248
Total	0	10	11	62	31	0	4	0	126	1,950

[a] All Event 2 samples were collected in Chilkoot Lake with the exception of 9-Oct samples, which were collected the inlet stream (Chilkoot River).

COMMERCIAL HARVEST ESTIMATE

2007

In 2007, a total of 156,936 sockeye salmon were caught in the District 15 commercial drift gillnet fishery, of which approximately 125,199 (80%) were estimated to be Chilkoot stock (Table 14; Appendix P). The total sample size used to determine stock proportions was 4,637 scales; about 3% of the total commercial sockeye salmon harvest. The 2007 exploitation rate, based on the weir count, was estimated to be 64% (including estimated subsistence and sport harvests; Appendix B).

Table 14.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks in the District 15 drift gillnet fishery based on scale pattern analysis, 2007.

Statistical week	Commercial harvest	Sample size	Estimated stock composition			Estimated harvest		
			Chilkoot	Chilkat	Other	Chilkoot	Chilkat	Other
25	3,557	423	59.8%	20.1%	20.1%	2,127	715	715
26	4,111	425	45.2%	20.2%	34.6%	1,857	832	1,422
27	4,376	421	49.4%	16.9%	33.7%	2,162	738	1,476
28	9,228	431	71.5%	9.0%	19.5%	6,594	835	1,798
29	16,300	400	82.5%	4.8%	12.8%	13,448	774	2,078
30	36,809	432	74.1%	10.2%	15.7%	27,266	3,749	5,794
31	39,330	446	92.2%	3.8%	4.0%	36,244	1,499	1,587
32	15,991	475	83.8%	10.1%	6.1%	13,399	1,616	976
33	10,657	432	92.1%	3.9%	3.9%	9,818	419	419
34	5,892	423	70.7%	22.2%	7.1%	4,165	1,309	418
35–41	10,685	329	76.0%	16.1%	7.9%	8,119	1,721	844
Total	156,936	4,637	79.8%	9.1%	11.2%	125,199	14,208	17,529

2008

In 2008, 46,655 sockeye salmon were caught in the District 15 commercial drift gillnet fishery, of which approximately 7,491 were estimated to be Chilkoot stock. Chilkoot stock accounted for 16% of the total commercial harvest (Table 15; Appendix P). The sample used to determine stock proportions was 4,499 scales; about 9% of the commercial sockeye salmon harvest. The 2008 exploitation rate was estimated to be 23% (including small, estimated subsistence and sport harvests; Appendix B).

2009

In 2009, 126,594 sockeye salmon were caught in the District 15 commercial drift gillnet fishery, of which approximately 16,622 were estimated to be Chilkoot stock. Chilkoot stock accounted for 13% of the total commercial harvest (Table 16; Appendix P). The sample used to determine stock proportions was 4,485 scales; about 4% of the commercial sockeye salmon harvest. The 2008 exploitation rate was estimated to be 32% (including small, estimated subsistence and sport harvests; Appendix B).

2010

In 2010, 100,973 sockeye salmon were caught in the District 15 commercial drift gillnet fishery, of which approximately 32,064 were estimated to be Chilkoot stock. Chilkoot stock accounted for 32% of the total commercial harvest (Table 17; Appendix P). The sample used to determine stock proportions was 4,485 scales; about 4% of the commercial sockeye salmon harvest. The 2008 exploitation rate was estimated to be 33% (including small, estimated subsistence and sport harvests; Appendix B).

Table 15.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks in the District 15 drift gillnet fishery based on scale pattern analysis , 2008.

Statistical week	Commercial harvest	Sample size	Estimated stock composition			Estimated harvest		
			Chilkoot	Chilkat	Other	Chilkoot	Chilkat	Other
25	1,292	101	5.0%	49.5%	45.5%	64	640	588
26	1,832	220	4.1%	19.5%	76.4%	75	358	1,399
27	3,420	419	11.2%	12.9%	75.9%	384	441	2,596
28	4,803	352	22.7%	20.7%	56.5%	1,092	996	2,715
29	5,588	406	27.6%	16.5%	55.9%	1,542	922	3,124
30	6,238	442	18.8%	28.5%	52.7%	1,171	1,778	3,288
31	4,395	473	20.9%	45.5%	33.6%	920	1,998	1,477
32	4,228	429	35.2%	45.2%	19.6%	1,488	1,912	828
33	4,475	467	7.1%	82.0%	10.9%	316	3,670	489
34	6,800	468	4.5%	91.5%	4.1%	305	6,219	276
35	1,647	475	2.9%	87.6%	9.5%	49	1,442	156
36–41	1,937	247	4.5%	91.9%	3.6%	86	1,780	71
Total	46,655	4,499	16.1%	47.5%	36.5%	7,491	22,156	17,008

Table 16.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks in the District 15 drift gillnet fishery based on scale pattern analysis, 2009.

Statistical week	Commercial harvest	Sample size	Estimated stock composition			Estimated harvest		
			Chilkoot	Chilkat	Other	Chilkoot	Chilkat	Other
26	2,404	175	23.4%	46.3%	30.3%	563	1,113	728
27	7,022	396	21.7 %	41.7%	36.6%	1,525	2,926	2,571
28	14,517	464	22.0%	42.0%	36.0%	3,191	6,101	5,225
29	10,699	379	29.0%	29.6%	41.4%	3,105	3,162	4,432
30	6,116	430	25.3%	42.3%	32.3%	1,550	2,589	1,977
31	9,063	434	19.8%	51.4%	28.8%	1,796	4,657	2,610
32	18,257	447	11.9%	72.3%	15.9%	2,165	13,192	2,900
33	19,844	442	9.7%	77.8%	12.4%	1,931	15,444	2,469
34	9,333	456	5.0%	88.4%	6.6%	471	8,248	614
35	9,174	441	2.5%	93.0%	4.5%	229	8,529	416
36–41	20,165	421	0.5%	97.1%	2.4%	96	19,590	479
Total	126,594	4,485	13.1%	67.6%	19.3%	16,622	85,551	24,422

Table 17.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks in the District 15 drift gillnet fishery based on scale pattern analysis, 2010.

Statistical week	Commercial harvest	Sample size	Estimated stock composition			Estimated harvest		
			Chilkoot	Chilkat	Other	Chilkoot	Chilkat	Other
26	1,533	171	30.4%	22.8%	46.8%	472	354	727
27	3,642	433	37.9%	18.5%	43.6%	1,379	673	1,590
28	5,762	376	40.4%	24.2%	35.4%	2,329	1,395	2,038
29	9,507	381	39.1%	27.3%	33.6%	3,718	2,595	3,194
30	10,173	411	37.2%	25.8%	37.0%	3,787	2,624	3,762
31	8,682	417	29.3%	34.8%	36.0%	2,540	3,019	3,123
32	20,551	438	42.9%	35.2%	21.9%	8,821	7,226	4,504
33	8,924	470	50.9%	37.0%	12.1%	4,538	3,304	1,082
34	11,249	452	26.3%	69.2%	4.4%	2,962	7,790	498
35–41	20,930	469	7.2%	91.3%	1.5%	1,517	19,100	312
Total	100,973	4,018	31.8%	47.6%	20.6%	32,064	48,079	20,830

2011

In 2011, 63,793 sockeye salmon were caught in the District 15 commercial drift gillnet fishery, of which approximately 26,766 were estimated to be Chilkoot stock. Chilkoot stock accounted for 42% of the commercial harvest (Table 18; Appendix P). The sample used to determine stock proportions was 4,351 scales; about 7% of the commercial sockeye harvest. The 2011 exploitation rate was estimated to be 31% (including small, estimated subsistence and sport harvests; Appendix B).

Table 18.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks in the District 15 drift gillnet fishery based on scale pattern analysis, 2011.

Statistical week	Commercial harvest	Sample size	Estimated stock composition			Estimated harvest		
			Chilkoot	Chilkat	Other	Chilkoot	Chilkat	Other
26	1,062	186	33.9%	16.7%	49.5%	360	177	525
27	4,425	408	31.1%	27.2%	41.7%	1,377	1,204	1,844
28	4,197	366	26.0%	25.7%	48.4%	1,089	1,078	2,030
29	6,873	414	41.5%	16.4%	42.0%	2,855	1,129	2,889
30	10,270	447	40.5%	16.3%	43.2%	4,159	1,677	4,434
31	8,285	445	35.3%	22.0%	42.7%	2,923	1,825	3,537
32	9,896	439	39.4%	22.6%	38.0%	3,900	2,232	3,765
33	9,559	431	58.0%	26.5%	15.5%	5,545	2,528	1,486
34	3,893	451	65.9%	25.1%	9.1%	2,564	975	354
35	3,627	448	41.3%	46.4%	12.3%	1,498	1,684	445
36–41	1,706	316	29.1%	63.9%	7.0%	497	1,091	119
Total	63,793	4,351	42.0%	24.5%	33.6%	26,766	15,599	21,428

2012

In 2012, 207,137 sockeye salmon were caught in the District 15 commercial drift gillnet fishery, of which approximately 115,509 were estimated to be Chilkoot stock. Chilkoot stock accounted for 56% of the commercial harvest (Table 19; Appendix P). The sample size used to determine stock proportions was 4,432 scales; about 2% of the total commercial sockeye harvest. The 2012 exploitation rate was estimated to be 51% (including small, estimated subsistence and sport harvests; Appendix B).

Table 19.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks based on scale pattern analysis, 2012.

Statistical week	Commercial harvest	Sample size	Estimated stock composition			Estimated harvest		
			Chilkoot	Chilkat	Other	Chilkoot	Chilkat	Other
25	3,527	348	51.4%	24.4%	24.1%	1,814	861	851
26	6,162	382	46.3%	25.1%	28.5%	2,855	1,549	1,758
27	9,139	407	44.5%	26.3%	29.2%	4,064	2,403	2,672
28	12,901	396	39.6%	26.3%	34.1%	5,115	3,388	4,398
29	41,385	432	45.6%	24.3%	30.1%	18,872	10,059	12,454
30	55,768	435	63.4%	17.0%	19.5%	35,384	9,487	10,897
31	41,036	391	69.1%	19.4%	11.5%	28,337	7,976	4.723
32	12,111	340	59.4%	31.8%	8.8%	7,195	3,847	1,069
33	17,741	421	50.4%	39.2%	10.5%	8,934	6,953	1,854
34	4,520	415	53.5%	44.3%	2.2%	2,418	2,004	98
35–40	2,847	465	18.3%	78.9%	2.8%	520	2,247	80
Total	207,137	4,432	55.8%	24.5%	19.7	115,509	50,774	40,854

Escapement Age, Sex, and Length Composition

2007

In 2007, the sockeye salmon escapement was composed primarily of age-1.3 (77%) and age-2.3 (12.3%) fish (Table 20; Appendix Q). The remainder of the escapement (10.7%) was composed of age-2.2, age-1.2, and age-1.4 fish. Age-1.3 fish had a mean length of 580 mm for males and 568 mm for females, and age-2.3 fish had a mean length of 578 mm for males and 566 mm for females (Table 21; Appendix R).

2008

In 2008, the sockeye salmon escapement was composed primarily of age-1.3 (80.5%) and age-1.2 (10.3%) fish (Table 22; Appendix Q). The remainder of the escapement (9.2%) was composed of age-2.3, age-1.4, age-0.3, and age-2.4 fish. Age-1.3 fish had a mean length of 584 mm for males and 572 mm for females, and age-1.2 fish had a mean length of 491 mm for males and 511 mm for females (Table 23; Appendix R).

Table 20.–Age composition of the Chilkoot Lake sockeye salmon escapement, weighted by statistical week, 2007.

Brood year	2003	2002	2001	2002	2001	
Age class	1.2	1.3	1.4	2.2	2.3	Total
Sample size	214	2,387	17	19	383	3,020
Escapement	7,120	55,604	421	618	8,908	72,678
Escapement SE	483	657	116	150	493	
Percent	10.0%	77.0%	0.6%	0.8%	12.3%	
Percent SE	0.7%	0.9%	0.2%	0.2%	0.7%	

Table 21.–Average length (mideye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2007.

Brood year	**2003**	**2002**	**2001**	**2002**	**2001**	
Age	**1.2**	**1.3**	**1.4**	**2.2**	**2.3**	**Total**
Male						
Sample size	156	1,133	14	13	185	1,501
Mean length (mm)	479	580	584	494	578	568
SE	3.0	0.8	5.9	15.2	1.8	1.1
Female						
Sample size	57	1,199	3	6	196	1,461
Mean length (mm)	506	568	600	522	566	565
SE	3.6	0.6	11.5	11.9	1.5	0.6
All Fish						
Sample size	213	2,332	17	19	381	2,962
Mean length (mm)	487	574	587	503	572	567
SE	3	0	5	11	1	0.6

Table 22.–Age composition of the Chilkoot Lake sockeye salmon escapement, weighted by statistical week, 2008.

Brood year	**2004**	**2003**	**2004**	**2003**	**2002**	**2002**	**2001**	
Age class	**1.2**	**2.2**	**0.3**	**1.3**	**2.3**	**1.4**	**2.4**	**Total**
Sample size	103	6	3	851	44	47	3	1,057
Escapement	3,405	330	55	26,672	1,403	1,213	39	33,117
Escapement SE	427	154	31	552	282	255	23	
Percent	10.3%	1.0%	0.2%	80.5%	4.2%	3.7%	0.1%	
Percent SE	1.3%	0.5%	0.1%	1.7%	0.9%	0.8%	0.1%	

Table 23.–Average length (mideye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2008.

Brood year	**2004**	**2004**	**2003**	**2002**	**2003**	**2002**	**2001**	
Age	**0.3**	**1.2**	**1.3**	**1.4**	**2.2**	**2.3**	**2.4**	**Total**
Male								
Sample size	2	67	350	25	4	15	2	465
Mean length (mm)	580	491	584	607	553	585	590	572
SE	0.0	5.4	1.4	5.8	18.9	4.5	10.0	2.1
Female								
Sample size	1	36	501	22	2	29	1	592
Mean length (mm)	580	511	572	586	510	571	610	569
SE	0.0	4.9	1.0	4.4	30.0	3.7	0.0	1.1
All Fish								
Sample size	3	103	851	47	6	44	3	1,057
Mean length (mm)	580	498	577	597	538	576	597	570
SE	0.0	4.0	0.9	4.0	16.8	3.0	8.8	1.1

2009

In 2009, the sockeye salmon escapement was composed primarily of age-1.3 (67.6%) and age-1.2 (28.3%) fish (Table 24; Appendix Q). The remainder of the escapement (4.0%) was composed of age-2.3, age-1.4, age-0.3, and age-2.2 fish. Age-1.3 fish had a mean length of 583 mm for males and 573 mm for females, and age-1.2 fish had a mean length of 487 mm for males and 508 mm for females (Table 25; Appendix R).

Table 24.–Age composition of the Chilkoot Lake sockeye escapement weighted by statistical week, 2009.

Brood year	2004	2003	2002	2002	2001	
Age class	**1.2**	**1.3**	**1.4**	**2.2**	**2.3**	**Total**
Sample size	479	1,288	5	35	34	1,841
Escapement	9,539	22,801	103	647	615	33,705
Escapement SE	386	399	45	119	115	
Percent	28.3%	67.6%	0.3%	1.9%	1.8%	
Percent SE	1.1%	1.2%	0.1%	0.4%	0.3%	

Table 25.– Average length (mideye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2009.

Brood year	2006	2005	2004	2005	2004	
Age	**1.2**	**1.3**	**1.4**	**2.2**	**2.3**	**Total**
Male						
Sample size	353	660	2	28	15	1,058
Mean length (mm)	487	583	585	498	586	549
SE	1.9	1.0	15.0	6.6	7.5	1.7
Female						
Sample size	126	628	2	7	19	782
Mean length (mm)	508	573	570	511	571	562
SE	2.2	0.9	40.0	9.6	5.8	1.2
All Fish						
Sample size	479	1,288	4	35	34	1,840
Mean length (mm)	492	578	578	501	577	554
SE	1.6	0.7	18.0	5.7	4.7	1.1

2010

In 2010, the sockeye salmon escapement was composed primarily of age-1.3 (81.3%) and age-2.3 (8.5%) fish (Table 26; Appendix Q). The remainder of the escapement (14.3%) was composed of age-1.2, age-1.4, age-2.2, and age-3.2 fish. Age-1.3 fish had a mean length of 574 mm for males and 564 mm for females, and age-2.3 fish had a mean length of 570 mm for males and 561 mm for females (Table 27; Appendix R).

Table 26.–Age composition of the Chilkoot Lake sockeye escapement weighted by statistical week, 2010.

Brood year	2006	2005	2004	2005	2004	2004	
Age class	**1.2**	**1.3**	**1.4**	**2.2**	**2.3**	**3.2**	**Total**
Sample size	122	2,070	3	72	223	3	2,493
Escapement	4,269	58,284	48	2,922	6,099	34	71,657
Escapement SE	544	883	30	466	619	25	
Percent	6.0%	81.3%	0.1%	4.1%	8.5%	0.0%	
Percent SE	0.8%	1.2%	0.0%	0.6%	0.9%	0.0%	

Table 27.–Average length (mideye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2010.

Brood year Age	2006 1.2	2005 1.3	2004 1.4	2005 2.2	2004 2.3	2004 3.2	Total
Male							
Sample size	103	887	2	56	101	3	1,152
Mean length (mm)	482	574	595	479	570	507	561
SE	4.0	0.8	5.0	4.7	2.5	21.9	1.2
Female							
Sample size	19	1,173	1	16	121	-	1,330
Mean length (mm)	514	564	560	518	561	-	563
SE	6.1	0.5	0.0	4.8	1.9	-	0.5
All Fish							
Sample size	122	2,060	3	72	222	3	2,482
Mean length (mm)	487	568	583	487	565	507	562
SE	3.6	0.4	12.0	4.3	1.6	21.9	0.6

2011

In 2011, the sockeye salmon escapement was composed primarily of age-1.3 (49.3%), age-1.2 (17.1%) and age-2.3 (17.1%) fish (Table 28; Appendix Q). The remainder of the escapement (2.6%) was composed of age-0.3, age-1.4, age-2.2, age-2.4, and age 3.3 fish. Age-1.3 fish had a mean length of 581 mm for males and 569 mm for females. Age-1.2 fish had a mean length of 494 mm for males and 511 mm for females and age-2.3 fish had a mean length of 580 mm for males and 567 mm for females (Table 29; Appendix R).

Table 28.–Age composition of the Chilkoot Lake sockeye escapement weighted by statistical week, 2011.

Brood year Age class	2007 0.3	2007 1.2	2006 1.3	2005 1.4	2005 2.3	2005 2.2	2004 2.4	2004 3.3	Total
Sample size	1	637	1,441	4	431	50	1	7	2,572
Escapement	4	11,301	32,475	120	11,301	1,421	8	136	65,915
Escapement SE	4	635	829	66	635	253	7	66	
Percent	0.0%	17.1%	49.3%	0.2%	17.1%	2.2%	0.0%	0.2%	
Percent SE	0.0%	1.0%	1.3%	0.1%	1.0%	0.4%	0.0%	0.1%	

2012

In 2012, the sockeye salmon escapement was composed primarily of age-1.3 (87.1%) and age-2.3 (10.0%) fish (Table 30; Appendix Q). The remainder of the escapement (3.0%) was composed of age-1.2, age-1.4, and age-2.2 fish. Age-1.3 fish had a mean length of 585 mm for males and 565 mm for females, and age-2.3 fish had a mean length of 580 mm for males and 558 mm for females (Table 31; Appendix R).

Table 29.–Average length (mideye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2011.

Brood year	**2007**	**2007**	**2006**	**2005**	**2006**	**2005**	**2004**	**2004**	
Age	**0.3**	**1.2**	**1.3**	**1.4**	**2.2**	**2.3**	**2.4**	**3.3**	**Total**
Male									
Sample size	1	480	811	3	35	203	1	3	1,537
Mean length (mm)	580	494	581	567	505	580	620	593	552
SE	0.0	1.8	0.8	13.3	7.5	1.6	0.0	8.8	1.3
Female									
Sample size	-	156	628	1	15	227	-	4	1,031
Mean length (mm)	-	511	569	550	512	567	-	553	559
SE	-	2.2	0.8	0.0	7.1	1.4	-	6.3	1.0
All Fish									
Sample size	1	636	1,439	4	50	430	1	7	2,568
Mean length (mm)	580	498	576	563	507	573	620	570	555
SE	0.0	1.5	0.6	10.3	5.6	1.1	0.0	9.5	0.9

Table 30.–Age composition of the Chilkoot Lake sockeye salmon escapement, weighted by statistical week, 2012.

Brood year	**2008**	**2007**	**2006**	**2007**	**2006**	
Age class	**1.2**	**1.3**	**1.4**	**2.2**	**2.3**	**Total**
Sample size	76	2,078	11	18	240	2,423
Escapement	2,730	102,954	230	449	11,803	118,166
Escapement SE	473	1,116	86	157	1,024	
Percent	2.4%	87.1%	0.2%	0.4%	10.0%	
Percent SE	0.2%	0.9%	0.1%	0.1%	0.9%	

Table 31.–Average length (mideye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2012.

Brood year	**2006**	**2005**	**2004**	**2005**	**2004**	
Age	**1.2**	**1.3**	**1.4**	**2.2**	**2.3**	**Total**
Male						
Sample size	54	1,052	5	13	126	1,250
Mean length (mm)	496	585	580	511	580	580
SE	5.8	0.7	13.8	9.6	1.9	0.9
Female						
Sample size	22	1,026	6	5	114	1,173
Mean length (mm)	499	565	578	498	558	563
SE	5.0	0.7	13	5.8	2.0	0.7
All Fish						
Sample size	76	2,078	11	18	240	2,423
Mean length (mm)	497	575	579	507	570	527
SE	0.0	11.1	171.3	141.4	33.7	0.6

FRY POPULATION ESTIMATE

Hydroacoustic and trawl surveys were conducted at Chilkoot Lake on 8 November, 2007, 16 October, 2008, 27 October, 2009, 27 October, 2010, 4 November, 2011, and 24 October, 2012 (Table 32). Estimates of the pelagic fish population were: 99,781 fish (SE = 6,178; CV = 6.19%) in 2007, 1,020,388 fish (SE = 143,333; CV = 14.1%) in 2008, 832,991 fish (SE = 120,191; CV = 14.4%) in 2009, 830,394 fish (SE = 44,771; CV = 5.4%) in 2010, 651,847 fish (SE = 154,334; CV = 23.7%) in 2011, and 721,386 fish (SE = 116,128; CV = 16.1%) in 2012. The number of trawls conducted each year ranged from 3 to 8. In 2008, 1 threespine stickleback (*Gasterosteus aculeatus*) and 2 coho salmon (*O. kisutch)* fry were captured along with 534 sockeye salmon fry; however, sockeye salmon fry were the only species of fish caught in 2007 and 2009–2012. We assumed that sockeye salmon fry accounted for 100% of the pelagic fish population in those years but small numbers of other species were likely also present during this study period (Table 32). The overall precision of the pelagic fish estimate did not meet the objectives for a CV ≤ 15% in 2011 and 2012.

Table 32.– Number and percentage of fish collected in trawl samples by species, and estimated total number of fish (hydroacoustic targets) and sockeye salmon fry in autumn surveys of Chilkoot Lake, 1987–1991 and 1995–2012.

	Tow net samples				Percent	Percent	Percent	Estimated	
Year[a]	Total fish	Sockeye	Stickleback	Other	sockeye	stickleback	other	Targets	Sockeye
1987	194	141	41	12	73%	21%	6%	1,344,951	977,516
1988	85	83	0	2	98%	0%	2%	3,066,118	2,993,974
1989	209	208	1	0	100%	1%	0%	874,794	870,608
1990	240	238	0	2	99%	0%	1%	607,892	602,826
1991	47	38	9	0	81%	19%	0%	475,404	384,369
1995	775	708	52	15	91%	7%	2%	260,797	238,250
1996	174	173	0	1	99%	0%	1%	418,152	415,749
1997	117	116	0	1	99%	0%	1%	755,060	748,606
1998	526	523	0	3	99%	0%	1%	1,446,736	1,438,485
1999	263	248	11	4	94%	4%	2%	351,096	330,478
2000	14	13	0	1	93%	0%	7%	1,190,717	1,105,666
2001	61	29	23	9	48%	38%	15%	696,000	330,885
2002	289	288	0	1	100%	0%	0%	1,196,701	1,192,560
2003	139	138	1	0	99%	0%	0%	1,384,754	1,384,754
2004	199	187	4	8	94%	2%	4%	1,059,963	996,046
2005	225	225	0	0	100%	0%	0%	247,283	247,283
2006	348	348	0	0	100%	0%	0%	356,957	356,957
2007	48	48	0	0	100%	0%	0%	99,781	99,781
2008	534	531	1	2	99%	<1%	<1%	1,020,388	1,014,655
2009	60	60	0	0	100%	0%	0%	832,991	832,991
2010	379	379	0	0	100%	0%	0%	830,394	830,394
2011	82	82	0	0	100%	0%	0%	651,847	651,847
2012	131	131	0	0	100%	0%	0%	721,386	721,386

[a] No hydroacoustic surveys were conducted from 1992 to 1994.

LIMNOLOGICAL ASSESSMENT

Light and Temperature Profiles

In most years, the euphotic zone depth in Chilkoot Lake was deepest at the beginning of sampling (May) and gradually became shallower as the season progressed. The euphotic zone depth generally increases during late fall months due to cooler temperatures resulting in reduced glacial melt.

In 2007, the average euphotic zone depth ranged from 12.6 m in May to 4.2 m in July and averaged 7.1 m for the season (Table 33). In 2008, the average euphotic zone depth ranged from 12.1 m in May to 4.4 m in late August and averaged 9.8 m for the season. In 2009, the average euphotic zone depth ranged from 13.7 m in May to 2.3 m in August and averaged 5.3 m for the season. Average euphotic zone depths in 2010 ranged from 12.8 m in May to 3.2 m in August and averaged 6.8 m for the season. The average euphotic zone depth in 2011 ranged from 22.2 m in May to 3.9 m in July with a seasonal average of 8.8 m. In 2012, the average euphotic zone depth ranged from 16.4 m in May to 5.5 m in July and August and averaged 9.4 m for the season.

In all years (2007-2012), weak thermoclines (the depths at which temperature change was >1ºC per m) developed between May and September but were not detected in all months in which temperature profiles were taken (Figure 12). The thermocline depth ranged from 1 m to 3 m, below which temperature declined steadily to a depth of about 20 m. Water temperature profiles taken in 2012 indicated a deeper thermocline during the month of September (35 m). The maximum lake surface temperature recorded in 2007 was 12.9ºC on 23 May, and the maximum lake surface temperature recorded since 2008 was 13.8ºC on 10 August, 2007.

Zooplankton Composition

Zooplankton samples from Chilkoot Lake were composed predominantly of copepods (*Cyclops* sp.) in all years of this study (Tables 34 and 35). The zooplankton population was lowest in 2007 and 2009 with seasonal mean densities of 34,000 per m^2 and 20,000 per m^2, respectively (Table 34). The seasonal mean biomass was also lowest in these years at 32.9 and 29.8 mg per m^3 in 2007 and 2009, respectively (Table 35). In 2007, zooplankton density peaked late in the fall and was very low all season. In 2008, zooplankton density was variable through the summer and much improved over 2007. The 2009 zooplankton density was well below that of 2008 and the lowest density of all years in this study. Since 2010, zooplankton density and biomass have been trending upward. Mean lengths of non-ovigerous *Cyclops* sp. increased throughout the season in all years of this study. Seasonal weighted biomass also increased in recent years (Table 35).

Table 33.–Euphotic zone depths (m) in Chilkoot Lake, 2007–2012.

Year	Date	Station 1	Station 2	Mean
2007	23-May	12.3	12.9	12.6
	28-Jun	6.3	6.4	6.4
	20-Jul	3.9	4.5	4.2
	16-Aug	6.2	6.2	6.2
	21-Sep	4.5	4.7	4.6
	19-Oct	9.6	7.2	8.4
	Seasonal mean	7.1	7.0	7.1
2008	21-May	13.8	10.5	12.1
	25-Jun	9.8	11.1	10.5
	22-Jul	6.4	6.5	6.4
	21-Aug	3.9	4.8	4.4
	25-Sep	12.9	17.9	15.4
	Seasonal mean	9.4	10.2	9.8
2009	13-May	13.1	14.4	13.7
	19-Jun	6.1	5.2	5.7
	22-Jul	3.7	3.5	3.6
	19-Aug	2.2	2.4	2.3
	15-Sep	2.5	2.4	2.5
	6-Oct	4.3	3.4	3.8
	Seasonal mean	5.3	5.2	5.3
2010	10-May	10.0	15.6	12.8
	16-Jun	7.2	7.4	7.3
	15-Jul	5.6	6.1	5.8
	12-Aug	2.7	3.6	3.2
	14-Sep	4.1	3.9	4.0
	19-Oct	7.1	8.4	7.8
	Seasonal mean	6.1	7.5	6.8
2011	11-May	21.0	23.4	22.2
	17-Jun	7.7	7.0	7.3
	14-Jul	3.8	4.0	3.9
	19-Aug	4.6	5.2	4.9
	4-Oct	5.4	5.6	5.5
	Seasonal mean	8.5	9.0	8.8
2012	17-May	15.3	17.5	16.4
	20-Jun	10.5	10.2	10.4
	20-Jul	5.7	5.2	5.5
	21-Aug	5.3	5.6	5.5
	17-Sep	8.4	10.6	9.5
	1-Nov	12.9	12.7	12.8
	Seasonal mean	9.1	9.8	9.4

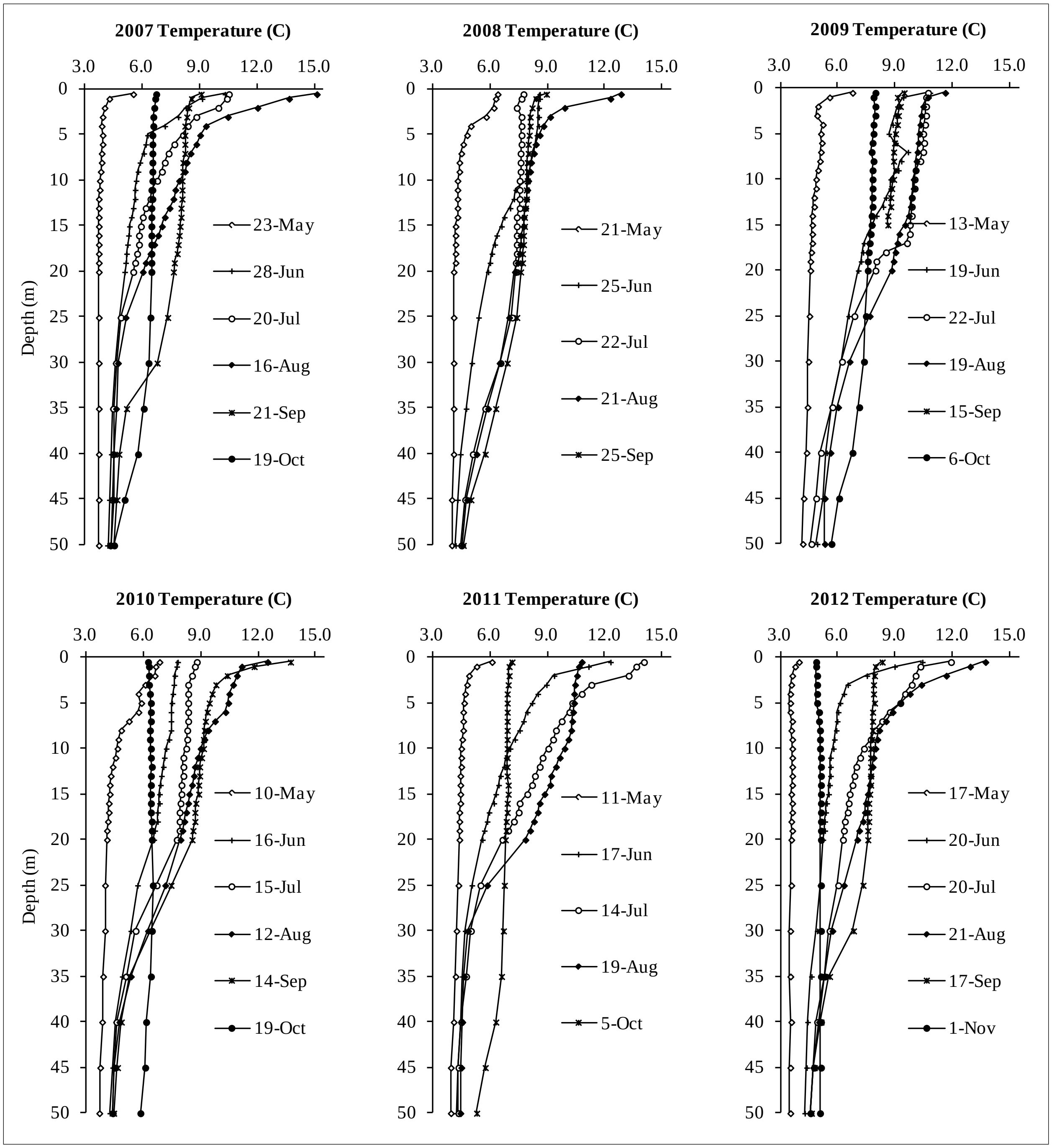

Figure 12.–Water temperature profiles by date (averaged between stations 1 and 2) at Chilkoot Lake, 2007–2012.

Table 34.–Mean density of zooplankton per m^2 of lake surface area, by sampling date and taxon, in Chilkoot Lake 2007–2012. Density estimates were averaged across four sampling stations in 2007 and two sampling stations in 2008–2012.

		Macrozooplankton density (number/m^2), by sampling date						Seasonal mean	
Year	**Taxon/Date**	**23-May**	**28-Jun**	**20-Jul**	**14-Aug**	**21-Sep**	**19-Oct**	**Density**	**% Density**
2007	*Cyclops* sp.	32,115	28,615	5,394	7,575	17,098	31,040	18,159	57.7%
	Ovig. Cyclops	0	788	159	780	318	425	409	1.2%
	Nauplii	70,719	1,624	377	321	4,648	2,629	15,538	41.1%
	Chydorinae	0	0	0	0	0	0	0	0.0%
	Daphnia longiremis	0	0	0	0	0	0	0	0.0%
	Total	102,835	31,027	5,930	8,676	22,064	34,094	34,106	
		21-May	**25-Jun**	**22-Jul**	**21-Aug**	**25-Sep**		**Density**	**% Density**
2008	*Cyclops* sp.	51,696	210,456	141,397	143,658	71,319		123,705	86.6%
	Ovig. Cyclops	180	732	127	828	340		442	0.3%
	Nauplii	45,615	11,929	2,356	27,169	6,623		18,738	13.1%
	Chydorinae	0	0	191	0	0		38	0.0%
	Daphnia longiremis	0	0	0	0	0		0	0.0%
	Total	97,491	223,117	144,072	171,655	78,282		142,923	
		13-May	**19-Jun**	**22-Jul**	**19-Aug**	**15-Sep**	**6-Oct**	**Density**	**% Density**
2009	*Cyclops* sp.	7,111	19,252	17,363	15,622	12,354	12,651	14,059	70.2%
	Ovig. Cyclops	0	212	255	934	1,613	3,311	1,054	5.3%
	Nauplii	22,712	446	934	2,972	1,698	679	4,907	24.5%
	Chydorinae	0	0	0	0	0	0	0	0.0%
	Daphnia longiremis	0	0	0	0	0	0	0	0.0%
	Total	29,823	19,910	18,552	19,528	15,665	16,641	20,020	
		10-May	**16-Jun**	**15-Jul**	**12-Aug**	**14-Sep**	**20-Oct**	**Density**	**% Density**
2010	*Cyclops* sp.	108,889	53,320	37,443	40,542	53,511	77,878	61,930	81.3%
	Ovig. Cyclops	955	764	1,019	6,644	4,946	9,021	3,891	5.1%
	Nauplii	10,931	849	4,075	3,099	10,146	32,603	10,284	13.5%
	Chydorinae	0	467	0	0	0	0	78	0.1%
	Daphnia longiremis	0	127	0	0	0	0	21	0.0%
	Total	120,776	55,527	42,537	50,284	68,602	119,502	76,205	
		11-May	**17-Jun**	**13-Jul**	**19-Aug**	**5-Oct**		**Density**	**% Density**
2011	*Cyclops* sp.	63,338	60,070	46,294	71,960	100,802		68,493	73.0%
	Ovig. Cyclops	170	6,113	12,736	21,268	29,971		14,052	15.0%
	Nauplii	16,280	2,781	5,158	18,182	13,924		11,265	12.0%
	Chydorinae	0	0	0	0	0		0	0.0%
	Daphnia longiremis	0	0	0	0	0		0	0.0%
	Total	79,789	68,963	64,187	111,411	144,698		93,810	
		17-May	**20-Jun**	**20-Jul**	**21-Aug**	**19-Sep**	**1-Nov**	**Density**	**% Density**
2012	*Cyclops* sp.	99,932	103,668	14,540	23,094	36,084	112,753	65,012	78.9%
	Ovig. Cyclops	1,507	1,528	2,717	14,009	18,594	7,132	7,581	9.2%
	Nauplii	23,625	7,387	1,528	3,057	6,113	17,151	9,810	11.9%
	Chydorinae	149	0	0	0	0	0	25	0.0%
	Daphnia longiremis	0	0	0	0	0	0	0	0.0%
	Total	125,212	112,583	18,785	40,160	60,791	137,035	82,428	

Table 35.–Mean length and biomass of zooplankton by sampling date and taxon in Chilkoot Lake, 2007–2012. Density estimates were averaged across four sampling stations in 2007 and two sampling stations in 2008–2012.

		Macrozooplankton length (mm), by sampling date						Seasonal Means (weighted)		
Year	**Taxon/Date**	**23-May**	**28-Jun**	**20-Jul**	**14-Aug**	**21-Sep**	**19-Oct**	**Length (mm)**	**Biomass (mg/m^2)**	**% biomass**
2007	*Cyclops* sp.	0.47	0.80	0.88	0.98	0.63	0.73	0.75	30.46	92.52%
	Ovig. Cyclops	0.00	1.27	1.19	1.27	1.30	1.32	1.06	2.46	7.48%
	Total								32.92	
		21-May	**25-Jun**	**22-Jul**	**21-Aug**	**25-Sep**		**Length (mm)**	**Biomass (mg/m^2)**	**% biomass**
2008	*Cyclops* sp.	0.54	0.71	0.89	0.83	0.86		0.79	193.06	92.17%
	Ovig. Cyclops	1.26	1.31	1.22	1.26	1.30		0.84	16.41	7.83%
	Total	0.00	0.00	0.00	0.00	0.00			209.47	
		13-May	**19-Jun**	**22-Jul**	**19-Aug**	**15-Sep**	**6-Oct**	**Length (mm)**	**Biomass (mg/m^2)**	**% biomass**
2009	*Cyclops* sp.	0.50	0.97	0.97	0.88	0.82	0.84	0.83	25.27	84.61%
	Ovig. Cyclops	0.00	1.25	1.27	1.35	1.24	1.36	1.08	4.60	15.39%
	Total	0.00	0.00	0.00	0.00	0.00	0.00		29.87	
		10-May	**16-Jun**	**15-Jul**	**12-Aug**	**14-Sep**	**20-Oct**	**Length (mm)**	**Biomass (mg/m^2)**	**% biomass**
2010	*Cyclops* sp.	0.58	0.86	0.89	0.89	0.66	0.77	0.77	78.33	82.50%
	Ovig. Cyclops	1.24	1.26	1.25	1.26	1.25	1.31	1.26	16.62	17.50%
	Total	0.00	0.00	0.00	0.00	0.00	0.00		94.95	
		11-May	**17-Jun**	**13-Jul**	**19-Aug**	**5-Oct**		**Length (mm)**	**Biomass (mg/m^2)**	**% biomass**
2011	*Cyclops* sp.	0.56	0.85	0.80	0.69	0.75		0.73	83.70	59.20%
	Ovig. Cyclops	1.19	1.27	1.24	1.29	1.31		1.26	57.65	40.80%
	Total	0.00	0.00	0.00	0.00	0.00			141.35	
		17-May	**20-Jun**	**20-Jul**	**21-Aug**	**19-Sep**	**1-Nov**	**Length (mm)**	**Biomass (mg/m^2)**	**% biomass**
2012	*Cyclops* sp.	0.56	0.83	0.82	0.89	0.73	0.72	0.76	115.45	70.86%
	Ovig. Cyclops	1.17	1.24	1.26	1.26	1.33	1.34	1.26	47.48	29.14%
	Total	0.00	0.00	0.00	0.00	0.00	0.00		162.93	

DISCUSSION

Chilkoot Lake sockeye salmon runs have steadily improved since declining to low levels in the 1990s (Appendix A). Although the 2008 and 2009 runs were below the long-term average in size, escapements and commercial harvests were above the recent 10-year average in 2007, 2010 to 2012. Chilkoot weir counts were higher than the long-term average in these years as well, with the largest weir count on record occurring in 2012. Established escapement goals were met or exceeded for all years except 2008 and 2009. Daily weir passages for all years fluctuated dramatically throughout the migration (Figures 3, 6 and 9). On average, peak migratory timing occurs on approximately 30 July. Peak weir counts in 2007 and 2011 occurred later than average, while peak weir counts during 2008, 2009 and 2010 were close to the historical average. Peak weir counts in 2012 were approximatly10 days earlier that average.

Chilkoot mark-recapture estimates have typically been much larger than weir counts (Kelley and Bachman 1999; Bachman and Sogge 2006; Bachman et al. 2013). Our 2010 and 2011 mark-recapture population estimates were 1.4 and 1.5 times the weir counts, respectively. Over the twelve-year series of mark-recapture estimates since 1996, mark-recapture estimates averaged 1.73 times greater than weir counts and weir counts fell within the 95% CI of the estimates in only three years (Appendix C). The reasons for the large differences between mark-recapture estimates and weir counts could be the result of bias in the mark-recapture estimates, systematic undercounting of fish at the weir, or potentially both.

Mark-recapture studies are subject to many assumptions, and serious, hard-to-detect bias may result when those conditions are not met (Arnason et al. 1996). In particular, loss of marked fish due to mortality, change in behavior, or non-recognition of marks, and variation in initial capture and final recapture probabilities could result in a mark-recapture estimate that is biased (Seber 1982; Schwarz and Taylor 1998). The initial mortality rate on fish marked at the Chilkoot weir in all three years of this study (2007, 2010 and 2011) was very low (<1%); however, once fish reach the lake it is impossible to know if marked fish died at a higher rate or behaved differently than unmarked fish. Our objective to mark fish at a constant rate of 10% of the daily weir passage was not maintained throughout the season (Tables 8, 10 and 12), resulting in diluted marked fraction on the spawning grounds and lower or variable mark ratios. Finally, it is often difficult to consistently sample the portion of the run that spawns above the lake in the Chilkat River. Fast river currents, high summer water levels, and glacial turbidity hampers recovery trips to upriver locations. Sampling opportunity improves later in the fall as the river level drops and visibility improves, but in some years a significant portion of the run that spawns upriver of Chilkoot Lake may have received little or no sampling effort for marks.

Weir counts, too, can be biased low due to the difficulty of maintaining the physical integrity of the weir. Flooding can allow fish to pass above or around the sides of the weir, streambed erosion can create holes large enough for fish to pass undetected under the weir, and glacial turbidity in the Chilkoot River makes it difficult to detect small gaps and openings. Pickets are removed from the weir during extreme high water levels to prevent damage to the weir. Recognition of these problems led to improvements in weir construction and maintenance. The Chilkoot weir was inspected daily for holes, loose pickets, and gaps through which fish could pass undetected, and sand bags and wire mesh are used liberally to plug or close small holes. Although flooding required the weir to be opened for two days in July 2007, it is highly unlikely that 40% of the run escaped in the two days the weir was out. No major holes or other problems were identified in the weir in 2010 or 2011. Estimates of escapement, total return, and exploitation rate would all change substantially if mark-recapture estimates were used instead of weir counts. Differences between the two estimates, however, have not been consistent enough to calibrate past weir counts, and escapement goal analyses to date have been based on weir counts, recognizing that they are likely conservative (Geiger et al. 2005; Eggers et al. 2009).

Exploitation rates on Chilkoot sockeye salmon (including commercial, subsistence, and sport harvest) fluctuated around the long term average of 48% during 2007–2012. The exploitation rate was lowest in 2008 (23%), followed by 2011 (31%), 2010 (33%), and 2009 (35%) as a result of the below-average run size and more conservative fishery management during those years. High exploitation rates in 2007 (64%) and 2012 (51%) resulted from more aggressive fishery management due to larger run size. The District 15 drift gillnet fishery is managed to achieve Chilkoot escapement objectives through time, area, and gear restrictions that are guided by inseason run projections based on daily weir counts. Openings early in the season are designed to harvest large hatchery runs of summer chum salmon in section 15-C (lower Lynn Canal; Figure 1) while minimizing the harvest of north bound sockeye salmon and other wild stocks until their run strengths can be determined. Once escapement objectives for Chilkoot Lake sockeye salmon are projected to be met (e.g., in 2007, 2010–2012), area along the eastern shoreline of section 15-A (upper Lynn Canal; Figure 1) is opened to target this stock. During years of high Chilkoot sockeye salmon abundance (e.g., in 2007 and 2012), additional commercial fishing opportunity is allowed north of the latitude of Mud Bay point, and during years of large runs, Lutak Inlet (Figure 1) has been open for extended time each week to harvest Chilkoot sockeye salmon in excess of escapement needs.

Fishing effort in the District 15 Lynn Canal drift gillnet fishery has been steadily increasing since 2008, however; fishing effort in recent years is well below the peak years in the 1980s (Figure 13). Participation in the drift gillnet fishery decreased from an average of 300 boats in the 1980s to 158 boats in recent years, due to restrictions to improve Chilkoot sockeye salmon escapements and to a downturn in salmon exvessel values.

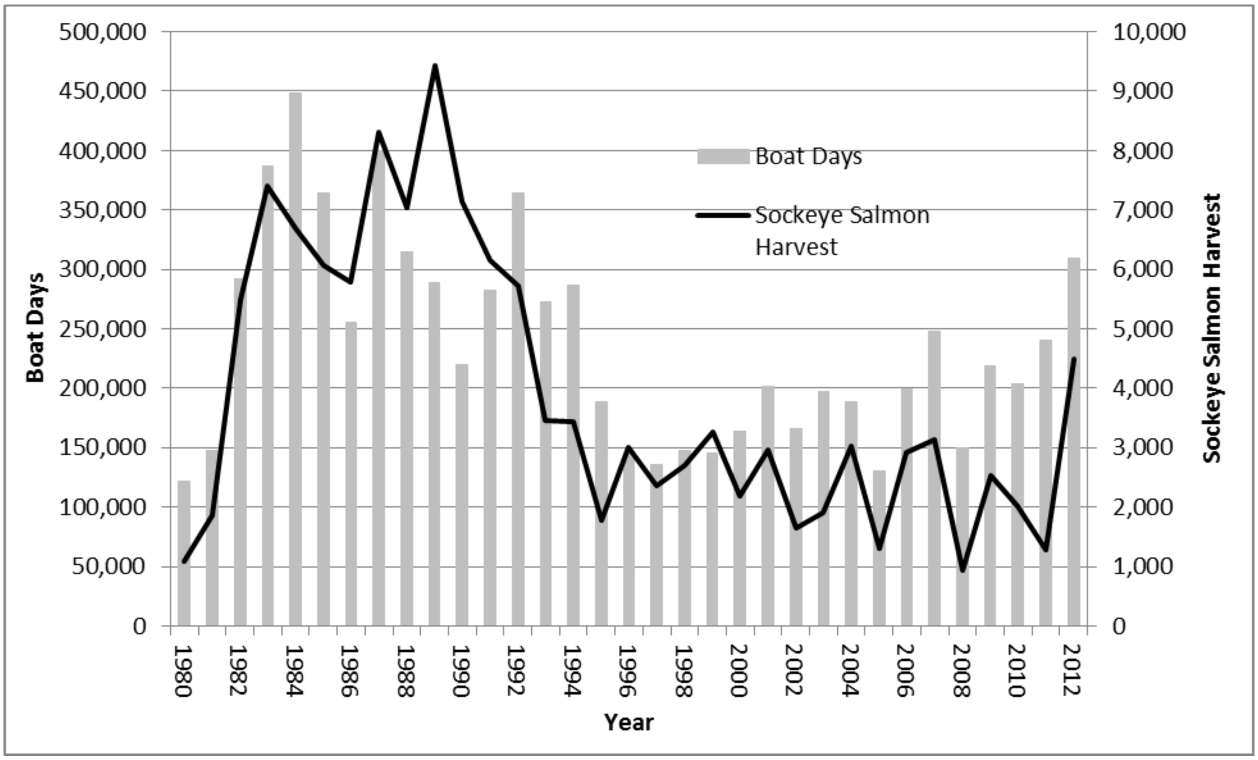

Figure 13.–Annual fishing effort in boat-days and total sockeye salmon harvest in the District 15 commercial drift gillnet fishery, 1980–2012.

The changing productivity of Chilkoot Lake presents challenges for management of the sockeye salmon stock. Riffe (2006) and Eggers et al. (2009) hypothesized that the dramatic downturn in Chilkoot Lake sockeye salmon production observed in the 1990s (Appendix B) was due to changes in freshwater conditions brought about by local warming. Chilkoot Lake is in transition between being a clear lake and a glacial lake. In the spring and winter, the lake has characteristics consistent with clear lakes and during the summer, especially warm dry summers, Chilkoot Lake becomes cold and silty as glacial melt flows into the lake. During hot dry summers similar to those observed in the 1990s, runoff from rainwater decreases, glacial melt increases, depositing more silt into the lake and reducing the euphotic volume. Reduced euphotic volume affects all trophic levels, from phytoplankton to zooplankton to sockeye salmon fry (Koenings and Burkett 1987). Like most glacially-influenced Alaska lakes (Koenings et al. 1989, 1990), the macrozooplankton community in Chilkoot Lake is represented solely by copepods (*Cyclops columbianus*; Barto 1996), which are not as responsive as cladocerans to variation in lake productivity and abundance of predators (Edmundson et al. 1992; Kyle et al. 1990).

Results of our 2007–2012 surveys of Chilkoot Lake productivity suggest the potential for increased runs of sockeye salmon in the future. Our estimates of rearing sockeye salmon fry populations, in particular, have been stable since 2008 (Table 32).

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APPENDICES

Appendix A.–Chilkoot River weir dates of operation and annual counts by species, 1976–2012.

Year	Dates	Chinook salmon	Sockeye salmon	Coho salmon	Pink salmon	Chum salmon
1976	5/29–11/4	NA	71,290	991	1,250	241
1977	5/28–9/18	NA	97,368	5	5,270	195
1978	6/6–11/8	NA	35,454	1,092	112	382
1979	6/9–11/4	NA	96,122	899	n/a	253
1980	6/15–10/4	NA	98,673	628	4,683	719
1981	6/10–10/12	NA	84,047	1,585	34,821	405
1982	6/3–9/14	6	103,038	5	6,665	507
1983	6/4–11/12	0	80,141	1,844	11,237	501
1984	6/3–9/14	0	100,781	321	5,034	372
1985	6/5–10/28	5	69,141	2,202	33,608	1,031
1986	6/4–10/28	6	88,024	1,966	1,249	508
1987	6/4–11/2	3	94,208	576	6,689	431
1988	6/9–11/12	1	81,274	1,476	5,274	450
1989	6/3–10/30	0	54,900	3,998	2,118	223
1990	6/3–10/30	0	76,119	988	10,398	216
1991	6/7–10/8	0	92,375	4,000	2,588	357
1992	6/2–9/26	1	77,601	1,518	7,836	193
1993	6/3–9/30	203	52,080	322	357	240
1994	6/4–9/24	118	37,005	463	22,472	214
1995	6/5–9/10	7	7,177	95	1,243	99
1996	6/6–9/11	19	50,739	86	2,867	305
1997	6/4–9/9	6	44,254	17	26,197	268
1998	6/4–9/13	11	12,335	131	44,001	368
1999	6/2–9/13	29	19,284	11	56,692	713
2000	6/3–9/12	10	43,555	47	23,636	1050
2001	6/7–9/12	24	76,283	103	32,294	810
2002	6/8–9/11	36	58,361	304	79,639	352
2003	6/6–9/9	12	75,065	15	55,424	498
2004	6/3–9/12	17	77,660	89	107,994	617
2005	6/6–9/12	9	51,178	23	90,486	262
2006	6/5–9/13	1	96,203	158	33,888	257
2007	6/4–9/12	39	72,678	13	61,469	252
2008	6/4–9/12	31	33,117	50	15,105	327
2009	6/3–9/10	12	33,705	11	34,483	171
2010	6/6–9/14	6	71,657	90	30,830	410
2011	6/5–9/5	43	65,915	18	76,244	118
2012	6/3–9/12	47	118,166	139	40,753	494
Average		23	66,899	710	27,081	400

Appendix B.–Annual Chilkoot Lake sockeye salmon escapements (weir counts), and estimated harvests (commercial, sport, and subsistence), total runs, and exploitation rates, 1976–2012.

Year	Weir count	Escapement goal range		Harvest				Total run	Exploitation Rate (%)
		Lower	Upper	Commercial	Sport[a]	Subsistence[b]	Total		
1976	71,290	80,000	100,000	62,452	ND	ND	62,452	133,748	47%
1977	97,368	80,000	100,000	113,313	400	ND	113,713	211,081	54%
1978	35,454	80,000	100,000	14,264	500	ND	14,764	50,218	29%
1979	96,122	80,000	100,000	69,864	300	ND	70,164	166,112	42%
1980	98,673	80,000	100,000	20,846	700	ND	21,546	118,059	18%
1981	84,047	60,000	80,000	43,792	1,200	ND	44,992	129,039	35%
1982	103,038	60,000	80,000	144,592	800	ND	145,392	248,430	59%
1983	80,141	60,000	80,000	241,469	600	ND	242,069	322,210	75%
1984	100,781	60,000	80,000	231,792	1,000	ND	232,792	333,573	70%
1985	69,141	60,000	80,000	152,325	1,100	1,001	154,426	223,567	69%
1986	88,024	60,000	80,000	110,430	3,000	1,640	115,070	203,094	57%
1987	94,208	60,000	80,000	334,995	1,700	1,237	337,932	432,140	78%
1988	81,274	60,000	80,000	253,968	300	828	255,096	336,370	76%
1989	54,900	60,000	80,000	291,863	900	1,831	294,594	349,494	84%
1990	76,119	50,500	91,500	178,864	2,600	2,207	183,671	259,790	71%
1991	92,375	50,500	91,500	224,041	600	4,348	228,989	319,743	72%
1992	77,601	50,500	91,500	140,719	500	4,104	145,323	212,394	68%
1993	52,080	50,500	91,500	51,424	100	2,896	54,420	106,500	51%
1994	37,005	50,500	91,500	30,717	400	1,589	27,403	69,713	47%
1995	7,177	50,500	91,500	9,673	200	384	8,530	17,398	59%
1996	50,739	50,500	91,500	18,861	400	2,311	21,572	72,313	30%
1997	44,254	50,500	91,500	31,822	500	1,781	31,194	78,357	44%
1998	12,335	50,500	91,500	2,838	closed	160	2,366	15,333	20%
1999	19,284	50,500	91,500	4,604	closed	115	4,373	24,003	25%
2000	43,555	50,500	91,500	14,133	400	251	14,784	58,339	25%
2001	76,283	50,500	91,500	67,502	2,300	1,499	71,301	147,584	48%
2002	58,361	50,500	91,500	24,275	1,500	1,258	27,033	85,394	32%
2003	75,065	50,500	91,500	32,324	1,500	2,091	35,915	110,374	33%
2004	77,660	50,500	91,500	66,537	889	1,766	69,192	144,788	48%
2005	51,178	50,500	91,500	29,321	566	1,427	31,314	82,492	38%
2006	96,203	50,000	90,000	119,236	520	2,279	122,035	218,238	56%
2007	72,678	50,000	90,000	125,199	303	3,290	128,792	201,535	64%
2008	33,117	50,000	90,000	7,491	298	1,894	9,683	42,640	23%
2009	33,705	38,000	86,000	16,622	165	892	17,679	51,224	32%
2010	71,657	38,000	86,000	32,064	567	2,251	34,882	106,539	33%
2011	65,915	38,000	86,000	26,766	973	1,977	29,716	95,631	31%
2012	118,166	38,000	86,000	115,509	1,000	3,080	119,589	233,614	51%
Average	66,899			93,410	847	1,800	95,558	162,456	48%

[a] Sport fish salmon record keeping began in 1977.
[b] Subsistence salmon record keeping began in 1985.

Appendix C.–Chilkoot Lake sockeye salmon mark-recapture data and estimates compared to weir counts, 1996–2004, 2007, 2010, and 2011.

Year [a]	Number marked	Number captured	Number recaptured	Mark-recapture estimate	SE	95% CI Lower	95% CI Upper	Weir count	Expansion factor [c]
1996[b]	NA	NA	NA	65,000	9,000	46,000	83,000	50,739	1.28
1997[b]	3,489	NA	NA	80,000	5,393	68,040	89,180	44,254	1.81
1998	1,248	700	29	28,000	5,000	18,000	38,000	12,335	2.27
1999	3,952	1,410	89	62,000	6,000	50,000	70,000	19,284	3.22
2000	4,386	1,781	128	60,000	5,000	50,000	70,000	43,555	1.38
2001	6,368	1,480	92	100,000	10,000	81,000	119,000	76,283	1.31
2002	5,419	1,887	166	61,000	4,000	52,000	70,000	58,361	1.05
2003	6,363	1,529	60	177,000	39,000	99,000	524,000	75,065	2.36
2004	6,682	1,869	82	150,000	16,000	123,000	186,000	77,660	1.93
2007	7,239	1,565	109	103,000	6,300	85,000	121,000	72,678	1.42
2010	6,535	1,962	153	82,600	6,300	70,000	95,000	71,657	1.15
2011	6,522	1,950	126	100,200	8,500	84,000	117,000	65,915	1.52

[a.] No mark-recapture experiment conducted in 2005, 2006, 2008, 2009 and 2012.
[b] Mark-recapture data not available for studies conducted in 1996 and 1997.
[c] The expansion factor equals the mark-recapture estimated divided by the weir count.

Appendix D.–Escapement sampling data analysis.

The weekly sockeye salmon age-sex distribution, the seasonal age-sex distribution weighted by week, and the mean length by age and sex weighted by week, were calculated using equations from Cochran (1977).

Let

h	=	index of the stratum (week),
j	=	index of the age class,
p_{hj}	=	proportion of the sample taken during stratum h that is age j,
n_h	=	number of fish sampled in week h, and
n_{hj}	=	number observed in class j, week h.

Then the age distribution was estimated for each week of the escapement in the usual manner:

$$\hat{p}_{hj} = n_{hj} / n_h \ . \tag{1}$$

If N_h equals the number of fish in the escapement in week h, standard errors of the weekly age class proportions are calculated in the usual manner (Cochran 1977, page 52, equation 3.12):

$$SE\left(\hat{p}_{hj}\right) = \sqrt{\left[\frac{\left(\hat{p}_{hj}\right)\left(1-\hat{p}_{hj}\right)}{n_h - 1}\right]\left[1 - n_h / N_h\right]} \ . \tag{2}$$

The age distributions for the total escapement were estimated as a weighted sum (by stratum size) of the weekly proportions. That is,

$$\hat{p}_j = \sum_h p_{hj}\left(N_h / N\right), \tag{3}$$

such that N equals the total escapement. The standard error of a seasonal proportion is the square root of the weighted sum of the weekly variances (Cochran 1977, pages 107–108):

$$SE\left(\hat{p}_j\right) = \sqrt{\sum_j^h \left[SE\left(\hat{p}_{hj}\right)\right]^2 \left(N_h / N\right)^2} \ . \tag{4}$$

The mean length, by sex and age class (weighted by week of escapement), and the variance of the weighted mean length, were calculated using the following equations from Cochran (1977, pages 142–144) for estimating means over subpopulations. That is, let i equal the index of the individual fish in the age-sex class j, and y_{hij} equal the length of the ith fish in class j, week h, so that,

$$\hat{\bar{Y}}_j = \frac{\sum_h \left(N_h / n_h\right) \sum_i y_{hij}}{\sum_h \left(N_h / n_h\right) n_{hj}} \text{, and} \tag{5}$$

$$\hat{V}\left(\hat{\bar{Y}}_j\right) = \frac{1}{\hat{N}_j^2} \sum_h \frac{N_h^2 \left(1 - n_h / N_h\right)}{n_h \left(n_h - 1\right)} \left[\sum_i \left(y_{hij} - \bar{y}_{hj}\right)^2 + n_{hj}\left(1 - \frac{n_{hj}}{n_h}\right)\left(\bar{y}_{hj} - \hat{\bar{Y}}_j\right)^2\right].$$

Appendix E.–ADF&G statistical weeks, 2007–2012.

Statistical	2007		2008		2009		2010		2011		2012	
week	Beginning	Ending	Beginning	Ending	Beginning	Ending	Beginning	Ending	Beginning	Ending	Beginning	Ending
23	03-Jun	09-Jun	01-Jun	7-Jun	31-May	06-Jun	30-May	05-Jun	29-May	04-Jun	03-Jun	09-Jun
24	10-Jun	16-Jun	08-Jun	14-Jun	07-Jun	13-Jun	06-Jun	12-Jun	05-Jun	11-Jun	10-Jun	16-Jun
25	17-Jun	23-Jun	15-Jun	21-Jun	14-Jun	20-Jun	13-Jun	19-Jun	12-Jun	18-Jun	17-Jun	23-Jun
26	24-Jun	30-Jun	22-Jun	28-Jun	21-Jun	27-Jun	20-Jun	26-Jun	19-Jun	25-Jun	24-Jun	30-Jun
27	01-Jul	07-Jul	29-Jun	5-Jul	28-Jun	04-Jul	27-Jun	03-Jul	26-Jun	02-Jul	01-Jul	07-Jul
28	08-Jul	14-Jul	06-Jul	12-Jul	05-Jul	11-Jul	04-Jul	10-Jul	03-Jul	09-Jul	08-Jul	14-Jul
29	15-Jul	21-Jul	13-Jul	19-Jul	12-Jul	18-Jul	11-Jul	17-Jul	10-Jul	16-Jul	15-Jul	21-Jul
30	22-Jul	28-Jul	20-Jul	26-Jul	19-Jul	25-Jul	18-Jul	24-Jul	17-Jul	23-Jul	22-Jul	28-Jul
31	29-Jul	04-Aug	27-Jul	2-Aug	26-Jul	01-Aug	25-Jul	31-Jul	24-Jul	30-Jul	29-Jul	04-Aug
32	05-Aug	11-Aug	03-Aug	9-Aug	02-Aug	8-Aug	01-Aug	07-Aug	31-Jul	06-Aug	05-Aug	11-Aug
33	12-Aug	18-Aug	10-Aug	16-Aug	09-Aug	15-Aug	08-Aug	14-Aug	07-Aug	13-Aug	12-Aug	18-Aug
34	19-Aug	25-Aug	17-Aug	23-Aug	16-Aug	22-Aug	15-Aug	21-Aug	14-Aug	20-Aug	19-Aug	25-Aug
35	26-Aug	01-Sep	24-Aug	30-Aug	23-Aug	29-Aug	22-Aug	28-Aug	21-Aug	27-Aug	26-Aug	01-Sep
36	02-Sep	08-Sep	31-Aug	6-Sep	30-Aug	05-Sep	29-Aug	04-Sep	28-Aug	03-Sep	02-Sep	08-Sep
37	09-Sep	15-Sep	07-Sep	13-Sep	06-Sep	12-Sep	05-Sep	11-Sep	04-Sep	10-Sep	09-Sep	15-Sep
38	16-Sep	22-Sep	14-Sep	20-Sep	13-Sep	19-Sep	12-Sep	18-Sep	11-Sep	17-Sep	16-Sep	22-Sep
39	23-Sep	29-Sep	21-Sep	27-Sep	20-Sep	26-Sep	19-Sep	25-Sep	18-Sep	24-Sep	23-Sep	29-Sep
40	30-Sep	06-Oct	28-Sep	4-Oct	27-Sep	03-Oct	26-Sep	02-Oct	25-Sep	01-Oct	30-Sep	06-Oct
41	07-Oct	13-Oct	05-Oct	11-Oct	04-Oct	10-Oct	03-Oct	09-Oct	02-Oct	08-Oct	07-Oct	13-Oct
42	14-Oct	20-Oct	12-Oct	18-Oct	11-Oct	17-Oct	10-Oct	16-Oct	09-Oct	15-Oct	14-Oct	20-Oct

Appendix F.–Daily and cumulative Chilkoot River weir counts of salmon, by species, number of sockeye salmon marked, and water temperature and gauge heights, 2007.

	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	**Daily**	**Cum.**	**Marked**	**Cum.**	**Mark[a]**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**level (mm)**	**temp (°C)**
4–Jun	16	16	2	2	AD	0	0	0	0	0	0	0	0	161	6.5
5–Jun	10	26	0	2	AD	0	0	0	0	0	0	0	0	170	6.5
6–Jun	23	49	4	6	AD	0	0	0	0	0	0	0	0	172	5.5
7–Jun	67	116	5	11	AD	0	0	0	0	0	0	0	0	165	5.0
8–Jun	152	268	17	28	AD	0	0	0	0	0	0	0	0	157	5.0
9–Jun	150	418	15	43	AD	0	0	0	0	0	0	0	0	150	5.5
10–Jun	103	521	12	55	AD	0	0	0	0	0	0	0	0	150	7.0
11–Jun	302	823	23	78	AD	0	0	0	0	0	0	0	0	153	6.0
12–Jun	383	1,206	40	118	AD	0	0	0	0	0	0	0	0	156	6.0
13–Jun	462	1,668	50	168	AD	0	0	0	0	0	0	0	0	154	5.5
14–Jun	518	2,186	53	221	AD		0	0	0	0	0	0	0	151	6.0
15–Jun	871	3,057	86	307	AD	0	0	0	0	0	0	0	0	152	6.0
16–Jun	266	3,323	29	336	AD	0	0	0	0	0	0	0	0	164	6.0
17–Jun	373	3,696	34	370	RV	0	0	0	0	0	0	0	0	174	6.0
18–Jun	260	3,956	27	397	RV	0	0	0	0	0	0	0	0	165	8.0
19–Jun	647	4,603	65	462	RV	0	0	0	0	0	0	0	0	161	6.0
20–Jun	570	5,173	59	521	RV	0	0	0	0	0	0	0	0	164	6.0
21–Jun	490	5,663	51	572	RV	0	0	0	0	0	0	0	0	166	5.5
22–Jun	286	5,949	32	604	RV	0	0	0	0	0	0	0	0	159	7.5
23–Jun	234	6,183	15	619	RV	0	0	0	0	0	0	0	0	154	7.5
24–Jun	391	6,574	40	659	RV	0	0	0	0	0	0	0	0	150	7.0
25–Jun	481	7,055	45	704	RV	0	0	0	0	0	0	0	0	147	7.5
26–Jun	632	7,687	70	774	RV	0	0	0	0	0	0	0	0	145	6.0
27–Jun	476	8,163	40	814	RV	0	0	0	0	0	0	0	0	146	7.0
28–Jun	521	8,684	54	868	RV	0	0	0	0	0	0	0	0	154	7.0
29–Jun	115	8,799	21	889	RV	0	0	0	0	0	0	0	0	157	8.0
30–Jun	243	9,042	16	905	RV	0	0	0	0	0	0	0	0	158	8.0
1–Jul	167	9,209	20	925	LV	0	0	0	0	0	0	0	0	157	7.0
2–Jul	534	9,743	50	975	LV	0	0	0	0	0	0	0	0	152	7.0
3–Jul	392	10,135	42	1,017	LV	0	0	0	0	0	0	0	0	149	8.0
4–Jul	454	10,589	43	1,060	LV	0	0	0	0	0	0	0	0	152	7.5
5–Jul	157	10,746	32	1,092	LV	0	0	2	2	0	0	0	0	159	7.0
6–Jul	145	10,891	2	1,094	LV	0	0	1	3	0	0	0	0	158	8.0
7–Jul	197	11,088	20	1,114	LV	1	1	0	3	0	0	0	0	153	8.5

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Date	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cum.	Marked	Cum.	Mark[a]	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (mm)	temp (°C)
8–Jul	303	11,391	25	1,139	LV	0	1	3	6		0			151	8.5
9–Jul	376	11,767	42	1,181	LV	2	3	0	6		0			149	8.0
10–Jul	660	12,427	61	1,242	LV	1	4	3	9		0			150	8.0
11–Jul	879	13,306	87	1,329	LV	6	10	0	9		0			156	6.0
12–Jul	393	13,699	40	1,369	LV	3	13	1	10		0			159	7.5
13–Jul	158	13,857	30	1,399	LV	1	14	1	11		0			170	8.0
14–Jul	87	13,944	0	1,399	LV	0	14	1	12		0			173	8.0
15–Jul	210	14,154	20	1,419	RA	0	14	0	12		0			169	8.0
16–Jul	184	14,338	17	1,436	RA	1	15	2	14		0			168	8.0
17–Jul	117[b]	14,455	0	1,436	RA	0	15	0	14		0			185	8.5
18–Jul	23	14,478	7	1,443	RA	3	18	2	16		0			172	9.0
19–Jul	51	14,529	0	1,443	RA	3	21	0	16		0			163	8.5
20–Jul	208	14,737	15	1,458	RA	8	29	4	20		0			161	8.0
21–Jul	280	15,017	26	1,484	RA	7	36	2	22		0			164	8.0
22–Jul	476	15,493	50	1,534	RA	6	42	3	25		0			161	8.0
23–Jul	1,242	16,735	134	1,668	RA	55	97	7	32		0			155	8.0
24–Jul	2,375	19,110	126	1,794	RA	102	199	4	36		0			150	8.0
25–Jul	1,951	21,061	160	1,954	RA	91	290	0	36		0			145	9.0
26–Jul	1,194	22,255	140	2,094	RA	49	339	0	36		0			143	9.0
27–Jul	1,189	23,444	120	2,214	RA	55	394	3	39		0			142	9.5
28–Jul	1,082	24,526	120	2,334	RA	63	457	0	39		0			142	9.0
29–Jul	1,755	26,281	183	2,517	LA	127	584	1	40		0			144	9.5
30–Jul	1,758	28,039	185	2,702	LA	184	768	0	40		0			148	9.5
31–Jul	1,298	29,337	130	2,832	LA	219	987	0	40		0			146	9.0
1–Aug	1,457	30,794	150	2,982	LA	261	1,248	1	41		0			146	10.0
2–Aug	1,315	32,109	133	3,115	LA	258	1,506	1	42		0			144	9.0
3–Aug	575	32,684	84	3,199	LA	59	1,565	1	43		0			142	9.5
4–Aug	638	33,322	80	3,279	LA	73	1,638	0	43		0			141	9.0
5–Aug	1,614	34,936	162	3,441	LA	101	1,739	0	43		0			139	10.0
6–Aug	1,678	36,614	160	3,601	LA	126	1,865	2	45		0			138	9.5
7–Aug	1,561	38,175	160	3,761	LA	237	2,102	0	45		0			142	10.0
8–Aug	1,338	39,513	140	3,901	LA	856	2,958	0	45		0			145	9.5
9–Aug	1,140	40,653	115	4,016	LA	3,056	6,014	0	45		0			145	6.5
10–Aug	622	41,275	69	4,085	LA	2,918	8,932	0	45		0			147	10.5
11–Aug	825	42,100	80	4,165	LA	1,666	10,598	0	45		0			143	9.5
12–Aug	1,206	43,306	120	4,285	DC	2,248	12,846	1	46		0			141	10.5

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Appendix F.–Page 3 of 3.

Date	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	**Cum.**	**Marked**	**Cum.**	**Mark[a]**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**level (mm)**	**temp (°C)**
13–Aug	1,812	45,118	190	4,475	DC	1,693	14,539	2	48		0			138	11.0
14–Aug	2,688	47,806	168	4,643	DC	2,604	17,143	1	49		0			135	10.0
15–Aug	2,317	50,123	160	4,803	DC	2,869	20,012	2	51		0			135	10.0
16–Aug	1,908	52,031	181	4,984	DC	3,962	23,974	4	55		0			135	10.0
17–Aug	536	52,567	67	5,051	DC	2,041	26,015	2	57		0			139	10.5
18–Aug	918	53,485	107	5,158	DC	2,030	28,045	0	57		0			140	10.0
19–Aug	598	54,083	61	5,219	DC	1,815	29,860	0	57		0			140	10.0
20–Aug	861	54,944	110	5,329	DC	1,904	31,764	1	58		0			139	10.0
21–Aug	854	55,798	90	5,419	DC	1,460	33,224	5	63		0			137	10.0
22–Aug	850	56,648	80	5,499	DC	2,935	36,159	1	64		0			134	10.0
23–Aug	1,097	57,745	113	5,612	DC	2,784	38,943	0	64		0			133	10.5
24–Aug	903	58,648	100	5,712	DC	2,080	41,023	1	65		0			129	10.0
25–Aug	507	59,155	60	5,772	DC	1,649	42,672	5	70		0			131	10.5
26–Aug	547	59,702	55	5,827	RP	1,811	44,483	2	72		0			132	10.0
27–Aug	504	60,206	50	5,877	RP	949	45,432	3	75		0			130	10.0
28–Aug	749	60,955	74	5,951	RP	1,453	46,885	11	86		0			127	10.5
29–Aug	1,888	62,843	200	6,151	RP	2,014	48,899	6	92		0			125	10.0
30–Aug	1,706	64,549	200	6,351	RP	2,040	50,939	7	99		0			125	10.5
31–Aug	1,550	66,099	160	6,511	RP	1,942	52,881	7	106		0			127	10.0
1–Sep	1,065	67,164	120	6,631	RP	1,556	54,437	9	115		0			126	10.0
2–Sep	730	67,894	73	6,704	RP	1,650	56,087	11	126		0			127	10.5
3–Sep	809	68,703	80	6,784	RP	784	56,871	12	138		0			126	10.0
4–Sep	639	69,342	80	6,864	RP	289	57,160	2	140	1	1			124	10.0
5–Sep	444	69,786	45	6,909	RP	201	57,361	0	140	2	3			124	8.0
6–Sep	634	70,420	65	6,974	RP	379	57,740	8	148	2	5			128	8.5
7–Sep	430	70,850	65	7,039	RP	568	58,308	14	162	1	6			135	8.5
8–Sep	500	71,350	55	7,094	RP	703	59,011	11	173	1	7			130	9.0
9–Sep	437	71,787	50	7,144	LP	738	59,749	13	186	1	8			131	9.0
10–Sep	225	72,012	40	7,184	LP	596	60,345	15	201	0	8			137	9.5
11–Sep	385	72,397	40	7,224	LP	607	60,952	28	229	3	11			142	9.0
12–Sep	281	72,678	31	7,255	LP	517	61,469	23	252	2	13			147	9.0

[a] Finclip mark types: AD=Adipose only; RV= Right Ventral; LV=Left Ventral; RA=Right Axillary; LA=Left Axillary; DC=Dorsal; RP=Right Pectoral; LP=Left Pectoral.
[b] Weir pickets removed 2145 hrs on 16 July through 1100 hrs on 18 July due to flood event; interpolated value calculated for 17 July.

Appendix G.–Daily and cumulative Chilkoot River weir counts of salmon by species, number of sockeye salmon marked, and water temperature and gauge heights, 2008.

	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	**Daily**	**Cum.**	**Marked**	**Cum.**	**Mark[a]**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**level (mm)**	**temp (°C)**
4–Jun	0	0	0	0		0	0	0	0	0	0	0		145	5.0
5–Jun	1	1	0	0		0	0	0	0	0	0	0		145	5.5
6–Jun	0	1	0	0		0	0	0	0	0	0	0		141	6.5
7–Jun	4	5	0	0		0	0	0	0	0	0	0		138	4.5
8–Jun	4	9	0	0		0	0	0	0	0	0	0		135	5.5
9–Jun	0	9	0	0		0	0	0	0	0	0	0		132	5.0
10–Jun	0	9	0	0		0	0	0	0	0	0	0		129	6.0
11–Jun	0	9	0	0		0	0	0	0	0	0	0		124	6.0
12–Jun	4	13	0	0		0	0	0	0	0	0	0		124	6.0
13–Jun	0	13	0	0		0	0	0	0	0	0	0		126	6.5
14–Jun	4	17	0	0		0	0	0	0	0	0	0		130	6.5
15–Jun	4	21	0	0		0	0	0	0	0	0	0		132	7.0
16–Jun	4	25	0	0		0	0	0	0	0	0	0		134	7.5
17–Jun	2	27	0	0		0	0	0	0	0	0	0		136	7.5
18–Jun	1	28	0	0		0	0	0	0	0	0	0		142	7.5
19–Jun	63	91	0	0		0	0	0	0	0	0	0		144	8.0
20–Jun	24	115	0	0		0	0	0	0	0	0	0		142	7.5
21–Jun	49	164	0	0		0	0	0	0	0	0	0		148	7.5
22–Jun	45	209	0	0		0	0	0	0	0	0	0		151	7.5
23–Jun	179	388	0	0		0	0	0	0	0	0	0		149	7.5
24–Jun	164	552	0	0		0	0	0	0	0	0	0		145	7.0
25–Jun	36	588	0	0		0	0	0	0	0	0	0		144	7.0
26–Jun	124	712	0	0		0	0	0	0	0	0	0		143	7.0
27–Jun	20	732	0	0		0	0	0	0	0	0	0		140	6.0
28–Jun	22	754	0	0		0	0	0	0	0	0	0		143	7.5
29–Jun	71	825	0	0		0	0	0	0	0	0	0		152	7.0
30–Jun	52	877	0	0		0	0	0	0	0	0	0		147	7.0
1–Jul	143	1,020	0	0		0	0	0	0	0	0	1	1	144	7.5
2–Jul	211	1,231	0	0		0	0	0	0	0	0	0	1	153	7.5
3–Jul	529	1,760	0	0		0	0	2	2	0	0	2	3	158	9.0
4–Jul	295	2,055	0	0		0	0	0	2	0	0	2	5	166	8.0
5–Jul	74	2,129	0	0		0	0	0	2	0	0	0	5	168	9.0
6–Jul	75	2,204	0	0		0	0	0	2	0	0	3	8	168	7.0
7–Jul	29	2,233	0	0		1	1	0	2	0	0	0	8	172	6.5

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Appendix G.–Page 2 of 3.

	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	**Daily**	**Cum.**	**Marked**	**Cum.**	**Mark[a]**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**level (mm)**	**temp (°C)**
8-Jul	125	2,358	0	0		1	2	1	3	0	0	0	8	164	7.5
9-Jul	85	2,443	0	0		0	2	3	6	0	0	2	10	156	7.0
10-Jul	125	2,568	0	0		5	7	2	8	0	0	0	10	148	8.0
11-Jul	324	2,892	0	0		0	7	2	10	0	0	2	12	144	7.5
12-Jul	125	3,017	0	0		0	7	0	10	0	0	0	12	143	7.5
13-Jul	152	3,169	0	0		4	11	0	10	0	0	0	12	140	8.0
14-Jul	122	3,291	0	0		3	14	0	10	0	0	0	12	139	8.0
15-Jul	174	3,465	0	0		5	19	1	11	0	0	2	14	140	8.0
16-Jul	1,309	4,774	0	0		29	48	3	14	0	0	2	16	143	8.0
17-Jul	678	5,452	0	0		12	60	3	17	0	0	0	16	144	8.0
18-Jul	184	5,636	0	0		1	61	2	19	0	0	0	16	144	6.5
19-Jul	129	5,765	0	0		7	68	2	21	0	0	0	16	156	7.5
20-Jul	85	5,850	0	0		7	75	1	22	0	0	1	17	161	7.0
21-Jul	61	5,911	0	0		4	79	2	24	0	0	1	18	150	7.5
22-Jul	58	5,969	0	0		14	93	5	29	0	0	0	18	141	6.5
23-Jul	25	5,994	0	0		23	116	2	31	0	0	0	18	139	7.5
24-Jul	22	6,016	0	0		33	149	3	34	0	0	1	19	140	6.5
25-Jul	75	6,091	0	0		58	207	4	38	0	0	0	19	142	7.5
26-Jul	2,159	8,250	0	0		68	275	4	42	0	0	1	20	162	7.5
27-Jul	2,067	10,317	0	0		82	357	13	55	0	0	2	22	162	7.5
28-Jul	2,348	12,665	0	0		200	557	10	65	0	0	0	22	154	8.0
29-Jul	7,004	19,669	0	0		686	1,243	10	75	0	0	4	26	146	8.0
30-Jul	3,782	23,451	0	0		442	1,685	10	85	0	0	2	28	144	8.5
31-Jul	1,083	24,534	0	0		409	2,094	2	87	0	0	2	30	142	8.0
1-Aug	800	25,334	0	0		259	2,353	0	87	0	0	1	31	144	8.0
2-Aug	1,053	26,387	0	0		193	2,546	3	90	0	0	0	31	143	8.5
3-Aug	291	26,678	0	0		150	2,696	2	92	0	0	0	31	141	8.5
4-Aug	168	26,846	0	0		148	2,844	1	93	0	0	0	31	140	8.5
5-Aug	159	27,005	0	0		104	2,948	0	93	0	0	0	31	139	8.0
6-Aug	352	27,357	0	0		202	3,150	2	95	0	0	0	31	140	8.0
7-Aug	104	27,461	0	0		71	3,221	1	96	0	0	0	31	145	8.0
8-Aug	505	27,966	0	0		145	3,366	2	98	0	0	0	31	148	8.5
9-Aug	449	28,415	0	0		123	3,489	2	100	0	0	0	31	148	8.0
10-Aug	194	28,609	0	0		145	3,634	2	102	0	0	0	31	145	8.5
11-Aug	603	29,212	0	0		183	3,817	3	105	0	0	0	31	141	8.5
12-Aug	194	29,406	0	0		118	3,935	2	107	0	0	0	31	139	9.0

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Date	Sockeye salmon Daily	Sockeye salmon Cum.	Sockeye salmon Marked	Sockeye salmon Cum.	Sockeye salmon Mark[a]	Pink salmon Daily	Pink salmon Cum.	Chum salmon Daily	Chum salmon Cum.	Coho salmon Daily	Coho salmon Cum.	Chinook salmon Daily	Chinook salmon Cum.	Water level (mm)	Water temp (^{o}C)
13-Aug	133	29,539	0	0		42	3,977	1	108	0	0	0	31	151	8.5
14–Aug	160[b]	29,699	0	0			3,977		108		0	0	31	184	
15–Aug	100	29,799	0	0		21	3,998	0	108	0	0	0	31	173	8.0
16–Aug	212	30,011	0	0		275	4,273	0	108	0	0	0	31	158	8.0
17–Aug	210	30,221	0	0		754	5,027	3	111	0	0	0	31	148	8.5
18–Aug	273	30,494	0	0		853	5,880	7	118	0	0	0	31	143	8.0
19–Aug	401	30,859	0	0		945	6,825	2	120	0	0	0	31	138	8.5
20–Aug	288	31,183	0	0		2,655	9,480	2	122	0	0	0	31	136	9.0
21–Aug	119	31,302	0	0		1,031	10,511	7	129	0	0	0	31	138	10.0
22–Aug	117	31,419	0	0		832	11,343	14	143	0	0	0	31	144	8.0
23–Aug	215	31,634	0	0		494	11,837	5	148	0	0	0	31	150	9.0
24–Aug	46	31,680	0	0		161	11,998	2	150	0	0	0	31	153	9.0
25–Aug	50	31,730	0	0		38	12,036	2	152	0	0	0	31	160	7.5
26–Aug	106	31,836	0	0		71	12,107	1	153	0	0	0	31	151	7.5
27–Aug	190	32,026	0	0		237	12,344	2	155	0	0	0	31	149	7.5
28–Aug	148	32,174	0	0		303	12,647	7	162	0	0	0	31	140	8.0
29–Aug	128	32,302	0	0		526	13,173	7	169	1	1	0	31	135	8.0
30–Aug	114	31,416	0	0		420	13,593	5	174	0	1	0	31	134	8.0
31–Aug	80	32,496	0	0		198	13,791	9	183	1	2	0	31	132	8.0
1–Sep	81	32,577	0	0		224	14,015	11	194	0	2	0	31	129	8.0
2–Sep	78	32,655	0	0		171	14,186	6	200	1	3	0	31	127	7.5
3–Sep	44	32,699	0	0		111	14,297	5	205	1	4	0	31	127	8.0
4–Sep	66	32,765	0	0		128	14,425	3	208	3	7	0	31	129	8.0
5–Sep	54	32,819	0	0		89	14,514	8	216	2	9	0	31	128	8.5
6–Sep	52	32,871	0	0		88	14,602	13	229	3	12	0	31	126	8.5
7–Sep	46	32,917	0	0		128	14,730	19	248	3	15	0	31	124	8.5
8–Sep	42	32,959	0	0		80	14,810	16	264	4	19	0	31	126	8.5
9–Sep	54	33,013	0	0		106	14,916	20	284	1	20	0	31	127	8.5
10–Sep	18	33,031	0	0		32	14,948	6	290	3	23	0	31	125	8.0
11–Sep	65	33,096	0	0		101	15,049	25	315	17	40	0	31	134	7.5
12–Sep	21	33,177	0	0		56	15,105	12	327	10	50	0	31	133	7.5

[a] No mark-recapture study was conducted in 2008.

[b] Weir pickets removed 0530 hrs on 14 August through 1030 hrs on 15 August due to flood event; interpolated value calculated for 14 August.

Appendix H.–Daily and cumulative Chilkoot River weir counts of salmon by species, number of sockeye salmon marked, and water temperature and gauge heights, 2009.

	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	**Daily**	**Cum.**	**Marked**	**Cum.**	**Mark[a]**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**level (mm)**	**temp (°C)**
3-Jun	0	0	0	0		0	0	0	0	0	0	0	0	150	
4–Jun	0	0	0	0		0	0	0	0	0	0	0	0	160	
5–Jun	0	0	0	0		0	0	0	0	0	0	0	0	163	
6–Jun	1	1	0	0		0	0	0	0	0	0	0	0	164	
7–Jun	0	1	0	0		0	0	0	0	0	0	0	0	170	
8–Jun	0	1	0	0		0	0	0	0	0	0	0	0	180	
9–Jun	0	1	0	0		0	0	0	0	0	0	0	0	176	8.5
10–Jun	0	1	0	0		0	0	0	0	0	0	0	0	170	8.5
11–Jun	0	1	0	0		0	0	0	0	0	0	0	0	172	9.0
12–Jun	2	3	0	0		0	0	0	0	0	0	0	0	168	8.0
13–Jun	23	26	0	0		0	0	0	0	0	0	0	0	160	6.5
14–Jun	13	39	0	0		0	0	0	0	0	0	0	0	162	6.5
15–Jun	9	48	0	0		0	0	0	0	0	0	0	0	147	6.5
16–Jun	22	70	0	0		0	0	0	0	0	0	0	0	145	7.0
17–Jun	38	108	0	0		0	0	0	0	0	0	0	0	152	7.0
18–Jun	10	118	0	0		0	0	0	0	0	0	0	0	149	6.0
19–Jun	54	172	0	0		0	0	0	0	0	0	0	0	149	6.0
20–Jun	33	205	0	0		0	0	0	0	0	0	0	0	146	7.5
21–Jun	235	440	0	0		0	0	0	0	0	0	0	0	144	7.0
22–Jun	83	523	0	0		0	0	0	0	0	0	0	0	142	7.0
23–Jun	72	595	0	0		0	0	1	1	0	0	0	0	140	6.0
24–Jun	135	730	0	0		0	0	0	1	0	0	0	0	144	7.0
25–Jun	80	810	0	0		0	0	0	1	0	0	0	0	138	6.0
26–Jun	110	920	0	0		0	0	0	1	0	0	0	0	138	6.0
27–Jun	254	1,174	0	0		0	0	0	1	0	0	0	0	135	7.0
28–Jun	219	1,393	0	0		0	0	0	1	0	0	0	0	134	7.5
29–Jun	71	1,464	0	0		0	0	0	1	0	0	0	0	133	8.0
30–Jun	383	1,847	0	0		0	0	1	2	0	0	0	0	133	8.5
1–Jul	414	2,261	0	0		0	0	0	2	0	0	0	0	137	8.0
2–Jul	191	2,452	0	0		5	5	0	2	0	0	0	0	142	8.5
3–Jul	2,398	4,850	0	0		38	43	1	3	0	0	1	1	147	9.0
4–Jul	491	5,341	0	0		5	48	0	3	0	0	1	2	153	9.5
5–Jul	361	5,702	0	0		7	55	2	5	0	0	1	3	157	10.0
6–Jul	139	5,841	0	0		9	64	2	7	0	0	0	3	161	10.5

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Date	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water level (mm)	Water temp (°C)
	Daily	Cum.	Marked	Cum.	Mark[a]	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.		
7–Jul	75	5,916	0	0		3	67	0	7	0	0	0	3	161	12.0
8-Jul	70	5,986	0	0		5	72	2	9	0	0	0	3	159	12.0
9-Jul	303	6,289	0	0		10	82	2	11	0	0	1	4	158	10.0
10-Jul	259	6,548	0	0		8	90	3	14	0	0	1	5	160	9.0
11-Jul	554	7,102	0	0		24	114	3	17	0	0	0	5	157	9.0
12-Jul	450	7,552	0	0		7	121	0	17	0	0	0	5	155	9.5
13-Jul	210	7,762	0	0		12	133	3	20	0	0	0	5	155	10.0
14-Jul	211	7,973	0	0		7	140	0	20	0	0	1	6	154	10.0
15-Jul	478	8,451	0	0		20	160	3	23	0	0	2	8	153	10.0
16-Jul	1,088	9,539	0	0		77	237	2	25	0	0	2	10	149	10.5
17-Jul	557	10,096	0	0		78	315	1	26	0	0	0	10	144	10.0
18-Jul	813	10,909	0	0		98	413	8	34	0	0	0	10	142	9.5
19-Jul	554	11,463	0	0		67	480	6	40	0	0	0	10	143	10.0
20-Jul	966	12,429	0	0		77	557	1	41	0	0	0	10	145	9.5
21-Jul	736	13,165	0	0		63	620	4	45	0	0	0	10	151	9.0
22-Jul	145	13,310	0	0		14	634	2	47	0	0	1	11	147	8.5
23-Jul	516	13,826	0	0		81	715	4	51	0	0	0	11	147	8.5
24-Jul	684	14,510	0	0		72	787	2	53	0	0	0	11	149	9.0
25-Jul	943	15,453	0	0		110	897	1	54	0	0	0	11	148	9.0
26-Jul	1,005	16,458	0	0		167	1,064	2	56	0	0	0	11	138	10.0
27-Jul	3,274	19,732	0	0		901	1,965	7	63	0	0	1	12	136	10.5
28-Jul	1,745	21,477	0	0		515	2,480	1	64	0	0	0	12	143	10.0
29-Jul	871	22,348	0	0		261	2,741	4	68	0	0	0	12	151	9.5
30-Jul	505	22,853	0	0		81	2,822	2	70	0	0	0	12	156	10.0
31-Jul	491	23,344	0	0		103	2,925	2	72	0	0	0	12	156	10.0
1-Aug	186	23,530	0	0		137	3,062	1	73	0	0	0	12	154	11.0
2-Aug	900	24,430	0	0		568	3,630	1	74	0	0	0	12	151	10.0
3-Aug	1,387	25,817	0	0		487	4,117	2	76	0	0	0	12	144	10.5
4-Aug	660	26,477	0	0		1,011	5,128	0	76	0	0	0	12	143	11.5
5-Aug	314	26,791	0	0		857	5,985	0	76	0	0	0	12	142	11.5
6-Aug	551	27,342	0	0		1,392	7,377	1	77	0	0	0	12	141	10.0
7-Aug	373	27,715	0	0		1,253	8,630	2	79	0	0	0	12	138	10.5
8-Aug	654	28,369	0	0		1,376	10,006	2	81	0	0	0	12	135	10.0
9-Aug	421	28,790	0	0		810	10,816	0	81	0	0	0	12	134	10.0
10-Aug	332	29,122	0	0		1,290	12,106	0	81	0	0	0	12	136	9.5
11-Aug	600	29,722	0	0		1,176	13,282	0	81	0	0	0	12	137	10.0

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Date	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cum.	Marked	Cum.	Mark[a]	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (mm)	temp (°C)
12-Aug	207	29,929	0	0		903	14,185	2	83	0	0	0	12	136	10.0
13-Aug	204	30,133	0	0		689	14,874	0	83	0	0	0	12	134	10.0
14–Aug	184	30,317	0	0		373	15,247	0	83	0	0	0	12	132	10.5
15–Aug	204	30,521	0	0		226	15,473	3	86	0	0	0	12	129	9.5
16–Aug	659	31,180	0	0		246	15,719	0	86	0	0	0	12	134	9.0
17–Aug	235	31,415	0	0		27	15,746	1	87	0	0	0	12	155	8.5
18–Aug	106	31,521	0	0		27	15,773	0	87	0	0	0	12	176	8.5
19–Aug	129	31,650	0	0		88	15,861	0	87	0	0	0	12	156	9.0
20–Aug	170	31,820	0	0		1,404	17,265	0	87	0	0	0	12	142	9.5
21–Aug	115	31,935	0	0		3,511	20,776	3	90	0	0	0	12	140	10.0
22–Aug	182	32,117	0	0		2,120	22,896	2	92	0	0	0	12	145	9.0
23–Aug	197	32,314	0	0		2,032	24,928	4	96	0	0	0	12	144	9.0
24–Aug	168	32,482	0	0		1,639	26,567	1	97	0	0	0	12	144	9.0
25–Aug	211	32,693	0	0		836	27,403	2	99	0	0	0	12	141	9.0
26–Aug	176	32,869	0	0		183	27,586	2	101	0	0	0	12	144	8.0
27–Aug	160	33,029	0	0		286	27,872	0	101	0	0	0	12	141	8.5
28–Aug	16	33,045	0	0		6	27,878	0	101	0	0	0	12	155	
29–Aug	71	33,116	0	0		0	27,878	0	101	0	0	0	12	171	
30–Aug	53	33,169	0	0		0	27,878	0	101	0	0	0	12	200+	
31–Aug	36	33,205	0	0		0	27,878	0	101	0	0	0	12	172	
1–Sep	9	33,214	0	0		111	27,989	0	101	0	0	0	12	150	8.5
2–Sep	28	33,242	0	0		269	28,258	1	102	0	0	0	12	140	8.5
3–Sep	55	33,297	0	0		278	28,536	2	104	0	0	0	12	137	8.5
4–Sep	89	33,386	0	0		820	29,356	11	115	1	1	0	12	134	8.5
5–Sep	63	33,449	0	0		1,093	30,449	4	119	1	2	0	12	131	9.5
6–Sep	66	33,515	0	0		1,211	31,660	12	131	0	2	0	12	131	10.0
7–Sep	87	33,602	0	0		730	32,390	7	138	3	5	0	12	128	9.0
8–Sep	49	33,651	0	0		750	33,140	13	151	2	7	0	12	126	9.5
9–Sep	46	33,697	0	0		1,156	34,296	15	166	3	10	0	12	126	9.5
10–Sep	8	33,705	0	0		187	34,483	5	171	1	11	0	12	133	10.0

[a] No mark-recapture study was conducted in 2009.
[b] Weir pickets removed 1000 hrs on 29 August through 1800 hrs on 31 August due to flood event; interpolated values calculated for 29–31 August.

Appendix I.–Daily and cumulative Chilkat River weir counts of salmon by species, number of sockeye salmon marked, and water temperature and gauge heights, 2010.

	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	**Daily**	**Cum.**	**Marked**	**Cum.**	**Mark[a]**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**level (mm)**	**temp (°C)**
6-Jun	0	0	0	0		0	0	0	0	0	0	0	0	152	8.5
7-Jun	0	0	0	0		0	0	0	0	0	0	0	0	151	8.5
8-Jun	0	0	0	0		0	0	0	0	0	0	0	0	150	8.0
9-Jun	3	3	1	1	AD	0	0	0	0	0	0	0	0	149	8.5
10-Jun	8	11	0	1	AD	0	0	0	0	0	0	0	0	152	9.5
11-Jun	8	19	2	3	AD	0	0	0	0	0	0	0	0	152	5.0
12-Jun	16	35	0	3	AD	0	0	0	0	0	0	0	0	152	7.5
13-Jun	19	54	2	5	RA	0	0	0	0	0	0	0	0	150	6.5
14-Jun	10	64	1	6	RA	0	0	0	0	0	0	0	0	144	7.0
15-Jun	9	73	1	7	RA	0	0	0	0	0	0	0	0	138	8.0
16-Jun	15	88	2	9	RA	0	0	0	0	0	0	0	0	134	7.0
17-Jun	18	106	2	11	RA	0	0	0	0	0	0	0	0	134	7.5
18-Jun	36	142	5	16	RA	0	0	0	0	0	0	0	0	134	7.5
19-Jun	11	153	4	20	RA	0	0	0	0	0	0	0	0	133	8.0
20-Jun	12	165	2	22	RA	0	0	0	0	0	0	0	0	135	8.5
21-Jun	971	1,136	97	119	RA	0	0	0	0	0	0	0	0	141	8.5
22-Jun	508	1,644	51	170	RA	0	0	0	0	0	0	0	0	144	8.0
23-Jun	345	1,989	41	211	RA	0	0	0	0	0	0	0	0	148	9.0
24-Jun	421	2,410	40	251	RA	0	0	0	0	0	0	0	0	165	9.0
25-Jun	78	2,488	5	256	RA	0	0	0	0	0	0	0	0	164	8.5
26-Jun	231	2,719	20	276	RA	0	0	0	0	0	0	0	0	160	7.5
27-Jun	83	2,802	10	286	LA	0	0	0	0	0	0	0	0	153	8.0
28-Jun	116	2,918	11	297	LA	0	0	0	0	0	0	0	0	150	8.0
29-Jun	107	3,025	15	312	LA	0	0	0	0	0	0	1	1	144	8.5
30-Jun	41	3,066	12	324	LA	0	0	0	0	0	0	0	1	142	8.0
1-Jul	366	3,432	26	350	LA	0	0	0	0	0	0	0	1	154	8.0
2-Jul	136	3,568	40	390	LA	0	0	0	0	0	0	0	1	148	9.0
3-Jul	49	3,617	0	390	LA	0	0	0	0	0	0	0	1	144	9.0
4-Jul	75	3,692	1	391	LA	0	0	0	0	0	0	0	1	146	8.0
5-Jul	270	3,962	20	411	LA	0	0	0	0	0	0	0	1	148	7.5
6-Jul	123	4,085	17	428	LA	0	0	0	0	0	0	0	1	148	7.5
7-Jul	100	4,185	5	433	LA	0	0	1	1	0	0	0	1	148	7.5

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Date	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water level (mm)	Water temp (°C)
	Daily	Cum.	Marked	Cum.	Mark[a]	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.		
8-Jul	892	5,077	72	505	LA	1	1	2	3	0	0	0	1	152	9.0
9-Jul	760	5,837	80	585	LA	3	4	1	4	0	0	0	2	155	9.0
10-Jul	742	6,579	75	660	LA	1	5	0	4	0	0	0	2	157	9.0
11-Jul	175	6,754	20	680	RV	0	5	0	4	0	0	0	2	168	9.0
12-Jul	643	7,397	65	745	RV	7	12	2	6	0	0	0	2	164	8.0
13-Jul	538	7,935	60	805	RV	17	29	0	6	0	0	0	2	153	8.5
14-Jul	443	8,378	60	865	RV	22	51	1	7	0	0	0	2	147	8.0
15-Jul	553	8,931	60	925	RV	24	75	1	8	0	0	0	2	151	8.5
16-Jul	466	9,397	51	976	RV	17	92	3	11	0	0	1	3	146	9.0
17-Jul	513	9,910	52	1,028	RV	18	110	1	12	0	0	1	4	143	8.5
18-Jul	732	10,642	75	1,103	RV	13	123	1	13	0	0	0	4	143	8.5
19-Jul	1,064	11,706	110	1,213	RV	24	147	4	17	0	0	0	4	145	9.0
20-Jul	490	12,196	52	1,265	RV	10	157	3	20	0	0	0	4	142	9.5
21-Jul	1,287	13,483	135	1,400	RV	40	197	4	24	0	0	0	4	141	9.0
22-Jul	1,866	15,349	190	1,590	RV	23	220	2	26	0	0	0	4	141	9.0
23-Jul	5,676	21,025	285	1,875	RV	85	305	3	29	0	0	0	4	142	9.0
24-Jul	1,840	22,865	184	2,059	RV	40	345	1	30	0	0	0	4	150	9.0
25-Jul	3,398	26,263	330	2,389	LV	54	399	1	31	0	0	0	4	145	9.0
26-Jul	2,652	28,915	278	2,667	LV	43	442	1	32	0	0	0	4	140	9.0
27-Jul	5,346	34,261	280	2,947	LV	82	524	2	34	0	0	0	4	140	9.0
28-Jul	7,262	41,523	320	3,267	LV	184	708	2	36	0	0	0	4	143	9.5
29-Jul	2,483	44,006	249	3,516	LV	108	816	4	40	0	0	0	4	144	9.5
30-Jul	2,108	46,114	220	3,736	LV	358	1,174	3	43	0	0	0	4	142	9.5
31-Jul	3,441	49,555	234	3,970	LV	343	1,517	3	46	0	0	0	4	141	9.0
1-Aug	1,913	51,468	251	4,221	LV	420	1,937	1	47	0	0	0	4	142	9.5
2-Aug	2,034	53,502	206	4,427	LV	606	2,543	2	49	0	0	0	4	143	10.0
3-Aug	1,716	55,218	180	4,607	LV	357	2,900	1	50	0	0	0	4	150	9.5
4-Aug	1,252	56,470	130	4,737	LV	290	3,190	0	50	0	0	0	4	156	10.0
5-Aug	722	57,192	110	4,847	LV	537	3,727	2	52	0	0	0	4	156	11.5
6-Aug	347	57,539	40	4,887	LV	224	3,951	1	53	0	0	0	4	154	12.0
7-Aug	664	58,203	75	4,962	LV	230	4,181	0	53	0	0	0	4	154	10.0
8-Aug	864	59,067	90	5,052	RP	306	4,487	0	53	0	0	0	4	149	9.5
9-Aug	898	59,965	100	5,152	RP	444	4,931	1	54	0	0	0	4	146	9.5
10-Aug	1,087	61,052	110	5,262	RP	601	5,532	1	55	0	0	0	4	142	10.0
11-Aug	894	61,926	92	5,354	RP	586	6,118	0	55	0	0	0	4	139	9.5

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Date	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cum.	Marked	Cum.	Mark[a]	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (mm)	temp (°C)
12-Aug	980	62,926	105	5,459	RP	1,761	7,879	0	55	0	0	0	4	138	9.5
13-Aug	496	63,422	56	5,515	RP	3,588	11,467	2	57	0	0	1	5	138	10.0
14-Aug	699	64,121	73	5,588	RP	2,127	13,594	2	59	0	0	0	5	139	10.0
15-Aug	891	65,012	92	5,680	RP	1,437	15,031	2	61	0	0	0	5	144	10.5
16-Aug	400	65,412	60	5,740	RP	697	15,728	0	61	0	0	0	5	150	10.0
17-Aug	240	65,652	40	5,780	RP	273	16,001	0	61	0	0	0	5	148	10.5
18-Aug	391	66,043	43	5,823	RP	455	16,456	3	64	0	0	1	6	146	9.5
19-Aug	488	66,531	52	5,875	RP	363	16,819	0	64	0	0	0	6	148	9.5
20-Aug	289	66,820	40	5,915	RP	471	17,290	0	64	0	0	0	6	145	10.0
21-Aug	451	67,271	50	5,965	RP	929	18,219	1	65	0	0	0	6	152	10.5
22-Aug	379	67,650	40	6,005	LP	1,295	19,514	2	67	0	0	0	6	136	10.0
23-Aug	123	67,773	40	6,045	LP	465	19,979	2	69	0	0	0	6	134	9.5
24-Aug	490	68,263	50	6,095	LP	845	20,824	1	70	0	0	0	6	134	10.5
25-Aug	400	68,663	41	6,136	LP	1,525	22,349	5	75	0	0	0	6	131	10.5
26-Aug	236	68,899	40	6,176	LP	1,263	23,612	1	76	0	0	0	6	131	10.5
27-Aug	157	69,056	40	6,216	LP	865	24,477	3	79	0	0	0	6	130	11.0
28-Aug	186	69,242	40	6,256	LP	585	25,062	8	87	0	0	0	6	127	10.5
29-Aug	209	69,451	40	6,296	LP	601	25,663	5	92	0	0	0	6	126	10.0
30-Aug	301	69,752	30	6,326	LP	609	26,272	7	99	0	0	0	6	125	10.5
31-Aug	359	70,111	37	6,363	LP	700	26,972	13	112	0	0	0	6	122	10.5
1-Sep	87	70,198	26	6,389	LP	239	27,211	10	122	0	0	0	6	122	10.5
2-Sep	330	70,528	35	6,424	LP	457	27,668	10	132	1	1	0	6	125	9.5
3-Sep	324	70,852	30	6,454	LP	433	28,101	12	144	2	3	0	6	128	10.5
4-Sep	112	70,964	23	6,477	LP	267	28,368	21	165	2	5	0	6	125	10.0
5-Sep	75	71,039	6	6,483	DC	247	28,615	24	189	5	10	0	6	124	9.0
6-Sep	215	71,254	25	6,508	DC	544	29,159	26	215	0	10	0	6	131	9.0
7-Sep	102	71,356	12	6,520	DC	374	29,533	27	242	3	13	0	6	128	10.5
8-Sep	47	71,403	11	6,531	DC	292	29,825	31	273	2	15	0	6	128	10.5
9-Sep	49	71,452	11	6,542	DC	255	30,080	26	299	8	23	0	6	128	9.5
10-Sep	71	71,523	0	6,542	DC	179	30,259	16	315	15	38	0	6	133	9.5
11-Sep	41	71,564	2	6,544	DC	151	30,410	29	344	11	49	0	6	130	10.5
12-Sep	38	71,602	3	6,547	DC	147	30,557	23	367	7	56	0	6	128	9.5
13-Sep	42	71,644	3	6,550	DC	167	30,724	27	394	14	70	0	6	125	10.0
14-Sep	13	71,657	2	6,552	DC	106	30,830	16	410	20	90	0	6	123	10.0

[a] Finclip mark types: AD=Adipose only; RV= Right Ventral; LV=Left Ventral; RA=Right Axillary; LA=Left Axillary; DC=Dorsal; RP=Right Pectoral; LP=Left Pectoral.

Appendix J.–Daily and cumulative Chilkoot River weir counts of salmon by species, number of sockeye salmon marked, and water temperature and gauge heights, 2011.

	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cum.	Marked	Cum.	Mark[a]	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (mm)	temp (°C)
5-Jun	39	39	4	4	AD	0	0	0	0	0	0	0	0	146	7.0
6-Jun	15	54	4	8	AD	0	0	0	0	0	0	0	0	140	7.0
7-Jun	27	81	2	10	AD	0	0	0	0	0	0	0	0	141	6.5
8-Jun	10	91	1	11	AD	0	0	0	0	0	0	0	0	150	6.5
9-Jun	22	113	3	14	AD	0	0	0	0	0	0	0	0	148	7.5
10-Jun	73	186	6	20	AD	0	0	0	0	0	0	0	0	140	4.5
11-Jun	30	216	3	23	AD	0	0	1	1	0	0	0	0	136	8.0
12-Jun	49	265	6	29	RV	0	0	0	1	0	0	0	0	134	8.0
13-Jun	44	309	6	35	RV	0	0	0	1	0	0	0	0	133	7.5
14-Jun	145	454	15	50	RV	0	0	0	1	0	0	0	0	136	7.0
15-Jun	96	550	10	60	RV	0	0	1	2	0	0	0	0	140	6.5
16-Jun	184	734	19	79	RV	0	0	0	2	0	0	0	0	142	7.5
17-Jun	276	1,010	25	104	RV	0	0	0	2	0	0	0	0	141	8.0
18-Jun	197	1,207	21	125	RV	0	0	0	2	0	0	0	0	141	8.0
19-Jun	203	1,410	21	146	RV	0	0	0	2	0	0	0	0	146	8.0
20-Jun	260	1,670	30	176	RV	0	0	0	2	0	0	0	0	150	8.0
21-Jun	204	1,874	20	196	RV	0	0	0	2	0	0	0	0	150	7.5
22-Jun	346	2,220	38	234	RV	0	0	0	2	0	0	0	0	146	9.0
23-Jun	123	2,343	25	259	RV	0	0	0	2	0	0	0	0	145	8.0
24-Jun	213	2,556	13	272	RV	0	0	0	2	0	0	0	0	149	8.0
25-Jun	359	2,915	21	293	RV	0	0	0	2	0	0	0	0	154	9.0
26-Jun	97	3,012	30	323	LV	0	0	0	2	0	0	0	0	155	9.0
27-Jun	362	3,374	10	333	LV	0	0	0	2	0	0	0	0	154	9.0
28-Jun	176	3,550	26	359	LV	0	0	0	2	0	0	0	0	157	8.5
29-Jun	18	3,568	3	362	LV	0	0	0	2	0	0	0	0	158	7.0
30-Jun	66	3,634	8	370	LV	0	0	0	2	0	0	0	0	155	7.5
1-Jul	266	3,900	28	398	LV	0	0	1	3	0	0	0	0	152	7.0
2-Jul	202	4,102	30	428	LV	0	0	0	3	0	0	0	0	147	8.5
3-Jul	222	4,324	25	453	LV	1	1	0	3	0	0	0	0	143	8.0
4-Jul	530	4,854	40	493	LV	4	5	0	3	0	0	0	0	142	7.5
5-Jul	389	5,243	40	533	LV	13	18	0	3	0	0	0	0	140	8.5
6-Jul	80	5,323	10	543	LV	6	24	0	3	0	0	0	0	140	9.0
7-Jul	165	5,488	16	559	LV	2	26	0	3	0	0	0	0	140	9.0

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	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	**Daily**	**Cum.**	**Marked**	**Cum.**	**Mark[a]**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**level (mm)**	**temp (°C)**
8-Jul	127	5,615	20	579	LV	11	37	1	4	0	0	0	0	140	9.0
9-Jul	172	5,787	15	594	LV	12	49	0	4	0	0	0	0	139	9.0
10-Jul	434	6,221	50	644	RA	20	69	1	5	0	0	0	0	138	9.0
11-Jul	426	6,647	45	689	RA	15	84	0	5	0	0	0	0	139	9.5
12-Jul	844	7,491	90	779	RA	41	125	0	5	0	0	0	0	149	10.0
13-Jul	1,266	8,757	127	906	RA	93	218	1	6	0	0	0	0	152	9.5
14-Jul	1,376	10,133	140	1,046	RA	149	367	2	8	0	0	0	0	154	10.0
15-Jul	1,020	11,153	115	1,161	RA	87	454	1	9	0	0	0	0	151	11.0
16-Jul	1,073	12,226	110	1,271	RA	210	664	0	9	0	0	0	0	147	10.5
17-Jul	1,048	13,274	120	1,391	RA	101	765	2	11	0	0	0	0	145	10.5
18-Jul	1,412	14,686	52	1,443	RA	30	795	1	12	0	0	1	1	140	10.0
19-Jul	882	15,568	140	1,583	RA	62	857	2	14	0	0	2	3	141	9.5
20-Jul	1,217	16,785	130	1,713	RA	121	978	3	17	0	0	1	4	140	10.5
21-Jul	1,020	17,805	107	1,820	RA	141	1,119	0	17	0	0	3	7	141	11.5
22-Jul	1,446	19,251	150	1,970	RA	136	1,255	1	18	0	0	1	8	142	10.0
23-Jul	1,430	20,681	145	2,115	RA	182	1,437	1	19	0	0	0	8	142	10.5
24-Jul	1,582	22,263	165	2,280	LA	83	1,520	5	24	0	0	0	8	144	11.0
25-Jul	1,731	23,994	190	2,470	LA	97	1,617	2	26	0	0	0	8	147	9.5
26-Jul	1,528	25,522	165	2,635	LA	122	1,739	1	27	0	0	1	9	148	10.5
27-Jul	1,090	26,612	158	2,793	LA	59	1,798	1	28	0	0	3	12	150	10.0
28-Jul	1,030	27,642	110	2,903	LA	99	1,897	3	31	0	0	2	14	147	10.0
29-Jul	529	28,171	102	3,005	LA	102	1,999	1	32	0	0	0	14	142	10.0
30-Jul	1,298	29,469	133	3,138	LA	181	2,180	2	34	0	0	0	14	140	10.5
31-Jul	1,932	31,401	214	3,352	LA	514	2,694	3	37	0	0	1	15	139	10.0
1-Aug	915	32,316	130	3,482	LA	148	2,842	10	47	0	0	1	16	138	10.5
2-Aug	2,841	35,157	280	3,762	LA	333	3,175	4	51	0	0	2	18	136	10.0
3-Aug	1,738	36,895	150	3,912	LA	126	3,301	2	53	0	0	0	18	132	11.0
4-Aug	2,206	39,101	155	4,067	LA	120	3,421	0	53	0	0	2	20	130	11.0
5-Aug	1,212	40,313	130	4,197	LA	126	3,547	1	54	0	0	1	21	132	10.0
6-Aug	4,733	45,046	230	4,427	LA	323	3,870	1	55	0	0	2	23	130	10.0
7-Aug	2,541	47,587	125	4,552	RP	402	4,272	0	55	0	0	3	26	130	11.0
8-Aug	1,914	49,501	103	4,655	RP	377	4,649	0	55	0	0	2	28	128	11.0
9-Aug	2,410	51,911	150	4,805	RP	1,343	5,992	1	56	0	0	3	31	126	11.0
10-Aug	1,585	53,496	178	4,983	RP	1,780	7,772	0	56	0	0	0	31	124	11.0
11-Aug	793	54,289	111	5,094	RP	948	8,720	1	57	0	0	2	33	122	11.0
12-Aug	2,871	57,160	170	5,264	RP	5,302	14,022	1	58	0	0	0	33	133	11.0

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	Sockeye salmon					Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	**Daily**	**Cum.**	**Marked**	**Cum.**	**Mark[a]**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**Daily**	**Cum.**	**level (mm)**	**temp (°C)**
13-Aug	1,052	58,212	210	5,474	RP	6,236	20,258	1	59	0	0	1	34	135	12.0
14-Aug	555	58,767	90	5,564	RP	7,026	27,284	0	59	0	0	3	37	133	12.0
15-Aug	1,562	60,329	157	5,721	RP	6,574	33,858	1	60	0	0	2	39	132	10.0
16-Aug	649	60,978	120	5,841	RP	1,710	35,568	0	60	0	0	1	40	142	10.0
17-Aug	551	61,529	100	5,941	RP	5,941	41,509	0	60	0	0	0	40	140	10.0
18-Aug	440	61,969	60	6,001	RP	4,682	46,191	1	61	0	0	0	40	136	10.0
19-Aug	197	62,166	61	6,062	RP	1,365	47,556	0	61	0	0	0	40	132	10.5
20-Aug	560	62,726	59	6,121	RP	247	47,803	1	62	0	0	1	41	148	11.0
21-Aug	79	62,805	17	6,138	DC	34	47,837	0	62	0	0	0	41	168	9.5
22-Aug	33	62,838	16	6,154	DC	15	47,852	0	62	0	0	1	42	171	10.0
23-Aug	22	62,860	5	6,159	DC	27	47,879	0	62	0	0	0	42	165	9.5
24-Aug	53	62,913	10	6,169	DC	42	47,921	0	62	0	0	0	42	159	9.5
25-Aug	347	63,260	35	6,204	DC	908	48,829	0	62	0	0	0	42	148	10.0
26-Aug	390	63,650	40	6,244	DC	1,699	50,528	2	64	0	0	0	42	141	10.0
27-Aug	436	64,086	40	6,284	DC	2,261	52,789	0	64	0	0	0	42	136	10.0
28-Aug	475	64,561	50	6,334	DC	3,127	55,916	1	65	0	0	0	42	136	10.0
29-Aug	333	64,894	40	6,374	DC	5,189	61,105	3	68	0	0	0	42	136	9.0
30-Aug	226	65,120	40	6,414	DC	4,235	65,340	3	71	1	1	0	42	130	10.0
31-Aug	133	65,253	40	6,454	DC	2,513	67,853	4	75	0	1	0	42	132	9.0
1-Sep	152	65,405	20	6,474	DC	3,093	70,946	6	81	1	2	0	42	142	10.0
2-Sep	175	65,580	25	6,499	DC	2,500	73,446	10	91	3	5	0	42	130	11.0
3-Sep	164	65,744	20	6,519	DC	1,300	74,746	4	95	4	9	1	43	133	9.0
4-Sep	106	65,850	15	6,534	DC	888	75,634	6	101	5	14	0	43	144	10.0
5-Sep	65	65,915	15	6,549	DC	610	76,244	17	118	4	18	0	43	141	9.0

[a] Finclip mark types: AD=Adipose only; RV= Right Ventral; LV=Left Ventral; RA=Right Axillary; LA=Left Axillary; DC=Dorsal; RP=Right Pectoral; LP=Left Pectoral.

Appendix K.–Daily and cumulative Chilkoot River weir counts of salmon by species, and water temperature and gauge heights, 2012.

Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water level (mm)	Water temp (°C)
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.		
3-Jun	3	3	0	0	0	0	0	0	0	0	144	5.5
4-Jun	41	44	0	0	0	0	0	0	0	0	140	5.5
5-Jun	209	253	0	0	0	0	0	0	0	0	141	7.0
6-Jun	1,396	1,649	0	0	0	0	0	0	0	0	145	6.0
7-Jun	909	2,558	0	0	0	0	0	0	0	0	156	7.5
8-Jun	161	2,719	0	0	0	0	0	0	0	0	160	5.5
9-Jun	294	3,013	0	0	0	0	0	0	0	0	164	5.5
10-Jun	496	3,509	0	0	0	0	0	0	0	0	155	5.5
11-Jun	242	3,751	0	0	0	0	0	0	0	0	149	5.5
12-Jun	167	3,918	0	0	0	0	0	0	0	0	147	5.0
13-Jun	23	3,941	0	0	0	0	0	0	0	0	144	4.5
14-Jun	17	3,958	0	0	0	0	0	0	0	0	138	5.5
15-Jun	2	3,960	0	0	0	0	0	0	0	0	134	5.5
16-Jun	85	4,045	0	0	0	0	0	0	0	0	134	5.5
17-Jun	120	4,165	0	0	0	0	0	0	0	0	138	6.0
18-Jun	202	4,367	0	0	0	0	0	0	0	0	145	6.0
19-Jun	4,571	8,938	0	0	0	0	0	0	0	0	150	6.0
20-Jun	2,612	11,550	0	0	0	0	0	0	0	0	152	6.0
21-Jun	1,188	12,738	0	0	0	0	0	0	0	0	156	6.0
22-Jun	1,755	14,493	0	0	0	0	0	0	0	0	165	6.5
23-Jun	1,257 [a]	15,750	0	0	0	0	0	0	0	0	ND	ND
24-Jun	1,043 [a]	16,793	0	0	0	0	0	0	0	0	ND	ND
25-Jun	828 [a]	17,621	0	0	0	0	0	0	0	0	ND	ND
26-Jun	614 [a]	18,235	0	0	0	0	0	0	0	0	ND	ND
27-Jun	399 [a]	18,634	0	0	0	0	0	0	0	0	ND	ND
28-Jun	200	18,834	0	0	0	0	0	0	0	0	168	6.5
29-Jun	170	19,004	0	0	0	0	0	0	0	0	161	7.0
30-Jun	123	19,127	0	0	0	0	0	0	0	0	158	6.5
1-Jul	76	19,203	0	0	0	0	0	0	0	0	159	7.0
2-Jul	224	19,427	0	0	0	0	0	0	0	0	154	8.0
3-Jul	301	19,728	0	0	0	0	0	0	0	0	146	8.0
4-Jul	259	19,987	0	0	0	0	0	0	1	1	143	9.0
5-Jul	1,456	21,443	7	7	1	1	0	0	0	1	140	7.0
6-Jul	1,920	23,363	12	19	0	1	0	0	0	1	141	7.5

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Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water level (mm)	Water temp (°C)
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.		
7-Jul	2,468	25,831	8	27	0	1	0	0	4	5	143	7.5
8-Jul	455	26,286	3	30	0	1	0	0	0	5	156	8.0
9-Jul	923	27,209	21	51	1	2	0	0	1	6	158	7.5
10-Jul	626	27,835	4	55	0	2	0	0	1	7	163	7.5
11-Jul	801	28,636	4	59	1	3	0	0	4	11	163	6.5
12-Jul	667	29,303	2	61	1	4	0	0	0	11	154	7.0
13-Jul	2,512	31,815	18	79	3	7	0	0	0	11	148	7.5
14-Jul	1,629	33,444	11	90	1	8	0	0	1	12	153	8.5
15-Jul	1,901	35,345	33	123	2	10	0	0	2	14	158	7.0
16-Jul	4,412	39,757	76	199	5	15	0	0	1	15	158	8.0
17-Jul	2,000	41,757	54	253	2	17	0	0	1	16	155	8.0
18-Jul	3,275	45,032	60	313	2	19	0	0	2	18	154	8.0
19-Jul	4,016	49,048	58	371	2	21	0	0	2	20	158	8.5
20-Jul	12,250	61,298	181	552	5	26	0	0	5	25	164	9.0
21-Jul	7,500	68,798	44	596	3	29	0	0	1	26	167	9.5
22-Jul	3,447	72,245	71	667	7	36	0	0	0	26	165	8.5
23-Jul	7,069	79,314	69	736	5	41	0	0	3	29	163	10.0
24-Jul	5,640	84,954	175	911	1	42	0	0	2	31	159	10.0
25-Jul	3,188	88,142	125	1,036	0	42	0	0	0	31	155	9.5
26-Jul	1,733	89,875	63	1,099	0	42	0	0	0	31	155	9.0
27-Jul	2,244	92,119	125	1,224	2	44	0	0	2	33	162	9.5
28-Jul	988	93,107	45	1,269	0	44	0	0	0	33	165	9.0
29-Jul	1,667	94,774	147	1,416	1	45	0	0	0	33	160	9.5
30-Jul	1,895	96,669	228	1,644	0	45	0	0	0	33	153	9.0
31-Jul	3,001	99,670	303	1,947	1	46	0	0	2	35	151	8.5
1-Aug	2,538	102,208	376	2,323	0	46	0	0	0	35	153	9.0
2-Aug	602	102,810	67	2,390	1	47	0	0	1	36	149	8.5
3-Aug	454	103,264	197	2,587	0	47	0	0	1	37	149	7.5
4-Aug	1,411	104,675	181	2,768	2	49	0	0	1	38	150	8.5
5-Aug	1,237	105,912	289	3,057	2	51	0	0	1	39	147	9.0
6-Aug	675	106,587	707	3,764	2	53	0	0	0	39	146	8.5
7-Aug	461	107,048	889	4,653	0	53	0	0	2	41	162	9.0
8-Aug	155	107,203	588	5,241	0	53	0	0	0	41	168	9.0
9-Aug	178	107,381	338	5,579	0	53	0	0	1	42	168	8.0
10-Aug	357	107,738	489	6,068	5	58	0	0	1	43	163	8.0

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Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water level (mm)	Water temp (°C)
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.		
11-Aug	806	108,544	663	6,731	5	63	0	0	0	43	155	8.0
12-Aug	792	109,336	466	7,197	2	65	0	0	1	44	146	9.0
13-Aug	537	109,873	571	7,768	1	66	0	0	0	44	144	9.0
14-Aug	560	110,433	679	8,447	0	66	0	0	0	44	144	9.0
15-Aug	610	111,043	2,263	10,710	3	69	0	0	0	44	147	9.0
16-Aug	849	111,892	2,643	13,353	0	69	0	0	1	45	146	9.0
17-Aug	460	112,352	2,495	15,848	1	70	0	0	0	45	143	10.0
18-Aug	511	112,863	1,559	17,407	2	72	0	0	0	45	144	10.0
19-Aug	752	113,615	1,631	19,038	0	72	0	0	1	46	146	9.5
20-Aug	701	114,316	1,965	21,003	1	73	0	0	0	46	142	10.0
21-Aug	339	114,655	1,739	22,742	5	78	0	0	0	46	139	10.0
22-Aug	208	114,863	1,856	24,598	2	80	0	0	0	46	136	10.0
23-Aug	200	115,063	2,034	26,632	3	83	0	0	0	46	136	10.0
24-Aug	239	115,302	1,094	27,726	4	87	0	0	1	47	138	10.0
25-Aug	265	115,567	808	28,534	5	92	0	0	0	47	138	10.0
26-Aug	203	115,770	1,290	29,824	7	99	0	0	0	47	138	10.0
27-Aug	188	115,958	901	30,725	13	112	0	0	0	47	137	10.0
28-Aug	190	116,148	666	31,391	20	132	1	1	0	47	136	9.0
29-Aug	272	116,420	1,193	32,584	21	153	0	1	0	47	146	9.5
30-Aug	181	115,601	598	33,182	19	172	1	2	0	47	139	9.5
31-Aug	212	116,813	436	33,618	38	210	1	3	0	47	135	9.0
1-Sep	222	117,035	764	34,382	18	228	6	9	0	47	130	9.0
2-Sep	214	117,249	623	35,005	16	244	6	15	0	47	127	9.0
3-Sep	265	117,514	1,378	36,383	17	261	13	28	0	47	129	9.0
4-Sep	149	117,663	668	37,051	7	268	6	34	0	47	131	9.0
5-Sep	90	117,753	521	37,572	15	283	11	45	0	47	137	9.0
6-Sep	78	117,831	365	37,937	7	290	2	47	0	47	135	8.0
7-Sep	61	117,892	441	38,378	11	301	8	55	0	47	135	8.0
8-Sep	74	117,966	466	38,844	16	317	7	62	0	47	138	8.0
9-Sep	92	118,058	629	39,473	33	350	22	84	0	47	147	8.0
10-Sep	60	118,118	538	40,011	67	417	34	118	0	47	146	8.0
11-Sep	39	118,157	505	40,513	61	478	19	137	0	47	136	8.0
12-Sep	9	118,166	237	40,753	16	494	2	139	0	47	130	8.0

[a] Weir pickets removed 0600 hrs on 23 June through 2130 hrs on 27 June due to flood event; interpolated values calculated for 23–27-June.

Appendix L.–Initial mark-recapture matrix used to calculate pooled-Petersen and Darroch population estimates of Chilkoot Lake sockeye salmon in 2007.

Marking stratum			**Recapture stratum (week)[a]**														**Marks recaptured**	
Stat. week	**Mark[b]**	**Marked**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**39**	**41**	**42**	**43**	**Total**	**Percent**
23–24	AD	336	4	5	5	0	0	0	0	0	0	0	0	2	1	0	17	5%
25–26	RV	568	5	2	5	7	3	1	1	2	0	0	0	0	0	0	26	5%
27–28	LV	492	0	0	0	2	1	4	2	1	0	0	0	0	0	0	10	2%
29–30	RA	933	0	0	0	0	1	2	2	0	0	0	0	4	1	0	10	1%
31–32	LA	1,827	0	0	0	0	0	0	1	0	0	0	2	7	3	2	15	1%
33–34	D	1,604	0	0	0	0	0	0	0	3	0	0	1	6	3	2	15	1%
35–36	RP	1,318	0	0	0	0	0	0	1	0	0	0	1	4	5	3	14	1%
37–38	LP	161	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1%
Total sampled			93	172	137	95	112	78	90	100	4	10	70	271	148	185		
Recaptures			9	7	10	9	5	7	7	6	0	0	4	23	13	9		
Percent marked			10%	4%	7%	10%	5%	9%	8%	6%	0%	0%	6%	8%	9%	5%		

[a] No recapture sampling was conducted in weeks 38 and 40.

[b] Mark types: AD = adipose clip; RV = right ventral fin clip; LV = left ventral fin clip; RA = right axillary process clip; LA = left axillary process clip; D = dorsal fin clip; RP = right pectoral fin clip; LP = left pectoral fin clip.

Appendix M.–Initial mark-recapture matrix used to calculate pooled-Petersen and Darroch population estimates of Chilkoot Lake sockeye salmon in 2010.

Marking stratum			Recapture stratum (week)[a]																Marks recaptured	
Stat. week	**Mark[b]**	**Marked**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**38**	**39**	**40**	**41**	**42**	**43**	**Total**	**Percent**
23–24	AD	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
25–26	RV	272	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	5	2%
27–28	LV	380	0	0	1	1	0	3	2	3	1	0	0	2	0	0	0	0	13	3%
29–30	RA	1,397	0	0	0	0	0	0	3	4	3	1	6	8	7	2	0	0	34	2%
31–32	LA	2,900	0	0	0	0	0	0	0	0	0	3	6	14	25	8	6	6	68	2%
33–34	D	1,001	0	0	0	0	0	0	0	0	0	0	7	7	2	2	3	2	23	2%
35–36	RP	508	0	0	0	0	0	0	0	0	0	0	1	1	1	4	1	1	9	2%
37–38	LP	74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	<1%
Total sampled			1	1	29	17	5	101	110	120	56	62	171	408	463	245	106	67		
Recaptures			0	0	1	1	0	5	7	8	4	4	20	32	35	16	10	10		
Percent marked			0%	0%	3%	6%	0%	5%	6%	7%	7%	6%	12%	8%	8%	7%	9%	15%		

[a] No recapture sampling was conducted in week 37.

[b] Mark types: AD = adipose clip; RV = right ventral fin clip; LV = left ventral fin clip; RA = right axillary process clip; LA = left axillary process clip; D = dorsal fin clip; RP = right pectoral fin clip; LP = left pectoral fin clip.

Appendix N.–Initial mark-recapture matrix used to calculate pooled-Petersen and Darroch population estimates of Chilkoot Lake sockeye salmon in 2011.

Marking stratum			Recapture stratum (week)[a]											Marks recaptured	
Stat. week	**Mark[b]**	**Marked**	**29**	**30**	**31**	**33**	**35**	**36**	**38**	**39**	**40**	**41**	**42**	**Total**	**Percent**
23–24	AD	23	0	0	0	0	0	0	0	0	0	0	0	0	0%
25–26	RV	268	1	3	0	3	1	0	2	0	0	0	0	10	4%
27–28	LV	299	0	1	0	4	3	0	2	0	1	0	0	11	4%
29–30	RA	1,513	0	0	0	0	10	3	21	6	11	7	4	62	4%
31–32	LA	2,306	0	0	0	0	0	0	5	5	8	5	8	31	1%
33–34	RP	1,687	0	0	0	0	0	0	0	1	3	2	2	8	1%
35–36	LP	396	0	0	0	0	0	0	2	0	0	1	1	4	1%
37–38	D	30	0	0	0	0	0	0	0	0	0	0	0	0	0%
Total sampled			10	74	8	89	147	34	490	179	446	225	248		
Recaptures			1	0	1	1	0	5	6	8	4	4	20		
Percent marked			10%	0%	13%	1%	0%	15%	1%	4%	1%	2%	8%		

[a] No recapture sampling was conducted in weeks 32, 34 and 37.

[b] Mark types: AD = adipose clip; RV = right ventral finclip; LV = left ventral finclip; RA = right axillary process clip; LA = left axillary process clip; D = dorsal finclip; RP = right pectoral finclip; LP = left pectoral finclip.

Appendix O.–Detection of size and/or sex selective sampling during a two-sample mark recapture experiment and its effects on estimation of population size and population composition.

Size selective sampling: The Kolmogorov-Smirnov two sample test (Conover 1980) is used to detect significant evidence that size selective sampling occurred during the first and/or second sampling events. The second sampling event is evaluated by comparing the length frequency distribution of all fish marked during the first event (*M*) with that of marked fish recaptured during the second event (*R*) by using the null test hypothesis of no difference. The first sampling event is evaluated by comparing the length frequency distribution of all fish inspected for marks during the second event (*C*) with that of *R*. A third test that compares *M* and *C* is then conducted and used to evaluate the results of the first two tests when sample sizes are small. Guidelines for small sample sizes are <30 for *R* and <100 for *M* or *C*.

Sex selective sampling: Contingency table analysis (χ^2 test) is generally used to detect significant evidence that sex selective sampling occurred during the first and/or second sampling events. The counts of observed males to females are compared between *M* and *R*, *C* and *R*, and *M* and *C* using the null hypothesis that the probability that a sampled fish is male or female is independent of sample. If the proportions by gender are estimated for a sample (usually *C*), rather observed for all fish in the sample, contingency table analysis is not appropriate and the proportions of females (or males) are then compared between samples using a two sample test (e.g., Student's t-test).

M* vs. *R	***C* vs. *R***	***M* vs. *C***
Case I:		
Fail to reject H_o	Fail to reject H_o	Fail to reject H_o

There is no size/sex selectivity detected during either sampling event.

Case II:		
Reject H_o	Fail to reject H_o	Reject H_o

There is no size/sex selectivity detected during the first event but there is during the second event sampling.

Case III:		
Fail to reject H_o	Reject H_o	Reject H_o

There is no size/sex selectivity detected during the second event but there is during the first event sampling.

Case IV:		
Reject H_o	Reject H_o	Either result possible

There is size/sex selectivity detected during both the first and second sampling events.

Evaluation Required:		
Fail to reject H_o	Fail to reject H_o	Reject H_o

Sample sizes and powers of tests must be considered:

A. If sample sizes for *M* vs. *R* and *C* vs. *R* tests are not small and sample sizes for *M* vs. *C* test are very large, the *M* vs. *C* test will likely detect small differences which have little potential to result in bias during estimation. *Case I* is appropriate.

B. If a) sample sizes for *M* vs. *R* are small, b) the *P*-value for *M* vs. *R* is not large (~0.20 or less), and c) the sample sizes for *C* vs. *R* are not small or the *P*-value for *C* vs. *R* is fairly large (~0.30 or more), the rejection of the null in the *M* vs. *C* test was likely the result of size/sex selectivity during the second event which the *M* vs. *R* test was not powerful enough to detect. *Case I* may be considered but *Case II* is the recommended, conservative interpretation.

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C. If a) sample sizes for *C* vs. *R* are small, b) the *P*-value for *C* vs. *R* is not large (~0.20 or less), and c) the sample sizes for *M* vs. *R* are not small or the *P*-value for *M* vs. *R* is fairly large (~0.30 or more), the rejection of the null in the *M* vs. *C* test was likely the result of size/sex selectivity during the first event which the *C* vs. *R* test was not powerful enough to detect. *Case I* may be considered but *Case III* is the recommended, conservative interpretation.

D. If a) sample sizes for *C* vs. *R* and *M* vs. *R* are both small, and b) both the *P*-values for *C* vs. *R* and *M* vs. *R* are not large (~0.20 or less), the rejection of the null in the *M* vs. *C* test may be the result of size/sex selectivity during both events which the *C* vs. *R* and *M* vs. *R* tests were not powerful enough to detect. *Cases I, II, or III* may be considered but *Case IV* is the recommended, conservative interpretation.

Case I. Abundance is calculated using a Petersen-type model from the entire data set without stratification. Composition parameters may be estimated after pooling length, sex, and age data from both sampling events.

Case II. Abundance is calculated using a Petersen-type model from the entire data set without stratification. Composition parameters may be estimated using length, sex, and age data from the first sampling event without stratification. If composition is estimated from second event data or after pooling both sampling events, data must first be stratified to eliminate variability in capture probability (detected by the *M* vs. *R* test) within strata. Composition parameters are estimated within strata, and abundance for each stratum needs to be estimated using a Petersen-type formula. Overall composition parameters are estimated by combining stratum estimates weighted by estimated stratum abundance according to the formulae below.

Case III. Abundance is calculated using a Petersen-type model from the entire data set without stratification. Composition parameters may be estimated using length, sex, and age data from the second sampling event without stratification. If composition is estimated from first event data or after pooling both sampling events, data must first be stratified to eliminate variability in capture probability (detected by the *C* vs. *R* test) within strata. Composition parameters are estimated within strata, and abundance for each stratum needs to be estimated using a Petersen-type type formula. Overall composition parameters are estimated by combining stratum estimates weighted by estimated stratum abundance according to the formulae below.

Case IV. Data must be stratified to eliminate variability in capture probability within strata for at least one or both sampling events. Abundance is calculated using a Petersen-type model for each stratum, and estimates are summed across strata to estimate overall abundance. Composition parameters may be estimated within the strata as determined above, but only using data from sampling events where stratification has eliminated variability in capture probabilities within strata. If data from both sampling events are to be used, further stratification may be necessary to meet the condition of capture homogeneity within strata for both events. Overall composition parameters are estimated by combining stratum estimates weighted by estimated stratum abundance.

If stratification by sex or length is necessary prior to estimating composition parameters, then overall composition parameters (p_k) is estimated by combining within stratum composition estimates using:

$$\hat{p}_k = \sum_{i=1}^{j} \frac{\hat{N}_i}{\hat{N}_\Sigma} \hat{p}_{ik} \text{ ; and,} \quad (1)$$

$$\hat{V}[\hat{p}_k] \approx \frac{1}{\hat{N}_\Sigma^2} \left(\sum_{i=1}^{j} \hat{N}_i^2 \hat{V}[\hat{p}_{ik}] + (\hat{p}_{ik} - \hat{p}_k)^2 \hat{V}[\hat{N}_i] \right). \quad (2)$$

where:

where:	j	=	the number of sex/size strata;
	$\hat{p}_{ik}$	=	the estimated proportion of fish that were age or size *k* among fish in stratum *i*;
	$\hat{N}_i$	=	the estimated abundance in stratum *i*; and,
	$\hat{N}_\Sigma$	=	sum of the $\hat{N}_i$ across strata.

Appendix P.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks in the District 15 drift gillnet fishery based on scale pattern analysis, 1984–2012.

	Chilkoot		Chilkat		Other	
Year	Harvest	Percent	Harvest	Percent	Harvest	Percent
1984	225,634	67%	99,592	30%	9,502	3%
1985	153,533	51%	131,091	43%	18,704	6%
1986	110,114	38%	168,006	58%	12,174	4%
1987	327,323	79%	69,900	17%	18,658	5%
1988	248,640	71%	76,883	22%	26,353	8%
1989	292,830	62%	156,160	33%	25,908	6%
1990	181,260	50%	149,377	41%	31,499	9%
1991	228,607	73%	60,721	19%	24,353	8%
1992	142,471	49%	113,146	39%	33,729	12%
1993	52,080	30%	103,531	59%	19,605	11%
1994	30,717	18%	119,245	69%	21,834	13%
1995	9,637	11%	68,737	78%	10,302	12%
1996	19,882	13%	99,677	67%	30,019	20%
1997	31,822	27%	73,761	62%	13,245	11%
1998	2,838	2%	112,630	84%	19,469	14%
1999	4,604	3%	149,410	91%	9,547	6%
2000	14,622	13%	78,265	71%	16,673	15%
2001	66,355	45%	60,183	41%	21,273	14%
2002	24,200	30%	47,332	58%	10,482	13%
2003	32,446	34%	49,955	53%	12,729	13%
2004	66,498	44%	51,110	34%	33,637	22%
2005	29,276	45%	22,852	35%	13,341	20%
2006	119,201	82%	15,979	11%	10,400	7%
2007	125,199	80%	14,208	9%	17,529	11%
2008	7,491	16%	22,156	47%	17,008	36%
2009	16,622	13%	85,551	68%	24,422	19%
2010	32,064	32%	48,079	48%	20,830	21%
2011	26,766	42%	15,599	24%	21,428	34%
2012	115,509	56%	50,774	25%	40,854	20%

Appendix Q.–Historical age composition of the Chilkoot Lake sockeye salmon escapement, weighted by statistical week, 1982–2012.

		Age Class														
Year	**Weighted by Stat. Week**	**0.1**	**1.1**	**2.1**	**3.1**	**0.2**	**1.2**	**2.2**	**3.2**	**0.3**	**1.3**	**2.3**	**3.3**	**1.4**	**2.4**	**Total**
1982	Escapement by Age Class	66	0	65	0	0	19,342	560	0	139	80,980	914	0	972	0	103,038
	SE of Number	65	0	65	0	0	938	185	0	98	989	244	0	243	0	
	Proportion by Age Class	0.1%	0.0%	0.1%	0.0%	0.0%	18.8%	0.5%	0.0%	0.1%	78.6%	0.9%	0.0%	0.9%	0.0%	
	SE of %	0.1%	0.0%	0.1%	0.0%	0.0%	0.9%	0.2%	0.0%	0.1%	1.0%	0.2%	0.0%	0.2%	0.0%	
	Sample size	1	0	1	0	0	320	9	0	2	1,322	16	0	16	0	1,687
1983	Escapement by Age Class	0	84	42	0	0	9,852	1,352	0	95	48,435	20,043	0	238	0	80,141
	SE of Number	0	59	42	0	0	637	279	0	69	972	837	0	118	0	
	Proportion by Age Class	0.0%	0.1%	0.1%	0.0%	0.0%	12.3%	1.7%	0.0%	0.1%	60.4%	25.0%	0.0%	0.3%	0.0%	
	SE of %	0.0%	0.1%	0.1%	0.0%	0.0%	0.8%	0.3%	0.0%	0.1%	1.2%	1.0%	0.0%	0.1%	0.0%	
	Sample size	0	2	1	0	0	214	25	0	2	1,081	461	0	4	0	1,790
1984	Escapement by Age Class	0	0	0	0	0	4,712	345	0	0	86,112	8,635	0	977	0	100,781
	SE of Number	0	0	0	0	0	525	132	0	0	921	751	0	279	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	4.7%	0.3%	0.0%	0.0%	85.4%	8.6%	0.0%	1.0%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.1%	0.0%	0.0%	0.9%	0.7%	0.0%	0.3%	0.0%	
	Sample size	0	0	0	0	0	86	7	0	0	1,649	145	0	15	0	1,902
1985	Escapement by Age Class	0	46	0	0	0	8,132	1,661	45	0	45,675	11,517	0	1,857	208	69,141
	SE of Number	0	46	0	0	0	552	252	45	0	876	700	0	342	93	
	Proportion by Age Class	0.0%	0.1%	0.0%	0.0%	0.0%	11.8%	2.4%	0.1%	0.0%	66.1%	16.7%	0.0%	2.7%	0.3%	
	SE of %	0.0%	0.1%	0.0%	0.0%	0.0%	0.8%	0.4%	0.1%	0.0%	1.3%	1.0%	0.0%	0.5%	0.1%	
	Sample size	0	1	0	0	0	198	43	1	0	1,078	258	0	39	5	1,623
1986	Escapement by Age Class	0	43	0	0	0	11,398	1,934	0	0	59,561	14,425	67	493	102	88,024
	SE of Number	0	42	0	0	0	627	289	0	0	906	718	67	144	59	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	12.9%	2.2%	0.0%	0.0%	67.7%	16.4%	0.1%	0.6%	0.1%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.3%	0.0%	0.0%	1.0%	0.8%	0.1%	0.2%	0.1%	
	Sample size	0	1	0	0	0	284	47	0	0	1,438	361	1	12	3	2,147
1987	Escapement by Age Class	0	0	0	0	0	7,706	2,074	0	0	62,153	21,773	79	283	139	94,208
	SE of Number	0	0	0	0	0	537	294	0	0	915	811	79	132	80	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	8.2%	2.2%	0.0%	0.0%	66.0%	23.1%	0.1%	0.3%	0.1%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.3%	0.0%	0.0%	1.0%	0.9%	0.1%	0.1%	0.1%	
	Sample size	0	0	0	0	0	185	49	0	0	1,527	437	1	5	3	2,207

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Year	**Weighted by Stat. Week**	**Age Class**														**Total**
		0.1	**1.1**	**2.1**	**3.1**	**0.2**	**1.2**	**2.2**	**3.2**	**0.3**	**1.3**	**2.3**	**3.3**	**1.4**	**2.4**	
1988	Escapement by Age Class	0	0	0	0	0	3,265	2,103	0	0	63,381	11,060	52	1,115	299	81,274
	SE of Number	0	0	0	0	0	317	263	0	0	705	592	51	196	107	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	2.6%	0.0%	0.0%	78.0%	13.6%	0.1%	1.4%	0.4%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.3%	0.0%	0.0%	0.9%	0.7%	0.1%	0.2%	0.1%	
	Sample size	0	0	0	0	0	117	72	0	0	2,074	350	1	38	9	2,661
1989	Escapement by Age Class	0	0	0	0	0	1,743	2,169	0	0	30,584	19,213	304	649	238	54,900
	SE of Number	0	0	0	0	0	178	226	0	0	680	657	102	146	96	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	4.0%	0.0%	0.0%	55.7%	35.0%	0.6%	1.2%	0.4%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.4%	0.0%	0.0%	1.2%	1.2%	0.2%	0.3%	0.2%	
	Sample size	0	0	0	0	0	116	130	0	0	1,419	866	14	31	10	2,586
1990	Escapement by Age Class	0	0	0	0	0	1,227	1,006	11	0	35,537	36,830	64	736	708	76,119
	SE of Number	0	0	0	0	0	185	180	10	0	806	807	46	161	150	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	1.3%	0.0%	0.0%	46.7%	48.4%	0.1%	1.0%	0.9%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.2%	0.0%	0.0%	1.1%	1.1%	0.1%	0.2%	0.2%	
	Sample size	0	0	0	0	0	55	41	1	0	1,277	1,382	3	27	29	2,815
1991	Escapement by Age Class	0	0	0	0	0	12,537	4,648	0	0	50,513	24,249	100	158	169	92,375
	SE of Number	0	0	0	0	0	870	538	0	0	1,236	1,104	62	53	74	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	13.6%	5.0%	0.0%	0.0%	54.7%	26.3%	0.1%	0.2%	0.2%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.6%	0.0%	0.0%	1.3%	1.2%	0.1%	0.1%	0.1%	
	Sample size	0	0	0	0	0	287	112	0	0	1,283	596	3	9	7	2,297
1992	Escapement by Age Class	0	0	0	0	0	1,824	4,028	56	17	52,400	18,410	105	419	342	77,601
	SE of Number	0	0	0	0	0	448	428	31	16	894	765	64	119	115	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	5.2%	0.1%	0.0%	67.5%	23.7%	0.1%	0.5%	0.4%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.6%	0.0%	0.0%	1.2%	1.0%	0.1%	0.2%	0.1%	
	Sample size	0	0	0	0	0	36	118	3	1	1,277	577	3	14	10	2,039
1993	Escapement by Age Class	0	0	0	19	0	1,560	901	0	0	18,693	30,396	91	180	239	52,080
	SE of Number	0	0	0	18	0	207	149	0	0	541	560	43	76	84	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	3.0%	1.7%	0.0%	0.0%	35.9%	58.4%	0.2%	0.3%	0.5%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.3%	0.0%	0.0%	1.0%	1.1%	0.1%	0.1%	0.2%	
	Sample size	0	0	0	1	0	54	37	0	0	739	1,224	5	6	9	2,075

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		Age Class														
Year	**Weighted by Stat. Week**	**0.1**	**1.1**	**2.1**	**3.1**	**0.2**	**1.2**	**2.2**	**3.2**	**0.3**	**1.3**	**2.3**	**3.3**	**1.4**	**2.4**	**Total**
1994	Escapement by Age Class	0	0	0	0	0	671	549	23	48	24,876	10,573	22	194	50	37,007
	SE of Number	0	0	0	0	0	112	98	23	34	392	378	21	56	24	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	1.5%	0.1%	0.1%	67.2%	28.6%	0.1%	0.5%	0.1%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%	0.1%	0.1%	1.1%	1.0%	0.1%	0.2%	0.1%	
	Sample size	0	0	0	0	0	35	32	1	2	1,328	571	1	12	4	1,986
1995	Escapement by Age Class	0	0	0	0	0	3,360	298	0	0	2,176	1,219	0	78	46	7,177
	SE of Number	0	0	0	0	0	129	67	0	0	139	114	0	40	27	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	46.8%	4.2%	0.0%	0.0%	30.3%	17.0%	0.0%	1.1%	0.6%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	0.9%	0.0%	0.0%	1.9%	1.6%	0.0%	0.6%	0.4%	
	Sample size	0	0	0	0	0	267	23	0	0	186	121	0	5	4	606
1996	Escapement by Age Class	0	0	0	0	0	3,365	517	23	11	43,232	3,559	0	35	0	50,741
	SE of Number	0	0	0	0	0	338	145	22	10	461	308	0	18	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	6.6%	1.0%	0.0%	0.0%	85.2%	7.0%	0.0%	0.1%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.3%	0.0%	0.0%	0.9%	0.6%	0.0%	0.0%	0.0%	
	Sample size	0	0	0	0	0	128	16	1	1	1,737	176	0	4	0	2,063
1997	Escapement by Age Class	0	0	0	0	0	1,022	183	0	23	39,858	3,114	8	45	0	44,254
	SE of Number	0	0	0	0	0	146	65	0	23	286	244	8	31	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.4%	0.0%	0.1%	90.1%	7.0%	0.0%	0.1%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.1%	0.0%	0.1%	0.6%	0.6%	0.0%	0.1%	0.0%	
	Sample size	0	0	0	0	0	47	8	0	1	1,902	150	1	2	0	2,111
1998	Escapement by Age Class	15	0	0	0	0	631	268	0	0	7,478	3,753	13	165	13	12,335
	SE of Number	15	0	0	0	0	86	57	0	0	189	177	13	44	13	
	Proportion by Age Class	0.1%	0.0%	0.0%	0.0%	0.0%	5.1%	2.2%	0.0%	0.0%	60.6%	30.4%	0.1%	1.3%	0.1%	
	SE of %	0.1%	0.0%	0.0%	0.0%	0.0%	0.7%	0.5%	0.0%	0.0%	1.5%	1.4%	0.1%	0.4%	0.1%	
	Sample size	1	0	0	0	0	47	20	0	0	570	288	1	13	1	941
1999	Escapement by Age Class	0	0	0	0	0	5,934	1,597	0	0	8,550	3,136	0	34	34	19,284
	SE of Number	0	0	0	0	0	203	124	0	0	212	163	0	16	18	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	30.8%	8.3%	0.0%	0.0%	44.3%	16.3%	0.0%	0.2%	0.2%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.6%	0.0%	0.0%	1.1%	0.8%	0.0%	0.1%	0.1%	
	Sample size	0	0	0	0	0	585	164	0	0	945	331	0	4	4	2,033

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Year	Weighted by Stat. Week	Age Class														Total
		0.1	**1.1**	**2.1**	**3.1**	**0.2**	**1.2**	**2.2**	**3.2**	**0.3**	**1.3**	**2.3**	**3.3**	**1.4**	**2.4**	
2000	Escapement by Age Class	0	0	0	0	24	6,678	1,041	0	0	25,864	9,903	0	29	15	43,555
	SE of Number	0	0	0	0	24	359	160	0	0	468	377	0	20	15	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.1%	15.3%	2.4%	0.0%	0.0%	59.4%	22.7%	0.0%	0.1%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.1%	0.8%	0.4%	0.0%	0.0%	1.1%	0.9%	0.0%	0.0%	0.0%	
	Sample size	0	0	0	0	1	295	42	0	0	1,306	581	0	2	1	2,228
2001	Escapement by Age Class	0	0	0	0	0	3,565	50	0	157	68,859	3,600	0	53	0	76,283
	SE of Number	0	0	0	0	0	436	29	0	62	606	437	0	52	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	4.7%	0.1%	0.0%	0.2%	90.3%	4.7%	0.0%	0.1%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.1%	0.8%	0.6%	0.0%	0.1%	0.0%	
	Sample size	0	0	0	0	0	113	4	0	7	2,106	114	0	1	0	2,345
2002	Escapement by Age Class	0	0	0	0	0	4,989	800	0	0	50,880	1,400	0	292	0	58,361
	SE of Number	0	0	0	0	0	382	155	0	0	441	181	0	85	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	8.5%	1.4%	0.0%	0.0%	87.2%	2.4%	0.0%	0.5%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.3%	0.0%	0.0%	0.8%	0.3%	0.0%	0.1%	0.0%	
	Sample size	0	0	0	0	0	182	30	0	0	2,540	71	0	13	0	2,836
2003	Escapement by Age Class	0	0	0	0	0	42,648	2,594	0	0	24,883	4,776	0	132	33	75,065
	SE of Number	0	0	0	0	0	960	326	0	0	905	458	0	60	32	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	56.8%	3.5%	0.0%	0.0%	33.1%	6.4%	0.0%	0.2%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.4%	0.0%	0.0%	1.2%	0.6%	0.0%	0.1%	0.0%	
	Sample size	0	0	0	0	0	1,078	110	0	0	1,174	238	0	10	1	2,611
2004	Escapement by Age Class	0	0	0	0	0	11,846	5,738	0	0	54,309	5,732	0	36	0	77,660
	SE of Number	0	0	0	0	0	611	460	0	0	770	414	0	25	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	15.3%	7.4%	0.0%	0.0%	69.9%	7.4%	0.0%	0.0%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.6%	0.0%	0.0%	1.0%	0.5%	0.0%	0.0%	0.0%	
	Sample size	0	0	0	0	0	399	161	0	0	1,929	220	0	2	0	2,711
2005	Escapement by Age Class	0	0	0	0	0	11,048	2,242	0	0	32,908	4,909	0	71	0	51,178
	SE of Number	0	0	0	0	0	433	228	0	0	508	326	0	38	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	21.6%	4.4%	0.0%	0.0%	64.3%	9.6%	0.0%	0.1%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.4%	0.0%	0.0%	1.0%	0.6%	0.0%	0.1%	0.0%	
	Sample size	0	0	0	0	0	542	106	0	0	1,843	235	0	4	0	2,730

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Year	Weighted by Stat. Week	Age Class														Total
		0.1	1.1	2.1	3.1	0.2	1.2	2.2	3.2	0.3	1.3	2.3	3.3	1.4	2.4	
2006	Escapement by Age Class	0	0	0	0	0	8,492	817	0	22	76,211	10,578	0	48	34	96,203
	SE of Number	0	0	0	0	0	582	187	0	21	839	653	0	48	34	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	8.8%	0.8%	0.0%	0.0%	79.2%	11.0%	0.0%	0.1%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.2%	0.0%	0.0%	0.9%	0.7%	0.0%	0.0%	0.0%	
	Sample size	0	0	0	0	0	211	22	0	1	2,076	269	0	1	1	2,581
2007	Escapement by Age Class	0	0	0	0	0	7,128	618	0	0	55,604	8,908	0	421	0	72,678
	SE of Number	0	0	0	0	0	483	150	0	0	658	493	0	116	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	9.8%	0.8%	0.0%	0.0%	76.5%	12.3%	0.0%	0.6%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.2%	0.0%	0.0%	0.9%	0.7%	0.0%	0.2%	0.0%	
	Sample size	0	0	0	0	0	214	19	0	0	2,387	383	0	17	0	3,020
2008	Escapement by Age Class	0	0	0	0	0	3,405	330	0	55	26,672	1,403	0	1,213	39	33,117
	SE of Number	0	0	0	0	0	427	154	0	31	552	282	0	255	23	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	10.3%	1.0%	0.0%	0.2%	80.5%	4.2%	0.0%	3.7%	0.1%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.5%	0.0%	0.1%	1.7%	0.9%	0.0%	0.8%	0.1%	
	Sample size	0	0	0	0	0	103	6	0	3	851	44	0	47	3	1,057
2009	Escapement by Age Class	0	0	0	0	0	9,539	647	0	0	22,801	615	0	103	0	33,705
	SE of Number	0	0	0	0	0	386	119	0	0	399	115	0	45	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	28.3%	1.9%	0.0%	0.0%	67.6%	1.8%	0.0%	0.3%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.4%	0.0%	0.0%	1.2%	0.3%	0.0%	0.1%	0.0%	
	Sample size	0	0	0	0	0	479	35	0	0	1,288	34	0	5	0	1,841
2010	Escapement by Age Class	0	0	0	0	0	4,269	2,922	34	0	58,284	6,099	0	48	0	71,657
	SE of Number	0	0	0	0	0	554	466	25	0	883	619	0	30	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	6.0%	4.1%	0.0%	0.0%	81.3%	8.5%	0.0%	0.1%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.6%	0.0%	0.0%	1.2%	0.9%	0.0%	0.0%	0.0%	
	Sample size	0	0	0	0	0	122	72	3	0	2,070	223	0	3	0	2,493
2011	Escapement by Age Class	0	0	0	0	0	20,450	1,421	0	4	32,475	11,301	136	120	8	65,915
	SE of Number	0	0	0	0	0	786	253	0	4	829	635	64	66	7	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	31.0%	2.2%	0.0%	0.0%	49.3%	17.1%	0.2%	0.2%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.4%	0.0%	0.0%	1.3%	1.0%	0.1%	0.1%	0.0%	
	Sample size	0	0	0	0	0	637	50	0	1	1,441	431	7	4	1	2,572

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		Age Class														
Year	**Weighted by Stat. Week**	**0.1**	**1.1**	**2.1**	**3.1**	**0.2**	**1.2**	**2.2**	**3.2**	**0.3**	**1.3**	**2.3**	**3.3**	**1.4**	**2.4**	**Total**
2012	Escapement by Age Class	0	0	0	0	0	2,730	449	0	0	102,954	11,803	0	230	0	118,166
	SE of Number	0	0	0	0	0	473	157	0	0	1,116	1,024	0	86	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.4%	0.0%	0.0%	87.1%	10.0%	0.0%	0.2%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.1%	0.0%	0.0%	0.9%	0.9%	0.0%	0.1%	0.0%	
	Sample size	0	0	0	0	0	76	18	0	0	2,078	240	0	11	0	2,423

Appendix R.–Average length (mideye to tail fork) of Chilkoot Lake sockeye salmon, by age class, 1982–2012.

Year	Sample size	Mean length (mm) by age class[a]												Average
		0.3	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	
1982	1,684	620	–	466	577	621	–	489	584	–	–	–	–	560
1983	1,790	572	377	455	573	595	420	474	567	–	–	–	–	504
1984	1,901	–	–	461	571	600	–	470	570	–	–	–	–	534
1985	1,623	–	320	471	569	604	–	476	565	608	–	470	–	510
1986	2,146	–	410	472	582	611	–	485	581	618	–	–	565	541
1987	2,207	–	–	468	583	593	–	472	582	596	–	–	560	551
1988	2,658	–	–	496	578	604	–	499	575	590	–	–	565	558
1989	2,584	–	–	468	580	604	–	480	576	592	–	–	569	553
1990	2,815	–	–	467	579	607	–	497	577	596	–	490	580	549
1991	2,293	–	–	481	565	616	–	477	565	583	–	–	550	548
1992	2,038	575	–	471	570	596	–	470	571	595	–	508	565	547
1993	2,073	–	–	487	575	583	–	506	573	565	550	–	550	549
1994	1,985	540	–	471	568	596	–	489	569	582	–	450	610	542
1995	605	–	–	496	571	594	–	506	573	608	–	–	–	558
1996	2,042	635	–	509	589	611	–	514	585	–	–	490	–	562
1997	2,107	565	–	508	577	577	–	508	569	–	–	–	575	554
1998	936	–	–	492	572	574	–	514	570	605	–	–	595	560
1999	2,030	–	–	491	578	579	–	512	574	605	–	–	–	557
2000	2,211	–	–	508	582	582	–	505	583	425	–	–	–	531
2001	2,344	562	–	494	581	560	–	527	574	–	–	–	–	550
2002	2,834	–	–	479	584	615	–	482	579	–	–	–	–	548
2003	2,605	–	–	494	577	590	–	496	578	574	–	–	–	552
2004	2,711	–	–	503	573	547	–	500	570	–	–	–	–	539
2005	2,728	–	–	488	567	606	–	490	561	–	–	–	–	542
2006	2,577	595	–	487	561	560	–	499	560	550	–	–	–	545
2007	2,962	–	–	487	574	587	–	503	572	–	–	–	–	567
2008	1,057	580	–	498	577	597	–	538	576	597	–	–	–	570
2009	1,840	–	–	492	578	578	–	501	577	–	–	–	–	554
2010	2,482	–	–	487	568	583	–	487	565	–	–	507	–	562
2011	2,568	580	–	498	576	563	–	507	573	620	–	–	570	555
2012	2,423	–	–	497	575	579	–	507	570	–	–	–	–	527
Average	2,157	582	369	485	575	591	420	496	573	584	550	486	571	548