Fishery Data Series No. 16-29

Stock Assessment Study of Chilkoot Lake Sockeye Salmon, 2013–2015

by

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and

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July 2016

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

Symbols and Abbreviations

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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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by

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ABSTRACT

From 2013 to 2015, the Alaska Department of Fish and Game, Division of Commercial Fisheries, continued a stock assessment program that begun in 1976 to estimate escapements and harvests of Chilkoot Lake sockeye salmon (*Oncorhynchus nerka*). 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. Sockeye salmon escapements at the weir were 46,140 fish in 2013, 105,058 fish in 2014, and 71,515 fish in 2015. Visual scale pattern analysis was conducted to determine the proportion of Chilkoot sockeye salmon harvested annually in the District 15 commercial drift gillnet fishery. Estimated commercial drift gillnet harvests of Chilkoot sockeye salmon were 23,111 fish in 2013, 110,487 fish in 2014, and 33,085 fish in 2015. Estimated harvest rates were 36% in 2013, 52% in 2014, and 46% in 2015. In addition, zooplankton and hydroacoustic surveys were conducted in Chilkoot Lake and analyzed each year.

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 (Figure 1). 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 river watersheds (Rich and Ball 1933). Over the past 2 decades, the average sockeye salmon harvest in northern Southeast Alaska was 0.5 million fish, of which an average 96,000 fish originated from Chilkat Lake and 65,000 fish originated from Chilkoot 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 (District 15) where most of the commercial harvest of Chilkoot Lake sockeye salmon takes place (Figure 1). A smaller portion of the Chilkoot Lake run is harvested in the 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 Lake sockeye salmon are also harvested annually in subsistence fisheries in Chilkoot Inlet and Lutak Inlet, with reported harvests for the period 1990–2014 averaging approximately 1,990 fish per year.

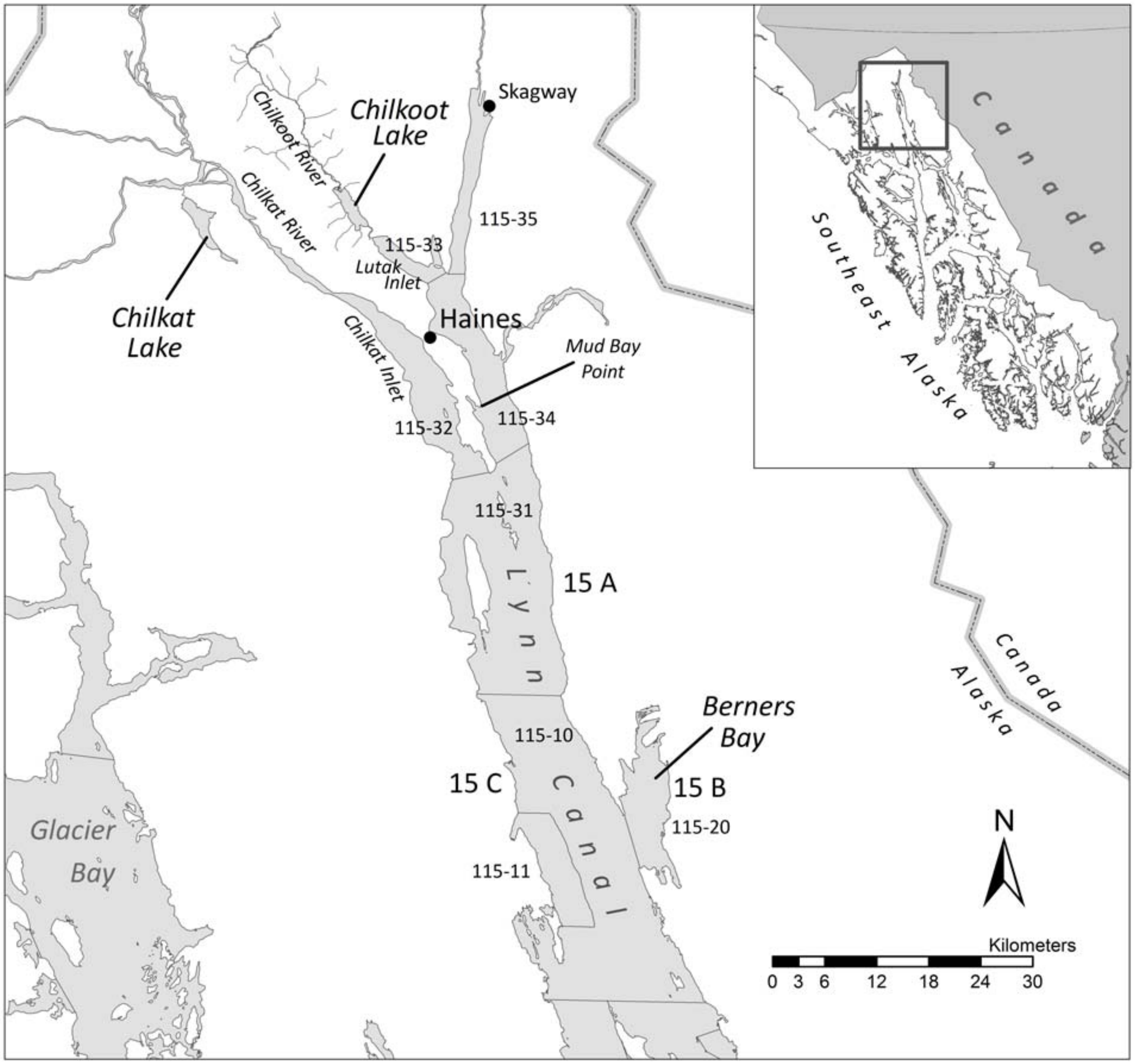

Figure 1.–Commercial fishing subdistricts with management boundary lines in the Haines area, District15.

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 fishery as Chilkoot Lake or Chilkat Lake 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 2 stocks could be identified accurately using a visual classification technique and blind testing procedure. That technique was expanded to include a group of "other" stocks—a combination of Chilkat River mainstem and Berners Bay stocks that contribute to early-season harvests in Lynn Canal (McPherson 1987a). 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 Lake 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 and 2014). The run has 2 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. Weir counts have averaged 68,000 fish since 2000. 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 also been collected through limnological and hydroacoustic sampling conducted most years since 1987 (Barto 1996; Riffe 2006; Bachman et al. 2014). 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 5 different escapement goals since 1976. Informal goals of 80,000–100,000 fish (1976–1980) and 60,000–80,000 fish (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 fish) and late runs (34,000–60,000 fish). 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 the sockeye salmon stock assessment program was to estimate the escapement and commercial harvest of Chilkoot Lake sockeye salmon. In conjunction with stock assessment projects on the adjacent Chilkat River (Sogge and Bachman 2014), information provided by this project was used inseason to manage the District 15 commercial drift gillnet fishery to ensure escapement goals were met while maximizing and sustaining the harvest of sockeye salmon from the 2 watersheds. Information on age at return is used in reconstruction of brood-year returns and escapement goal evaluations. In addition, hydroacoustic and limnological surveys of Chilkoot Lake were conducted to estimate populations of rearing sockeye salmon fry and to collect information on zooplankton abundance, light penetration, and water temperature profiles.

STUDY SITE

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. Although the climate is characterized by cold winters and cool, wet summers, the lake is set in a transitional zone, with warmer and drier summers and cooler winters than the rest of Southeast Alaska (Bieniek et al. 2012). Average precipitation in the study area is approximately 165 cm/year (Bugliosi 1988). Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), and Sitka alder (*Alnus viridis*) dominate the forested watershed.

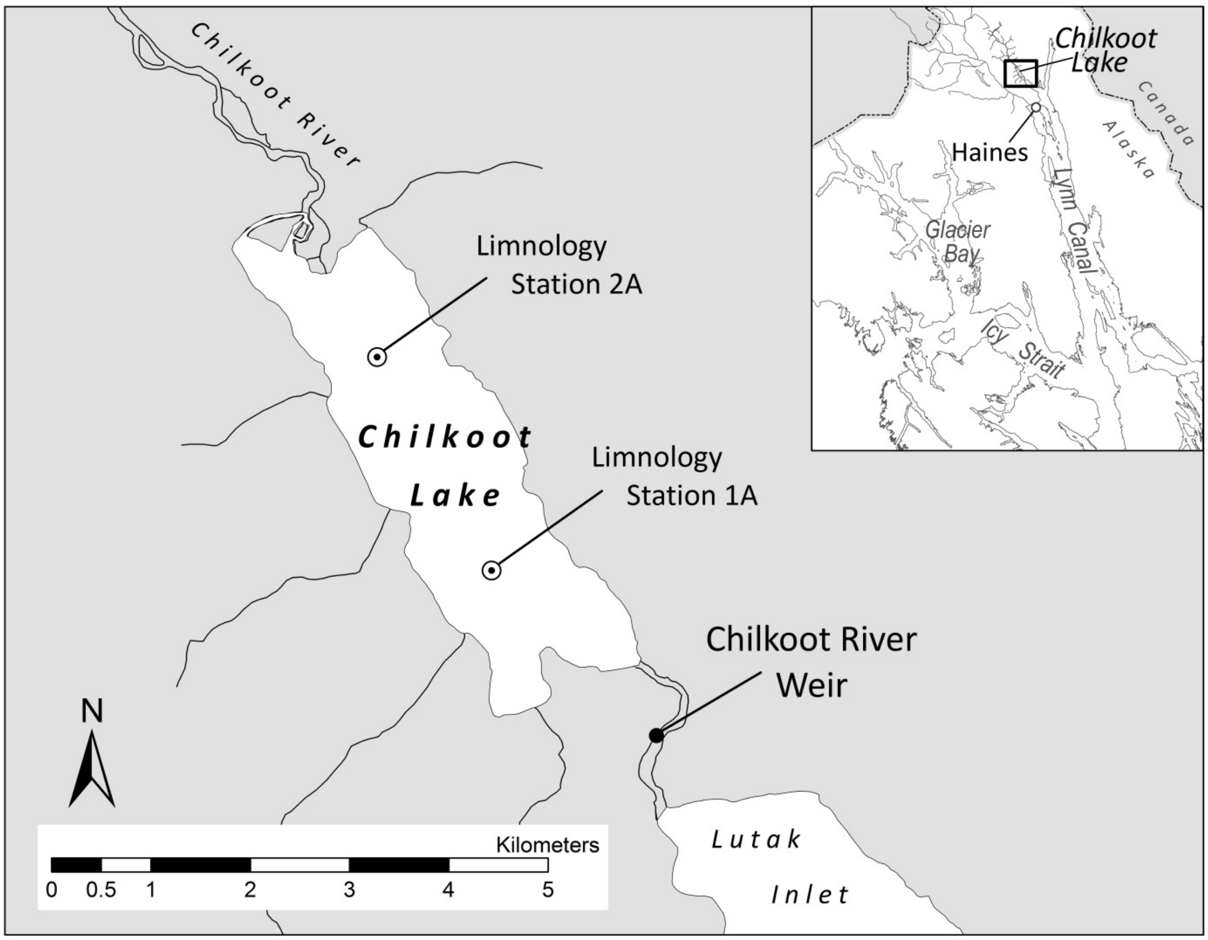

Figure 2.–Map showing Lutak Inlet, Chilkoot Lake, and the location of the limnology stations and salmon counting weir.

OBJECTIVES

1. Enumerate sockeye, pink, chum (*O. keta*), and coho (*O. kisutch*) salmon as they migrate upstream through the Chilkoot River weir, 2013–2015.
2. Estimate the age, sex, and length composition of the sockeye salmon escapement, 2013–2015.

3. Estimate the annual commercial harvest of Chilkoot Lake sockeye salmon in the District 15 commercial drift gillnet fishery, 2013–2015.
4. 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, 2013–2015.
5. 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, 2013–2015.

METHODS

ESCAPEMENT

The Chilkoot River adult salmon counting weir is located 1 km downstream from Chilkoot Lake. It was operated from at least the first week of June through the second week of September. 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 of black iron pipe were installed into the support structure to form a fence across the river channel. The pickets were 2- to 3-m long, with a 2.5 cm outside diameter, and 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 the middle of the channel.

In order to minimize handling, most fish were passed by temporarily removing 2 to 3 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. In 2014 and 2015, we attempted to keep separate counts of jack (age 1-ocean) and adult sockeye salmon. However, it was often difficult to accurately determine the size of a fish as it moved quickly through the weir opening. As a result, we maintained 1 count of sockeye salmon to be consistent with past weir counts.

Fish were trapped or caught with a dip net (as they passed through the counting station in the weir) for age, sex, and length sampling. Sampled fish were released into a 2 m × 2 m × 2.5 m plywood recovery box on the upstream side of the weir to recover from handling. Once recuperated, fish exited through a large hole in the side of the box.

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

In some years, brief periods of flooding required removal of pickets to prevent structural damage to the weir, therefore 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 2013). When the weir was not operated for all of 1 day, an estimate for that day ($\hat{n}_i$) was calculated as the average of the number of fish counted on the 2 days before (n_b and $n_{b\text{-}1}$) and the 2 days after (n_a and n_{a+1}) the missed 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 operated for a period of 2 or more days, passage estimates for the missed days was 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 2 days before and 2 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:

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

ESCAPEMENT AGE, SEX, AND LENGTH COMPOSITION

Scale samples were collected at the weir from a daily sample of 40 sockeye salmon. This sampling goal was established to ensure sufficient samples of each age class for use in scale pattern analysis of fishery samples (McPherson and Olson 1992) and is more than sufficient to estimate the age composition of the escapement. Approximately 20 fish were sampled during the morning shift and 20 more fish in the afternoon or evening shift. The length of each fish was measured from mid eye 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 was 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 were separated by a period (e.g., 1.3 denoted a fish with 1 freshwater and 3 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 A).

COMMERCIAL HARVEST ESTIMATE

Visual scale pattern analysis was used to determine stock composition of sockeye salmon harvested in the District 15 commercial drift gillnet fishery (Bachman et al. 2014). The general methods have remained unchanged since the mid-1980s: escapement scale samples from 3 stocks of known origin, Chilkoot Lake, Chilkat Lake, and “other” (Chilkat River mainstem and Berners Bay stocks), were aged and compared to scale samples from the commercial fisheries.

Commercial Harvest Information

Commercial harvest data for the District 15 commercial drift gillnet fishery was obtained from the ADF&G Southeast Alaska Integrated Fisheries Database. Harvest was summarized by statistical week, 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 B).

Scale samples from District 15 commercial drift gillnet fishery landings of sockeye salmon were collected weekly through the season by ADF&G personnel at fish processing facilities at Excursion Inlet and Juneau. A sampling goal of 510 fish was sufficient to describe the weekly estimated sockeye salmon age composition within 0.05 of the true proportion with a probability of 0.95 (Thompson 1987). Sampling protocols ensured that samples were as representative of harvests as possible: deliveries with harvests mixed from more than 1 gear type or fishing district were not sampled, no more than 40 samples were collected from a single delivery, and, whenever possible, samples were systematically collected from the entire hold as it was offloaded to ensure they were representative of the entire delivery. Sampled fish were identified to sex, and 1 scale per fish was taken from the preferred area (INPFC 1963). 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 fish wheel project conducted on the Chilkat River which includes both Chilkat Lake and Chilkat River mainstem spawners (Sogge and Bachman 2014). Samples were also collected annually from spawning populations in Berners Bay (Berners and Lace rivers) and along the mainstem of the Chilkat River. These latter samples may not have been representative of the entire Berners River and Chilkat River mainstem populations, because they were collected opportunistically and were sometimes temporally and spatially limited. 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 1 of 3 stocks, Chilkoot Lake, Chilkat Lake, 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 drift gillnet 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 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 (2 from each of 6 sampling sections of the lake) that were randomly chosen in 2002 as permanent transects (Riffe 2006). Hydroacoustic surveys were conducted annually in either late October or early November.

Hydroacoustic sampling was conducted after sunset, and all transects were sampled in the same 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 5 pings sec^{-1} and pulse width at 0.3 ms. Surveys were conducted at a constant boat speed of about 2.0 m sec^{-1}. A 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 $\hat{M}_{ij}$ (targets/m^2) in section *i* across transect *j* was estimated using Biosonics Visual Analyzer © version 4.1 software, using echo integration methods (MacLennan and Simmonds 1992). Methods for calculating fish population estimates were similar to DeCino (2001) and DeCino and Willette (2014), and adapted from Burczynski and Johnson (1986). The population estimate of each transect *j* in a section *i* was estimated as:

$$\hat{N}_{ij} = a_i \hat{M}_{ij}, \tag{3}$$

where a_i represents the surface area (m^2) of the lake in section *i*. Using transects as the sampling unit (Burczynski and Johnson 1986), fish abundance ($\hat{N}_i$) across each section was estimated from the mean abundance of the replicate transects *j* in section *i,*

$$\hat{N}_i = J^{-1} \sum_{j=1}^{J} \hat{N}_{ij}, \tag{4}$$

with variance

$$v(\hat{N}_i) = \sum (\hat{N}_{ij} - \hat{N}_i)^2 (J-1)^{-1} J^{-1}. \tag{5}$$

The sum of the 6 section estimates ($\hat{N}_i$) provided an estimate of total targets for the entire lake ($\hat{N}$). Note that target density was expressed as average targets per unit of lake surface area a_i, not per unit of volume. Because the estimate of total targets in each section was essentially independent (neglecting any movement of fry from 1 section to the other during surveys), the sample variance of the estimate of the total targets in the entire lake ($v(\hat{N})$) was estimated by summing the sample variances $v(\hat{N}_i)$ across all 6 sections. Sampling error for the estimate of total targets for the entire lake was measured and reported with the coefficient of variation (CV) (Sokal and Rohlf 1981). The CV of population estimates was 15% or less in 8 of the 12 years from 2004 to 2015 (Sogge 2016).

In 2013 and 2014, estimates of total targets were partitioned into species categories based on the proportion of each species captured in mid water trawls. A 2 m × 2 m elongated trawl net was used to capture pelagic fish and estimate species composition (Riffe 2006). Four to 6 nighttime trawls were conducted at various depths, ranging from near surface to 15 m. Trawl depths and duration were determined from observations of fish densities and distributions throughout the lake during the hydroacoustic survey. Fish were counted by species and released.

In 2015, trawl surveys were discontinued because the vast majority of fish captured in past trawl surveys were sockeye salmon fry (median=99%; n=26 years). Trawl surveys were used to apportion the hydroacoustic population estimate when 2 or more species of similar size occurred together (e.g., sockeye salmon fry and threespine stickleback). Species apportionment may be biased, however, if the catchability of each species is not the same. Hyatt et al. (2005) reported that sockeye salmon fry over 40 mm in length begin to swim at speeds that allow them to more easily avoid trawl nets of the same type we have used in Southeast Alaska. This would cause the proportion of sockeye salmon in trawl samples to be biased low relative to other species. Again, though, sockeye salmon fry consistently represent the vast majority of fish captured in Chilkoot Lake.

LIMNOLOGICAL ASSESSMENT

Basic limnological data, including zooplankton, light, and temperature sampling, was collected monthly between April and October. Since 2008, all limnological sampling has been conducted at stations 1A and 2A (Figure 2), which are marked by anchored buoys in the lake (Bachman et al. 2014).

Light and Temperature Profiles

Light and temperature profiles were collected at each station. Underwater light intensity was recorded at 0.5-m intervals, from just below the surface to the depth at which ambient light level equals 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 was 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 and 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}. Once the top of the net cleared the surface, the rest of the net was pulled slowly out of the water and rinsed from the outside with lake water to wash organisms into the screened sampling container at the cod end of the net. All specimens in the sampling container were carefully rinsed into a sampling bottle and 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

2013

In 2013, 46,140 sockeye, 43 coho, 8,195 pink, 566 chum, and 139 Chinook salmon were enumerated through the Chilkoot River weir between 1 June and 7 September (statistical weeks 23–36; Table 1; Figure 3; Appendix C; Appendix D). A high water event required the removal of every other picket 17–18 June to prevent damage to the weir. The estimated unobserved passage of adult sockeye salmon during this time was 189 fish. Weekly escapements were below the lower bound escapement goal targets for the first 6 weeks of the season then increased dramatically in statistical week 29. The total sockeye salmon escapement, including estimated passage, was 46,329 fish, which exceeded the lower bound of the escapement goal range (Table 1; Figure 4). The pink salmon escapement was well below the historical average (Appendix C).

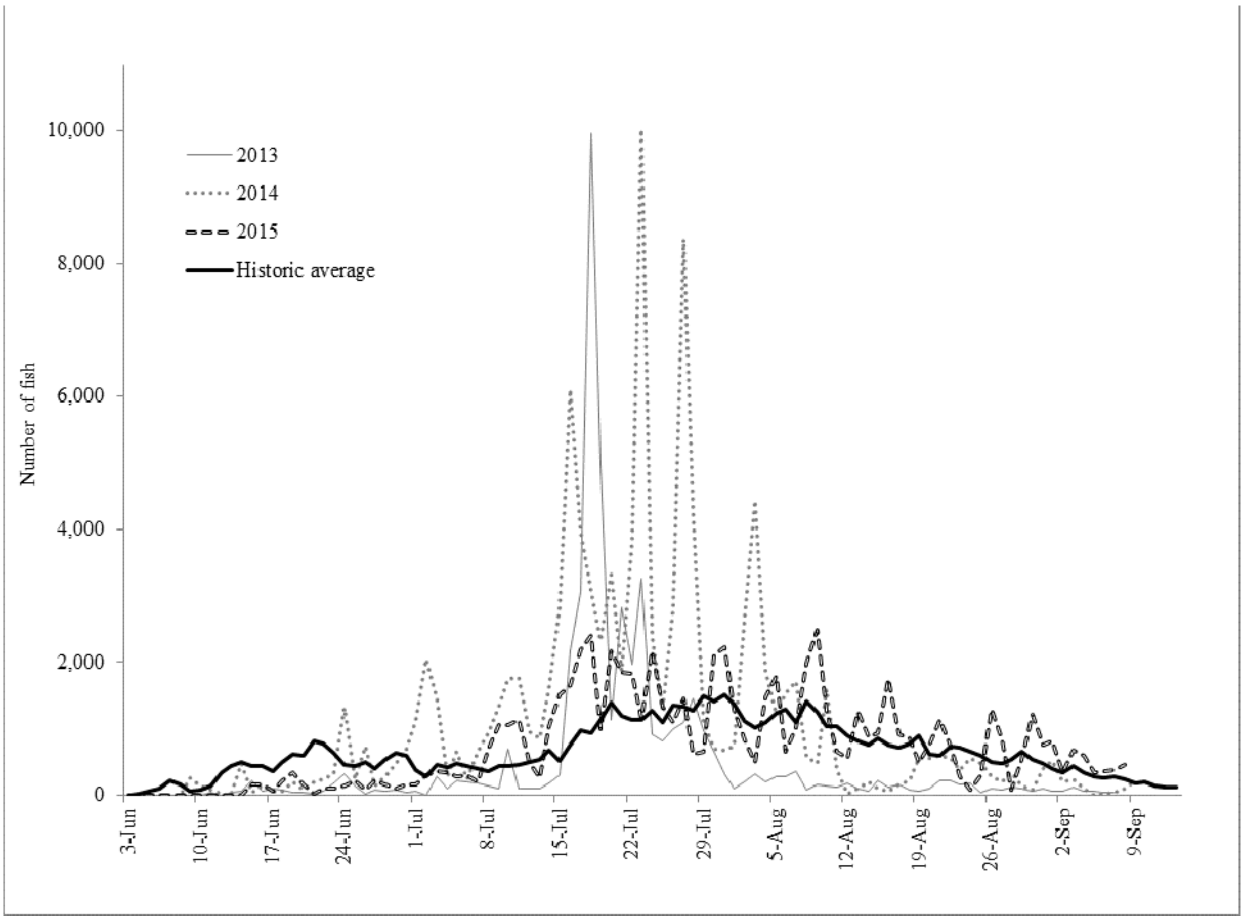

Figure 3.–Daily sockeye salmon counts at the Chilkoot River weir from 2013 to 2015 compared to the long-term average (1976–2012).

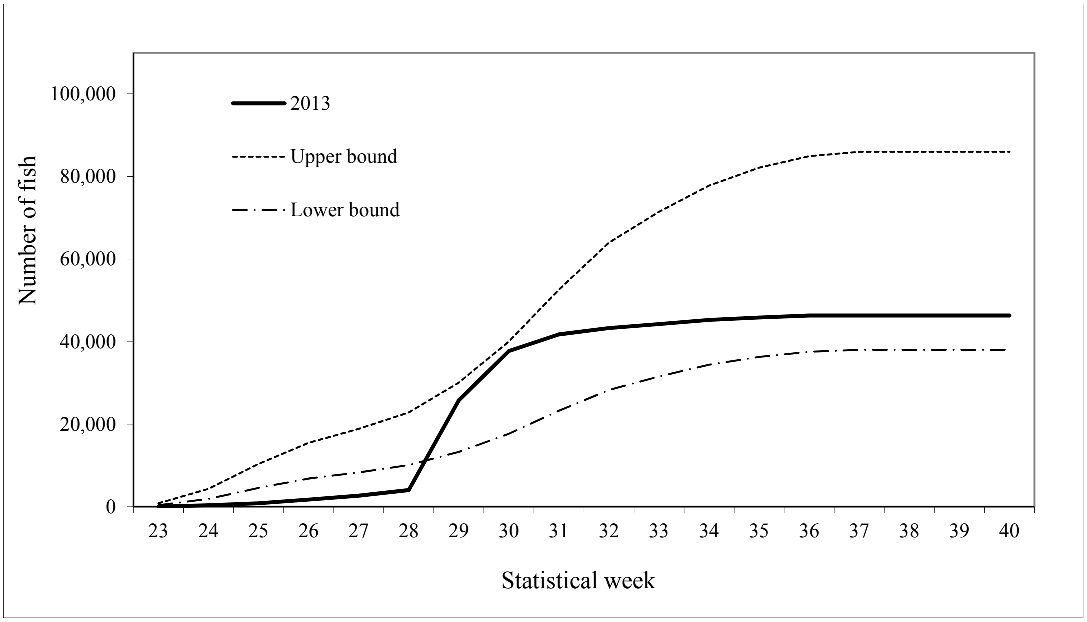

Figure 4.–Cumulative weekly escapement of sockeye salmon through the Chilkoot River weir compared to upper and lower bounds of the *sustainable* escapement goal range, 2013.

Table 1.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and *sustainable* escapement goal range, 2013.

	Escapement		Escapement goal	
Statistical Week	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
23	8	8	378	856
24	386	394	1,924	4,354
25	447	841	4,593	10,396
26	889	1,730	6,852	15,508
27	924	2,654	8,333	18,858
28	1,402	4,056	10,102	22,863
29	21,774	25,830	13,286	30,069
30	11,884	37,714	17,689	40,032
31	4,045	41,759	23,236	52,587
32	1,517	43,276	28,267	63,973
33	959	44,235	31,565	71,437
34	1,027	45,262	34,371	77,787
35	606	45,868	36,275	82,096
36	461	46,329	37,524	84,923
37	–	46,329	38,000	86,000
Total	46,329	46,329	38,000	86,000

2014

In 2014, 105,058 sockeye (104,812 adults and 246 jacks), 162 coho, 41,592 pink, 185 chum, and 22 Chinook salmon were enumerated through the Chilkoot River weir between 27 May and 12 September (statistical week 22–37; Table 2; Figure 3; Appendix C; Appendix E). One high water event required the removal of every other picket 4–6 July to prevent damage to the weir. The estimated unobserved passage of adult sockeye salmon during this time was 655 fish. Weekly escapements were below the lower bound escapement goal targets for the first 4 weeks of the season, and increased dramatically in statistical weeks 29 and 30. The total sockeye salmon escapement was 105,713 fish, which exceeded the upper bound of the escapement goal range (Table 2; Figure 5). The pink salmon escapement was below the historical average (Appendix C).

Table 2.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and *sustainable* escapement goal range, 2014.

	Escapement		Escapement goal	
Statistical Week	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
23	4	4	378	856
24	1,001	1,005	1,924	4,354
25	807	1,812	4,593	10,396
26	3,267	5,079	6,852	15,508
27	6,741	11,820	8,333	18,858
28	7,666	19,486	10,102	22,863
29	20,757	40,243	13,286	30,069
30	25,602	65,845	17,689	40,032
31	18,554	84,399	23,236	52,587
32	11,883	96,282	28,267	63,973
33	2,462	98,744	31,565	71,437
34	3,037	101,781	34,371	77,787
35	2,060	103,841	36,275	82,096
36	1,500	105,341	37,524	84,923
37	372	105,713	38,000	86,000
Total		105,713	38,000	86,000

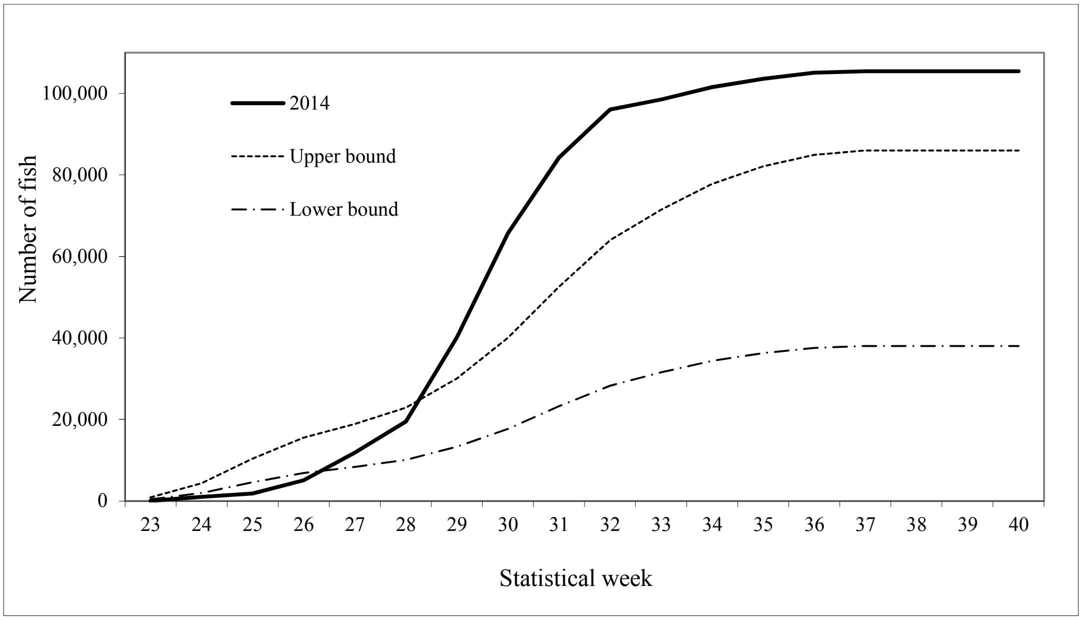

Figure 5.–Cumulative weekly escapement of sockeye salmon through the Chilkoot River weir compared to upper and lower bounds of the *sustainable* escapement goal range, 2014.

2015

In 2015, 71,515 sockeye (71,122 adults and 393 jacks), 11 coho, 41,592 pink, 185 chum, and 22 Chinook salmon were enumerated through the Chilkoot River weir between 1 June and 8 September (statistical weeks 23–37; Table 3; Figure 3; Appendix C; Appendix F). Weekly escapements were below the lower bound escapement goal targets for the first 6 weeks of the season. Sockeye salmon escapement was within the bounds of the escapement goal range (Table 3; Figure 6) and pink salmon escapement was above the historical average (Appendix C).

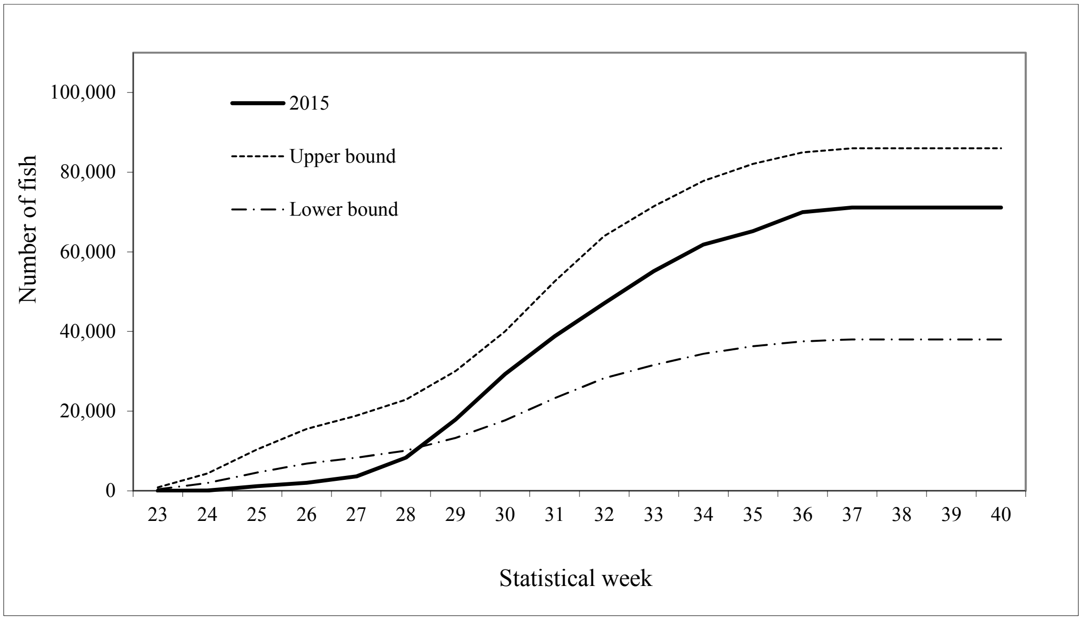

Figure 6.–Cumulative weekly escapement of sockeye salmon through the Chilkoot River weir upper and lower bounds of the *sustainable* escapement goal range, 2015.

Table 3.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and *sustainable* escapement goal range, 2015.

	Escapement		Escapement goal	
Statistical Week	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
23	5	5	378	856
24	21	26	1,924	4,354
25	1,102	1,128	4,593	10,396
26	876	2,004	6,852	15,508
27	1,578	3,582	8,333	18,858
28	4,757	8,339	10,102	22,863
29	9,541	17,880	13,286	30,069
30	11,534	29,414	17,689	40,032
31	9,495	38,909	23,236	52,587
32	8,309	47,218	28,267	63,973
33	8,129	55,347	31,565	71,437
34	6,710	62,057	34,371	77,787
35	3,478	65,535	36,275	82,096
36	4,780	70,315	37,524	84,923
37	1,200	71,515	38,000	86,000
Total			38,000	86,000

COMMERCIAL HARVEST ESTIMATE

2013

In 2013, 122,103 sockeye salmon were harvested in the District 15 commercial drift gillnet fishery, of which approximately 23,111 fish were estimated to be Chilkoot stock. Chilkoot stock accounted for 19% of the total commercial harvest (Table 4; Appendix G). Scale samples from a total sample of 3,984 fish (about 4% of the commercial harvest) were used to determine stock proportions of the commercial sockeye salmon harvest. The 2013 harvest rate was estimated to be 36% (including small, estimated subsistence and sport harvests; Appendix H).

2014

In 2014, 234,682 sockeye salmon were harvested in the District 15 commercial drift gillnet fishery, of which approximately 110,487 fish were estimated to be Chilkoot stock. Chilkoot stock accounted for 47% of the total commercial harvest (Table 5; Appendix G). Scale samples from a total sample of 3,778 fish (about 2% of the commercial harvest) were used to determine stock proportions of the commercial sockeye salmon harvest. The 2014 harvest rate was estimated to be 52% (including small, estimated subsistence and sport harvests; Appendix H).

2015

In 2015, 131,577 sockeye salmon were harvested in the District 15 commercial drift gillnet fishery, of which approximately 58,568 fish were estimated to be Chilkoot stock. Chilkoot stock accounted for 45% of the total commercial harvest (Table 6; Appendix G). Scale samples from a total sample of 4,421 fish (about 4% of the commercial harvest) were used to determine stock proportions of the commercial sockeye salmon harvest. The 2015 harvest rate was estimated to be 46% (including small, estimated subsistence and sport harvests; Appendix H).

Table 4.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks in the District 15 commercial drift gillnet fishery based on scale pattern analysis, 2013.

Statistical week	Commercial harvest	Sample size	Estimated stock composition			Estimated harvest		
			Chilkoot	Chilkat	Other	Chilkoot	Chilkat	Other
25	1,634	289	22%	33%	45%	368	537	729
26	10,163	389	20%	25%	56%	2,012	2,508	5,643
27	12,109	402	21%	42%	37%	2,530	5,060	4,518
28	9,784	411	24%	43%	33%	2,381	4,190	3,214
29	10,295	425	32%	46%	22%	3,270	4,748	2,277
30	10,211	417	18%	53%	29%	1,837	5,387	2,987
31	27,828	425	26%	69%	5%	7,203	19,119	1,506
32	8,131	164	12%	86%	2%	992	6,991	149
33	14,856	397	10%	77%	13%	1,534	11,376	1,946
34	8,025	447	9%	89%	2%	736	7,145	144
35–41	9,067	218	3%	94%	3%	250	8,526	291
Total	122,103	3,984	19%	62%	19%	23,111	75,588	23,404

Table 5.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks in the District 15 commercial drift gillnet fishery based on scale pattern analysis, 2014.

Statistical week	Commercial harvest	Sample size	Estimated stock composition			Estimated harvest		
			Chilkoot	Chilkat	Other	Chilkoot	Chilkat	Other
25	3,247	260	18%	68%	14%	574	2,210	462
26	3,138	419	17%	59%	24%	532	1,842	764
27	14,962	416	17%	55%	28%	2,590	8,236	4,136
28	23,145	430	29%	50%	21%	6,621	11,573	4,952
29	36,118	285	40%	33%	27%	14,320	11,913	9,885
30	38,188	299	51%	23%	26%	19,413	8,813	9,962
31	24,432	416	69%	20%	11%	16,973	4,816	2,643
32	45,491	386	53%	30%	17%	23,924	13,671	7,896
33	16,748	414	58%	37%	5%	9,669	6,189	890
34	15,991	323	57%	39%	4%	9,159	6,238	594
35–41	13,222	130	51%	45%	4%	6,713	6,001	509
Total	234,682	3,778	47%	35%	18%	110,487	81,502	42,693

Table 6.–Estimated commercial harvest of Chilkoot, Chilkat, and other sockeye salmon stocks in the District 15 commercial drift gillnet fishery based on scale pattern analysis, 2015.

Statistical week	Commercial harvest	Sample size	Estimated stock composition			Estimated harvest		
			Chilkoot	Chilkat	Other	Chilkoot	Chilkat	Other
26	3,111	421	26%	33%	41%	798	1,035	1,278
27	2,137	485	22%	32%	46%	467	692	978
28	9,466	481	26%	24%	50%	2,460	2,303	4,703
29	7,943	433	41%	24%	35%	3,284	1,908	2,752
30	10,842	435	41%	23%	36%	4,461	2,467	3,913
31	15,825	478	52%	23%	26%	8,210	3,576	4,039
32	25,662	445	47%	21%	31%	12,168	5,478	8,016
33	23,169	436	39%	21%	40%	9,034	4,889	9,246
34	14,732	410	63%	25%	12%	9,306	3,629	1,797
35–40	18,690	397	45%	38%	17%	8,380	7,109	3,201
total	131,577	4,421	45%	25%	30%	58,568	33,085	39,924

Escapement Age, Sex, and Length Composition

2013

In 2013, the sockeye salmon escapement was composed primarily of age-1.3 (48.6%) and age-1.2 (29.3%) fish (Table 7; Appendix I). The remainder of the escapement (22.2%) was composed of age-1.4, age-2.2, age-2.3, age-2.4, and age-3.3 fish. Age-1.3 fish had a mean length of 578 mm for males and 560 mm for females, and age-1.2 fish had mean lengths of 490 mm for males and 507 mm for females (Table 8; Appendix J).

Table 7.–Age composition of the Chilkoot Lake sockeye salmon escapement, weighted by statistical week, 2013.

Brood year	2009	2008	2007	2008	2007	2006	2006	
Age class	1.2	1.3	1.4	2.2	2.3	2.4	3.3	Total
Sample size	452	826	58	71	208	1	1	1,617
Escapement	13,563	22,493	1,383	2,821	5,908	59	102	46,329
Escapement SE	800	876	261	445	566	59	102	
Percent	29.3%	48.6%	3.0%	6.1%	12.8%	0.1%	0.2%	
Percent SE	1.7%	1.9%	0.6%	1.0%	1.2%	0.1%	0.2%	

Table 8.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2013.

Brood year	2009	2008	2007	2008	2007	2006	2006	
Age	1.2	1.3	1.4	2.2	2.3	2.4	3.3	Total
Male								
Sample size	329	414	50	50	99	-	-	942
Mean length (mm)	490	578	597	496	578	-	-	548
SE	2.1	1.0	4.8	5.3	2.3	-	-	1.7
Female								
Sample size	122	412	8	21	109	1	1	674
Mean length (mm)	507	560	575	511	560	550	560	546
SE	2.2	1.0	8.2	5.6	1.8	0.0	0.0	1.2
All Fish								
Sample size	451	826	58	71	208	1	1	1,616
Mean length (mm)	494	569	594	501	569	550	560	548
SE	1.7	0.8	4.4	4.1	1.6	0.0	0.0	1.1

2014

In 2014, the sockeye salmon escapement was composed primarily of age-1.3 (60.8%) and age-1.2 (27.1%) fish (Table 9; Appendix I). The remainder of the escapement (12.2%) was composed of age-1.4, age-1.5, age-2.2, and age-2.3 fish. Age-1.3 fish had a mean length of 579 mm for males and 560 mm for females, and age-1.2 fish had mean lengths of 484 mm for males and 512 mm for females (Table 10; Appendix J).

Table 9.–Age composition of the Chilkoot Lake sockeye escapement weighted by statistical week, 2014.

Brood year	2010	2009	2008	2007	2009	2008	
Age class	1.2	1.3	1.4	1.5	2.2	2.3	Total
Sample size	421	1,503	5	1	101	150	2,181
Escapement	28,533	64,114	116	35	5,901	6,769	105,467
Escapement SE	1,314	1,403	54	34	677	678	
Percent	27.1%	60.8%	0.1%	0.0%	5.6%	6.4%	
Percent SE	1.2%	1.3%	0.1%	0.0%	0.6%	0.6%	

Table 10.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2014.

Brood year	2010	2009	2008	2007	2009	2008	
Age	1.2	1.3	1.4	1.5	2.2	2.3	Total
Male							
Sample size	347	732	1	-	84	64	1,228
Mean length (mm)	484	579	570	-	489	578	540
SE	1.7	1.0	0.0	-	3.9	3.5	1.5
Female							
Sample size	73	770	4	1	17	86	951
Mean length (mm)	512	560	573	640	511	562	560
SE	2.2	0.9	12.5	0.0	6.3	2.7	0.9
All Fish							
Sample size	420	1,502	5	1	101	150	2,179
Mean length (mm)	489	569	572	640	492	569	555
SE	1.6	0.7	9.7	0.0	3.5	2.2	1.0

2015

In 2015, the sockeye salmon escapement was composed primarily of age-1.3 (75.9%) and age-1.2 (15.6%) fish (Table 11; Appendix I). The remainder of the escapement (8.6%) was composed of age-0.3, age-1.4, age-2.2, age-2.3, and age 2.4 fish. Age-1.3 fish had a mean length of 550 mm for males and 540 mm for females. Age-1.2 fish had mean lengths of 555 mm for males and 534 mm for females (Table 12; Appendix J). Mean lengths of age-2.2, age-1.3, and age-2.3 fish were the smallest on record, 1982 to 2015 (Appendix J).

Table 11.–Age composition of the Chilkoot Lake sockeye escapement weighted by statistical week, 2015.

Brood year	2011	2011	2010	2009	2010	2009	2008	
Age class	0.3	1.2	1.3	1.4	2.2	2.3	2.4	Total
Sample size	1	211	1,253	3	28	100	1	1,597
Escapement	9	11,065	53,959	180	1,496	4,405	7	71,122
Escapement SE	9	749	885	105	301	503	6	
Percent	0.0%	15.6%	75.9%	0.3%	2.1%	6.2%	0.0%	
Percent SE	0.0%	1.1%	1.2%	0.1%	0.4%	0.7%	0.0%	

Table 12.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2015.

Brood year	2011	2011	2010	2009	2010	2009	2008	
Age	0.3	1.2	1.3	1.4	2.2	2.3	2.4	Total
Male								
Sample size	175	724	1	22	60	1	1	175
Mean length (mm)	463	555	550	463	554	570	620	463
SE	3.1	1.0	0.0	7.9	2.6	0.0	0.0	3.1
Female								
Sample size	36	527	2	6	40	-	-	36
Mean length (mm)	477	534	540	485	538	-	-	477
SE	7.3	0.9	10.0	15.2	3.1	-	-	7.3
All Fish								
Sample size	211	1,251	3	28	100	1	1	211
Mean length (mm)	465	546	543	468	548	570	620	465
SE	2.9	0.7	6.7	7.1	2.1	0.0	0.0	2.9

FRY POPULATION ESTIMATE

Hydroacoustic and trawl surveys were conducted at Chilkoot Lake on 5 November 2013 and 6 November 2014, and a hydroacoustic survey was conducted on 29 October 2015 (Table 13). Estimates of the pelagic fish population were: 642,256 fish (SE = 37,465; CV = 6%) in 2013, 1,098,029 fish (SE = 124,820; CV = 11%) in 2014, and 1,148,335 fish (SE = 75,468; CV = 7%) in 2015. The precision of pelagic fish estimates met our objective for a CV ≤ 15% in all 3 years. Four trawl surveys were conducted in 2013 and 5 were conducted in 2014. In 2013 only sockeye salmon (131 fry) were captured. In 2014, 2 coho salmon fry and 1 sculpin (*Cottus* sp.) were captured along with 546 sockeye salmon fry. In 2015 we did not conduct trawl surveys. We assumed that sockeye salmon fry accounted for 100% of the pelagic fish population, but small numbers of other species were likely also present (Table 13).

Table 13.– 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 1995–2015.

	Trawl samples				Percent	Hydroacoustic Estimates		
Year[a]	Total fish	Sockeye	Stickleback	Other	sockeye	Targets	CV	Sockeye
1987	194	141	41	12	73%	1,344,951	ND	977,516
1988	85	83	0	2	98%	3,066,118	ND	2,993,974
1989	209	208	1	0	100%	874,794	ND	870,608
1990	240	238	0	2	99%	607,892	ND	602,826
1991	47	38	9	0	81%	475,404	ND	384,369

1995	775	708	52	15	91%	260,797	ND	238,250
1996	174	173	0	1	99%	418,152	ND	415,749
1997	117	116	0	1	99%	637,628	ND	632,178
1998	526	523	0	3	99%	1,309,711	ND	1,302,241
1999	263	248	11	4	94%	351,096	ND	330,478
2000	15	14	0	1	93%	1,380,950	ND	1,288,887
2001	61	29	23	9	48%	696,000	ND	330,885
2002	289	288	0	1	100%	1,196,701	ND	1,192,560
2003	139	138	1	0	99%	1,384,754	ND	1,384,754
2004	199	187	4	8	94%	1,059,963	10%	996,046
2005	25	25	0	0	100%	247,283	22%	247,283
2006	80	80	0	0	100%	356,957	17%	356,957
2007	48	48	0	0	100%	99,781	6%	99,781
2008	534	531	1	2	99%	1,020,388	14%	1,014,655
2009	60	60	0	0	100%	832,991	14%	832,991
2010	379	379	0	0	100%	830,394	5%	830,394
2011	82	82	0	0	100%	651,847	24%	651,847
2012	142	142	0	0	100%	721,386	16%	721,386
2013	131	131	0	0	100%	642,256	6%	642,256
2014	551	546	0	5	99%	1,098,029	11%	1,088,065
2015	ND	ND	ND	ND	ND	1,148,335	7%	1,148,335

[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 season (May) and gradually became shallower as the season progressed. In 2013, the average euphotic zone depth ranged from 12.4 m in May to 2.5 m in August and September and averaged 5.1 m for the season (Table 14). In 2014, the average euphotic zone depth ranged from 16.6 m in May to 2.2 m in August and averaged 6.2 m for the season. In 2015, the average euphotic zone depth ranged from 15.8 m in April to 3.0 m in July and averaged 4.4 m for the season.

In all years (2013–2015), weak thermoclines (the depths at which temperature change was >1ºC per m) were detected in only 1 or 2 months between May and September and only to 3 or 4 m below the surface (Figure 7). The maximum lake surface temperature recorded per season was 19º C on 14 June 2013, 16º C on 19 June 2014, and 19º C on 19 May 2015.

Zooplankton Composition

Zooplankton samples from Chilkoot Lake were composed predominantly of copepods (*Cyclops* sp.) in all years of this study (Tables 15 and 16). Seasonal mean zooplankton density and biomass were lowest in 2013, and increased substantially in 2014 and 2015 (Tables 15 and 16). Mean lengths of non-ovigerous *Cyclops* sp. peaked in the middle of the season in all 3 years. In 2015, there was an anomaly in the June sample—the zooplankton abundance at station 1A was estimated to be 1,372,050/m^2, which was about 4 times larger than any other sample from 26 years of sampling (Appendix K). We decided to exclude the station 1A sample and use only the station 2A sample for June 2015, because the samplers stated that it was possible the station 1A sample for June may have been contaminated with material from the buoy line, and because including this sample in the analysis resulted in the doubling of the estimated seasonal mean density and biomass.

Table 14.–Euphotic zone depths (m) in Chilkoot Lake, 2013–2015.

Year	Date	Station 1A	Station 2A	Average
2013	April	NA	NA	NA
	16-May	13.7	11.1	12.4
	14-Jun	6.1	6.2	6.2
	19-Jul	4.0	3.8	3.9
	19-Aug	2.3	2.8	2.5
	19-Sep	2.5	2.4	2.5
	15-Oct	3.4	3.5	3.4
	Average (May–October)	5.3	5.0	5.1
2014	April	NA	NA	NA
	7-May	15.7	17.5	16.6
	19-Jun	6.6	7.2	6.9
	19-Jul	3.0	3.3	3.1
	15-Aug	2.1	2.3	2.2
	18-Sep	3.7	4.0	3.8
	15-Oct	3.8	4.7	4.2
	Average (May–October)	5.8	6.5	6.2
2015	14-Apr	13.2	18.3	15.8
	19-May	7.0	8.9	7.9
	16-Jun	5.3	5.3	5.3
	15-Jul	2.7	3.3	3.0
	17-Aug	3.6	3.5	3.5
	15-Sep	3.2	3.3	3.2
	14-Oct	3.4	3.9	3.6
	Average (May–October)	4.2	4.7	4.4

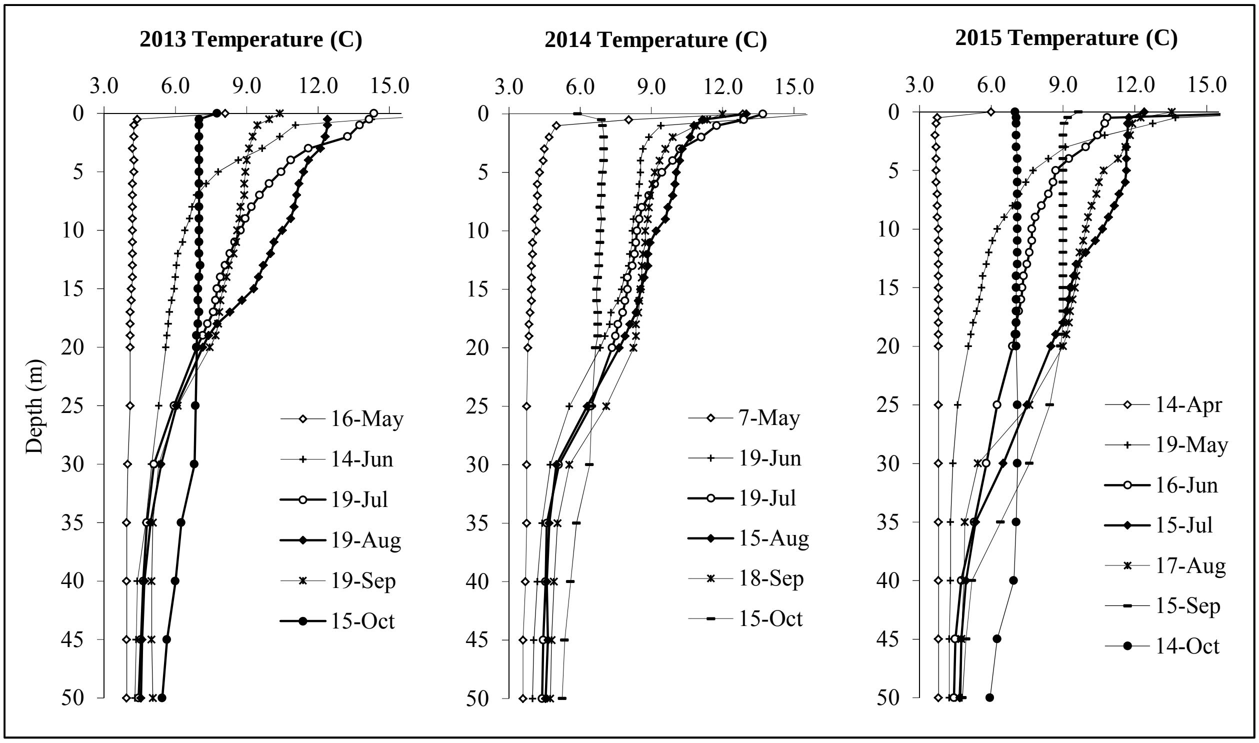

Figure 7.–Water temperature profiles by date (averaged between stations 1A and 2A) at Chilkoot Lake, 2013–2015.

Table 15.–Mean density of zooplankton per m^2 of lake surface area, by sampling date and taxon, in Chilkoot Lake 2013–2015. Density estimates were the average of 2 sampling stations.

		Macrozooplankton density (number/m^2), by sampling date							Seasonal mean	
Year	Taxon/Date		16-May	14-Jun	19-Jul	19-Aug	19-Sep	15-Oct	Density	% Density
2013	*Cyclops* sp.		65,382	18,718	32,953	43,471	70,131	45,604	46,043	76%
	Ovig. *Cyclops*		0	382	722	1,698	2,264	2,649	1,286	2%
	Nauplii		16,573	11,152	10,369	7,260	16,735	16,669	13,126	22%
	Chydorinae		0	47	0	0	0	0	8	0%
	Total		81,954	30,298	44,044	52,429	89,129	64,922	60,462	
			7-May	19-Jun	19-Jul	15-Aug	18-Sep	15-Oct	Density	% Density
2014	*Cyclops* sp.		127,781	141,259	140,517	104,942	81,890	145,441	123,638	77%
	Ovig. *Cyclops*		170	1,062	5,370	23,943	26,363	10,316	11,204	7%
	Nauplii		40,669	4,882	2,675	8,915	29,038	63,169	24,891	16%
	Chydorinae									
	Total		168,620	147,203	148,561	137,800	137,291	218,926	159,733	
		14-Apr	19-May	16-Jun[a]	15-Jul	17-Aug	15-Sep	14-Oct	Density	% Density
2015	*Cyclops* sp.	253,184	91,866	201,223	147,393	52,980	23,264	63,763	119,096	73%
	Ovig. *Cyclops*	0	255	8,490	8,321	16,556	4,245	9,000	6,695	4%
	Nauplii	231,788	4,924	2,123	594	6,368	3,226	17,575	38,086	23%
	Chydorinae									
	Total	484,972	97,045	211,836	156,308	75,904	30,735	90,338	163,877	

[a] The June 2015 sample is station 2A only.

Table 16.–Mean length and biomass of zooplankton by sampling date and taxon in Chilkoot Lake, 2013–2015. Biomass estimates were the average of the 2 sampling stations.

		Macrozooplankton length (mm), by sampling date							Seasonal Means (weighted)		
Year	Taxon/Date		16-May	14-Jun	19-Jul	19-Aug	19-Sep	15-Oct	Length (mm)	Biomass (mg/m^2)	% biomass
2013	*Cyclops* sp.		0.53	0.77	0.85	0.70	0.75	0.87	0.75	84	90%
	Ovig. *Cyclops*		0.00	1.33	1.40	1.35	1.33	1.37	1.13	9	10%
	Total									92	
			7-May	19-Jun	19-Jul	15-Aug	18-Sep	15-Oct	Length (mm)	Biomass (mg/m^2)	% biomass
2014	*Cyclops* sp.		0.59	0.97	1.11	1.11	0.90	0.83	0.92	367	83%
	Ovig. *Cyclops*		1.40	1.38	1.35	1.31	1.35	1.38	1.36	75	17%
	Total									440	
		14-Apr	19-May	16-Jun	15-Jul	17-Aug	15-Sep	14-Oct	Length (mm)	Biomass (mg/m^2)	% biomass
2015	*Cyclops* sp.	0.56	0.68	0.95	1.06	0.97	0.81	0.79	0.83	242	93%
	Ovig. *Cyclops*	0.00	1.21	1.30	1.23	1.24	1.26	1.29	1.08	39	7%
	Total									281	

DISCUSSION

Chilkoot Lake sockeye salmon escapements exceeded the lower bound of the current escapement goal range of 38,000–86,000 fish over all 3 years of the project. The 2014 escapement of 105,713 fish also exceeded the upper bound of the escapement goal range and was the second largest escapement recorded since the project first started in 1976. Although the escapement goal was met in all 3 years, the total run (escapement plus District 15 commercial drift gillnet fishery harvest) fluctuated dramatically. The total run in 2013 (72,000 fish) was below the historical 25th percentile (years 1976–2015), the 2014 run (220,000 fish) was near the 70th percentile, and the 2015 run (133,000 fish) was near the 50th percentile. Harvest rates on Chilkoot sockeye salmon (including commercial, subsistence, and sport harvest) averaged 45% over the 3 years 2013–2015, which is very close to the long term average of 48%. The harvest rate was lower in 2013 (36%) than in 2014 (52%) and 2015 (46%), as a result of the below-average run size and more conservative fishery management in 2013 (Gray et al. 2014).

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 northbound sockeye salmon and other wild stocks until run strength can be determined. Although the Chilkoot sockeye salmon escapement goal was met in all 3 years 2013–2015, escapements were below management targets during the first 4–6 weeks each season. As a result, fishery openings were restricted to the western side of section 15-A (upper Lynn Canal; Figure 1) to conserve Chilkoot Lake sockeye salmon (Gray et al. 2014, 2015, 2016). Once escapement objectives were projected to be met, area along the eastern shoreline of section 15-A was opened to target this stock. During years of high Chilkoot sockeye salmon abundance, additional time and area are granted north of the latitude of Mud Bay Point (Figure 1). During very strong years, like in 2014, Lutak Inlet (Figure 1) has been open for extended time each week to harvest Chilkoot sockeye salmon in excess of escapement needs. In 2014, the Chilkoot sockeye escapement exceeded the upper bound of the escapement goal during statistical week

32, and Lutak Inlet was open to the terminus of the Chilkoot River in statistical weeks 32–36 for 3–6 days each week (Gray et al. 2015).

Fishing effort in the District 15 commercial drift gillnet fishery has continued to increase from the lower levels observed in the 2000s (Figure 8). The fishing effort in recent years is still well below the peak years in the 1980s, when strong sockeye returns to the Chilkat and Chilkoot Lake systems attracted a large fleet. Participation in the drift gillnet fishery decreased from an average of 300 boats in the 1980s to 158 boats in recent years. The development of the hatchery-produced chum salmon return to lower Lynn Canal (Section 15-C) has been the primary cause of the more recent rise in fishing effort in District 15. The increase of fishing effort to target hatchery chum salmon in 15-C has resulted in greater pressure on early stocks of Chilkoot Lake sockeye salmon. This intensified effort in the early part of the season (Figure 9) may have resulted in the overharvest of the early stock with proportionally more of the total escapement depending on the later component of the run. The management goal is to harvest each portion of the run equally rather than depending on the later portion of the run to meet escapement goals. Time and area management strategies will continue to be developed to ensure that inseason escapement targets are met at the Chilkoot weir.

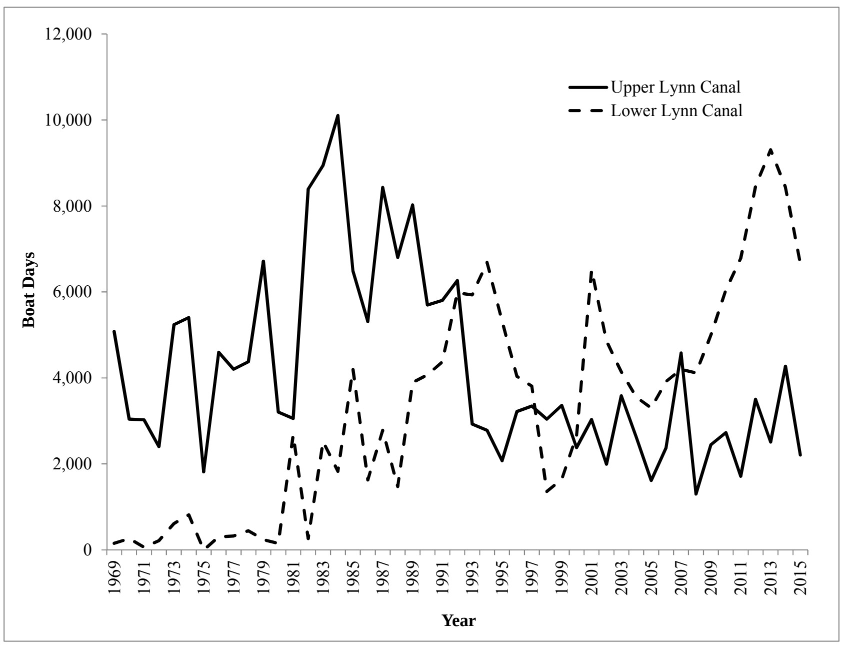

Figure 8.–Annual fishing effort (boat days) through statistical week 36 by management sections in the traditional District 15 commercial drift gillnet fishery, 1969–2015.

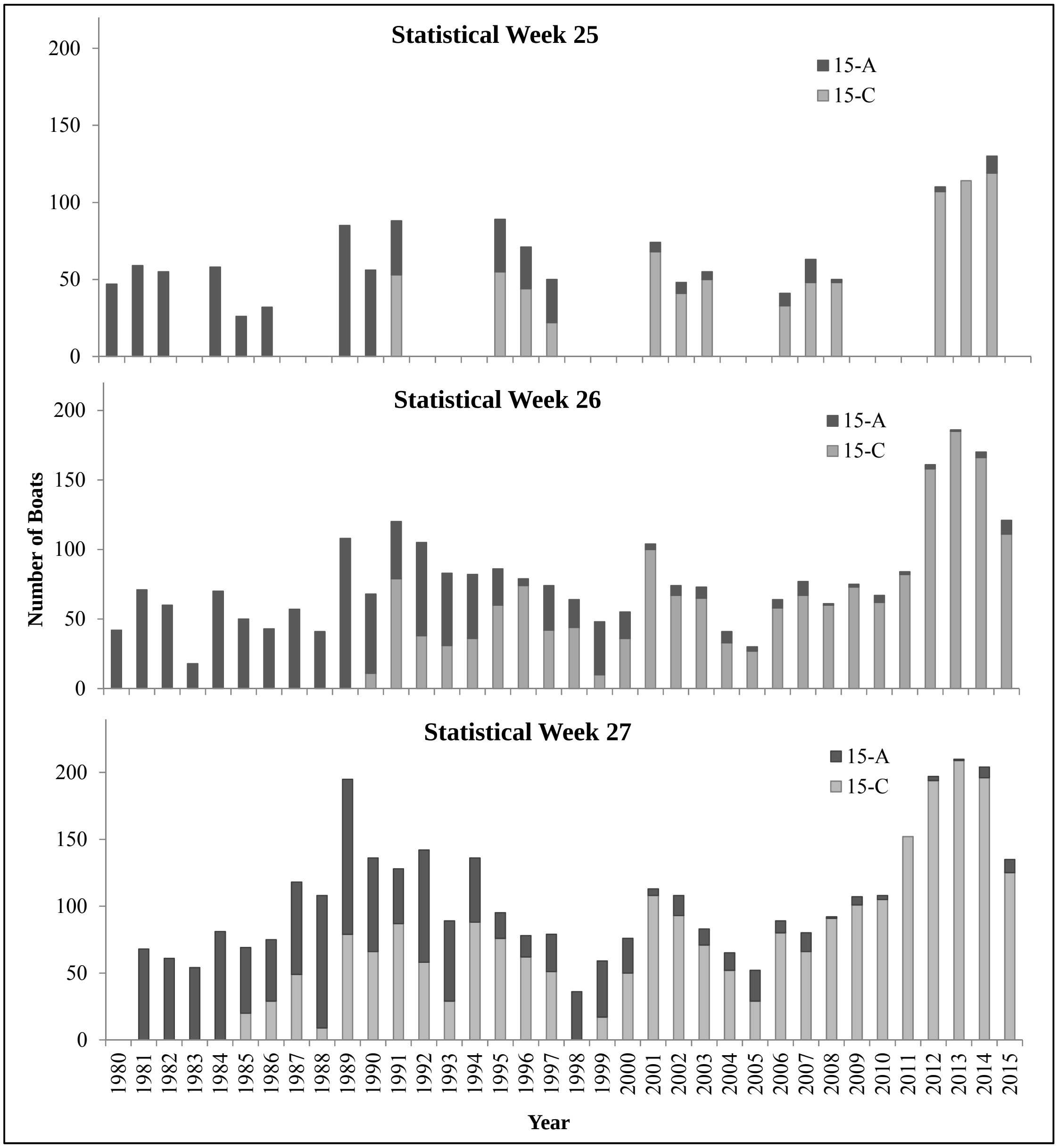

Figure 9.–Fishing effort (boats) in statistical weeks 25 to 27 by management sections in the traditional District 15 commercial drift gillnet fishery, 1980–2015.

The 2015 Chilkoot sockeye salmon run was notable for the small size of the fish. Sockeye salmon in the major age classes (age 1.2, 2.2, 1.3, and 2.3) were 27–32 mm or 5–6% shorter than the 1982–2012 average, and age-2.2, -1.3, and -2.3 fish were the smallest during that period. Scales from fish of all ages apparently exhibited normal growth patterns in the freshwater zone, and scales from age-1.2 fish also exhibited normal growth patterns in the saltwater zone despite the small size of the fish. Scale samples of age 1.3 fish, however, exhibited unusual saltwater growth patterns in both the second and third ocean years—growth in the third ocean year, in particular, was unusually minimal or stunted (Iris S. Frank, ADF&G salmon-aging laboratory, Douglas, personal communication). The unusual age-1.3 scale patterns were also observed in scale samples collected from both the commercial harvest and in all monitored sockeye salmon escapements in Southeast Alaska (Iris S. Frank, ADF&G salmon-aging laboratory, Douglas), indicating the phenomenon was not unique to the Chilkoot sockeye salmon run. Sockeye salmon were also smaller than average in Bristol Bay (smallest in 20 years; Brenner and Munro 2016), the Kodiak area (Wattum 2016), Upper Cook Inlet (second smallest on record; Brenner and Munro 2016), the Copper River (smallest on record; Brenner and Munro 2016), the Nass River (Richard Alexander, Stock Assessment Biologist, LGL Limited, personal communication) and the Skeena River (Steve Cox-Rogers, Stock Assessment Biologist, Fisheries and Oceans Canada, personal communication). Although the mechanism responsible for the reduced size and growth in the final year at sea is not well understood, it may be linked to the anomalously warm sea water mass that developed in the Gulf of Alaska in fall 2013 (the "blob"; Freeland and Whitney 2014; Bond et al. 2015) and subsequent response of the marine ecosystem in 2014 and 2015 (Peterson et al. 2015).

Estimates of the rearing fry population in Chilkoot Lake suggest the potential for good runs of sockeye salmon when they return as adults in 2017–2019. Fall fry populations in 2014 (1,088,000 fish) and 2015 (1,148,000 fish) were the fifth and sixth largest in the last 21 years and 31–38% greater than the long-term average of 830,000 fish. Although there has been very little relationship ($R^2 = 0.05$) between the size of the spawning escapement in the parent year and the fall fry population 1 year later, there is a positive correlation ($R^2 = 0.40$; $P < 0.01$) between the size of the fall fry population and subsequent adult returns (ADF&G unpublished data; Figure 10). For this comparison we assumed that all fry are age-1, which is not true; however, a very large portion (average = 80%) of returning adults spent only 1 year in freshwater.

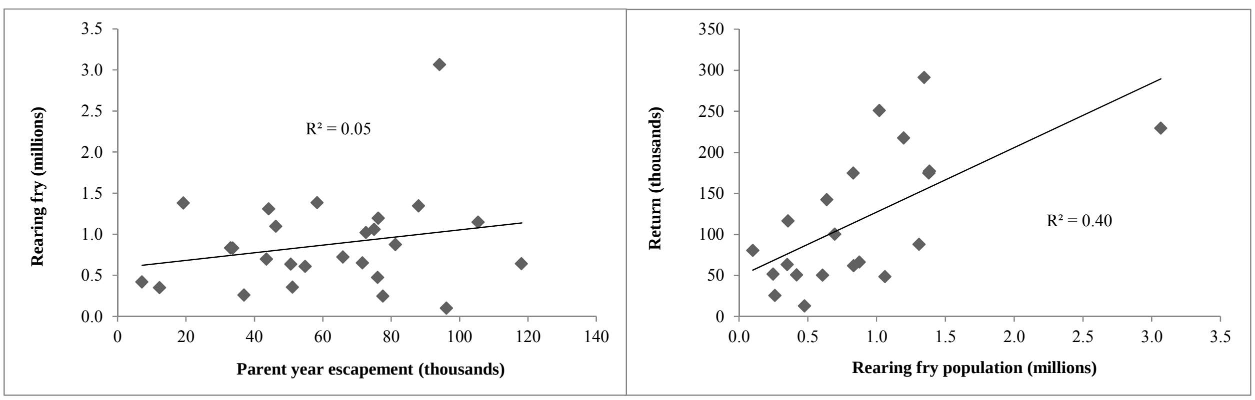

Figure 10.–Comparison of parent year escapement (1986–2014) to the rearing fry population (1987–2015) 1 year later (left), and comparison of the rearing fry population to the subsequent adult return (right).

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APPENDICES

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:

$$\hat{p}_{hj} = n_{hj} / n_h \ . \qquad (1)$$

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):

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

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

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

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):

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

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,

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

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

Appendix B.–ADF&G statistical weeks, 2013–2015.

Statistical	2013		2014		2015	
week	Beginning	Ending	Beginning	Ending	Beginning	Ending
23	02-Jun	08-Jun	01-Jun	7-Jun	31-May	06-Jun
24	09-Jun	15-Jun	08-Jun	14-Jun	07-Jun	13-Jun
25	16-Jun	22-Jun	15-Jun	21-Jun	14-Jun	20-Jun
26	23-Jun	29-Jun	22-Jun	28-Jun	21-Jun	27-Jun
27	30-Jun	6-Jul	29-Jun	5-Jul	28-Jun	04-Jul
28	7-Jul	13-Jul	06-Jul	12-Jul	05-Jul	11-Jul
29	14-Jul	20-Jul	13-Jul	19-Jul	12-Jul	18-Jul
30	21-Jul	27-Jul	20-Jul	26-Jul	19-Jul	25-Jul
31	28-Jul	3-Aug	27-Jul	2-Aug	26-Jul	01-Aug
32	4-Aug	10-Aug	03-Aug	9-Aug	02-Aug	8-Aug
33	11-Aug	17-Aug	10-Aug	16-Aug	09-Aug	15-Aug
34	18-Aug	24-Aug	17-Aug	23-Aug	16-Aug	22-Aug
35	25-Aug	31-Aug	24-Aug	30-Aug	23-Aug	29-Aug
36	1-Sep	7-Sep	31-Aug	6-Sep	30-Aug	05-Sep
37	8-Sep	14-Sep	07-Sep	13-Sep	06-Sep	12-Sep
38	15-Sep	21-Sep	14-Sep	20-Sep	13-Sep	19-Sep
39	22-Sep	28-Sep	21-Sep	27-Sep	20-Sep	26-Sep
40	29-Sep	5-Oct	28-Sep	4-Oct	27-Sep	03-Oct
41	6-Oct	12-Oct	05-Oct	11-Oct	04-Oct	10-Oct
42	13-Oct	19-Oct	12-Oct	18-Oct	11-Oct	17-Oct

Appendix C.–Chilkoot River weir dates of operation, annual estimates of sockeye salmon escapement, and counts of other species, 1976–2015.

Year	Date In	Date Out	Sockeye salmon	Pink salmon	Chum salmon	Coho salmon	Chinook salmon
1976	29-May	4-Nov	71,296	1,250	241	991	ND
1977	28-May	18-Sep	97,368	5,270	195	5	ND
1978	6-Jun	8-Nov	35,454	112	382	1,092	ND
1979	9-Jun	4-Nov	95,948	NA	253	899	ND
1980	15-Jun	4-Oct	96,513	4,683	719	628	ND
1981	10-Jun	12-Oct	84,047	34,821	405	1,585	ND
1982	3-Jun	14-Sep	103,038	6,665	507	5	6
1983	4-Jun	12-Nov	80,141	11,237	501	1,844	0
1984	3-Jun	14-Sep	100,781	5,034	372	321	0
1985	5-Jun	28-Oct	69,141	33,608	1,031	2,202	5
1986	4-Jun	28-Oct	88,024	1,249	508	1,966	6
1987	4-Jun	2-Nov	94,208	6,689	431	576	3
1988	9-Jun	12-Nov	81,274	5,274	450	1,476	1
1989	3-Jun	30-Oct	54,900	2,118	223	3,998	0
1990	3-Jun	30-Oct	76,119	10,398	216	988	0
1991	7-Jun	8-Oct	90,754	2,588	357	4,000	0
1992	2-Jun	26-Sep	67,071	7,836	193	1,518	1
1993	3-Jun	30-Sep	52,080	357	240	322	203
1994	4-Jun	24-Sep	37,007	22,472	214	463	118
1995	5-Jun	10-Sep	7,177	1,243	99	95	7
1996	6-Jun	11-Sep	50,741	2,867	305	86	19
1997	4-Jun	9-Sep	44,254	26,197	268	17	6
1998	4-Jun	13-Sep	12,335	44,001	368	131	11
1999	2-Jun	13-Sep	19,284	56,692	713	11	29
2000	3-Jun	12-Sep	43,555	23,636	1050	47	10
2001	7-Jun	12-Sep	76,283	32,294	810	103	24
2002	8-Jun	11-Sep	58,361	79,639	352	304	36
2003	5-Jun	9-Sep	74,459	55,424	498	15	12
2004	3-Jun	12-Sep	75,596	107,994	617	89	17
2005	5-Jun	12-Sep	51,178	90,486	262	23	9
2006	4-Jun	13-Sep	96,203	33,888	257	158	1
2007	4-Jun	12-Sep	72,561	61,469	252	13	39
2008	4-Jun	12-Sep	32,957	15,105	321	50	31
2009	5-Jun	10-Sep	33,545	34,483	171	11	12
2010	6-Jun	14-Sep	71,657	30,830	410	90	6
2011	3-Jun	6-Sep	65,915	76,244	118	18	43
2012	1-Jun	12-Sep	114,025	40,753	494	139	47
Average (1984–2012)	4-Jun	29-Sep	66,899	27,081	400	710	23
2013	1-Jun	7-Sep	46,329	8,195	566	43	139
2014	27-May	9-Sep	105,713	12,457	126	162	83
2015	2-Jun	8-Sep	71,515	41,592	185	11	22

Appendix D.–Daily and cumulative Chilkoot River weir counts of salmon, by species, and water temperature and gauge heights, 2013.

	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	level (mm)	temp (°C)
1-Jun	0	0	0	0	0	0	0	0	0	0		
2-Jun	0	0	0	0	0	0	0	0	0	0	162	5.0
3-Jun	1	1	0	0	0	0	0	0	0	0	153	6.0
4-Jun	0	1	0	0	0	0	0	0	0	0	148	5.0
5-Jun	1	2	0	0	0	0	0	0	0	0	152	5.0
6-Jun	2	4	0	0	0	0	0	0	0	0	149	5.0
7-Jun	1	5	0	0	0	0	0	0	0	0	146	6.0
8-Jun	3	8	0	0	0	0	0	0	0	0	145	6.0
9-Jun	3	11	0	0	0	0	0	0	0	0	148	7.5
10-Jun	4	15	0	0	0	0	0	0	0	0	156	8.0
11-Jun	46	61	0	0	0	0	0	0	0	0	165	8.0
12-Jun	6	67	0	0	0	0	0	0	0	0	169	8.0
13-Jun	52	119	0	0	0	0	0	0	0	0	170	7.0
14-Jun	53	172	0	0	0	0	0	0	0	0	160	8.0
15-Jun	222	394	0	0	0	0	0	0	0	0	156	8.5
16-Jun	66	460	0	0	0	0	0	0	1	1	168	9.5
17-Jun[a]	*111*	460	–	0	–	0	–	0	–	1	176	9.5
18-Jun[a]	*78*	460	–	0	–	0	–	0	–	1	182	9.5
19-Jun	45	505	0	0	0	0	0	0	0	1	173	9.5
20-Jun	45	550	0	0	0	0	0	0	0	1	175	10.0
21-Jun	31	581	0	0	0	0	0	0	0	1	174	8.0
22-Jun	71	652	0	0	0	0	0	0	0	1	173	8.5
23-Jun	173	825	0	0	0	0	0	0	0	1	168	10.0
24-Jun	313	1,138	0	0	0	0	0	0	0	1	164	8.5
25-Jun	151	1,289	0	0	1	1	0	0	0	1	173	9.0
26-Jun	29	1,318	0	0	0	1	0	0	0	1	182	8.5
27-Jun	83	1,401	0	0	0	1	0	0	0	0	179	8.0
28-Jun	64	1,465	0	0	1	2	0	0	0	0	173	8.5
29-Jun	76	1,541	0	0	1	3	0	0	0	0	162	8.0
30-Jun	46	1,587	1	1	1	4	0	0	0	0	154	9.0
1-Jul	62	1,649	2	3	1	5	0	0	0	0	152	9.0
2-Jul	2	1,651	0	3	0	5	0	0	0	0	156	8.0
3-Jul	284	1,935	0	3	0	5	0	0	0	0	156	8.0
4-Jul	108	2,043	2	5	4	9	0	0	0	0	153	8.0

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Appendix D.–continued (page 2 of 3).

	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	level (mm)	temp (°C)
5-Jul	220	2,263	9	14	12	21	0	0	0	0	148	8.5
6-Jul	202	2,465	2	16	7	28	0	0	0	1	142	8.5
7-Jul	172	2,637	0	16	4	32	0	0	0	1	138	8.5
8-Jul	133	2,770	1	17	1	33	0	0	0	1	137	8.5
9-Jul	92	2,862	1	18	0	33	0	0	1	2	150	8.5
10-Jul	704	3,566	10	28	8	41	0	0	1	3	151	8.5
11-Jul	102	3,668	2	30	1	42	0	0	0	3	144	8.0
12-Jul	92	3,760	2	32	2	44	0	0	0	3	140	9.5
13-Jul	107	3,867	2	34	3	47	0	0	0	3	140	9.0
14-Jul	186	4,053	9	43	5	52	0	0	1	4	141	9.0
15-Jul	302	4,355	4	47	3	55	0	0	1	5	140	10.0
16-Jul	2,160	6,515	40	87	11	66	0	0	5	10	141	9.0
17-Jul	3,062	9,577	65	152	4	70	0	0	5	15	146	10.5
18-Jul	9,967	19,544	192	344	10	80	0	0	9	24	150	10.0
19-Jul	4,969	24,513	110	454	6	86	0	0	3	27	148	11.0
20-Jul	1,128	25,641	164	618	3	89	0	0	2	29	145	11.5
21-Jul	2,832	28,473	106	724	6	95	0	0	11	40	146	10.5
22-Jul	1,968	30,441	99	823	15	110	0	0	7	47	152	10.0
23-Jul	3,263	33,704	330	1,153	15	125	0	0	8	55	148	10.5
24-Jul	915	34,619	100	1,253	20	145	0	0	2	57	146	11.0
25-Jul	818	35,437	78	1,331	24	169	0	0	2	59	147	11.0
26-Jul	1,002	36,439	53	1,384	17	186	0	0	1	60	145	10.0
27-Jul	1,086	37,525	93	1,477	7	193	0	0	1	61	142	11.0
28-Jul	1,446	38,971	177	1,654	10	203	0	0	5	66	144	10.0
29-Jul	970	39,941	91	1,745	6	209	0	0	1	67	147	11.5
30-Jul	662	40,603	98	1,843	5	214	0	0	5	72	152	10.0
31-Jul	324	40,927	95	1,938	3	217	0	0	3	75	154	11.0
1-Aug	111	41,038	70	2,008	1	218	0	0	1	76	155	11.5
2-Aug	204	41,242	157	2,165	0	218	0	0	2	78	153	12.0
3-Aug	328	41,570	244	2,409	5	223	0	0	1	79	152	12.0
4-Aug	206	41,776	66	2,475	4	227	0	0	1	80	149	12.0
5-Aug	275	42,051	124	2,599	4	231	0	0	2	82	147	12.0
6-Aug	290	42,341	116	2,715	6	237	0	0	4	86	142	12.0
7-Aug	367	42,708	319	3,034	10	247	0	0	5	91	142	11.0
8-Aug	73	42,781	98	3,132	1	248	0	0	0	91	140	12.0
9-Aug	158	42,939	96	3,228	12	260	0	0	7	98	142	11.0

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Appendix D.–continued (page 3 of 3).

Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	level (mm)	temp (°C)
10-Aug	148	43,087	41	3,269	3	263	0	0	1	99	140	11.0
11-Aug	117	43,204	59	3,328	2	265	0	0	5	104	139	11.0
12-Aug	180	43,384	80	3,408	3	268	0	0	3	107	140	11.5
13-Aug	106	43,490	82	3,490	5	273	0	0	5	112	143	11.5
14-Aug	62	43,552	61	3,551	1	274	0	0	4	116	143	12.0
15-Aug	212	43,764	219	3,770	3	277	0	0	7	123	144	12.0
16-Aug	121	43,885	101	3,871	1	278	0	0	3	126	144	11.0
17-Aug	161	44,046	132	4,003	2	280	0	0	1	127	144	11.5
18-Aug	83	44,129	116	4,119	4	284	0	0	0	127	142	12.0
19-Aug	70	44,199	120	4,239	5	289	1	1	0	127	141	11.0
20-Aug	105	44,304	141	4,380	5	294	0	1	2	129	137	11.0
21-Aug	216	44,520	190	4,570	1	295	0	1	1	130	135	11.0
22-Aug	226	44,746	400	4,970	6	301	2	3	0	130	130	11.0
23-Aug	155	44,901	487	5,457	9	310	2	5	0	130	127	7.5
24-Aug	172	45,073	246	5,703	8	318	1	6	0	130	126	10.0
25-Aug	51	45,124	190	5,893	10	328	0	6	2	132	144	10.0
26-Aug	109	45,233	454	6,347	22	350	0	6	1	133	142	11.5
27-Aug	84	45,317	322	6,669	20	370	0	6	0	133	139	10.0
28-Aug	112	45,429	405	7,074	19	389	2	8	2	135	135	11.5
29-Aug	101	45,530	357	7,431	28	417	1	9	0	135	133	11.0
30-Aug	55	45,585	259	7,690	28	445	0	9	2	137	131	12.0
31-Aug	94	45,679	227	7,917	22	467	0	9	0	137	130	10.5
1-Sep	64	45,743	80	7,997	23	490	0	9	0	137	136	11.0
2-Sep	67	45,810	49	8,046	7	497	2	11	0	137	141	11.0
3-Sep	117	45,927	44	8,090	14	511	4	15	1	138	137	10.5
4-Sep	68	45,995	53	8,143	26	537	5	20	1	139	136	10.5
5-Sep	54	46,049	7	8,150	7	544	5	25	0	139	150	9.0
6-Sep	48	46,097	27	8,177	10	554	11	36	0	139	143	10.0
7-Sep	43	46,140	18	8,195	12	566	7	43	0	139	146	10.0

[a] Weir pickets were removed from 1000 hrs on 17 June through 2130 hrs on 18 June due to flood event; interpolated values calculated for 17–18 June.

Appendix E.–Daily and cumulative Chilkoot River weir counts of salmon by species, and water temperature and gauge heights, 2014.

	Sockeye salmon		Jack sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (mm)	temp (°C)
27-May	0	0	0	0	0	0	0	0	0	0	0	0	130	7.0
28-May	0	0	0	0	0	0	0	0	0	0	0	0	127	5.0
29-May	0	0	0	0	0	0	0	0	0	0	0	0	124	5.0
30-May	0	0	0	0	0	0	0	0	0	0	0	0	125	7.0
31-May	0	0	0	0	0	0	0	0	0	0	0	0	129	5.0
1-Jun	1	1	0	0	0	0	0	0	0	0	0	0	137	7.5
2-Jun	0	1	0	0	0	0	0	0	0	0	0	0	136	7
3-Jun	0	1	0	0	0	0	0	0	0	0	0	0	136	7
4-Jun	1	2	0	0	0	0	0	0	0	0	0	0	134	7.5
5-Jun	1	3	0	0	0	0	0	0	0	0	0	0	134	7.5
6-Jun	1	4	0	0	0	0	0	0	0	0	0	0	133	8
7-Jun	0	4	0	0	0	0	0	0	0	0	0	0	135	8.5
8-Jun	2	6	0	0	0	0	0	0	0	0	0	0	139	9
9-Jun	253	259	0	0	0	0	0	0	0	0	0	0	150	7.5
10-Jun	145	404	0	0	0	0	0	0	0	0	0	0	151	8
11-Jun	88	492	0	0	0	0	0	0	0	0	0	0	144	8.5
12-Jun	22	514	0	0	0	0	0	0	0	0	0	0	140	8
13-Jun	7	521	0	0	0	0	0	0	0	0	0	0	135	8
14-Jun	484	1,005	0	0	0	0	0	0	0	0	0	0	133	7
15-Jun	46	1,051	0	0	0	0	0	0	0	0	0	0	137	8
16-Jun	137	1,188	0	0	0	0	0	0	0	0	0	0	136	7.5
17-Jun	71	1,259	0	0	0	0	0	0	0	0	0	0	136	8
18-Jun	65	1,324	0	0	0	0	0	0	0	0	0	0	145	8
19-Jun	194	1,518	0	0	0	0	0	0	0	0	0	0	142	8
20-Jun	87	1,605	0	0	0	0	0	0	0	0	0	0	146	8.5
21-Jun	207	1,812	0	0	0	0	0	0	0	0	0	0	139	8
22-Jun	234	2,046	0	0	0	0	0	0	0	0	0	0	136	9
23-Jun	318	2,364	0	0	0	0	1	1	0	0	0	0	142	10
24-Jun	1309	3,673	1	1	0	0	1	2	0	0	1	1	150	10
25-Jun	240	3,913	0	1	0	0	0	2	0	0	0	1	156	8
26-Jun	733	4,646	0	1	0	0	0	2	0	0	0	1	155	8
27-Jun	146	4,792	0	1	0	0	0	2	0	0	0	1	146	9
28-Jun	286	5,078	0	1	0	0	1	3	0	0	0	1	143	10
29-Jun	488	5,566	0	1	0	0	0	3	0	0	0	1	142	9.5
30-Jun	689	6,255	0	1	0	0	1	4	0	0	0	1	144	10

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Appendix E.–continued (page 2 of 3).

Date	Sockeye salmon		Jack sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (mm)	temp (°C)
1-Jul	1,118	7,373	6	7	0	0	0	4	0	0	1	2	146	9
2-Jul	2,041	9,414	6	13	0	0	0	4	0	0	1	3	147	10
3-Jul	1,447	10,861	8	21	0	0	1	5	0	0	1	4	147	10
4-Jul	283	11,144	0	21	0	0	0	5	0	0	0	4	163	9
5-Jul[a]	*655*	11,799	–	21	–	0	–	5	–	0	–	4	179	8.5
6-Jul	241	12,040	0	21	0	0	1	6	0	0	0	4	160	10
7-Jul	650	12,690	1	22	0	0	2	8	0	0	0	4	153	9.5
8-Jul	946	13,636	1	23	0	0	1	9	0	0	2	6	152	11
9-Jul	1,343	14,979	1	24	0	0	1	10	0	0	0	6	158	9
10-Jul	1,755	16,734	3	27	1	1	3	13	0	0	1	7	151	9
11-Jul	1,769	18,503	5	32	4	5	4	17	0	0	3	10	146	9.5
12-Jul	947	19,450	4	36	0	5	1	18	0	0	0	10	145	9.5
13-Jul	854	20,304	1	37	1	6	6	24	0	0	1	11	162	10
14-Jul	1,613	21,917	0	37	6	12	5	29	0	0	2	13	167	10
15-Jul	2,824	24,741	5	42	11	23	5	34	0	0	1	14	166	9
16-Jul	6,099	30,840	0	42	3	26	4	38	0	0	2	16	158	10
17-Jul	3,961	34,801	2	44	30	56	1	39	0	0	3	19	150	10
18-Jul	3,064	37,865	8	52	14	70	0	39	0	0	4	23	143	9.5
19-Jul	2,322	40,187	4	56	16	86	1	40	0	0	3	26	141	10
20-Jul	3,331	43,518	8	64	11	97	2	42	0	0	0	26	140	10
21-Jul	1,878	45,396	6	70	34	131	1	43	0	0	0	26	140	10
22-Jul	3,841	49,237	7	77	24	155	0	43	0	0	1	27	139	10
23-Jul	10,016	59,253	1	78	34	189	1	44	0	0	3	30	142	10.5
24-Jul	2,379	61,632	23	101	32	221	0	44	0	0	0	30	139	10
25-Jul	1,285	62,917	14	115	13	234	2	46	0	0	2	32	136	10
26-Jul	2,809	65,726	4	119	48	282	0	46	0	0	3	35	141	10.5
27-Jul	8,370	74,096	6	125	147	429	1	47	0	0	4	39	145	11
28-Jul	4,265	78,361	4	129	206	635	0	47	0	0	1	40	157	10
29-Jul	1,096	79,457	3	132	263	898	0	47	0	0	3	43	152	10.5
30-Jul	703	80,160	2	134	440	1,338	2	49	0	0	2	45	152	10.5
31-Jul	684	80,844	4	138	581	1,919	1	50	0	0	4	49	145	10.5
1-Aug	745	81,589	4	142	406	2,325	3	53	0	0	1	50	143	10
2-Aug	2,652	84,241	16	158	883	3,208	3	56	0	0	5	55	142	10
3-Aug	4,426	88,667	22	180	1,007	4,215	2	58	0	0	9	64	141	11
4-Aug	1,869	90,536	12	192	1,061	5,276	2	60	0	0	4	68	140	11
5-Aug	1,213	91,749	10	202	578	5,854	0	60	0	0	5	73	141	11

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Appendix E.–continued (page 3 of 3).

Date	Sockeye salmon		Jack 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.	Daily	Cum.		
6-Aug	1,533	93,282	7	209	961	6,815	0	60	0	0	1	74	138	10.5
7-Aug	1,709	94,991	12	221	1,108	7,923	1	61	0	0	1	75	135	10
8-Aug	572	95,563	7	228	1,143	9,066	1	62	0	0	0	75	133	10.5
9-Aug	488	96,051	3	231	1,034	10,100	0	62	0	0	0	75	132	10.5
10-Aug	1,588	97,639	7	238	747	10,847	0	62	0	0	1	76	141	11.5
11-Aug	388	98,027	1	239	192	11,039	0	62	0	0	0	76	158	10.5
12-Aug	18	98,045	0	239	4	11,043	0	62	0	0	0	76	171	10.5
13-Aug	93	98,138	0	239	37	11,080	0	62	0	0	0	76	169	10.5
14-Aug	195	98,333	0	239	32	11,112	0	62	0	0	0	76	156	9.5
15-Aug	103	98,436	0	239	10	11,122	0	62	0	0	0	76	158	10.5
16-Aug	69	98,505	0	239	27	11,149	0	62	0	0	0	76	166	10
17-Aug	165	98,670	0	239	23	11,172	3	65	0	0	0	76	152	9
18-Aug	212	98,882	0	239	18	11,190	4	69	0	0	0	76	159	10
19-Aug	565	99,447	0	239	54	11,244	0	69	0	0	4	80	154	10
20-Aug	559	100,006	0	239	110	11,354	0	69	0	0	2	82	156	9.5
21-Aug	600	100,606	0	239	158	11,512	5	74	0	0	0	82	142	10
22-Aug	557	101,163	0	239	121	11,633	2	76	0	0	0	82	140	10
23-Aug	379	101,542	0	239	90	11,723	4	80	0	0	0	82	137	10
24-Aug	550	102,092	1	240	104	11,827	0	80	0	0	0	82	136	10
25-Aug	475	102,567	2	242	89	11,916	2	82	0	0	1	83	137	10
26-Aug	273	102,840	0	242	91	12,007	1	83	0	0	0	83	139	11
27-Aug	197	103,037	0	242	51	12,058	2	85	0	0	0	83	137	10
28-Aug	342	103,379	4	246	96	12,154	3	88	4	4	0	83	131	10
29-Aug	133	103,512	0	246	32	12,186	3	91	6	10	0	83	130	10.5
30-Aug	83	103,595	0	246	24	12,210	1	92	3	13	0	83	130	10.5
31-Aug	397	103,992	0	246	40	12,250	8	100	1	14	0	83	129	10.5
1-Sep	523	104,515	0	246	60	12,310	9	109	3	17	0	83	133	10
2-Sep	200	104,715	0	246	37	12,347	2	111	5	22	0	83	136	10
3-Sep	239	104,954	0	246	29	12,376	4	115	15	37	0	83	130	10
4-Sep	104	105,058	0	246	30	12,406	0	115	21	58	0	83	132	10
5-Sep	6	105,064	0	246	3	12,409	0	115	5	63	0	83	132	11
6-Sep	31	105,095	0	246	6	12,415	0	115	16	79	0	83	136	10
7-Sep	46	105,141	0	246	6	12,421	1	116	11	90	0	83	146	10
8-Sep	103	105,244	0	246	12	12,433	1	117	45	135	0	83	140	10.5
9-Sep	223	105,467	0	246	24	12,457	9	126	27	162	0	83	145	9.5

[a] Weir pickets were removed from 1700 hrs on 4 July through 1200 hrs on 6 July due to flood event; interpolated values calculated for 5 July.

Appendix F.–Daily and cumulative Chilkoot River weir counts of salmon by species, and water temperature and gauge heights, 2015.

	Sockeye salmon		Jack sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (mm)	temp (°C)
2-Jun	0	0	0	0	0	0	0	0	0	0	0	0	154	10.0
3-Jun	1	1	0	0	0	0	0	0	0	0	0	0	150	6.5
4-Jun	0	1	0	0	0	0	0	0	0	0	0	0	150	6.0
5-Jun	2	3	0	0	0	0	0	0	0	0	0	0	168	6.5
6-Jun	2	5	0	0	0	0	0	0	0	0	0	0	166	7.5
7-Jun	3	8	0	0	0	0	0	0	0	0	0	0	165	7.0
8-Jun	2	10	0	0	0	0	0	0	0	0	0	0	150	7.0
9-Jun	0	10	0	0	0	0	0	0	0	0	0	0	143	5.7
10-Jun	3	13	0	0	0	0	0	0	0	0	0	0	139	7.0
11-Jun	9	22	0	0	0	0	0	0	0	0	0	0	138	7.0
12-Jun	1	23	1	1	0	0	0	0	0	0	0	0	138	7.5
13-Jun	2	25	0	1	0	0	0	0	0	0	0	0	136	7.5
14-Jun	8	33	0	1	0	0	0	0	0	0	0	0	139	7.5
15-Jun	156	189	0	1	0	0	0	0	0	0	0	0	151	10.5
16-Jun	156	345	0	1	0	0	0	0	0	0	0	0	152	9.5
17-Jun	60	405	0	1	0	0	0	0	0	0	0	0	154	9.0
18-Jun	230	635	0	1	0	0	0	0	0	0	0	0	151	9.0
19-Jun	332	967	0	1	0	0	0	0	0	0	0	0	150	9.0
20-Jun	160	1,127	0	1	4	4	0	0	0	0	0	0	148	9.0
21-Jun	19	1,146	0	1	0	4	0	0	0	0	0	0	146	9.5
22-Jun	92	1,238	0	1	0	4	0	0	0	0	0	0	148	9.5
23-Jun	93	1,331	0	1	1	5	0	0	0	0	0	0	150	10.0
24-Jun	147	1,478	0	1	3	8	0	0	0	0	0	0	151	10.0
25-Jun	215	1,693	0	1	5	13	0	0	0	0	0	0	149	10.5
26-Jun	79	1,772	1	2	0	13	0	0	0	0	0	0	148	8.0
27-Jun	230	2,002	0	2	0	13	0	0	0	0	0	0	160	9.0
28-Jun	168	2,170	0	2	0	13	0	0	0	0	0	0	149	9.5
29-Jun	99	2,269	0	2	1	14	0	0	0	0	0	0	145	10.0
30-Jun	156	2,425	0	2	1	15	0	0	0	0	0	0	146	10.0
1-Jul	163	2,588	0	2	21	36	0	0	0	0	0	0	140	10.0
2-Jul	300	2,888	0	2	8	44	0	0	0	0	0	0	139	11.0
3-Jul	358	3,246	0	2	35	79	0	0	0	0	0	0	158	8.5
4-Jul	334	3,580	0	2	23	102	0	0	0	0	1	1	148	9.0
5-Jul	274	3,854	0	2	5	107	0	0	0	0	1	2	148	9.0

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Appendix F.–continued (page 2 of 3).

	Sockeye salmon		Jack sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (mm)	temp (°C)
6-Jul	295	4,149	0	2	19	126	0	0	0	0	0	2	148	10.0
7-Jul	211	4,360	0	2	25	151	0	0	0	0	0	2	151	11.0
8-Jul	705	5,065	1	3	79	230	0	0	0	0	0	2	149	10.0
9-Jul	1,063	6,128	4	7	156	386	1	1	0	0	1	3	146	10.5
10-Jul	1,057	7,185	2	9	121	507	0	1	0	0	1	4	143	11.5
11-Jul	1,141	8,326	4	13	112	619	0	1	0	0	0	4	149	10.0
12-Jul	497	8,823	0	13	50	669	0	1	0	0	1	5	149	10.0
13-Jul	257	9,080	0	13	22	691	0	1	0	0	0	5	150	10.0
14-Jul	1,029	10,109	0	13	130	821	0	1	0	0	0	5	150	10.0
15-Jul	1,508	11,617	1	14	104	925	2	3	0	0	1	6	150	10.0
16-Jul	1,647	13,264	1	15	130	1,055	1	4	0	0	1	7	150	10.5
17-Jul	2,180	15,444	13	28	82	1,137	4	8	0	0	0	7	143	9.0
18-Jul	2,400	17,844	8	36	124	1,261	1	9	0	0	2	9	148	9.0
19-Jul	1,002	18,846	0	36	50	1,311	0	9	0	0	0	9	147	9.5
20-Jul	2,159	21,005	0	36	155	1,466	0	9	0	0	2	11	146	9.5
21-Jul	1,853	22,858	0	36	499	1,965	0	9	0	0	0	11	141	9.0
22-Jul	1,826	24,684	7	43	706	2,671	7	16	0	0	2	13	139	10.0
23-Jul	1,155	25,839	7	50	153	2,824	4	20	0	0	2	15	137	10.0
24-Jul	2,169	28,008	9	59	345	3,169	2	22	0	0	2	17	139	10.5
25-Jul	1,330	29,338	17	76	181	3,350	2	24	0	0	0	17	140	10.5
26-Jul	1,091	30,429	0	76	206	3,556	0	24	0	0	0	17	140	11.0
27-Jul	1,446	31,875	0	76	412	3,968	0	24	0	0	0	17	141	11.0
28-Jul	622	32,497	0	76	136	4,104	0	24	0	0	0	17	161	10.5
29-Jul	667	33,164	2	78	53	4,157	0	24	0	0	0	17	160	9.0
30-Jul	2,102	35,266	17	95	213	4,370	2	26	0	0	0	17	154	10.0
31-Jul	2,228	37,494	9	104	802	5,172	1	27	0	0	1	18	149	10.5
1-Aug	1,304	38,798	7	111	2,861	8,033	2	29	0	0	0	18	144	10.0
2-Aug	831	39,629	12	123	3,582	11,615	3	32	0	0	1	19	139	10.5
3-Aug	504	40,133	3	126	4,177	15,792	1	33	0	0	1	20	142	10.0
4-Aug	1,483	41,616	6	132	3,272	19,064	1	34	0	0	1	21	144	11.0
5-Aug	1,789	43,405	2	134	2,966	22,030	3	37	0	0	0	21	145	10.5
6-Aug	661	44,066	3	137	936	22,966	0	37	0	0	0	21	142	10.0
7-Aug	1,015	45,081	2	139	1,136	24,102	2	39	0	0	0	21	140	10.0
8-Aug	1,986	47,067	12	151	627	24,729	1	40	0	0	0	21	138	10.0

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Appendix F.–continued (page 3 of 3).

Date	Sockeye salmon Daily	Sockeye salmon Cum.	Jack sockeye salmon Daily	Jack sockeye salmon Cum.	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 (^oC)
9-Aug	2,484	49,551	15	166	551	25,280	4	44	0	0	0	21	138	10.0
10-Aug	1,283	50,834	4	170	157	25,437	3	47	0	0	0	21	138	10.0
11-Aug	660	51,494	5	175	147	25,584	1	48	0	0	0	21	143	10.0
12-Aug	563	52,057	23	198	220	25,804	0	48	0	0	0	21	152	10.0
13-Aug	1,255	53,312	11	209	858	26,662	0	48	0	0	0	21	145	10.1
14-Aug	883	54,195	1	210	959	27,621	0	48	0	0	0	21	136	10.0
15-Aug	936	55,131	6	216	1,464	29,085	0	48	0	0	1	22	134	10.0
16-Aug	1,760	56,891	1	217	1,568	30,653	1	49	0	0	0	22	134	10.5
17-Aug	909	57,800	9	226	554	31,207	0	49	0	0	0	22	130	10.5
18-Aug	854	58,654	4	230	102	31,309	0	49	0	0	0	22	135	10.0
19-Aug	505	59,159	7	237	57	31,366	0	49	0	0	0	22	156	9.9
20-Aug	757	59,916	15	252	225	31,591	0	49	0	0	0	22	146	10.0
21-Aug	1,143	61,059	13	265	928	32,519	0	49	0	0	0	22	138	10.0
22-Aug	729	61,788	4	269	619	33,138	1	50	0	0	0	22	135	10.0
23-Aug	273	62,061	2	271	62	33,200	0	50	0	0	0	22	153	10.0
24-Aug	76	62,137	2	273	6	33,206	0	50	0	0	0	22	165	9.5
25-Aug	304	62,441	4	277	182	33,388	0	50	0	0	0	22	148	10.0
26-Aug	1,299	63,740	25	302	789	34,177	0	50	0	0	0	22	142	10.0
27-Aug	841	64,581	16	318	292	34,469	0	50	0	0	0	22	138	10.0
28-Aug	80	64,661	2	320	17	34,486	0	50	0	0	0	22	160	10.0
29-Aug	547	65,208	7	327	158	34,644	0	50	0	0	0	22	143	10.0
30-Aug	1,206	66,414	13	340	423	35,067	11	61	0	0	0	22	135	10.5
31-Aug	752	67,166	12	352	509	35,576	6	67	1	1	0	22	134	10.0
1-Sep	818	67,984	7	359	805	36,381	24	91	0	1	0	22	128	9.5
2-Sep	349	68,333	4	363	627	37,008	6	97	1	2	0	22	122	10.0
3-Sep	677	69,010	7	370	1,328	38,336	22	119	1	3	0	22	119	9.2
4-Sep	593	69,603	6	376	936	39,272	13	132	0	3	0	22	120	9.5
5-Sep	333	69,936	3	379	484	39,756	10	142	0	3	0	22	116	9.5
6-Sep	352	70,288	6	385	543	40,299	8	150	2	5	0	22	116	9.5
7-Sep	375	70,663	5	390	583	40,882	14	164	3	8	0	22	116	9.5
8-Sep	459	71,122	3	393	710	41,592	21	185	3	11	0	22	117	10.5

Appendix G.–Estimated commercial harvest of Chilkoot Lake, Chilkat Lake, and other sockeye salmon stocks in the District 15 commercial drift gillnet fishery based on scale pattern analysis, 1984–2015. Other includes Chilkat River stocks.

	Harvest			Percentile rank			Percent of Harvest		
Year	Chilkoot Lake	Chilkat Lake	Other	Chilkoot Lake	Chilkat Lake	Other	Chilkat Lake	Chilkoot Lake	Other
1984	225,634	99,592	9,502	0.87	0.68	0.00	30%	67%	3%
1985	153,533	131,091	18,704	0.81	0.87	0.42	43%	51%	6%
1986	110,114	168,006	12,174	0.61	1.00	0.16	58%	38%	4%
1987	327,323	69,900	18,658	1.00	0.45	0.39	17%	79%	5%
1988	248,640	76,883	26,353	0.94	0.55	0.77	22%	71%	8%
1989	292,830	156,160	25,908	0.97	0.97	0.74	33%	62%	6%
1990	181,260	149,377	31,499	0.84	0.90	0.84	41%	50%	9%
1991	228,607	60,721	24,353	0.90	0.39	0.68	19%	73%	8%
1992	142,471	113,146	33,729	0.77	0.81	0.90	39%	49%	12%
1993	52,080	103,531	19,605	0.48	0.74	0.48	59%	30%	11%
1994	30,717	119,245	21,834	0.35	0.84	0.61	69%	18%	13%
1995	9,637	68,737	10,302	0.10	0.42	0.06	78%	11%	12%
1996	19,882	99,677	30,019	0.19	0.71	0.81	67%	13%	20%
1997	31,822	73,761	13,245	0.39	0.48	0.23	62%	27%	11%
1998	2,838	112,630	19,469	0.00	0.77	0.45	84%	2%	14%
1999	4,604	149,410	9,547	0.03	0.94	0.03	91%	3%	6%
2000	14,622	78,265	16,673	0.13	0.58	0.29	71%	13%	15%
2001	66,355	60,183	21,273	0.55	0.35	0.55	41%	45%	14%
2002	24,200	47,332	10,482	0.26	0.19	0.13	58%	30%	13%
2003	32,446	49,955	12,729	0.45	0.26	0.19	53%	34%	13%
2004	66,498	51,110	33,637	0.58	0.32	0.87	34%	44%	22%
2005	29,276	22,852	13,341	0.32	0.13	0.26	35%	45%	20%
2006	119,201	15,979	10,400	0.71	0.06	0.10	11%	82%	7%
2007	125,199	14,208	17,529	0.74	0.00	0.35	9%	80%	11%
2008	7,491	22,156	17,008	0.06	0.10	0.32	47%	16%	36%
2009	16,622	85,551	24,422	0.16	0.65	0.71	68%	13%	19%
2010	32,064	48,079	20,830	0.42	0.23	0.52	48%	32%	21%
2011	26,766	15,599	21,428	0.29	0.03	0.58	24%	42%	34%
2012	115,509	50,774	40,854	0.68	0.29	0.97	24%	55%	20%
2013	23,111	75,588	23,404	0.23	0.52	0.65	62%	19%	19%
2014	110,487	81,502	42,693	0.65	0.61	1.00	35%	47%	18%
2015	58,568	33,085	39,924	0.52	0.16	0.94	25%	45%	30%
Average	91,575	78,253	21,610				46%	40%	14%
Median	55,324	74,675	20,218				42%	43%	13%
Lower Quartile	23,928	49,486	13,317				29%	19%	8%
Upper Quartile	129,517	105,806	26,019				62%	52%	19%

Appendix H.–Annual Chilkoot Lake sockeye salmon escapements based on weir counts, and estimated harvests (commercial, sport, and subsistence), total runs, and harvest rates, 1976–2015.

	Escapement goal range			Harvest					
Year	Lower	Upper	Escapement estimate	Commercial	Sport	Subsistence	Total	Total run	Harvest Rate (%)
1976	80,000	100,000	71,291	62,452	ND	ND	62,452	133,743	47%
1977	80,000	100,000	97,368	113,313	400	ND	113,713	211,081	54%
1978	80,000	100,000	35,454	14,264	500	ND	14,764	50,218	29%
1979	80,000	100,000	96,122	69,864	300	ND	70,164	166,286	42%
1980	80,000	100,000	98,673	20,846	700	ND	21,546	120,219	18%
1981	60,000	80,000	84,047	43,792	1,200	ND	44,992	129,039	35%
1982	60,000	80,000	103,038	144,592	800	ND	145,392	248,430	59%
1983	60,000	80,000	80,141	241,469	600	ND	242,069	322,210	75%
1984	60,000	80,000	100,781	225,634	1,000	ND	232,792	333,573	70%
1985	60,000	80,000	69,141	153,533	1,100	1,055	155,688	224,829	69%
1986	60,000	80,000	88,024	110,114	3,000	1,640	114,754	202,778	57%
1987	60,000	80,000	94,208	327,323	1,700	1,237	330,260	424,468	78%
1988	60,000	80,000	81,274	248,640	300	1013	249,953	331,227	75%
1989	60,000	80,000	54,900	292,830	900	2,055	295,785	350,685	84%
1990	50,500	91,500	76,119	181,260	2,600	2,391	186,251	262,370	71%
1991	50,500	91,500	92,375	228,607	600	4,399	233,606	325,981	72%
1992	50,500	91,500	77,601	142,471	500	4,104	147,075	224,676	65%
1993	50,500	91,500	52,080	52,080	100	2,896	55,076	107,156	51%
1994	50,500	91,500	37,007	30,717	400	1,592	32,709	69,716	47%
1995	50,500	91,500	7,177	9,637	200	384	10,221	17,398	59%
1996	50,500	91,500	50,741	19,882	400	2,311	22,593	73,334	31%
1997	50,500	91,500	44,254	31,822	500	1,784	34,106	78,360	44%
1998	50,500	91,500	12,335	2,838	closed	160	2,998	15,333	20%
1999	50,500	91,500	19,284	4,604	closed	115	4,719	24,003	20%
2000	50,500	91,500	43,555	14,622	400	252	15,274	58,829	26%
2001	50,500	91,500	76,283	66,355	2,300	1,499	70,154	146,437	48%
2002	50,500	91,500	58,361	24,200	1,500	1,258	26,958	85,319	32%
2003	50,500	91,500	75,065	32,446	1,500	2,091	36,037	111,102	32%
2004	50,500	91,500	77,660	66,498	889	1,766	69,153	146,813	47%
2005	50,500	91,500	51,178	29,276	566	1,427	31,269	82,447	38%
2006	50,000	90,000	96,203	119,201	520	2,279	122,000	218,203	56%
2007	50,000	90,000	72,678	125,199	303	3,290	128,792	201,470	64%
2008	50,000	90,000	33,117	7,491	298	1,894	9,683	42,800	23%
2009	38,000	86,000	33,705	17,038	165	892	18,095	51,800	35%
2010	38,000	86,000	71,657	32,064	567	2,251	34,882	106,539	33%
2011	38,000	86,000	65,915	26,766	973	1,977	29,716	95,631	31%
2012	38,000	86,000	118,166	115,509	1,025	3,080	119,614	237,780	50%
2013	38,000	86,000	46,329	23,111	204	2,439	25,754	72,083	36%
2014	38,000	86,000	105,713	110,487	318	3,231	114,036	219,749	52%
2015	38,000	86,000	71,515	58,568	**800**	**1,704**	61,072	132,587	46%
Average			68,013	91,035	814	1,886	93,404	161,418	48%
Median			72,168	62,462	584	1,835	65,113	139,512	48%
Lower Quartile			49,638	23,928	400	1,248	26,657	77,104	33%
Upper Quartile			89,112	129,517	1,000	2,351	132,942	224,714	60%

Note: Bold estimates are preliminary.

Appendix I.–Historical age composition of the Chilkoot Lake sockeye salmon escapement, weighted by statistical week, 1982–2015.

		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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Appendix I.–continued (page 2 of 6).

		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
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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Appendix I.–continued (page 3 of 6).

Year	Weighted by Stat. Week	Age Class 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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Appendix I.–continued (page 4 of 6).

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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		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
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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Appendix I.–continued (page 6 of 6).

Year	Weighted by Stat. Week	Age Class 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
2013	Escapement by Age Class	0	0	0	0	0	13,563	2,821	0	0	22,493	5,908	102	1,383	59	46,329
	SE of Number	0	0	0	0	0	800	445	0	0	876	566	102	261	59	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	29.3%	6.1%	0.0%	0.0%	48.6%	12.8%	0.2%	3.0%	0.1%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	1.0%	0.0%	0.0%	1.9%	1.2%	0.2%	0.6%	0.1%	
	Sample size	0	0	0	0	0	452	71	0	0	826	208	1	58	1	1,617
2014	Escapement by Age Class	0	0	0	0	0	28,533	5,901	0	0	64,114	6,769	0	116	0	105,467
	SE of Number	0	0	0	0	0	1,314	677	0	0	1,403	678	0	54	0	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	27.1%	5.6%	0.0%	0.0%	60.8%	6.4%	0.0%	0.1%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.6%	0.0%	0.0%	1.3%	0.6%	0.0%	0.1%	0.0%	
	Sample size	0	0	0	0	0	421	101	0	0	1,503	150	0	5	0	2,181
2015	Escapement by Age Class	0	0	0	0	0	11,065	1,496	0	9	53,959	4,405	0	180	7	71,122
	SE of Number	0	0	0	0	0	749	301	0	9	885	503	0	105	6	
	Proportion by Age Class	0.0%	0.0%	0.0%	0.0%	0.0%	15.6%	2.1%	0.0%	0.0%	75.9%	6.2%	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%	0.7%	0.0%	0.1%	0.0%	
	Sample size	0	0	0	0	0	211	28	0	1	1,253	100	0	3	1	1,597

Appendix J.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon, by age class, 1982–2015.

Year	Sample size	Mean length (mm) by age class											
		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	–	–	–	–
1983	1,790	572	377	455	573	595	420	474	567	–	–	–	–
1984	1,901	–	–	461	571	600	–	470	570	–	–	–	–
1985	1,623	–	320	471	569	604	–	476	565	608	–	470	–
1986	2,146	–	410	472	582	611	–	485	581	618	–	–	565
1987	2,207	–	–	468	583	593	–	472	582	596	–	–	560
1988	2,658	–	–	496	578	604	–	499	575	590	–	–	565
1989	2,584	–	–	468	580	604	–	480	576	592	–	–	569
1990	2,815	–	–	467	579	607	–	497	577	596	–	490	580
1991	2,293	–	–	481	565	616	–	477	565	583	–	–	550
1992	2,038	575	–	471	570	596	–	470	571	595	–	508	565
1993	2,073	–	–	487	575	583	–	506	573	565	550	–	550
1994	1,985	540	–	471	568	596	–	489	569	582	–	450	610
1995	605	–	–	496	571	594	–	506	573	608	–	–	–
1996	2,042	635	–	509	589	611	–	514	585	–	–	490	–
1997	2,107	565	–	508	577	577	–	508	569	–	–	–	575
1998	936	–	–	492	572	574	–	514	570	605	–	–	595
1999	2,030	–	–	491	578	579	–	512	574	605	–	–	–
2000	2,211	–	–	508	582	582	–	505	583	425	–	–	–
2001	2,344	562	–	494	581	560	–	527	574	–	–	–	–
2002	2,834	–	–	479	584	615	–	482	579	–	–	–	–
2003	2,605	–	–	494	577	590	–	496	578	574	–	–	–
2004	2,711	–	–	503	573	547	–	500	570	–	–	–	–
2005	2,728	–	–	488	567	606	–	490	561	–	–	–	–
2006	2,577	595	–	487	561	560	–	499	560	550	–	–	–
2007	2,962	–	–	487	574	587	–	503	572	–	–	–	–
2008	1,057	580	–	498	577	597	–	538	576	597	–	–	–
2009	1,840	–	–	492	578	578	–	501	577	–	–	–	–
2010	2,482	–	–	487	568	583	–	487	565	–	–	507	–
2011	2,568	580	–	498	576	563	–	507	573	620	–	–	570
2012	2,423	–	–	497	575	579	–	507	570	–	–	–	–
2013	1,617	–	–	492	567	592	–	498	566	550	–	–	560
2014	2,181	–	–	486	567	569	–	490	567		–	–	–
2015	1,597	565	–	463	543	542	–	465	546	615	–	–	–
Average	2,126	581	369	485	574	589	420	495	572	584	550	486	570

Appendix K.–Chilkoot Lake zooplankton abundance summary from 1987 to 2015. All stations were averaged and species combined.

			Monthly mean density (no./m^2)									
Lab	Stations	Year	Apr	May	June	July	Aug	Sep	Oct	Nov	Seasonal Mean	Biomass (mg/m^2)
Soldotna	2	1987	ND	74,291	166,794	247,623	131,559	246,859	166,645	124,109	165,411	207
Soldotna	2	1988	ND	129,840	304,596	105,239	76,223	135,953	36,827	3,481	113,165	147
Soldotna	2	1989	ND	50,073	13,001	155,720	15,506	11,505	35,430	11,080	41,759	136
Soldotna	2	1990	ND	113,496	62,426	101,715	37,857	21,035	8,877	9,871	47,157	146
Soldotna	2	1991	ND	20,110	9,493	3,906	6,113	2,853	16,030	ND	9,751	25

Soldotna	4	1995	ND	ND	46,778	36,755	25,081	ND	ND	3,178	27,948	85
Soldotna	4	1996	ND	76,537	76,728	54,180	37,528	10,103	3,354	ND	47,644	143
Soldotna	4	1997	ND	32,320	43,522	8,287	6,818	3,136	4,136	ND	16,229	46
Soldotna	4	1998	118,331	99,399	72,667	23,930	2,547	6,801	3,129	ND	48,139	91
Soldotna	4	1999	ND	22,202	28,163	13,661	12,961	12,854	9,637	ND	16,580	46
Soldotna	4	2000	ND	102,706	67,418	105,175	62,123	22,778	12,738	ND	62,156	196
Soldotna	4	2001	ND	190,588	127,123	102,203	60,516	20,052	7,149	ND	84,605	243
Soldotna	4	2002	ND	148,739	76,142	84,416	44,723	34,841	11,360	ND	66,704	194
Soldotna	4	2003	ND	72,126	58,403	41,696	34,344	27,645	ND	ND	46,299	155
Kodiak	4	2004	322,445	204,279	114,239	103,138	77,528	60,430	41,911	ND	131,996	219
Kodiak	4	2005	569	2,433	3,212	6,392	4,035	3,362	1,675	ND	3,222	8
Kodiak	4	2006	119,545	100,484	54,169	103,498	49,032	53,999	ND	ND	78,358	211
Kodiak	4	2007	ND	106,593	29,610	6,018	8,639	20,080	31,563	ND	33,751	33
Kodiak	2	2008	ND	90,784	181,865	215,996	167,304	94,753	ND	ND	156,727	314
Kodiak	2	2009	ND	29,822	19,910	18,552	19,528	15,666	ND	ND	20,020	45
Kodiak	2	2010	ND	121,519	56,207	43,301	50,582	68,731	119,503	ND	79,964	142
Kodiak	2	2011	ND	79,789	68,963	64,187	111,411	144,698	ND	ND	93,810	212
Kodiak	2	2012	ND	125,212	112,583	18,785	40,160	60,792	137,035	ND	82,428	164
Kodiak	2	2013	ND	81,954	30,298	44,044	52,429	89,129	64,922	ND	60,462	93
Kodiak	2	2014	ND	168,620	147,203	148,561	137,800	137,291	218,926	ND	159,733	441
Kodiak	2	2015	484,972	97,045	211,836 [a]	156,308	75,904	30,735	90,338	ND	171,361	562

Note: The majority of the species present were *Cyclops* sp. and Ovig. *Cyclops.* Nauplii were not enumerated in lab samples until 2002.

[a] Stations were not averaged in June 2015. Only Station 2A was used, because the Station 1A sample was about 4 times larger than any other sample since 1987.