Fishery Data Series No. 21-18

Stock Assessment Study of Chilkoot Lake Sockeye Salmon, 2016–2019

by

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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)

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	$\geq$
harvest per unit effort	HPUE
less than	$<$
less than or equal to	$\leq$
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 2016 to 2019, the Alaska Department of Fish and Game, Division of Commercial Fisheries, continued a stock assessment program that began 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 86,721 fish in 2016, 43,098 fish in 2017, 85,463 fish in 2018, and 140,378 fish in 2019, all of which fell within or exceeded the sustainable escapement goal range of 38,000–86,000 fish. Ocean-age-3 sockeye salmon (ages 1.3 and 2.3 combined) of both sexes were the shortest in length since scale sampling began in 1982. The stock compositions of sockeye salmon harvested annually in the District 15 commercial drift gillnet fishery were estimated through scale pattern analysis (2016) and genetic stock identification (2017–2019). Estimated commercial harvests of Chilkoot Lake sockeye salmon were 119,843 fish in 2016, 1,933 fish in 2017, 33,969 fish in 2018, and 149,586 fish in 2019. Estimated harvest rates (including subsistence and sport harvests) were 59% in 2016, 9% in 2017, 31% in 2018, and 52% in 2019. Estimated fall sockeye salmon fry populations at Chilkoot Lake were 42% above average in 2016, 45% below average in 2017, and at or slightly below average in 2018 and 2019, respectively. Average May–September zooplankton density and biomass at Chilkoot Lake were nearly double the long-term average, and zooplankton density in 2019 and biomass in 2016 were the highest recorded since sampling began in 1987.

Keywords: Chilkoot Lake, Chilkoot River, commercial harvest, escapement, enumeration weir, hydroacoustic survey, *Oncorhynchus nerka*, scale pattern analysis, genetic stock identification, sockeye salmon, sustainable escapement goal, zooplankton

INTRODUCTION

The Chilkoot and Chilkat River watersheds, located in northern Southeast Alaska near the town of Haines, support 2 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 the Chilkat and Chilkoot River watersheds (Rich and Ball 1933). Harvests decreased in the early 1920s and remained at relatively low levels thereafter (Eggers et al. 2009). 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 now takes place. District 15 encompasses Section 15-A (north Lynn Canal), Section 15-B (Berners Bay), and Section 15-C (central Lynn Canal; Figure 1). Historically, the sockeye salmon was the primary species targeted from late June through September (McPherson 1990). In recent decades, however, fishing effort has shifted to Section 15-C to harvest substantial hatchery summer chum salmon (*O. keta*) runs to Douglas Island Pink and Chum, Inc. (DIPAC) release sites at Boat Harbor and Amalga Harbor Terminal Harvest Areas (THAs), which have attracted record-level effort (Bednarski et al. 2016; Gray et al. 2017). The fall fishery is managed to target wild fall-run chum and coho *(O. kisutch*) salmon. Following a sharp decline in Chilkat River fall-run chum salmon runs in the early 1990s, management of the fall fishery shifted abruptly from an emphasis on harvesting chum salmon to exploiting abundant coho salmon runs (Shaul et al. 2017).

The annual harvest of sockeye salmon in the District 15 commercial drift gillnet fishery averaged 192,000 fish from 1984 to 2015, of which an average 79,000 fish originated from Chilkat Lake, 92,000 originated from Chilkoot Lake, and the remainder were of mixed stock origin (Bednarski et al. 2016). 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 (Ingledue 1989; Gilk-Baumer et al. 2015). 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, where reported harvests for the period 2010–2019 averaged 3,000 fish per year.

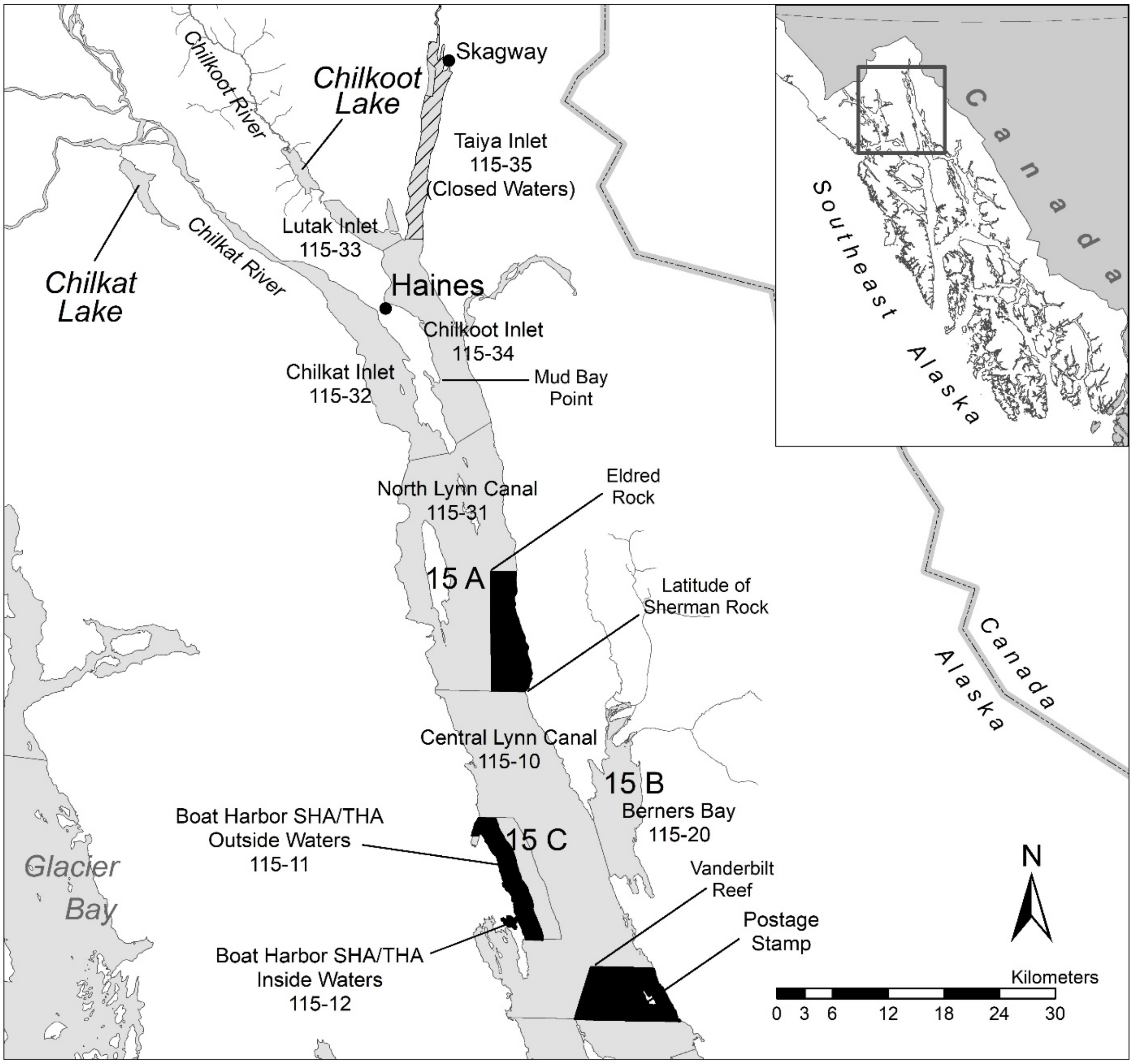

Figure 1.–Haines Management Area with sections and statistical areas for the District 15 commercial drift gillnet fishery. Early in the 2018 and 2019 seasons, the fishery was restricted to the black shaded areas in accordance with management actions implemented in the 2018 Chilkat River Chinook salmon action plan (Lum and Fair 2018) and the 2019 Southeast Alaska drift gillnet fishery management plan (Gray et al. 2019) that were designed to reduce commercial harvest of Chilkat River Chinook salmon.

The stock composition of the sockeye salmon harvest in the District 15 commercial drift gillnet fishery has been estimated from scale pattern analysis and, more recently, genetic stock identification (Bednarski et al. 2017). These projects provided information regarding stock contribution (stratified by time), run timing, and age composition. The Alaska Department of Fish and Game (ADF&G) initiated a scale pattern analysis program in 1980 to estimate the contribution of Chilkat Lake, Chilkoot Lake, and "other" sockeye salmon stocks to the District 15 commercial drift gillnet fishery harvest. Bergander (1974) first developed a dichotomous key 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 were only conducted in the early 1990s. However, historical stock-specific harvest estimates based solely on visual classification were considered to be highly accurate due to consistent differences in freshwater scale patterns, 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).

Although accurate, scale pattern analysis required highly skilled personnel trained in very specific pattern recognition, which could take years to master, and required intensive field sampling and inseason analysis of a very large number of scale samples (Bednarski et al. 2017), whereas genetic stock identification methods are standardized and used widely throughout the state (Shedd et al. 2016). Multiple blind tests conducted by the Northern Boundary Technical Committee of the Pacific Salmon Commission (years 2003, 2009) and by ADF&G (Lynn Canal, years 2015–2016) indicated that the 2 methods offered similar estimates of salmon stock contribution but that the genetic techniques were able to discriminate stocks at a finer resolution in less time compared to scale pattern analysis (Anne Reynolds-Manney, ADF&G fisheries biologist, unpublished data[1]). As a result, stock composition of sockeye salmon harvests in the District 15 commercial drift gillnet fishery have been estimated solely through genetic stock identification since 2017 (Bednarski et al. 2017).

Chilkoot Lake sockeye salmon escapements have been counted and sampled annually at an adult counting weir on the Chilkoot River since 1976 (Bachman and Sogge 2006; Bachman et al. 2013 and 2014; Bednarski et al. 2016; Brenner et al. 2018). Historically, the run had 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 81,000 sockeye salmon through 1993 but declined to an average of only 28,000 fish from 1994 to 1999. Weir counts later rebounded to an average of 62,000 sockeye salmon from 2000 to 2009 and an average of 83,000 fish from 2010 to 2019. 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, prior to 2017, 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

[1] Reynolds Manney, A. M. Lynn Canal sockeye stock identification. Saltonstall-Kennedy final performance report, July 1, 2015 through June 30, 2017, NOAA Cooperative Agreement No. NA15NMF4270274, September 22, 2017.

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, along with weekly escapement targets, was established in 2009 based on an updated stock-recruit analysis by Eggers et al. (2009). The escapement goal was subsequently reviewed by Brenner et al. (2018), who recommended maintaining the current sustainable escapement goal and weekly escapement targets.

The primary purpose of the sockeye salmon stock assessment program was to estimate escapement and commercial harvest of Chilkoot Lake sockeye salmon. Information provided by this project, in conjunction with stock assessment projects on the adjacent Chilkat River (Sogge and Bachman 2014; Rhea-Fournier et al. 2018), 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 and it 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 originates 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.

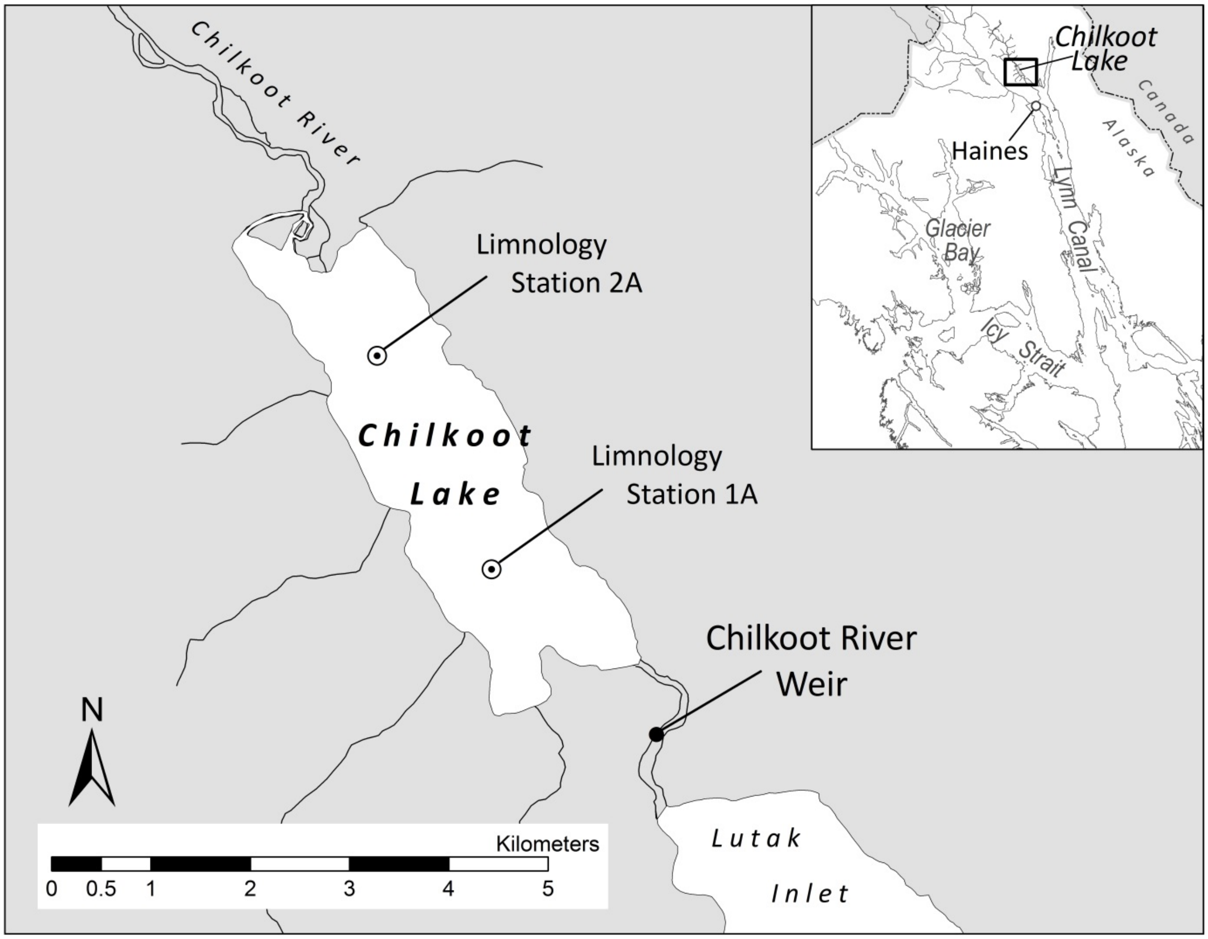

Figure 2.–Map showing Lutak Inlet, Chilkoot Lake, and the location of the limnology stations and salmon counting weir.

OBJECTIVES

Primary Objectives:

1. Enumerate adult salmon by species through the Chilkoot River weir from the first week of June to the second week of September.
2. Estimate the seasonal age, sex, and length composition of the Chilkoot River sockeye salmon escapement such that the estimated proportions are within 5% of the true value with at least 95% probability.
3. Estimate the weekly and annual stock composition of the sockeye salmon harvest by age in the District 15 commercial drift gillnet fishery in 2016 using visual scale pattern analysis.
4. Estimate the weekly stock composition of the sockeye salmon harvest in the District 15 commercial drift gillnet fishery during 2017–2019 using genetic stock identification, such that the estimates are within 7% of the true value with at least 90% probability.
5. Estimate the seasonal age-specific stock composition of the sockeye salmon harvest in the District 15 commercial drift gillnet fishery for major age classes (i.e., those contributing >0.5%; ages 0.3, 1.2, 1.3, 2.2, and 2.3) and "other" age classes combined (e.g., minor age classes, such as ages 1.4, 2.4, 3.3).

Secondary Objectives:

1. 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.
2. Measure water column temperature, record light penetration profiles, and estimate zooplankton species composition, size, density, and biomass in Chilkoot Lake on a monthly basis during the middle of the month, May–September.

METHODS

ESCAPEMENT

The Chilkoot Lake adult salmon escapement was counted through a weir located in the Chilkoot River 1 km downstream from Chilkoot Lake. The weir was operated from at least the first week of June through the second week of September each year. 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. A fish trap, recovery box, counting station, and sampling stations were installed near the center of the weir structure.

In order to minimize handling, most fish were passed by temporarily removing up to 4 pickets at a counting station located between 2 weir-mounted counting chairs near the center of the weir. Fish were counted by species as they passed through the opening. To facilitate identification and enumeration of fish, white plywood panels were stacked in front of and below the opening to force fish higher in the water column as they passed upstream. Fish were trapped or caught with a dip net as they passed through the counting station in the weir and sampled for age, sex, and length. 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 fish recuperated, they exited the recovery box by swimming through a large hole in the side of the box.

Stream height and water temperature were recorded at approximately 6:30 am 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.

Weir Passage Estimates

In some years, brief periods of flooding required removal of pickets to prevent structural damage to the weir, and therefore upstream salmon passage had to be estimated for days the weir was inoperable. Estimates were assumed to be zero if passage was probably 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 one 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-1}) and the 2 days after (n_a and n_{a+1}) the missed day:

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

When the weir was not operated for a period of 3 or more days, passage estimates for the missed days were calculated using linear interpolation. This method was appropriate for short periods of inoperability when fish passage was reasonably assumed to have a linear relationship with time. Average fish counts from the 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:

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

ESCAPEMENT AGE, SEX, AND LENGTH COMPOSITION

The seasonal age composition of the Chilkoot Lake sockeye salmon escapement was determined from a minimum sample of 665 fish captured at the weir. This sample size was based on work by Thompson (2002) to estimate proportions of 4 or more major age classes. A sample of 510 fish is needed to ensure the estimated proportion of each major age class will be within 5% of the true value with at least 95% probability. The sample size was increased to 665 fish to ensure the sampling goal will be met, even if age cannot be determined from 30% of the sampled fish. In addition, beginning in 2017, 3 scales were sampled from each fish to increase the proportion of readable scales.

In 2016, scale samples were collected at the weir from a daily sample of 40 sockeye salmon (Sogge 2016). 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 was far above the number required 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. In 2016, one scale per fish was taken from the preferred area above the lateral line on the left side of the fish on a diagonal downward from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (INPFC 1963) and placed on a gum card. Date of sample, sex, length, and data regarding the condition of each fish were recorded on standard optical scan forms.

Scale sampling goals were reduced starting in 2017, when escapement samples were no longer required to provide known-origin samples for scale pattern analysis. Up to 10 sockeye salmon (70 fish/week) were sampled for matched scales, sex, and length data each morning, and three scales were collected from each sampled fish. This sampling goal was sufficient to meet the objective criteria for estimating age composition because the total seasonal sample typically exceeded the goal of 665 samples. This sample size also met seasonal sex and length composition requirements, because only 385 samples (assuming no data loss) were needed to achieve the precision criteria (within 5% of the true value 95% of the time) for estimating sex composition (Thompson 2002).

Scale samples were analyzed at the ADF&G Region 1 Scale 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). Age, length, and sex data were entered into the Region 1 Commercial Fisheries Database by Douglas staff. The weekly age distribution, the seasonal age distribution weighted by week, and the mean length by age and sex weighted by week were calculated using standard sampling summary statistics from Cochran (1977; Appendix A).

COMMERCIAL HARVEST ESTIMATE

The stock composition of sockeye salmon harvested in the District 15 commercial drift gillnet fishery was determined by visual scale pattern analysis from 1976 to 2016 and by genetic stock identification from 2017 onward (Bednarski et al. 2016). The District 15 commercial drift gillnet fishery season typically begins at 12:00 noon on the third Sunday of June. Openings are then conducted weekly starting at 12:00 noon on Sunday. Each week typically begins with a 48-hour opening, with the possibility of an extension depending on fishery performance. Commercial harvest data for the District 15 commercial drift gillnet fishery, stratified by statistical week, were obtained from the Region 1 Commercial Fisheries Database. ADF&G statistical weeks begin on Sunday at 12:01 am and end the following Saturday at midnight and are numbered sequentially starting from the beginning of the calendar year (Appendix B).

Fishery Sampling

Matched sockeye salmon scale and genetic tissue samples were collected from District 15 commercial drift gillnet fishery landings by ADF&G port sampling personnel primarily at fish processing facilities in Excursion Inlet and Juneau (Buettner et al. 2017), and also at Petersburg's processing facility in 2018 and 2019. Sampling was stratified by statistical week, and sampling effort spanned the first 10 weeks of the fishery. During the previous 10 years, 2006–2015, an average 92% of the sockeye salmon harvest occurred during the first 10 weeks of the fishery. In 2016 and 2017, sampling goals were set at 600 fish per week (300 at Excursion Inlet and 300 at Juneau; Buettner et al. 2017). In 2018 and 2019, sampling goals were set at 150 fish each from Juneau and Excursion Inlet, and 100 fish from Petersburg. If Excursion Inlet or Juneau were short of samples in a given week, more were collected from Petersburg. A sample of 510 fish was sufficient to describe the weekly estimated sockeye salmon age composition within 5% of the true proportion with at least 95% probability. In addition, according to sample theory, under the worst-case scenario (stocks contributing equal proportions) a minimum sample of 200 fish should provide weekly estimates of relative stock composition proportions within 7% of the true value 90% of the time (Thompson 1987).

Starting in 2018, sockeye salmon harvested in the District 15 commercial drift gillnet fishery were sampled regardless of the harvest type and all samples were recorded as traditional harvest (harvest code 11). Previously, sockeye salmon harvested in the Boat Harbor terminal harvest area (THA; statistical area 115-11) were not sampled, including sockeye salmon on tenders with fish mixed from traditional and terminal harvest (harvest code 12) fisheries. The Boat Harbor THA is designated to harvest hatchery chum salmon released inside Boat Harbor; however, the THA encompasses a portion of central Lynn Canal (Figure 1) through which mixed stocks of sockeye salmon must migrate, and sockeye salmon are harvested incidentally in the fishery. Over the 10 years 2008–2017, an average 21% (range: 12–36%) of sockeye salmon harvested in central Lynn Canal (statistical areas 115-10 and 115-11) were harvested in the Boat Harbor THA. Since 2018, all sockeye salmon samples have been identified as harvest code 11.

Sampling protocols ensured that samples were as representative of harvests as possible to account for fluctuations in harvest and effort over the course of a weekly fishery. Deliveries with harvests mixed from more than one gear type or fishing district were not sampled, no more than 40 samples were collected from a single delivery, no more than 200 samples were collected from a single tender delivery, samples were collected without regard to size or sex of fish, 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 one 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 escapement samples.

Scale Pattern Analysis

The general methods of District 15 scale pattern analysis remained unchanged from the mid-1980s through 2016: 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 (McPherson and Olson 1992). Known-origin scale samples were collected weekly from sockeye salmon at the Chilkoot River weir (this study), at Chilkat Lake, and from Chilkat River mainstem spawning populations (Rhea-Fournier et al. 2018). 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 scale aging laboratory following procedures described above for escapement samples.

Known-origin scale samples were analyzed inseason on a weekly basis at the ADF&G scale aging laboratory, 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 principal 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. The stock proportions in the last sampled statistical week in 2016 (statistical week 35) were used to estimate contribution for the final weeks of the fishery, statistical weeks 35–40, which accounted for 2% of the sockeye salmon harvest.

Genetic Stock Identification

Beginning in 2017, stock composition of the sockeye salmon harvest in the District 15 commercial drift gillnet fishery was estimated through genetic stock identification. Laboratory analysis, including quality control, was performed by the ADF&G Gene Conservation Laboratory following methods outlined in Dann et al. (2012). Sockeye salmon were identified to 7 reporting groups: Chilkat Lake, Chilkat mainstem, Chilkoot Lake, Juneau mainland, Snettisham, Taku River/Stikine mainstem, and Other; however, reporting groups were reduced to Chilkat Lake, Chilkoot Lake, and Other for postseason reporting (Appendix C; Zeiser et al. 2019). Stock composition was estimated inseason for each statistical week using a Bayesian mixed stock analysis (MSA) approach as implemented in the R package *rubias*[2] (Moran and Anderson 2019), which compared

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[2] R Development Core Team. 2019. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

fishery samples against the genetic baseline described in Rogers Olive et al. (2018). Postseason, samples were reanalyzed with age composition data from the harvest using Mark and Age-enhanced Genetic Mixture Analysis (MAGMA), an extension of the Pella-Masuda genetic stock identification model (Pella and Masuda 2001) that incorporates ages from matched scale samples to provide age-specific stock composition estimates for all major contributing age classes (i.e., those contributing >0.5%). MAGMA was used to analyze stock composition in the first ten statistical weeks of the sockeye salmon fishery. The stock proportions in the last sampled statistical week were used to estimate contribution for the final weeks of the fishery, generally statistical weeks 35–40, which accounted for an average 9% (range 3–15%) of the sockeye salmon harvest during 2017–2019.

Laboratory Analysis

Genomic DNA was extracted from tissue samples using a NucleoSpin 96 Tissue Kit by Macherey-Nagel (Düren, Germany). A multiplexed preamplification polymerase chain reaction (PCR) of 48 screened single nucleotide polymorphism (SNP) markers was used to increase the concentration of template DNA. Samples were genotyped for 48 screened SNP markers using two sets of Fluidigm 192.24 Dynamic ArrayTM Integrated Fluidic Circuits, which systematically combined up to 24 assays and 192 samples into 4,608 parallel reactions (https://www.fluidigm.com). The Dynamic Arrays were read on a Fluidigm EP1 System after amplification and scored using Fluidigm SNP Genotyping Analysis software. If necessary, SNPs were rescreened on a QuantStudio 12K Flex Real-Time PCR System (Life Technologies) as a backup method for assaying genotypes. Genotypes were imported and archived in the Gene Conservation Laboratory Oracle database, LOKI.

A quality control (QC) analysis was conducted postseason to identify laboratory errors and to measure the background discrepancy rate of the genotyping process. The QC analyses were performed by staff not involved in the original genotyping as described in detail by Dann et al. (2012). Briefly, the method consisted of re-extracting 8% of project fish and genotyping them for the same SNPs assayed in the original genotyping process. Discrepancy rates were calculated as the number of conflicting genotypes, divided by the total number of genotypes compared. These rates describe the difference between original project data and QC data for all SNPs and can identify extraction, assay plate, and genotyping errors. Assuming that discrepancies among analyses are due equally to errors during the original genotyping and during QC, error rates in the original genotyping was estimated as half the rate of discrepancies. If there were many discrepancies, a duplicate check was performed to determine if the QC fish were a better match to any other project fish. A QC fish matching other project fish would indicate that fish were swapped during the extraction process. This information was used to identify which, and how many, fish should be re-extracted.

Statistical Analysis

Genotypes in the LOKI database were imported into the statistical program R for analysis. Prior to statistical analysis, 3 statistical quality control analyses were performed to ensure high-quality data: 1) individuals missing >20% of their genotype data (markers) were identified and removed from analyses because this is indicative of low-quality DNA (80% rule; Dann et al. 2012); 2) duplicate individuals were identified and removed; and 3) non-sockeye salmon were identified and removed.

Stock composition for each stratum was estimated using the R package *rubias*. Markov Chain Monte Carlo (MCMC) methods, using a single chain with starting values equal among all populations, formed the posterior distribution that described the stock composition of each stratum. Summary statistics were tabulated from these distributions to describe stock compositions. Stock composition estimates of commercial harvest were applied to observed harvest (obtained from fish ticket data) to quantify stock-specific harvests within each week. Postseason, age-specific stock composition for all major contributing age classes (>0.5%) was estimated seasonally through a MAGMA model. Weekly and seasonal estimates were provided, by age group, using MAGMA. This method requires 2 sets of parameters: 1) a vector of stock compositions summing to 1 weighted by harvest per stratum; and 2) a matrix of age composition, with a row for each stock summing to 1 and a column for each age class. This information was "completed" iteratively by stochastically assigning each fish to a population, then estimating the stock proportions based on summaries of assignment from each iteration. In this process, all available information (i.e., age and genotype) was used to assign individuals to stock of origin.

To initialize the algorithm, all fish with unknown origin or age were stochastically assigned to a population or age group, and then proportions for populations and age groups were estimated in the following steps:

1) All age data were summarized by assigned and observed populations for both wild and hatchery individuals;
2) Population and age compositions were estimated from previous summaries (accounting for sampling error);
3) Each wild fish with genotypes was stochastically assigned to a wild population of origin based on the product of its genotypic frequency, age frequency, and population proportion;
4) Each wild fish without genotypes was stochastically assigned to a population of origin based on the product of its age frequency and population proportion; and
5) Steps 1–4 were repeated while updating the estimates of the stock proportions and age compositions with each iteration.

This algorithm was run for 40,000 repetitions, and the first 20,000 repetitions were discarded to eliminate the effect of the initial state. Five MCMC chains were run and checked for convergence among chains using the Gelman-Rubin convergence diagnostic (Gelman and Rubin 1992; Brooks and Gelman 1998). The point estimates and credible intervals for stock-specific age compositions were summary statistics of the output.

FRY POPULATION ESTIMATE

Hydroacoustic 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, 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 between early October and mid-November, and a midwater trawl survey was performed in 2019 to examine species composition.

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. The ping rate was set to 5 pings/sec and the pulse width was set to 0.3 ms. Surveys were conducted at a constant boat speed of about 2.0 m/sec. 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 $\widehat{M}_{ij}$ (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:

$$\widehat{N}_{ij} = a_i \widehat{M}_{ij}, \quad (3)$$

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 ($\widehat{N}_i$) across each section was estimated from the mean abundance of the replicate transects j in section i,

$$\widehat{N}_i = J^{-1} \sum_{j=1}^{J} \widehat{N}_{ij}, \quad (4)$$

with variance

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

The sum of the 6 section estimates ($\widehat{N}_i$) provided an estimate of total targets for the entire lake ($\widehat{N}$). 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 one section to the other during surveys), the sample variance of the estimate of the total targets in the entire lake, $v(\widehat{N})$, was estimated by summing the sample variances $v(\widehat{N}_i)$ 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 12 years from 2004 to 2015 (Sogge 2016).

Historically, estimates of total targets were partitioned into species categories based on the proportion of each species captured in annual midwater trawls. A 2 m × 2 m elongated trawl net was used to capture pelagic fish and estimate species composition (Riffe 2006). Four to six 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. Beginning in 2015, the frequency of the trawl surveys was reduced because the vast majority of fish captured in past trawl surveys were sockeye salmon fry (median = 99%; n = 26 years; Bednarski et al. 2016). The most recent trawl, conducted in 2019, was performed to ensure that species composition in the lake had not changed markedly since 2014.

LIMNOLOGICAL ASSESSMENT

Basic limnological data, including zooplankton, light, and temperature sampling, were collected monthly between May and October. Since 2008, all limnological sampling has been conducted at stations 1A (59° 21.88′ N, 135° 36.64′ W) and 2A (59° 20.81′ N, 135° 35.79′ W; Figure 2), which are marked by anchored buoys in the lake (Bednarski et al. 2016; Zeiser et al. 2019). The stations were marked by anchored buoys at the beginning of the season using a GPS navigational device. Results were averaged between stations by month and season, and the season was standardized to May–September average to be comparable over all years.

Light and Temperature Profiles

Light penetration measurements were used to estimate the euphotic zone depth (EZD) of the lake, defined as the depth at which light (photosynthetically available radiation at 400–700 nm) is attenuated to 1% of the intensity just below the lake surface (Schindler 1971). Photometric illuminance was recorded as lumens per square meter (lm/m^2) at 0.5 m intervals, from just below the lake surface to the depth at which ambient light level equals 1% of the subsurface recording. The natural log of the ratio of light intensity I just below the surface (I_0) to light intensity at depth Z, or $\ln(I_0/I_Z)$, was calculated for each depth. The vertical light extinction coefficient (K_d), the rate (m^{-1}) at which light dims with increasing depth, was estimated as the slope of the regression of $\ln(I_0/I_z)$ versus depth, and EZD was calculated as $4.6502/K_d$ (Kirk 1994; Edmundson et al. 2000). Only the measurements recorded from 5 cm below the surface to just below 1% of the subsurface light level were used in the calculations, because use of data at depths below 1% of the initial subsurface measurement would skew the estimate of EZD.

Light profiles were collected at each station using an ILT 1400 International Light Technologies Photometer. A Protomatic light meter that measures illumination in foot candles or a secchi disk (Koenings et al. 1987) were occasionally used as a backup.

Temperature (ºC) was measured with a Yellow Springs Instruments Model 58 meter. Temperature was recorded at 1 m intervals from the lake surface to a depth of 20 m, and at 5 m intervals from 20 m 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. 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 250 ml sampling bottle and preserved in buffered 10% formalin or 10% EtOH. 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 and standardized to May–September in order to compare across all years of sampling.

RESULTS

ESCAPEMENT

2016

In 2016, 86,721 sockeye, 8,354 pink, 116 chum, 53 coho, and 2 Chinook salmon were enumerated through the Chilkoot River weir between 3 June and 9 September (statistical weeks 23–37; Table 1; Figure 3; Appendices D and E). A high-water event during 28–29 July required removing pickets from the weir, which allowed fish to pass uncounted for approximately 27 hours. An interpolation of 1,749 sockeye salmon (2% of the total weir count) was calculated to estimate sockeye salmon passage during those 2 days. Weekly sockeye salmon escapements were below the lower-bound escapement goal targets for the first 5 weeks of the season, rose above the lower bound beginning in statistical week 28, and then increased dramatically in statistical week 32. The total sockeye salmon escapement of 86,721 slightly exceeded the upper bound of the escapement goal range

(Table 1; Figure 3). The pink salmon escapement of 8,354 fish was well below the long-term (1976–2015) average of 26,594 fish (Appendix D).

2017

In 2017, 43,098 sockeye, 58,664 pink, 529 chum, 12 coho, and 11 Chinook salmon were enumerated through the Chilkoot River weir between 2 June and 6 September (statistical weeks 22–36; Table 2; Figure 3; Appendices D and F). A high-water event during 9–11 June required removing pickets from the weir, which allowed fish to pass uncounted for approximately 34 hours. An interpolation of 60 sockeye salmon (<1% of the total weir count) was calculated to estimate the sockeye salmon passage during those 3 days. Weekly sockeye salmon escapements were below the lower-bound escapement goal targets for the first 7 weeks of the season but rose above the lower bound escapement goal target in statistical week 30. The total sockeye salmon escapement of 43,098 fish exceeded the lower bound of the escapement goal range (Table 2; Figure 3). The pink salmon escapement of 58,664 was well above the long-term (1976–2015) average (Appendix D).

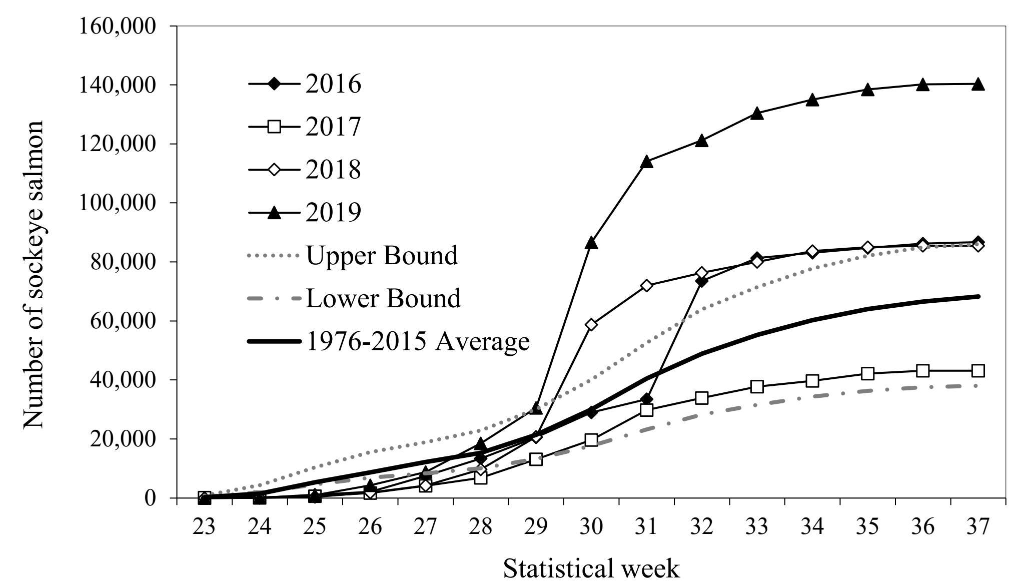

Figure 3.–Comparison of weekly cumulative escapement of sockeye salmon through the Chilkoot River weir compared to the 1976–2015 average and upper and lower bounds of the weekly escapement goal targets (based on Eggers et al. 2009).

Table 1.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and sustainable escapement goal range, 2016.

	Escapement		Escapement goal[a]	
Statistical week	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
23	0	0	378	856
24	73	73	1,924	4,354
25	1,067	1,140	4,593	10,396
26	955	2,095	6,852	15,508
27	5,410	7,505	8,333	18,858
28	5,863	13,368	10,102	22,863
29	7,167	20,535	13,286	30,069
30	8,429	28,964	17,689	40,032
31	4,552	33,516	23,236	52,587
32	40,054	73,570	28,267	63,973
33	7,723	81,293	31,565	71,437
34	1,816	83,109	34,371	77,787
35	1,633	84,742	36,275	82,096
36	1,455	86,197	37,524	84,923
37	524	86,721	38,000	86,000

[a] Weekly escapement goal targets are from Eggers et al. (2009).

Table 2.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and sustainable escapement goal range, 2017.

	Escapement		Escapement goal[a]	
Statistical week	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
22–23	137	137	378	856
24	82	219	1,924	4,354
25	391	610	4,593	10,396
26	1,091	1,701	6,852	15,508
27	2,403	4,104	8,333	18,858
28	2,717	6,821	10,102	22,863
29	6,293	13,114	13,286	30,069
30	6,539	19,653	17,689	40,032
31	10,169	29,822	23,236	52,587
32	4,039	33,861	28,267	63,973
33	3,853	37,714	31,565	71,437
34	1,995	39,709	34,371	77,787
35	2,429	42,138	36,275	82,096
36	960	43,098	37,524	84,923
37	–[b]	–[b]	38,000	86,000

[a] Weekly escapement goal targets are from Eggers et al. (2009).

[b] Weir removed prior to statistical week 37.

2018

In 2018, 85,463 sockeye, 5,475 pink, 225 chum, 95 coho, and 31 Chinook salmon were enumerated through the Chilkoot River weir between 3 June and 8 September (statistical weeks 23–36; Table 3; Figure 3; Appendices D and G). A high-water event during 9–10 August required removing pickets from the weir, which allowed fish to pass uncounted for approximately 27 hours. An interpolation of 897 sockeye salmon (1% of the total weir count) was calculated to estimate the sockeye salmon passage during those 2 days. Weekly sockeye salmon escapements were below the lower-bound escapement goal targets for the first 6 weeks of the season. The total sockeye salmon escapement of 85,463 fish was near the upper bound of the escapement goal range (Table 3; Figure 3). The pink salmon escapement of 5,475 fish was well below the long-term (1976–2015) average (Appendix D).

2019

In 2019, 140,378 sockeye, 17,156 pink, 396 chum, 80 coho, and 64 Chinook salmon were enumerated through the Chilkoot River weir between 7 June and 8 September (statistical weeks 23–37; Table 4; Figure 3; Appendices D and H). No interpolation for missed days was required during the season. Weekly sockeye salmon escapements were below the lower-bound escapement goal targets for the first 4 weeks of the season, but by statistical week 30, a dramatic increase in sockeye salmon numbers pushed escapement over the upper bound of the escapement goal. The 2019 sockeye salmon escapement was the largest on record (Table 4; Figure 3), surpassing the record of 118,166 sockeye salmon set in 2012. The pink salmon escapement of 17,156 fish was below the historical average (Appendix D).

Table 3.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and sustainable escapement goal range, 2018.

	Escapement		Escapement goal[a]	
Statistical week	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
23	4	4	378	856
24	26	30	1,924	4,354
25	330	360	4,593	10,396
26	1,518	1,878	6,852	15,508
27	2,359	4,237	8,333	18,858
28	5,421	9,658	10,102	22,863
29	11,108	20,766	13,286	30,069
30	37,968	58,734	17,689	40,032
31	13,262	71,996	23,236	52,587
32	4,304	76,300	28,267	63,973
33	3,692	79,992	31,565	71,437
34	3,732	83,724	34,371	77,787
35	1,275	84,999	36,275	82,096
36	464	85,463	37,524	84,923
37	–[b]	–[b]	38,000	86,000

[a] Weekly escapement goal targets are from Eggers et al. (2009).

[b] Weir removed prior to statistical week 37.

Table 4.–Weekly escapement of sockeye salmon at the Chilkoot River weir compared to weekly management targets and sustainable escapement goal range, 2019.

	Escapement		Escapement goal[a]	
Statistical week	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
23	2	2	378	856
24	17	19	1,924	4,354
25	924	943	4,593	10,396
26	3,323	4,266	6,852	15,508
27	4,509	8,775	8,333	18,858
28	9,718	18,493	10,102	22,863
29	12,072	30,565	13,286	30,069
30	56,078	86,643	17,689	40,032
31	27,446	114,089	23,236	52,587
32	7,150	121,239	28,267	63,973
33	9,182	130,421	31,565	71,437
34	4,600	135,021	34,371	77,787
35	3,458	138,479	36,275	82,096
36	1,694	140,173	37,524	84,923
37	205	140,378	38,000	86,000

[a] Weekly escapement goal targets are from Eggers et al. (2009).

COMMERCIAL HARVEST ESTIMATE

2016

In 2016, 188,844 sockeye salmon were harvested in the District 15 commercial drift gillnet fishery. Scale samples from a total sample of 3,995 fish (about 2% of the commercial harvest) were used in scale pattern analysis to determine weekly stock proportions of the commercial sockeye salmon harvest. Chilkoot Lake sockeye salmon accounted for an estimated 64% of the total harvest, all weeks combined, or approximately 119,843 fish (Table 5; Appendix I). The Chilkoot Lake sockeye salmon harvest was dominated by age-1.3 fish (86%), followed by age-2.3 fish (12%) and age-1.2 fish (1%). The total run was estimated to be 211,830 fish, including the estimated subsistence (5,051 fish) and sport (215 fish) harvests, and the total harvest rate was estimated to be 59% (Appendix M).

2017

In 2017, 39,716 sockeye salmon were harvested in the District 15 commercial drift gillnet fishery. A total of 2,915 sockeye salmon were sampled, of which 1,840 fish (about 5% of the commercial harvest) were genotyped for use in genetic stock identification analysis. Chilkoot Lake sockeye salmon accounted for an estimated 5% of the total harvest, all weeks combined, or approximately 1,933 fish (90% CI = 1,524–2,370 fish; Table 6; Appendices I and J). The Chilkoot Lake sockeye salmon harvest was dominated by age-1.3 fish (61%), followed by age-1.2 fish (18%) and age-2.3 fish (14%). The total run was estimated to be 47,366 fish, including the estimated subsistence (2,102 fish) and sport (233 fish) harvests, and the total harvest rate was estimated to be 9% (Appendix M).

Table 5.–Estimated commercial harvest of Chilkoot Lake, Chilkat Lake, and other sockeye salmon stocks in the District 15 commercial drift gillnet fishery based on visual scale pattern analysis, 2016.

			Estimated stock composition			Estimated harvest		
Statistical week	Commercial harvest	Sample size	Chilkoot Lake	Chilkat Lake	Other[a]	Chilkoot Lake	Chilkat Lake	Other[a]
25	0	0	0%	0%	0%	0	0	0
26	1,896	212	33%	41%	26%	626	778	492
27	2,514	378	35%	22%	43%	878	552	1,084
28	8,361	436	40%	10%	50%	3,318	863	4,181
29	15,335	436	38%	23%	39%	5,768	3,552	6,014
30	32,443	481	58%	20%	22%	18,886	6,408	7,150
31	9,941	450	48%	14%	38%	4,772	1,370	3,800
32	21,154	309	61%	19%	19%	13,007	4,108	4,039
33	58,180	440	81%	12%	7%	47,205	7,140	3,835
34	22,461	416	74%	20%	6%	16,630	4,589	1,242
35–40[b]	16,559	437	53%	40%	7%	8,753	6,631	1,175
Total	188,844	3,995	63%	19%	17%	119,843	35,991	33,010

[a] *Other* includes Chilkat River mainstem spawning stocks.

[b] Harvest proportions and numbers for statistical weeks 36–40 were estimated using the proportions from the last statistical week with scale pattern analysis estimates, in this case statistical week 35.

Table 6.–Estimated commercial harvest of Chilkoot Lake, Chilkat Lake, and other sockeye salmon stocks in the District 15 commercial drift gillnet fishery based on MAGMA genetic stock identification analysis, 2017.

		Estimated stock composition			Estimated Chilkoot harvest and CI		
Statistical week	Commercial harvest	Chilkoot Lake	Chilkat Lake	Other[a]	Harvest	Lower 90%	Upper 90%
25	1,358	5%	13%	82%	62	31	100
26	2,623	6%	11%	82%	167	91	259
27	1,743	6%	21%	73%	113	60	176
28	759	11%	16%	72%	86	49	129
29	6,077	2%	6%	92%	145	42	296
30	5,834	3%	6%	91%	202	82	356
31	5,590	6%	9%	86%	312	148	512
32	5,772	5%	36%	59%	288	136	480
33	2,171	8%	17%	74%	184	110	269
34–40[b]	7,789	5%	14%	82%	374	166	625
Total	39,716	5%	14%	81%	1,933	1,524	2,370

[a] *Other* includes Chilkat River mainstem spawning stocks.

[b] Harvest proportions and numbers for statistical weeks 35–40 were estimated using the proportions from the last statistical week with genetic samples, in this case statistical week 34.

2018

In 2018, 81,688 sockeye salmon were harvested in the District 15 commercial drift gillnet fishery. A total of 3,407 sockeye salmon were sampled, of which 1,794 fish (about 2% of the commercial harvest) were genotyped for use in genetic stock identification analysis. Chilkoot Lake sockeye salmon accounted for an estimated 42% of the total harvest, all weeks combined, or approximately 33,969 fish (90% CI = 32,077–35,850 fish; Table 7; Appendices I and K). The Chilkoot Lake sockeye salmon harvest was dominated by age-1.3 fish (73%), followed by age-1.2 fish (21%) and age-2.3 fish (5%). The total run was estimated to be 123,997 fish, including the estimated subsistence (4,406 fish) and sport (159 fish) harvests, and the total harvest rate was estimated to be 31% (Appendix M).

2019

In 2019, 241,533 sockeye salmon were harvested in the District 15 commercial drift gillnet fishery. A total of 3,803 sockeye salmon were sampled, of which 1,880 fish (about 1% of the commercial harvest) were genotyped for use in genetic stock identification analysis. Chilkoot Lake sockeye salmon accounted for an estimated 62% of the total harvest, all weeks combined, or approximately 149,586 fish (90% CI = 144,305–154,702 fish; Table 8; Appendices I and L). The Chilkoot Lake sockeye salmon harvest was dominated by age-1.3 fish (90%) and age-1.2 fish (8%). The total run was estimated to be 293,723 fish, including the estimated subsistence (3,673 fish) and sport (86 fish) harvests, and the total harvest rate was estimated to be 52% (Appendix M).

Table 7.–Estimated commercial harvest of Chilkoot Lake, Chilkat Lake, and other sockeye salmon stocks in the District 15 commercial drift gillnet fishery based on MAGMA genetic stock identification analysis, 2018.

		Estimated stock composition			Estimated Chilkoot harvest and CI		
Statistical week	Commercial harvest	Chilkoot Lake	Chilkat Lake	Other[a]	Harvest	Lower 90%	Upper 90%
25	263	18%	27%	55%	47	33	62
26	904	8%	26%	66%	74	44	108
27	3,630	16%	24%	60%	580	428	745
28	6,450	27%	16%	57%	1,725	1,380	2,081
29	4,303	28%	17%	55%	1,216	976	1,468
30	10,149	39%	21%	40%	3,977	3,373	4,583
31	19,931	50%	21%	29%	10,026	8,803	11,209
32	8,880	42%	28%	31%	3,702	3,189	4,228
33	8,357	24%	26%	50%	1,995	1,582	2,431
34–40[b]	18,821	56%	28%	15%	10,628	9,553	11,676
Total	81,688	42%	24%	35%	33,969	32,077	35,850

[a] *Other* includes Chilkat River mainstem spawning stocks.

[b] Harvest proportions and numbers for statistical weeks 35–40 were estimated using the proportions from the last statistical week with genetic samples, in this case statistical week 34.

Table 8.–Estimated commercial harvest of Chilkoot Lake, Chilkat Lake, and other sockeye salmon stocks in the District 15 commercial drift gillnet fishery based on MAGMA genetic stock identification analysis, 2019.

		Estimated stock composition			Estimated Chilkoot harvest and CI		
Statistical week	Commercial harvest	Chilkoot Lake	Chilkat Lake	Other[a]	Harvest	Lower 90%	Upper 90%
25–26	2,215	17%	27%	57%	366	275	466
27	6,573	20%	16%	64%	1,325	1,026	1,639
28	10,573	28%	21%	52%	2,927	2,383	3,495
29	18,540	49%	22%	29%	9,137	8,078	10,202
30	42,029	60%	15%	25%	25,109	22,636	27,486
31	69,841	77%	13%	10%	53,766	50,233	57,109
32	36,104	79%	11%	10%	28,406	26,719	29,952
33	33,072	54%	23%	23%	17,738	15,836	19,596
34	15,126	53%	20%	27%	8,048	7,188	8,928
35–40[b]	7,460	37%	33%	30%	2,763	2,350	3,192
Total	241,533	62%	17%	21%	149,586	144,305	154,702

[a] *Other* includes Chilkat River mainstem spawning stocks.

[b] Harvest proportions and numbers for statistical weeks 36–40 were estimated using the proportions from the last statistical week with genetic samples, in this case statistical week 35.

ESCAPEMENT AGE, SEX, AND LENGTH COMPOSITION

2016

In 2016, the sockeye salmon escapement was composed primarily of age-1.3 (84.2%) and age-2.3 (12.7%) fish (Table 9; Appendix N). The remainder of the escapement (3.1%) was composed of age-1.1, age-1.2, age-1.4, and age-2.2 fish. The mean length of age-1.3 fish was 555 mm for males and 543 mm for females, and the mean length of age-2.3 fish was 549 mm for males and 543 mm for females (Table 10; Appendices O and P).

Table 9.–Age composition of the Chilkoot Lake sockeye salmon escapement, weighted by statistical week, 2016.

Brood year and	2013	2012	2011	2010	2011	2010	2009	
age class	1.1	1.2	1.3	1.4	2.2	2.3	3.3	Total
Sample size	1	33	1,376	2	9	207	1	1,629
Escapement	5	2,186	73,061	73	362	11,024	9	86,721
Escapement SE	5	521	1,214	52	133	1,126	8	
Percent	0.0%	2.5%	84.2%	0.1%	0.4%	12.7%	0.0%	
Percent SE	0.0%	0.6%	1.4%	0.1%	0.2%	1.3%	0.0%	

Table 10.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2016. (A dash indicates the age class was not present.)

Brood year and	2013	2012	2011	2010	2011	2010	
age class	1.1	1.2	1.3	1.4	2.2	2.3	Total
Male							
Sample size	1	31	644	1	7	97	781
Mean length (mm)	330	476	555	550	474	549	489
SE	0.0	6.5	1.0	0.0	8.7	3.0	1.1
Female							
Sample size	–	2	638	1	2	82	725
Mean length (mm)	–	478	543	520	535	543	524
SE	–	20.0	0.7	0.0	15.0	2.0	0.6
All Fish							
Sample size	1	33	1,282	2	9	179	1,506
Mean length (mm)	330	476	549	535	487	547	487
SE	0.0	6.2	0.6	15.0	11.1	1.9	0.7

2017

In 2017, the sockeye salmon escapement was composed primarily of age-1.3 (68.0%) and age-1.2 (20.2%) fish (Table 11; Appendix N). The remainder of the escapement (11.8%) was composed of age-0.1, age-0.3, age-1.4, age-2.2, age 2.3, and age-2.4 fish. The mean length of age-1.3 fish was 559 mm for males and 547 mm for females, and the mean length of age-1.2 fish was 484 mm for males and 496 mm for females (Table 12; Appendices O and P).

Table 11.–Age composition of the Chilkoot Lake sockeye escapement weighted by statistical week, 2017.

Brood year and	2015	2013	2013	2012	2011	2012	2011	2010	
age class	0.1	0.3	1.2	1.3	1.4	2.2	2.3	2.4	Total
Sample size	1	2	124	504	18	10	43	3	705
Escapement	117	55	8,702	29,286	737	799	3,265	137	43,098
Escapement SE	116	38	867	1,050	202	328	644	92	
Percent	0.3%	0.1%	20.2%	68.0%	1.7%	1.9%	7.6%	0.3%	
Percent SE	0.3%	0.1%	2.0%	2.4%	0.5%	0.8%	1.5%	0.2%	

Table 12.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2017. (A dash indicates the age class was not present.)

Brood year and age class	2015 0.1	2013 0.3	2013 1.2	2012 1.3	2011 1.4	2012 2.2	2011 2.3	2010 2.4	Total
Male									
Sample size	1	1	105	266	12	6	23	3	417
Mean length (mm)	490	565	484	559	581	484	550	560	534
SE	0.0	0.0	3.6	1.6	5.4	16.2	6.3	21.9	2.2
Female									
Sample size	–	1	19	238	6	4	20	–	288
Mean length (mm)	–	510	496	547	565	502	538	–	526
SE	–	0.0	6.5	1.5	7.9	2.9	3.6	–	1.6
All Fish									
Sample size	1	2	124	504	18	10	43	3	705
Mean length (mm)	490	538	486	554	576	490	544	560	530
SE	0.0	30.0	3.2	1.1	4.7	10.2	3.8	21.9	1.4

2018

In 2018, the sockeye salmon escapement was composed primarily of age-1.3 (47.5%) and age-1.2 (47.2%) fish (Table 13; Appendix N). The remainder of the escapement (5.3%) was composed of age-0.3, age-1.1, age-1.4, age-2.3, and age-2.4 fish. The mean length of age-1.3 fish was 562 mm for males and 548 mm for females, and the mean length of age-1.2 fish was 477 mm for males and 490 mm for females (Table 14; Appendices O and P).

Table 13.–Age composition of the Chilkoot Lake sockeye escapement weighted by statistical week, 2018.

Brood year and age class	2014 0.3	2015 1.1	2014 1.2	2013 1.3	2012 1.4	2012 2.3	2011 2.4	Total
Sample size	1	2	205	442	7	28	1	686
Escapement	24	128	40,331	40,570	819	3,581	9	85,463
Escapement SE	24	90	2,885	2,857	673	1,198	9	
Percent	0.0%	0.1%	47.2%	47.5%	1.0%	4.2%	0.0%	
Percent SE	0.0%	0.1%	3.4%	3.3%	0.8%	1.4%	0.0%	

Table 14.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2018. (A dash indicates the age class was not present.)

Brood year and	2014	2015	2014	2013	2012	2012	2011	
age class	0.3	1.1	1.2	1.3	1.4	2.3	2.4	Total
Male								
Sample size	–	2	176	201	7	14	1	401
Mean length (mm)	–	333	477	562	562	576	565	525
SE	–	5.0	2.7	1.5	8.7	5.6	0.0	2.6
Female								
Sample size	1	–	29	241	–	14	–	285
Mean length (mm)	545	–	490	548	–	551	–	541
SE	0.0	–	4.6	1.2	–	5.2	–	1.6
All Fish								
Sample size	1	2	205	442	7	28	1	686
Mean length (mm)	545	333	479	554	562	563	565	514
SE	0.0	5.0	2.5	1.0	8.7	4.4	0.0	1.7

2019

In 2019, the sockeye salmon escapement was composed primarily of age-1.3 (80.8%) and age-1.2 (17.1%) fish (Table 15; Appendix N). The remainder of the escapement (2.1%) was composed of age-1.4, age-2.2, and age-2.3 fish. The mean length of age-1.3 fish was 562 mm for males and 544 mm for females, and the mean length of age-1.2 fish was 479 mm for males and 478 mm for females (Table 16; Appendices O and P).

Table 15.–Age composition of the Chilkoot Lake sockeye escapement weighted by statistical week, 2019.

Brood year and	2015	2014	2013	2014	2013	
age class	1.2	1.3	1.4	2.2	2.3	Total
Sample size	92	700	2	4	13	811
Escapement	23,987	113,393	407	557	2,034	140,378
Escapement SE	3,141	3,252	392	295	966	
Percent	17.1%	80.8%	0.3%	0.4%	1.4%	
Percent SE	2.2%	2.3%	0.3%	0.2%	0.7%	

Table 16.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2019.

Brood year	2015	2014	2013	2014	2013	
Age	1.2	1.3	1.4	2.2	2.3	Total
Male						
Sample size	54	296	1	3	5	359
Mean length (mm)	479	562	605	488	537	549
SE	4.8	1.5	0.0	15.3	13.0	2.1
Female						
Sample size	38	404	1	1	8	452
Mean length (mm)	478	544	554	453	532	538
SE	4.6	1.2	0.0	0.0	10.9	1.5
All Fish						
Sample size	92	700	2	4	13	811
Mean length (mm)	479	552	580	479	534	525
SE	3.4	1.0	30.0	14.7	8.0	1.3

FRY POPULATION ESTIMATE

Hydroacoustic surveys were conducted at Chilkoot Lake on 26 October 2016, 16 November 2017, 2 October 2018, and 31 October 2019 (Table 17). The precision of pelagic fish estimates met our objective for a CV ≤15% in all four years. In 2016, the pelagic fish population was estimated to be 1,294,334 fish (CV = 4%), about 42% above the long-term average (1987–2015; 908,000 fish). The 2017 estimate of 491,901 fish (CV = 5%) was the smallest since 2007 and about 45% below average. Pelagic fish populations improved to about average in 2018 (919,761 fish; CV = 11%) but were about 21% below average in 2019 (719,165 fish; CV = 8%). Trawl surveys conducted on 6 November 2019 to check species composition resulted in a catch of 107 sockeye salmon fry; no other species of fish were captured.

Table 17.–Number of fish collected in trawl samples by species, percentage of sockeye salmon in trawl samples, and estimated total number of fish (hydroacoustic targets) and sockeye salmon fry in autumn surveys of Chilkoot Lake, 1987–2019.

	Trawl samples				Percent	Hydroacoustic estimates		
Year	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
1992	ND	ND	ND	ND	ND	ND	ND	ND
1993	ND	ND	ND	ND	ND	ND	ND	ND
1994	ND	ND	ND	ND	ND	ND	ND	ND
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%	**400,307**	ND	**377,476**
2000	15	14	0	1	93%	1,380,950	ND	1,288,887
2001	61	29	23	9	48%	**1,351,068**	ND	**642,311**
2002	289	288	1	0	100%	**1,389,712**	4%	**1,384,903**
2003	139	138	1	0	99%	1,384,754	ND	1,384,754
2004	199	187	4	8	94%	1,059,963	10%	**996,200**
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%	**741,537**	5%	**741,537**
2011	82	82	0	0	100%	651,847	24%	651,847
2012	142	142	0	0	100%	**752,212**	13%	**752,212**
2013	131	131	0	0	100%	642,256	6%	642,256
2014	551	546	0	5	99%	**1,160,985**	8%	**1,150,450**
2015	ND	ND	ND	ND	ND	1,148,335	7%	1,148,335
2016	ND	ND	ND	ND	ND	1,294,334	4%	1,294,334
2017	ND	ND	ND	ND	ND	491,901	5%	491,901
2018	ND	ND	ND	ND	ND	919,761	11%	919,761
2019	107	107	0	0	100%	719,165	8%	719,165

Note: Bold estimates are historical records that have been updated since the last project report by Bednarski et al. (2016). 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 the sampling season (May), gradually became shallower as the season progressed, and increased again in October. In 2016, the average euphotic zone depth ranged from 8.3 m in May to 2.7 m in August and averaged 4.9 m for the season (Table 18). In 2017, the average euphotic zone depth ranged from 13.9 m in May to 3.4 m in September and averaged 6.1 m for the season. In 2018, the average euphotic zone depth ranged from 11.6 m in June to 2.3 m in August and averaged 6.3 m for the season. In 2019, the euphotic zone depth was remarkably shallow throughout the season, particularly in the spring. The average euphotic zone depth in 2019 ranged from 4.2 m in October to 1.4 m in September and averaged 2.2 m for the season.

In all years (2016–2019), 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 4). The maximum lake surface temperature recorded per season was 13.3º C on 13 July 2016, 11.0º C on 14 July 2017, 13.6º C on 18 August 2018, and 16.5º C on 16 August 2019.

Zooplankton Composition

Zooplankton samples from Chilkoot Lake were composed predominantly of copepods (*Cyclops* sp.) in all years (Tables 19 and 20). Despite wide fluctuations during this period, average zooplankton density and biomass (standardized to May–September period) were nearly double the long-term average. Seasonal mean zooplankton density in 2019 (290,000 no./m^2) and mean biomass in 2016 (570 mg/m^2) were the largest recorded since sampling began in 1987 (Figure 5; Appendix Q). No zooplankton samples were collected in August 2018, making it difficult to compare this year directly to the other years; however, examination of the months that were sampled shows that zooplankton populations were at relatively high levels (Table 19).

Table 18.–Euphotic zone depths (m) in Chilkoot Lake, 2016–2019.

Year	Date	Station 1A	Station 2A	Average
2016	18-May	8.5	8.1	8.3
	21-Jun	5.1	4.8	4.9
	13-Jul	4.5	2.7	3.6
	17-Aug	3.2	2.2	2.7
	17-Sep	3.9	3.1	3.5
	28-Oct	5.8	7.0	6.4
	Average (May–Oct.)	5.2	4.7	4.9
2017	19-May	13.8	14.0	13.9
	18-Jun	5.6	5.8	5.7
	14-Jul	5.2	5.5	5.3
	17-Aug	3.8	4.2	4.0
	15-Sep	3.0	3.8	3.4
	16-Oct	4.1	4.1	4.1
	Average (May–Oct.)	5.9	6.2	6.1
2018	16-May	10.6	11.8	11.2
	13-Jun	13.5	9.6	11.6
	18-Jul	4.0	3.4	3.7
	18-Aug	2.2	2.4	2.3
	16-Sep	1.5	4.0	2.7
	October	ND	ND	ND
	Average (May–Oct.)	6.3	6.3	6.3
2019	15-May	1.2	3.3	2.2
	June	ND	ND	ND
	17-Jul	1.7	1.9	1.8
	16-Aug	1.5	1.6	1.6
	16-Sep	1.3	1.5	1.4
	17-Oct	4.0	4.5	4.2
	Average (May–Oct.)	1.9	2.6	2.2

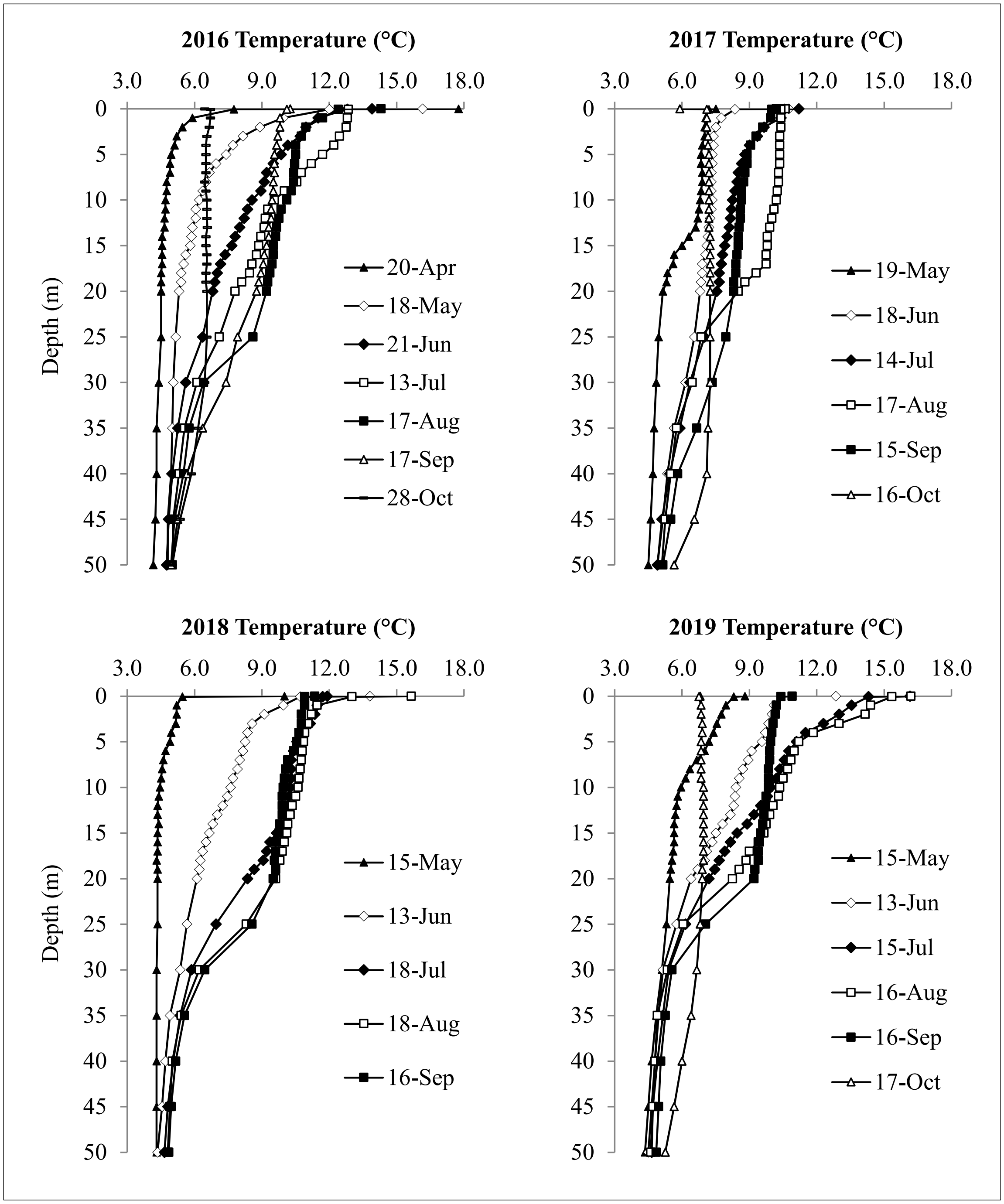

Figure 4.–Water temperature profiles by date (averaged between stations 1A and 2A) at Chilkoot Lake, 2016–2019.

Table 19.–Mean density of zooplankton per m^2 of lake surface area, by sampling date and taxon, in Chilkoot Lake 2016–2019. Density estimates were the average of 2 sampling stations. Ovigerous (ovig.) individuals were separated from non-egg bearing individuals.

		Macrozooplankton density (number/m^2) by sampling date							Seasonal mean	
Year	Taxon/Date	20-Apr	18-May	21-Jun	13-Jul	17-Aug	17-Sep	28-Oct	Density	% Density
2016	*Cyclops* sp.	530,226	300,561	139,668	68,390	71,659	91,696	123,620	189,403	86%
	Ovig. *Cyclops*	0	1,698	2,123	5,604	17,830	43,301	11,887	11,777	5%
	Nauplii	39,905	849	1,274	2,165	6,580	16,132	70,131	70,131	9%
	Total	570,131	303,108	143,064	76,159	96,069	151,129	205,638	220,757	
		Apr	19-May	18-Jun	14-Jul	17-Aug	15-Sep	Oct	Density	% Density
2017	*Cyclops* sp.	ND	240,406	113,771	137,629	73,612	181,525	ND	149,389	82%
	Ovig. *Cyclops*	ND	0	9,594	29,759	12,226	29,334	ND	16,183	9%
	Nauplii	ND	11,420	1,613	5,986	2,038	62,447	ND	16,701	9%
	Total	ND	251,825	124,979	173,374	87,876	273,306	ND	182,272	
		Apr	18-May	13-Jun	18-Jul	Aug	16-Sep	Oct	Density	% Density
2018	*Cyclops* sp.	ND	164,120	249,193	143,488	ND	88,589	ND	161,347	83%
	Ovig. *Cyclops*	ND	0	0	11,717	ND	6,673	ND	4,598	2%
	Nauplii	ND	26,830	5,837	2,547	ND	55,400	ND	22,653	12%
	Bosmina	ND	0	0	5,094	ND	2,725	ND	1,955	1%
	Daphnia sp.	ND	0	0	7,641	ND	1,987	ND	2,407	1%
	Daphnia rosea	ND	0	0	0	ND	1,274	ND	318	<1%
	Total	ND	130,752	320,937	220,751	ND	156,648	ND	193,279	
		Apr	14-May	13-Jun	17-Jul	16-Aug	16-Sep	17-Oct	Density	% Density
2019	*Cyclops* sp.	ND	343,352	185,940	286,127	184,412	264,137	145,950	234,986	86%
	Ovig. *Cyclops*	ND	0	0	0	0	1,019	255	212	<1%
	Nauplii	ND	44,999	509	679	75,310	53,235	30,990	34,287	13%
	Bosmina	ND	0	0	0	2,802	3,566	2,632	1,500	1%
	Ovig. *Bosmina*	ND	0	0	0	0	0	255	42	<1%
	Daphnia sp.	ND	0	0	0	764	4,075	1,443	1,047	<1%
	Daphnia rosea	ND	0	0	0	0	509	0	85	<1%
	Total	ND	388,351	186,449	286,806	263,287	326,541	181,525	272,160	

Table 20.–Mean length and biomass of zooplankton by sampling date and taxon in Chilkoot Lake, 2016–2019. Biomass estimates were the average of the 2 sampling stations. Ovigerous (ovig.) individuals were separated from non-egg bearing individuals. (A dash indicates the taxon was not present.)

		Macrozooplankton length (mm) by sampling date						Seasonal means (weighted)		
Year	Taxon/Date	18-May	21-Jun	13-Jul	17-Aug	17-Sep	28-Oct	Length (mm)	Biomass (mg/m²)	% biomass
2016	*Cyclops* sp.	0.91	1.11	1.17	1.06	0.90	0.83	0.82	443	85%
	Ovig. *Cyclops*	1.24	1.39	1.28	1.33	1.25	1.34	1.31	76	15%
	Total								519	
		19-May	18-Jun	14-Jul	17-Aug	15-Sep	Oct	Length (mm)	Biomass (mg/m²)	% biomass
2017	*Cyclops* sp.	0.56	0.92	1.06	1.23	0.73	ND	0.81	376	80%
	Ovig. *Cyclops*	–	1.13	1.14	1.29	1.34	ND	1.23	92	20%
	Total								467	
		18-May	13-Jun	18-Jul	Aug	16-Sep	Oct	Length (mm)	Biomass (mg/m²)	% biomass
2018	*Cyclops* sp.	0.53	0.85	1.10	ND	0.68	ND	0.80	363	91%
	Ovig. *Cyclops*	–	–	1.33	ND	1.30	ND	1.31	29	7%
	Bosmina	–	–	0.28	ND	0.34	ND	0.29	<1	<1%
	Daphnia sp.	–	–	0.95	ND	0.71	ND	0.62	4	1%
	Daphnia rosea	–	–	–	ND	1.05	ND	1.05	1	<1%
	Total								398	
		14-May	13-Jun	17-Jul	16-Aug	16-Sep	17-Oct	Length (mm)	Biomass (mg/m²)	% biomass
2019	*Cyclops*	0.54	0.86	1.07	0.86	0.70	0.59	0.77	487	99%
	Ovig. *Cyclops*	–	–	–	–	1.29	–	1.12	1	<1%
	Bosmina	–	–	–	0.41	0.31	0.36	0.25	1	<1%
	Ovig. *Bosmina*	–	–	–	–	–	0.50	0.50	<1	<1%
	Daphnia rosea	–	–	–	1.07	1.12	1.06	1.01	4	1%
	Ovig. *D. rosea*	–	–	–	–	1.30	–	1.30	1	<1%
	Total								493	

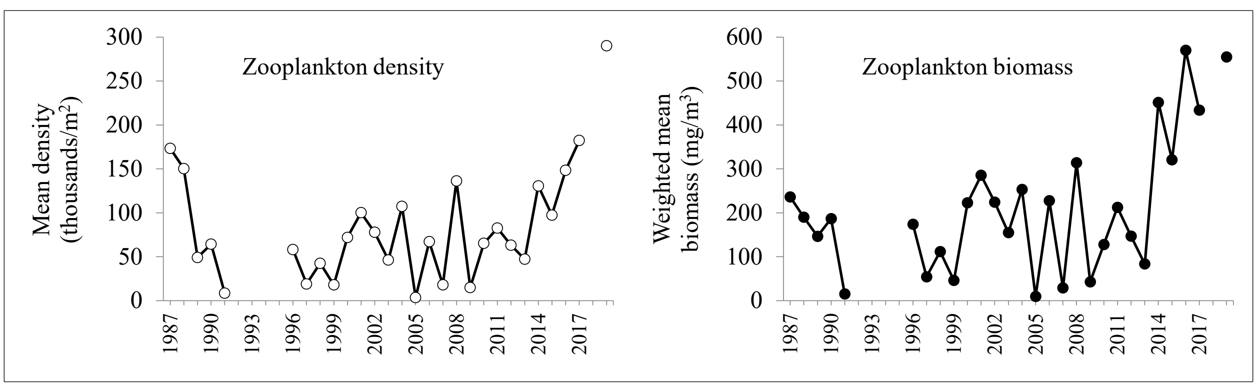

Figure 5.–Annual (standardized to May–September period) zooplankton density and biomass in Chilkoot Lake, 1987–2019. Estimates not included for 1992–1994 (no samples were collected), 1995 (samples were only collected in the months of June–August), or 2018 (no samples collected in August).

DISCUSSION

Chilkoot Lake sockeye salmon escapements annually met or exceeded the current escapement goal range of 38,000–86,000 fish during 2016–2019. The 2019 escapement of 140,378 fish was the largest recorded since the project first started in 1976. However, total runs (escapement plus District 15 fishery harvest) fluctuated dramatically over the 4-year period, and the 2017 run of 47,366 fish was the fifth lowest on record (Figure 6; Appendix M). Total runs in 2016 (211,830 fish) and 2018 (123,997 fish) were closer to the average for this system and fell into the 67th and 44th percentiles, respectively. The 2019 run (293,723 fish) was in the 86th percentile and was the largest run since 1991. Harvest rates on Chilkoot Lake sockeye salmon (including commercial, subsistence, and sport harvest) averaged 38% over the four years 2016–2019, which was below the long-term average of 48%. The poor run in 2017 required conservative fishery management in order to meet the escapement goal, which limited the harvest rate to 9%, far below the harvest rates in 2016 (59%), 2018 (31%), and 2019 (52%).

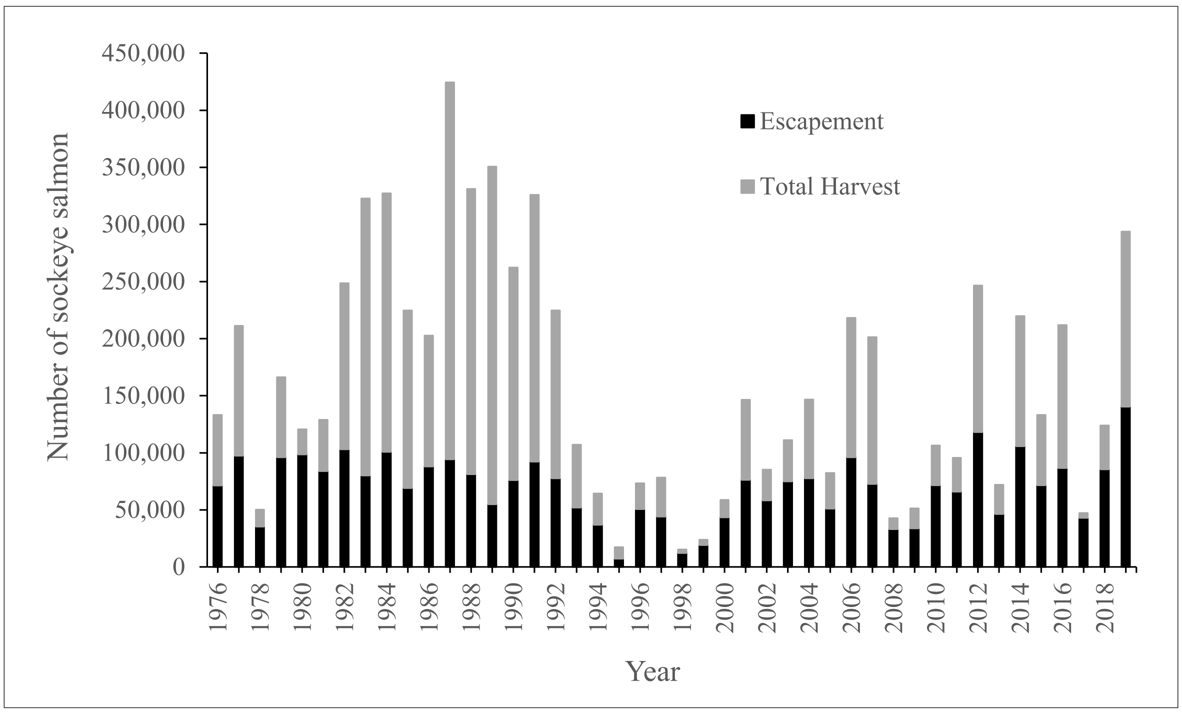

Figure 6.–Estimated total runs (escapement plus District 15 fishery harvest) of Chilkoot Lake sockeye salmon, 1976–2019. Harvest includes commercial, sport, and subsistence.

SOURCES OF UNCERTAINTY

Total Chilkoot sockeye salmon run estimates presented in this report are defined as the annual escapement plus terminal subsistence, sport, and commercial (District 15) harvests. The total run estimates represent minimum point estimates and currently do not incorporate sources of uncertainty, including 1) variability in the annual escapement estimate (e.g., interpolation for missed days, fish escaping into the lake after the weir is removed); 2) inconsistent or lack of reporting of subsistence and sport harvest; 3) uncertainty in harvest estimates generated through visual scale pattern analysis (e.g., in 2016) or GSI (2017–2019); 4) unaccounted for incidental commercial fishing mortality (Patterson et al. 2017); 5) variability in the commercial harvest estimates through the weight-to-numbers conversion on fish tickets; and, in particular, 6) unaccounted for commercial harvest of Chilkoot sockeye salmon outside of District 15. Much of this uncertainty is probably minimal, with the exception of unaccounted for harvest outside of District 15, which would require genetic stock identification to be conducted for those fisheries (Gilk-Baumer et al. 2015; Miller and Heinl 2018).

DISTRICT 15 MANAGEMENT

The District 15 commercial drift gillnet fishery has been managed in accordance with the *Lynn Canal and Chilkat River King Salmon Fishery Management Plan* (5 AAC 33.384) since 2003. The overall management goal is to achieve desired spawning escapement levels while harvesting the available surplus for a long-term maximum sustainable yield of all Lynn Canal salmon stocks. Management decisions are guided by inseason run projections based on daily weir counts and stock composition information from the fishery. Openings early in the season are typically designed to harvest large hatchery runs of summer chum salmon in Section 15-C (central Lynn Canal; Figure 1) while minimizing the harvest of northbound sockeye salmon and other wild stocks until run strength can be determined.

In 2018, the Alaska Board of Fisheries designated the Chilkat River Chinook salmon run as a stock of management concern after multiple years of failing to achieve the Chinook salmon escapement goal. The board adopted the *Chilkat River and King Salmon River King Salmon Stock Status and Action Plan, 2018* (Lum and Fair 2018), which outlined management measures intended to reduce the harvest rate on Chilkat River Chinook salmon stocks and rebuild the run to consistently achieve escapements within the escapement goal range. In 2018, management of the District 15 commercial drift gillnet fishery followed the action plan; however, in 2019, additional time and area restrictions beyond those prescribed in the action plan were implemented (Thynes et al. 2020).

The management actions taken to reduce harvest of Chilkat River Chinook salmon subsequently limited harvest opportunities for hatchery chum and wild sockeye salmon in 2018 and 2019. During years of high Chilkoot Lake sockeye salmon abundance, additional time and area in Section 15-A are normally granted north of the latitude of Mud Bay Point (Figure 1), and during very strong years, such as 2019, Lutak Inlet (Figure 1) is also usually opened to harvest fish surplus to escapement needs. In 2019, the Chilkoot Lake sockeye salmon escapement exceeded the upper bound of the weekly management targets during statistical week 29 and reached the upper bound of the escapement goal range of 38,000–86,000 fish by the end of statistical week 30. Due to Chilkat River Chinook salmon conservation measures outlined in the action plan (Lum and Fair 2018; Thynes et al. 2020), restrictions could not be liberalized in Section 15-A until after the fifth week of the fishery (statistical week 29). In statistical week 30, the open area was extended north to Talsani Island, and by the seventh week of the fishery (statistical week 31) the open area was extended to the terminus of the Chilkoot River. Due to the delay, the gillnet fleet could not effectively intercept the run and the Chilkoot Lake sockeye salmon escapement goal was greatly exceeded.

REDUCED SIZE AND GROWTH OF SOCKEYE SALMON

During 2015–2019, Chilkoot Lake sockeye salmon in each of the major age classes (ages 1.2, 1.3, 2.2, and 2.3) were smaller than the historical average, with the exception of age-1.2 males in 2017 and age-2.2 females in 2016 (Appendices O and P). Ocean-age-2 male sockeye salmon (ages 1.2 and 2.2 combined; Figure 7) appeared to have recovered to near average size from the notably small size observed in 2015 (Bednarski et al. 2016). Ocean-age-2 females were larger than average in 2016 but subsequently decreased in size. Ocean-age-3 sockeye salmon (ages 1.3 and 2.3 combined) of both sexes were the smallest in the entire time series, 1982–2019 (Figure 7).

The mechanism responsible for the reduced size and growth remains poorly understood, but the widespread nature of the decline suggests that the mechanism is large and affects broad ocean communities. After 2010, sockeye salmon runs across all 4 regions of Alaska declined in average body size, and a 2.1% decrease was documented in Southeast Alaska sockeye salmon (Oke et al. 2020). The small size of Chilkoot and other sockeye salmon stocks starting in 2015 (Bednarski et al. 2016; Brunette and Piston 2019) was thought to be a product of the "blob", a warm water anomaly that developed off the Gulf of Alaska in 2013 (Bond et al. 2015; Di Lorenzo and Mantua 2016). The discovery of a second, warmer "blob" in the Gulf of Alaska in 2019 (Amaya et al. 2020) suggests that continued decreases in the size and number of Chilkoot Lake sockeye salmon may occur in future years.

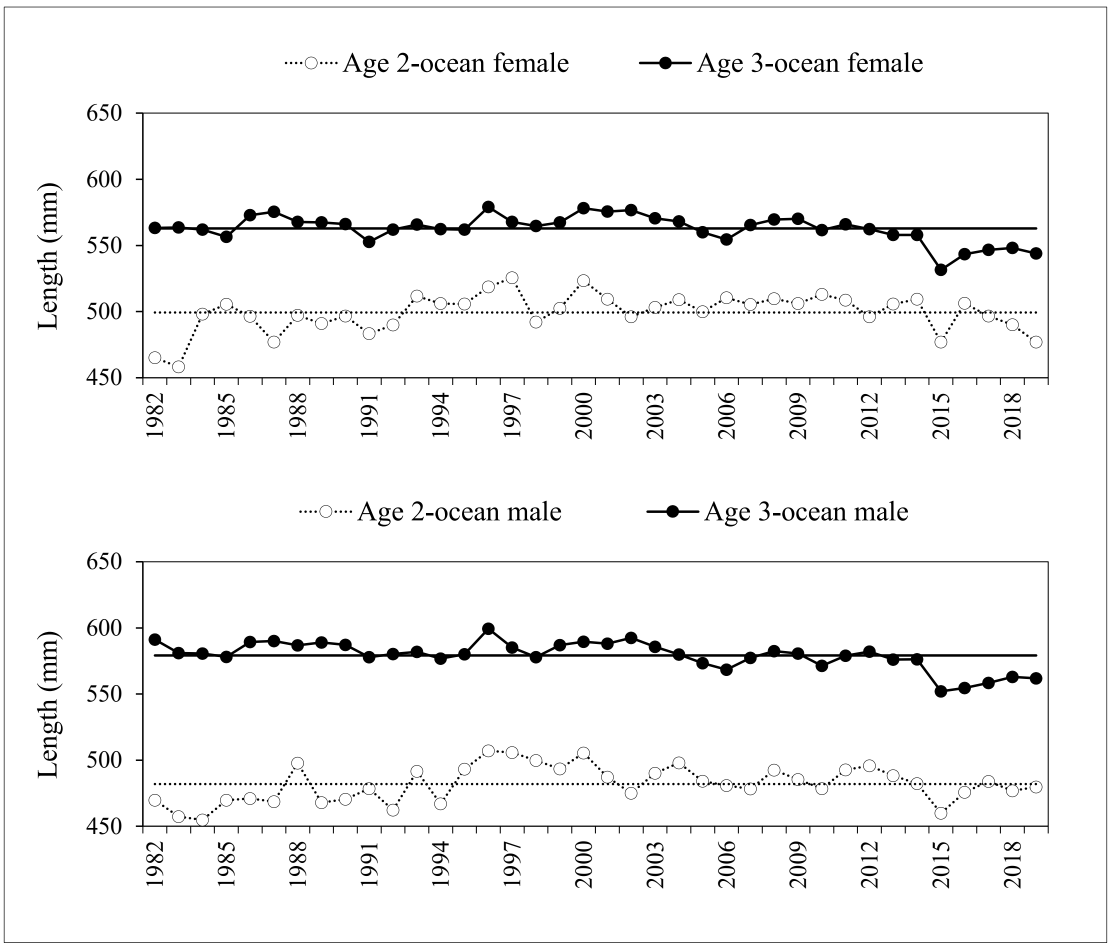

Figure 7.–Average annual sockeye salmon mid eye to fork length by sex and ocean age for the major age classes (ages 1.2, 1.3, 2.2, and 2.3) in the Chilkoot Lake escapement compared to the 1982–2019 averages (horizontal lines). Ocean-age-2 refers to age classes 1.2 and 2.2, and ocean-age-3 refers to age classes 1.3 and 2.3.

Previous estimates of rearing sockeye salmon populations in Chilkoot Lake suggested good runs of adult sockeye salmon during 2017–2019 (Bednarski et al. 2016). Although this prediction held true for the large run in 2019, the 2017 sockeye salmon run was one of the smallest on record. The fall fry population in 2016 (1,294,000 fish) was the largest in 13 years and 42% greater than the long-term average of 908,000 fish. However, by 2017 the rearing population had declined to 492,000 fish, and the lake held relatively moderate numbers of rearing fry in 2018 (920,000 fish) and 2019 (719,000 fish), despite recording the highest numbers and biomass of zooplankton since 1987 (Figure 5). Although there has been no relationship (adjusted R^2 = <0.01; p-value = 0.31) between the size of the spawning escapement in the parent year and the fall fry population 1 year later, there is a very weak positive correlation (adjusted R^2 = 0.25; p-value < 0.01) between the size of the fall fry population and subsequent adult returns (Figure 8). Some known sources of error may be weakening the correlation. For example, we assumed that all sockeye salmon fry are age-1, which is not true; however, a very large portion (average = 82%) of the adult return (by brood year) to Chilkoot Lake spent only 1 year in freshwater. Further research may uncover a stronger correlation between rearing fry abundance and adult returns.

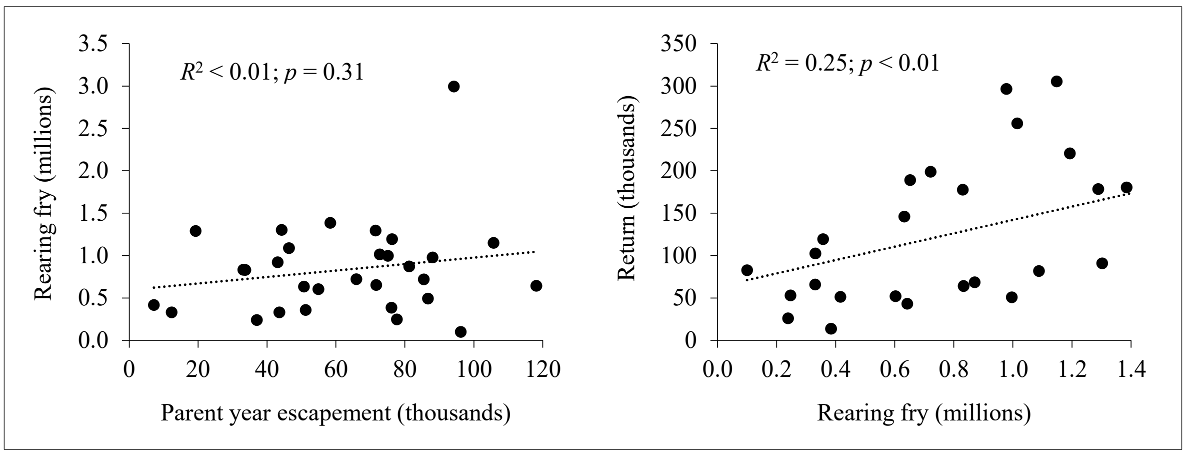

Figure 8.–Comparison of Chilkoot Lake sockeye salmon parent year escapement (1986–1990; 1994–2018) to the rearing fry population (1987–1991; 1995–2019) 1 year later (left), and comparison of the rearing fry population (1987–1991; 1995–2015) to the subsequent adult return, brood years 1986–1990; 1994–2014 (right). No hydroacoustic surveys were conducted during 1992–1994. The adjusted R^2 and p-values (p) from the regression are shown on each figure.

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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:

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

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):

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

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

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

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):

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

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,

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

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

Appendix B.–ADF&G statistical weeks, 2016–2019.

Statistical week	2016 Beginning	2016 Ending	2017 Beginning	2017 Ending	2018 Beginning	2018 Ending	2019 Beginning	2019 Ending
23	29-May	4-Jun	4-Jun	10-Jun	3-Jun	9-Jun	2-Jun	8-Jun
24	5-Jun	11-Jun	11-Jun	17-Jun	10-Jun	16-Jun	9-Jun	15-Jun
25	12-Jun	18-Jun	18-Jun	24-Jun	17-Jun	23-Jun	16-Jun	22-Jun
26	19-Jun	25-Jun	25-Jun	1-Jul	24-Jun	30-Jun	23-Jun	29-Jun
27	26-Jun	2-Jul	2-Jul	8-Jul	1-Jul	7-Jul	30-Jun	6-Jul
28	3-Jul	9-Jul	9-Jul	15-Jul	8-Jul	14-Jul	7-Jul	13-Jul
29	10-Jul	16-Jul	16-Jul	22-Jul	15-Jul	21-Jul	14-Jul	20-Jul
30	17-Jul	23-Jul	23-Jul	29-Jul	22-Jul	28-Jul	21-Jul	27-Jul
31	24-Jul	30-Jul	30-Jul	5-Aug	29-Jul	4-Aug	28-Jul	3-Aug
32	31-Jul	6-Aug	6-Aug	12-Aug	5-Aug	11-Aug	4-Aug	10-Aug
33	7-Aug	13-Aug	13-Aug	19-Aug	12-Aug	18-Aug	11-Aug	17-Aug
34	14-Aug	20-Aug	20-Aug	26-Aug	19-Aug	25-Aug	18-Aug	24-Aug
35	21-Aug	27-Aug	27-Aug	2-Sep	26-Aug	1-Sep	25-Aug	31-Aug
36	28-Aug	3-Sep	3-Sep	9-Sep	2-Sep	8-Sep	1-Sep	7-Sep
37	4-Sep	10-Sep	10-Sep	16-Sep	9-Sep	15-Sep	8-Sep	14-Sep
38	11-Sep	17-Sep	17-Sep	23-Sep	16-Sep	22-Sep	15-Sep	21-Sep
39	18-Sep	24-Sep	24-Sep	30-Sep	23-Sep	29-Sep	22-Sep	28-Sep
40	25-Sep	1-Oct	1-Oct	7-Oct	30-Sep	6-Oct	29-Sep	5-Oct
41	2-Oct	8-Oct	8-Oct	14-Oct	7-Oct	13-Oct	6-Oct	12-Oct
42	9-Oct	15-Oct	15-Oct	21-Oct	14-Oct	20-Oct	13-Oct	19-Oct

Appendix C.–ADF&G collection code, location, reporting group, and the number (*n*) of sockeye salmon used in the genetic baseline for mixed stock analysis in District 15 commercial drift gillnet fishery (Zeiser et al. 2019).

ADF&G collection code	Location	Reporting group	*n*
SCKAT07E	Chilkat Lake07 Early	Chilkat Lake	95
SCKAT07L	Chilkat Lake07 Late	Chilkat Lake	95
SCKAT13	Chilkat Lake13	Chilkat Lake	189
SBEARFL07	Bear Flats - Chilkat	Chilkat Mainstem	95
SMULE03.SMULE07	Mule Meadows - Chilkat	Chilkat Mainstem	190
SMOSQ07	Mosquito Lake - Chilkat	Chilkat Mainstem	95
SCHIK03	Chilkoot River	Chilkoot	159
SCHILBC07	Chilkoot Lake - Bear Creek	Chilkoot	233
SCHILB07	Chilkoot Lake - beaches	Chilkoot	251
SLACE13	Lace River	Juneau Mainland	63
SBERN03.SBERN13	Berners Bay	Juneau Mainland	165
SANTGILK13	Antler-Gilkey River	Juneau Mainland	53
SWIND03.SWIND07	Windfall Lake	Juneau Mainland	142
SSTEE03	Steep Creek	Juneau Mainland	91
SAUKE13baseline.SLAKECR14	Lake Creek (Auke Creek Weir)	Juneau Mainland	318
SKUTH06	Kuthai Lake	Taku River/Stikine Mainstem	171
SKSLK10.SKSLK11	King Salmon Lake	Taku River/Stikine Mainstem	214
SLTRA90.SLTRA06	Little Trapper Lake	Taku River/Stikine Mainstem	237
SLTAT11	Little Tatsamenie11	Taku River/Stikine Mainstem	59
STATS05.STATS06	Tatsamenie Lake	Taku River/Stikine Mainstem	288
SHACK08	Hackett River	Taku River/Stikine Mainstem	52
SNAHL03.SNAHL07. SNAHL12	Nahlin River	Taku River/Stikine Mainstem	179
STAKU07	Taku River	Taku River/Stikine Mainstem	95
STAKWA09	Taku Mainstem – Takwahoni/Sinwa	Taku River/Stikine Mainstem	67
SSUSTA08.SSHUST09	Shustahini Slough	Taku River/Stikine Mainstem	185
STUCH08.SCHUNK09.STUSK08.SBEARSL09. STUSKS08.STUSKS09	Tuskwa/Chunk Slough	Taku River/Stikine Mainstem	356
SYELLB08.SYELLB10. SYELLB11	Yellow Bluff Slough	Taku River/Stikine Mainstem	81
STULS07.STULS08. STULS09	Tulsequah River	Taku River/Stikine Mainstem	156
SFISHCR09.SFISHCR10	Fish Creek	Taku River/Stikine Mainstem	160
SYEHR07.SYEHR09	Yehring Creek	Taku River/Stikine Mainstem	171
SCHUT08	Chutine River	Taku River/Stikine Mainstem	94
SCHUTL09.SCHUT11	Chutine Lake	Taku River/Stikine Mainstem	224
SFOWL07.SFOWL08.SFOWL09.SANDY07. SANDY09	Andy Smith slough	Taku River/Stikine Mainstem	54
SPORCU07.SPORCU11	Porcupine	Taku River/Stikine Mainstem	74
SDEVIL07.SDEVIL08	Devil's Elbow0708	Taku River/Stikine Mainstem	148

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ADF&G collection code	Location	Reporting group	*n*
SDEVIL09	Devil's Elbow09	Taku River/Stikine Mainstem	53
SSCUD07.SSCUD08.SSCUD09	Scud River	Taku River/Stikine Mainstem	192
SISKU85.SISKU86.SISKU02.SISKU06.SISKU08.SISKU09	Iskut River	Taku River/Stikine Mainstem	153
SISKU07	Iskut River (Craigson Slough)	Taku River/Stikine Mainstem	42
SCRAIG06.SCRAIG07.SCRAIG08	Craig River-CAN	Taku River/Stikine Mainstem	38
SBRON08.SBRON09	Bronson Slough	Taku River/Stikine Mainstem	78
SSHAKS06.SSHAKES07.SSHAKS09	Shakes Slough	Taku River/Stikine Mainstem	67
SCHRI11.SCHRI12	Christina Lake	Taku River/Stikine Mainstem	70
SCRES03	Crescent Lake	Snettisham	194
SSPEE03	Speel Lake	Snettisham	95
SSNET06.SSPEE07	Snettisham Hatchery0607	Snettisham	190
SSPEE13	Snettisham Hatchery13	Snettisham	146
SVIVID93	Vivid Lake	Other	48
SSECLK14.SSECLKIN14	Seclusion Lake	Other	117
SNBERG91	North Berg Bay Inlet91	Other	53
SNBERG92	North Berg Bay Inlet92	Other	100
SBART13	Bartlett River	Other	69
SNEVA08	Neva Lake08	Other	94
SNEVA09.SNEVA13	Neva Lake0913	Other	255
SHOKTAI04	Hoktaheen - main inlet	Other	47
SHOKTAO04	Hoktaheen - outlet	Other	49
SHOKTAM14	Hoktaheen - marine waters	Other	47
SKLAG09	Klag Bay Stream	Other	200
SFORD04	Ford Arm Lake	Other	207
SFORD13	Ford Arm Creek	Other	199
SREDOUBT13	Redoubt Lake	Other	200
SSALML07.SSALML08	Salmon Lake	Other	185
SNECKER91.SNECKER93	Benzeman Lake	Other	95
SFALL03.SFALL10	Falls Lake	Other	190
SREDB93	Redfish Lake	Other	94
SKUTL03	Kutlaku03	Other	95
SKUTL12	Kutlaku12	Other	78
SKUTL13	Kutlaku13	Other	50
SPAVLOF12.SPAVLOFR13	Pavlof River	Other	174
SKOOK07.SKOOK10L.SKOOK12L	Kook Lake Late	Other	194
SKOOK12E.SKOOK13	Kook Lake early	Other	148

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ADF&G collection code	Location	Reporting group	*n*
SSITK03.SSITK11.SSITK12	Sitkoh Lake	Other	351
SLEVA12	Lake Eva	Other	115
SHASSEL12.SHASSELR13	Hasselborg Lake	Other	209
SKANA07.SKANA10.SKANAL13	Kanalku Lake	Other	319
SBAIN10	Bainbridge Lake	Other	95
SCOGH91.SCOG92HL.SCOG92ES.SCOGH10	Coghill Lake	Other	378
SESHAR08.SESHA91	Eshamy Creek	Other	185
SMAIN91	Main Bay	Other	96
SMINE91.SMINE09	Miners Lake	Other	191
SEYAM07	Eyak Lake - Middle Arm	Other	95
SEYASB07	Eyak Lake - South beaches	Other	87
SEYAK10	Eyak Lake - Hatchery Creek	Other	95
SMEND08.SMEND09	Mendeltna Creek	Other	188
SSWEDE08	Swede Lake	Other	95
SFISHC08	East Fork Gulkana River	Other	95
SGULK08EF	Gulkana River - East Fork	Other	75
SPAXSO09	Paxson Lake	Other	75
SMENT08	Mentasta Lake	Other	95
STANA05	Tanada Creek	Other	94
STANAO09	Tanada Lake - lower outlet	Other	95
STANAS09	Tanada Lake - shore	Other	93
SKLUT08	Klutina River	Other	95
SKLUTI08.SKLUTI09	Klutina Lake	Other	95
SBEARH08	Bear Hole - Klutina	Other	94
SBANA08	Banana Lake - Klutina	Other	80
SSANN05.SSTACR08	St. Anne Creek	Other	186
SMAHL08	Mahlo River	Other	94
STONSL09	Tonsina Lake	Other	94
SLONGLK05	Long Lake	Other	95
STEBA08	Tebay River	Other	93
SSTEAM08	Steamboat Lake - Bremner	Other	95
SSALMC08	Salmon Creek - Bremner	Other	93
SCLEAR07	Clear Creek	Other	87
SMCKI07	McKinley Lake07	Other	95
SMCKI08	McKinley Lake08	Other	95
SMCKI91	McKinley Lake91	Other	95
SMCKSC07	McKinley Lake - Salmon Creek	Other	93
SMART07.SMART08	Martin Lake	Other	187

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ADF&G collection code	Location	Reporting group	*n*
SMARTR08	Martin River Slough	Other	95
STOKUN08.STOKUN09	Tokun Lake	Other	189
SBERI91	Bering Lake	Other	95
SKUSH07.SKUSH08	Kushtaka Lake	Other	189
SSITU07	Mountain Stream	Other	159
SSITU13	Situk Lake	Other	190
SOSITU07	Old Situk River	Other	163
SLOST03B	Lost/Tahwah Rivers	Other	93
SAHRN07	Ahrnklin River	Other	90
SDANG09	Dangerous River	Other	95
SAKWE09	Akwe River	Other	95
SEAST03B	East Alsek River	Other	94
SDATLAS12	Datlasaka Creek	Other	95
SGOATC07.SGOATC12	Goat Creek	Other	56
SBORD07.SBORD08	Border Slough0708	Other	71
SBORD09.SBORD11	Border Slough0911	Other	70
STWEED07	Tweedsmuir07	Other	48
STWEED09	Tweedsmuir09	Other	46
SVERNR09.SVERNR10	Vern Ritchie	Other	114
SNESK07	Neskataheen Lake	Other	195
SKLUK06	Klukshu River06	Other	95
SKLUK07	Klukshu River07	Other	94
SKUDW09.SKUDW10.SKUDW11	Kudwat Creek	Other	100
SBRIDGE11.SBRIDGE12	Tatshenshini - Bridge/Silver	Other	105
SSTINKY11	Tatshenshini - Stinky Creek	Other	40
SUTATS03	Upper Tatshenshini	Other	95
SLTATS01.SLTATS03	Little Tatshenshini Lake	Other	65
SKWAT11	Kwatini River	Other	65
SBLAN07	Blanchard River07	Other	89
SBLAN09	Blanchard River09	Other	62
SLTAH90	Tahltan Lake90	Other	95
STAHL06	Tahltan Lake06	Other	196
SPETL04	Petersburg Lake	Other	95
SKAHS03	Kah Sheets Lake	Other	96
SMILLC07E	Mill Creek Weir Early	Other	94
SMILLC07L	Mill Creek Weir Late	Other	95
SKUNK03	Kunk Lake	Other	96
STHOM04.STHOM14	Thoms Lake	Other	93
SREDBL04	Red Bay Lake	Other	95

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ADF&G collection code	Location	Reporting group	*n*
SSALM04.SSALM07	Salmon Bay Lake	Other	170
SSHIP03	Shipley Lake	Other	94
SSARK00.SSARF05	Sarkar Lakes	Other	91
SHATC03.SHATC07	Hatchery Creek	Other	142
SLUCK04	Luck Lake	Other	94
SBIGLK10.SBIGLA14	Big Lake	Other	161
SMCDO01.SMCDO03.SMCDO07.SMCDO13	McDonald Lake	Other	369
SKART92.SMCGI03.SMCGI04.SMCGI16	Karta River	Other	472
SGENE07	Unuk River07	Other	95
SGENE08	Unuk River08	Other	69
SHELM05	Helm Lake	Other	94
SHECK04.SHECK07	Heckman Lake	Other	189
SMAHO03.SMAHO07	Mahoney Creek	Other	154
SKEGA04	Kegan Lake	Other	95
SFILLM05	Fillmore Lake	Other	52
STHRE04.STHRE10	Klawock - Three Mile	Other	181
SINCK03.SINCK08.SHALF08	Klawock - Inlet Creek	Other	212
SHETT03.SHETT08.SHETT09L	Hetta Lake	Other	281
SHETT09M	Hetta Creek - middle run	Other	95
SHETT10E	Hetta Creek - early run	Other	95
SEEK04.SEEK07	Eek Creek	Other	50
SKLAK04	Klakas Lake	Other	95
SBAR04	Essowah Lake	Other	95
SHSMI92.SHUGH13	Hugh Smith	Other	155
SHUGH04	HS - Buschmann	Other	151
SCOBB07	HS - Cobb Creek	Other	99
SKWIN01.SKWIN12U	Kwinageese	Other	76
SBOWS01	Bowser Lake	Other	94
SBONN01.SBONN12	Bonney Creek	Other	164
SDAMD01	Damdochax Creek	Other	93
SMERI01.SMEZIB06	Meziadin Lake	Other	186
SHANNA06	Hanna Creek	Other	93
STINT06	Tintina Creek	Other	94
SGING97	Gingit Creek	Other	94
SALAS87.SALAS06	Alastair Lake	Other	118
SLAKEL06	Lakelelse Lake	Other	93
SSUST01	Sustut River	Other	79
SSALIX87.SSALIX88	Salix Bear	Other	94

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ADF&G collection code	Location	Reporting group	*n*
SMOTA87	Motase Lake	Other	47
SSLAM06	Slamgeesh River	Other	95
SUBAB06	Babine River	Other	95
SFMILE06	Four Mile Creek	Other	85
SPINK94.SPINK06	Pinkut Creek	Other	187
SGRIZ87	Grizzly Creek	Other	76
SPIER06	Pierre Creek	Other	95
SFULT06	Fulton River	Other	95
SMORR07	Morrison	Other	92
SLTAH94	Lower Tahlo River	Other	78
STAHLO07	Tahlo Creek	Other	95
SMCDON02.SMCDON06	McDonell Lake (Zymoetz River)	Other	131
SKALUM06	Kitsumkalum Lake06	Other	56
SKALUM12	Kitsumkalum Lake12	Other	94
SKITW12	Kitwanga River	Other	92
SSTECR01	Stephens Creek	Other	95
SNANG06	Nangeese River	Other	40
SKISP02	Kispiox River	Other	53
SSWANLK06	Swan Lake	Other	93
SNANI88.SNANI07	Nanika River	Other	114
SKYNO97	Trembleur - Kynock	Other	94
STACH01	Tachie River	Other	94
SSTEL07	Stellako River	Other	94
SFRAS96	Fraser Lake	Other	85
SMITCH01	Mitchell River	Other	94
SLHOR01.SUHOR01.SHORSE07	Horsefly River	Other	274
SNAHAT02	Nahatlatch River	Other	92
SCULT02	Cultus Lake	Other	91
SCHILW04	Chilliwack Lake	Other	90
SCHILK01	Chilko Lake	Other	87
SRAFT01	Raft River	Other	84
SLADA02.SADAM07	Adams River	Other	187
SMSHU02	Middle Shuswap River	Other	91
SSCOT00	Scotch River	Other	91
SGATES09	Gates Creek	Other	90
SBIRK07	Birkenhead River	Other	90
SWEAV01	Weaver Creek	Other	89
SHARR07	Harrison River	Other	95
SNTHOM05	North Thompson	Other	95

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ADF&G collection code	Location	Reporting group	*n*
SNADE95	Naden River	Other	95
SYAKO93	QCI - Yakoun Lake	Other	70
SKITIM10	Kitimat River	Other	93
SBLOOM05	Bloomfield Lake	Other	94
STANK03	Tankeeah River03	Other	47
STANK05	Tankeeah River05	Other	47
SAMBA04	Central Coast - Amback Creek	Other	91
SKITL06	Kitlope Lake	Other	95
SGCENLK02	Great Central Lake	Other	95
SQUAT03	Vancouver Island - Quatse River	Other	95
SOKAN02	Okanagan River	Other	95
SLAKE97	Lake Pleasant	Other	89
SISSA96	Issaquah Creek	Other	82
SWENA98	Lake Wenatchee	Other	95

Appendix D.–Chilkoot River weir dates of operation, annual estimates of sockeye salmon escapement, and counts of other species, 1976–2019. (Numbers in bold are historical records that have been updated since the last report by Bednarski et al. [2016]).

Year	Date in	Date out	Sockeye	Pink	Chum	Coho	Chinook
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	**72,678**	61,469	252	13	39
2008	4-Jun	12-Sep	**33,117**	15,105	**327**	50	31
2009	5-Jun	10-Sep	**33,705**	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	**118,166**	40,753	494	139	47
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
2016	3-Jun	9-Sep	86,721	8,354	116	53	2
2017	2-Jun	6-Sep	43,098	58,664	529	12	11
2018	3-Jun	8-Sep	85,463	5,475	225	95	31
2019	7-Jun	8-Sep	140,378	17,156	396	80	64
Average[a]	1-Jun	27-Sep	67,448	26,594	392	662	28

[a] Average values use 1976–2015 data and are based on standardized dates (1 June through 27 September).

Appendix E.–Daily and cumulative (cum.) Chilkoot River weir salmon counts by species, and water temperature and gauge heights, 2016.

	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp. (°C)
3-Jun	0	0	0	0	0	0	0	0	0	0	146	8.5
4-Jun	0	0	0	0	0	0	0	0	0	0	149	5.5
5-Jun	1	1	0	0	0	0	0	0	0	0	152	8.0
6-Jun	2	3	0	0	0	0	0	0	0	0	154	8.0
7-Jun	26	29	0	0	0	0	0	0	0	0	156	8.0
8-Jun	8	37	0	0	0	0	0	0	0	0	150	8.0
9-Jun	6	43	0	0	0	0	0	0	0	0	146	8.5
10-Jun	16	59	0	0	0	0	0	0	0	0	153	8.5
11-Jun	14	73	0	0	0	0	0	0	0	0	155	9.0
12-Jun	73	146	0	0	0	0	0	0	0	0	153	8.5
13-Jun	61	207	0	0	0	0	0	0	0	0	153	8.0
14-Jun	59	266	0	0	0	0	0	0	0	0	152	9.0
15-Jun	177	443	0	0	0	0	0	0	0	0	149	11.0
16-Jun	186	629	0	0	0	0	0	0	0	0	156	10.5
17-Jun	261	890	0	0	0	0	0	0	0	0	153	10.5
18-Jun	250	1,140	0	0	0	0	0	0	0	0	156	10.5
19-Jun	176	1,316	0	0	0	0	0	0	0	0	155	10.0
20-Jun	123	1,439	0	0	0	0	0	0	0	0	152	10.0
21-Jun	64	1,503	0	0	0	0	0	0	0	0	146	10.5
22-Jun	24	1,527	0	0	0	0	0	0	0	0	144	11.0
23-Jun	187	1,714	0	0	1	1	0	0	0	0	149	10.5
24-Jun	190	1,904	0	0	0	1	0	0	0	0	153	10.5
25-Jun	191	2,095	0	0	0	1	0	0	0	0	150	10.0
26-Jun	450	2,545	1	1	0	1	0	0	0	0	153	10.0
27-Jun	1,022	3,567	0	1	0	1	0	0	0	0	160	10.5
28-Jun	212	3,779	0	1	0	1	0	0	0	0	154	10.0
29-Jun	321	4,100	0	1	1	2	0	0	0	0	150	10.0
30-Jun	724	4,824	0	1	2	4	0	0	0	0	150	10.0
1-Jul	1,455	6,279	0	1	0	4	0	0	0	0	150	10.0
2-Jul	1,226	7,505	0	1	1	5	0	0	0	0	148	12.0
3-Jul	849	8,354	0	1	3	8	0	0	0	0	148	11.0
4-Jul	841	9,195	0	1	0	8	0	0	0	0	142	10.0
5-Jul	1,150	10,345	0	1	1	9	0	0	0	0	140	11.0
6-Jul	601	10,946	0	1	3	12	0	0	0	0	138	11.5

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Appendix E.–Page 2 of 3.

Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water level (cm)	Water temp. (°C)
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.		
7-Jul	342	11,288	1	2	0	12	0	0	0	0	137	10.5
8-Jul	1,178	12,466	2	4	2	14	0	0	0	0	138	11.0
9-Jul	902	13,368	2	6	3	17	0	0	0	0	144	12.0
10-Jul	544	13,912	3	9	0	17	0	0	0	0	149	12.0
11-Jul	671	14,583	0	9	2	19	0	0	0	0	146	11.5
12-Jul	1,518	16,101	0	9	0	19	0	0	0	0	147	11.5
13-Jul	910	17,011	0	9	0	19	0	0	0	0	152	11.5
14-Jul	1,215	18,226	0	9	3	22	0	0	0	0	155	11.5
15-Jul	1,218	19,444	10	19	5	27	0	0	0	0	154	12.0
16-Jul	1,091	20,535	23	42	1	28	0	0	0	0	154	11.5
17-Jul	524	21,059	3	45	0	28	0	0	0	0	155	13.0
18-Jul	769	21,828	3	48	3	31	0	0	0	0	155	12.5
19-Jul	959	22,787	5	53	3	34	0	0	0	0	157	13.5
20-Jul	1,813	24,600	13	66	1	35	0	0	1	1	152	12.0
21-Jul	1,420	26,020	34	100	4	39	0	0	0	1	147	12.0
22-Jul	2,003	28,023	11	111	1	40	0	0	0	1	144	11.5
23-Jul	941	28,964	4	115	2	42	0	0	0	1	152	11.0
24-Jul	448	29,412	0	115	1	43	0	0	0	1	169	9.5
25-Jul	124	29,536	0	115	3	46	0	0	0	1	162	10.5
26-Jul	287	29,823	0	115	3	49	0	0	0	1	157	11.0
27-Jul	802	30,625	3	118	3	52	0	0	0	1	154	11.0
28-Jul[a]	**765**	31,390	0	118	0	52	0	0	0	1	168	11.0
29-Jul[a]	**984**	32,374	0	118	1	53	0	0	0	1	172	11.0
30-Jul	1,142	33,516	16	134	3	56	0	0	0	1	153	11.0
31-Jul	1,265	34,781	14	148	9	65	0	0	0	1	144	11.0
1-Aug	3,057	37,838	71	219	2	67	0	0	1	2	138	11.0
2-Aug	5,058	42,896	67	286	2	69	0	0	0	2	139	11.0
3-Aug	4,442	47,338	74	360	0	69	0	0	0	2	136	11.5
4-Aug	13,701	61,039	232	592	0	69	0	0	0	2	138	11.5
5-Aug	8,488	69,527	1,131	1,723	0	69	0	0	0	2	137	11.0
6-Aug	4,043	73,570	919	2,642	0	69	0	0	0	2	137	11.0
7-Aug	4,354	77,924	786	3,428	0	69	0	0	0	2	140	11.0
8-Aug	1,607	79,531	958	4,386	0	69	1	1	0	2	139	11.5
9-Aug	343	79,874	515	4,901	0	69	0	1	0	2	147	11.0

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Appendix E.–Page 3 of 3.

Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp. (°C)
10-Aug	468	80,342	269	5,170	1	70	0	1	0	2	144	10.0
11-Aug	282	80,624	272	5,442	0	70	0	1	0	2	142	11.0
12-Aug	338	80,962	411	5,853	0	70	0	1	0	2	143	11.0
13-Aug	331	81,293	133	5,986	0	70	0	1	0	2	146	11.0
14-Aug	392	81,685	24	6,010	0	70	0	1	0	2	158	11.0
15-Aug	175	81,860	4	6,014	0	70	0	1	0	2	174	11.0
16-Aug	402	82,262	33	6,047	0	70	0	1	0	2	158	11.0
17-Aug	198	82,460	36	6,083	1	71	0	1	0	2	148	11.0
18-Aug	112	82,572	106	6,189	0	71	0	1	0	2	140	10.5
19-Aug	209	82,781	178	6,367	0	71	0	1	0	2	145	10.5
20-Aug	328	83,109	348	6,715	0	71	0	1	0	2	142	10.5
21-Aug	319	83,428	401	7,116	0	71	0	1	0	2	136	10.5
22-Aug	447	83,875	258	7,374	1	72	0	1	0	2	135	10.5
23-Aug	447	84,322	163	7,537	0	72	0	1	0	2	132	10.5
24-Aug	124	84,446	99	7,636	0	72	0	1	0	2	135	10.5
25-Aug	102	84,548	63	7,699	0	72	0	1	0	2	137	11.5
26-Aug	112	84,660	106	7,805	2	74	1	2	0	2	142	11.5
27-Aug	82	84,742	35	7,840	0	74	1	3	0	2	146	12.0
28-Aug	304	85,046	141	7,981	2	76	0	3	0	2	140	12.5
29-Aug	272	85,318	94	8,075	9	85	6	9	0	2	136	12.0
30-Aug	360	85,678	93	8,168	3	88	5	14	0	2	132	11.0
31-Aug	59	85,737	19	8,187	2	90	3	17	0	2	129	11.5
1-Sep	103	85,840	16	8,203	1	91	1	18	0	2	124	12.0
2-Sep	147	85,987	40	8,243	9	100	1	19	0	2	123	11.5
3-Sep	210	86,197	25	8,268	3	103	3	22	0	2	125	12.0
4-Sep	143	86,340	26	8,294	4	107	13	35	0	2	123	12.0
5-Sep	206	86,546	21	8,315	4	111	8	43	0	2	122	11.5
6-Sep	23	86,569	5	8,320	4	115	3	46	0	2	122	11.5
7-Sep	94	86,663	22	8,342	1	116	6	52	0	2	124	10.0
8-Sep	55	86,718	12	8,354	0	116	1	53	0	2	124	10.5
9-Sep	3	86,721	0	8,354	0	116	0	53	0	2	ND	ND

[a] Weir pickets were removed from 1200 hours on 28 July through 1500 hours on 29 July due to flood event; interpolated (**bold**) values were calculated for 28–29 July.

Appendix F.–Daily and cumulative (cum.) Chilkoot River weir salmon counts species, and water temperature and gauge heights, 2017.

	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp. (ºC)
1-Jun	0	0	0	0	0	0	0	0	0	0	150	9.0
2-Jun	1	1	0	0	0	0	0	0	0	0	152	8.0
3-Jun	8	9	0	0	0	0	0	0	0	0	152	9.0
4-Jun	14	23	0	0	0	0	0	0	0	0	154	8.0
5-Jun	16	39	0	0	0	0	0	0	0	0	148	8.0
6-Jun	4	43	0	0	0	0	0	0	0	0	142	9.0
7-Jun	6	49	0	0	0	0	0	0	0	0	146	9.0
8-Jun	45	94	0	0	0	0	0	0	0	0	156	10.0
9-Jun[a]	**23**	117	0	0	0	0	0	0	0	0	180	10.0
10-Jun[a]	**20**	137	0	0	0	0	0	0	0	0	177	9.0
11-Jun[a]	**17**	154	0	0	0	0	0	0	0	0	158	8.0
12-Jun	13	167	0	0	0	0	0	0	0	0	154	7.5
13-Jun	14	181	0	0	0	0	0	0	0	0	147	7.0
14-Jun	17	198	0	0	0	0	0	0	0	0	142	7.5
15-Jun	9	207	0	0	0	0	0	0	0	0	137	7.5
16-Jun	2	209	0	0	0	0	0	0	0	0	139	8.0
17-Jun	10	219	0	0	0	0	0	0	0	0	148	7.5
18-Jun	8	227	0	0	0	0	0	0	1	1	144	8.0
19-Jun	6	233	0	0	0	0	0	0	0	1	141	9.0
20-Jun	179	412	0	0	0	0	0	0	0	1	141	8.5
21-Jun	11	423	0	0	0	0	0	0	0	1	142	8.0
22-Jun	36	459	0	0	0	0	0	0	0	1	139	9.0
23-Jun	35	494	0	0	0	0	0	0	0	1	136	7.5
24-Jun	116	610	0	0	0	0	0	0	0	1	137	8.0
25-Jun	46	656	0	0	0	0	0	0	0	1	138	9.0
26-Jun	462	1,118	0	0	0	0	0	0	0	1	140	9.0
27-Jun	117	1,235	0	0	0	0	0	0	0	1	141	9.0
28-Jun	48	1,283	0	0	0	0	0	0	0	1	140	9.0
29-Jun	84	1,367	1	1	0	0	0	0	0	1	139	8.5
30-Jun	212	1,579	0	1	0	0	0	0	1	2	139	8.0
1-Jul	122	1,701	5	6	0	0	0	0	0	2	145	8.0
2-Jul	300	2,001	7	13	1	1	0	0	0	2	150	9.0
3-Jul	271	2,272	0	13	0	1	0	0	0	2	154	8.5
4-Jul	213	2,485	0	13	0	1	0	0	0	2	149	9.0

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Appendix F.–Page 2 of 3.

Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp. (ºC)
5-Jul	318	2,803	9	22	0	1	0	0	0	2	146	9.0
6-Jul	343	3,146	51	73	1	2	0	0	1	3	146	9.0
7-Jul	352	3,498	63	136	0	2	0	0	0	3	151	10.0
8-Jul	606	4,104	15	151	2	4	0	0	1	4	153	9.5
9-Jul	285	4,389	21	172	1	5	0	0	0	4	152	9.0
10-Jul	404	4,793	18	190	6	11	0	0	0	4	155	9.0
11-Jul	555	5,348	17	207	5	16	0	0	0	4	151	9.5
12-Jul	572	5,920	40	247	2	18	0	0	0	4	157	8.5
13-Jul	533	6,453	52	299	4	22	0	0	0	4	150	8.0
14-Jul	297	6,750	66	365	3	25	0	0	0	4	150	8.0
15-Jul	71	6,821	39	404	1	26	0	0	0	4	148	7.5
16-Jul	386	7,207	163	567	3	29	0	0	0	4	149	8.5
17-Jul	576	7,783	136	703	2	31	0	0	1	5	152	8.5
18-Jul	700	8,483	116	819	7	38	0	0	0	5	150	9.0
19-Jul	920	9,403	246	1,065	6	44	0	0	0	5	148	9.0
20-Jul	1,107	10,510	449	1,514	13	57	0	0	1	6	146	8.0
21-Jul	1,348	11,858	559	2,073	16	73	0	0	0	6	142	8.5
22-Jul	1,256	13,114	858	2,931	13	86	0	0	3	9	140	8.0
23-Jul	1,016	14,130	2,095	5,026	6	92	0	0	0	9	138	9.0
24-Jul	1,139	15,269	568	5,594	6	98	0	0	0	9	139	9.5
25-Jul	371	15,640	144	5,738	4	102	0	0	0	9	140	9.5
26-Jul	1,077	16,717	446	6,184	8	110	0	0	1	10	140	8.5
27-Jul	1,270	17,987	613	6,797	7	117	0	0	0	10	139	9.0
28-Jul	1,176	19,163	459	7,256	3	120	0	0	0	10	141	8.5
29-Jul	490	19,653	141	7,397	2	122	0	0	0	10	138	9.0
30-Jul	2,217	21,870	384	7,781	10	132	0	0	0	10	135	9.5
31-Jul	1,370	23,240	595	8,376	6	138	0	0	0	10	134	9.5
1-Aug	1,049	24,289	1,302	9,678	1	139	0	0	0	10	134	10.5
2-Aug	2,385	26,674	2,288	11,966	4	143	0	0	1	11	134	10.0
3-Aug	1,245	27,919	1,781	13,747	9	152	0	0	0	11	135	9.5
4-Aug	859	28,778	1,826	15,573	0	152	0	0	0	11	136	10.5
5-Aug	1,044	29,822	1,943	17,516	8	160	0	0	0	11	141	11.0
6-Aug	947	30,769	1,776	19,292	6	166	0	0	0	11	145	10.5

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Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp. (ºC)
7-Aug	1,144	31,913	5,919	25,211	5	171	0	0	0	11	148	11.0
8-Aug	395	32,308	2,519	27,730	3	174	0	0	0	11	146	11.0
9-Aug	217	32,525	1,356	29,086	5	179	0	0	0	11	149	11.0
10-Aug	380	32,905	1,198	30,284	5	184	0	0	0	11	141	11.0
11-Aug	243	33,148	1,750	32,034	9	193	0	0	0	11	142	11.5
12-Aug	713	33,861	2,178	34,212	10	203	0	0	0	11	138	11.0
13-Aug	305	34,166	410	34,622	9	212	0	0	0	11	138	11.0
14-Aug	634	34,800	547	35,169	30	242	0	0	0	11	143	9.5
15-Aug	48	34,848	90	35,259	11	253	0	0	0	11	138	10.5
16-Aug	541	35,389	456	35,715	9	262	0	0	0	11	135	10.0
17-Aug	628	36,017	1,118	36,833	20	282	0	0	0	11	135	9.0
18-Aug	928	36,945	3,346	40,179	14	296	0	0	0	11	138	10.0
19-Aug	769	37,714	2,247	42,426	25	321	0	0	0	11	134	9.5
20-Aug	502	38,216	1,901	44,327	6	327	0	0	0	11	134	9.5
21-Aug	607	38,823	2,681	47,008	10	337	0	0	0	11	139	10.0
22-Aug	233	39,056	1,841	48,849	4	341	0	0	0	11	149	10.0
23-Aug	63	39,119	200	49,049	2	343	0	0	0	11	160	8.5
24-Aug	139	39,258	709	49,758	4	347	0	0	0	11	152	8.5
25-Aug	405	39,663	1,703	51,461	5	352	1	1	0	11	142	9.0
26-Aug	46	39,709	61	51,522	1	353	0	1	0	11	157	9.5
27-Aug	167	39,876	133	51,655	2	355	0	1	0	11	155	8.5
28-Aug	677	40,553	681	52,336	5	360	0	1	0	11	145	9.0
29-Aug	706	41,259	1,837	54,173	18	378	0	1	0	11	138	9.0
30-Aug	176	41,435	1,263	55,436	28	406	0	1	0	11	139	9.5
31-Aug	235	41,670	365	55,801	6	412	0	1	0	11	148	9.5
1-Sep	223	41,893	606	56,407	4	416	1	2	0	11	144	9.0
2-Sep	245	42,138	398	56,805	9	425	0	2	0	11	135	9.0
3-Sep	448	42,586	1,078	57,883	30	455	2	4	0	11	132	9.0
4-Sep	276	42,862	561	58,444	37	492	3	7	0	11	130	9.0
5-Sep	101	42,963	142	58,586	14	506	3	10	0	11	144	9.5
6-Sep	135	43,098	78	58,664	23	529	2	12	0	11	150	10.0

[a] Weir pickets were removed from 0600 hours on 9 June through 1530 hours on 11 June due to flood event; interpolated (**bold**) values were calculated for 9–11 June.

Appendix G.–Daily and cumulative (cum.) Chilkoot River weir salmon counts by species, and water temperature and gauge heights, 2018.

	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp (ºC)
3-Jun	0	0	0	0	0	0	0	0	0	0	127	7.5
4-Jun	0	0	0	0	0	0	0	0	0	0	128	8.0
5-Jun	1	1	0	0	0	0	0	0	0	0	132	7.0
6-Jun	2	3	0	0	0	0	0	0	0	0	133	8.5
7-Jun	0	3	0	0	0	0	0	0	0	0	133	7.5
8-Jun	1	4	0	0	0	0	0	0	0	0	132	7.5
9-Jun	0	4	0	0	0	0	0	0	0	0	128	8.5
10-Jun	0	4	0	0	0	0	0	0	0	0	131	8.0
11-Jun	0	4	0	0	0	0	0	0	0	0	130	7.5
12-Jun	0	4	0	0	0	0	0	0	0	0	129	7.0
13-Jun	1	5	0	0	0	0	0	0	0	0	129	7.5
14-Jun	23	28	0	0	0	0	0	0	0	0	133	8.5
15-Jun	2	30	0	0	0	0	0	0	0	0	142	8.0
16-Jun	0	30	0	0	0	0	0	0	0	0	137	8.0
17-Jun	38	68	0	0	0	0	0	0	0	0	139	8.0
18-Jun	19	87	0	0	0	0	0	0	0	0	144	8.0
19-Jun	53	140	0	0	0	0	0	0	0	0	154	9.0
20-Jun	104	244	0	0	0	0	0	0	0	0	161	9.0
21-Jun	40	284	0	0	1	1	0	0	0	0	166	8.3
22-Jun	27	311	0	0	0	1	0	0	0	0	164	9.5
23-Jun	49	360	0	0	0	1	0	0	0	0	157	9.5
24-Jun	252	612	0	0	1	2	0	0	0	0	146	9.0
25-Jun	54	666	0	0	0	2	0	0	0	0	142	9.5
26-Jun	58	724	0	0	0	2	0	0	0	0	138	8.5
27-Jun	435	1,159	0	0	0	2	0	0	0	0	136	9.0
28-Jun	319	1,478	0	0	1	3	0	0	0	0	136	9.0
29-Jun	179	1,657	0	0	0	3	0	0	0	0	134	9.5
30-Jun	221	1,878	0	0	2	5	0	0	0	0	134	9.5
1-Jul	209	2,087	0	0	2	7	0	0	0	0	134	9.0
2-Jul	245	2,332	0	0	1	8	0	0	0	0	134	9.5
3-Jul	593	2,925	0	0	2	10	0	0	0	0	139	9.5
4-Jul	330	3,255	0	0	1	11	0	0	0	0	148	12.0
5-Jul	339	3,594	0	0	2	13	0	0	1	1	152	10.5
6-Jul	270	3,864	0	0	3	16	0	0	0	1	154	11.0

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	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp (ºC)
7-Jul	373	4,237	0	0	3	19	0	0	0	1	152	11.0
8-Jul	178	4,415	0	0	1	20	0	0	0	1	146	11.0
9-Jul	541	4,956	0	0	3	23	0	0	0	1	142	10.5
10-Jul	1,532	6,488	0	0	6	29	0	0	2	3	138	9.0
11-Jul	991	7,479	0	0	3	32	0	0	0	3	147	9.0
12-Jul	579	8,058	0	0	1	33	0	0	1	4	143	9.0
13-Jul	518	8,576	0	0	3	36	0	0	3	7	138	9.5
14-Jul	1,082	9,658	1	1	4	40	0	0	1	8	136	9.5
15-Jul	540	10,198	0	1	5	45	0	0	1	9	134	9.0
16-Jul	229	10,427	2	3	2	47	0	0	3	12	142	9.0
17-Jul	257	10,684	1	4	2	49	0	0	2	14	142	9.5
18-Jul	696	11,380	7	11	8	57	0	0	3	17	138	10.0
19-Jul	282	11,662	3	14	1	58	0	0	0	17	136	9.5
20-Jul	389	12,051	9	23	5	63	0	0	1	18	136	9.5
21-Jul	8,715	20,766	68	91	14	77	0	0	2	20	140	10.5
22-Jul	13,041	33,807	106	197	10	87	0	0	2	22	142	11.0
23-Jul	1,583	35,390	125	322	5	92	0	0	0	22	146	11.5
24-Jul	2,424	37,814	95	417	4	96	0	0	0	22	148	11.5
25-Jul	4,740	42,554	61	478	6	102	0	0	3	25	144	11.5
26-Jul	4,938	47,492	168	646	5	107	0	0	1	26	144	12.0
27-Jul	4,770	52,262	279	925	7	114	0	0	1	27	142	13.0
28-Jul	6,472	58,734	233	1,158	3	117	0	0	0	27	144	12.0
29-Jul	5,002	63,736	269	1,427	13	130	0	0	0	27	145	12.0
30-Jul	3,244	66,980	228	1,655	5	135	0	0	0	27	147	13.0
31-Jul	1,533	68,513	113	1,768	1	136	0	0	0	27	148	13.5
1-Aug	679	69,192	139	1,907	1	137	0	0	1	28	150	12.5
2-Aug	425	69,617	60	1,967	1	138	0	0	1	29	148	12.5
3-Aug	739	70,356	58	2,025	1	139	0	0	0	29	142	12.5
4-Aug	1,640	71,996	211	2,236	1	140	0	0	0	29	140	12.5
5-Aug	944	72,940	464	2,700	5	145	0	0	0	29	142	13.0
6-Aug	1,073	74,013	486	3,186	1	146	0	0	0	29	140	12.5
7-Aug	642	74,655	287	3,473	14	160	0	0	0	29	138	10.5
8-Aug	665	75,320	93	3,566	0	160	0	0	0	29	150	10.0

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Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp (ºC)
9-Aug[a]	**517**	75,837	**167**	3,733	**5**	165	0	0	0	29	174	10.0
10-Aug[a]	**380**	76,217	**144**	3,877	**3**	168	0	0	0	29	162	10.5
11-Aug	83	76,300	37	3,914	1	169	0	0	0	29	150	10.5
12-Aug	402	76,702	206	4,120	1	170	0	0	0	29	141	10.5
13-Aug	402	77,104	92	4,212	2	172	0	0	0	29	137	10.5
14-Aug	584	77,688	26	4,238	4	176	0	0	0	29	156	10.5
15-Aug	500	78,188	46	4,284	2	178	0	0	0	29	152	10.0
16-Aug	266	78,454	128	4,412	3	181	0	0	0	29	140	10.0
17-Aug	922	79,376	187	4,599	5	186	0	0	0	29	132	10.0
18-Aug	616	79,992	90	4,689	4	190	0	0	0	29	128	10.0
19-Aug	1,193	81,185	131	4,820	3	193	0	0	0	29	124	10.0
20-Aug	562	81,747	94	4,914	0	193	0	0	1	30	124	10.0
21-Aug	343	82,090	53	4,967	0	193	0	0	0	30	125	10.5
22-Aug	176	82,266	54	5,021	1	194	0	0	0	30	134	10.0
23-Aug	258	82,524	42	5,063	3	197	0	0	0	30	134	11.0
24-Aug	1,002	83,526	98	5,161	1	198	0	0	0	30	130	10.0
25-Aug	198	83,724	63	5,224	2	200	0	0	0	30	138	10.5
26-Aug	174	83,898	64	5,288	1	201	0	0	0	30	133	11.0
27-Aug	802	84,700	69	5,357	6	207	0	0	0	30	133	10.5
28-Aug	120	84,820	58	5,415	1	208	0	0	0	30	138	10.5
29-Aug	89	84,909	21	5,436	2	210	1	1	0	30	151	10.5
30-Aug	18	84,927	11	5,447	2	212	0	1	0	30	142	10.0
31-Aug	34	84,961	5	5,452	2	214	1	2	0	30	135	10.0
1-Sep	38	84,999	7	5,459	2	216	2	4	0	30	130	10.0
2-Sep	106	85,105	3	5,462	0	216	1	5	0	30	128	10.0
3-Sep	46	85,151	1	5,463	0	216	0	5	0	30	124	10.0
4-Sep	33	85,184	2	5,465	2	218	0	5	0	30	123	10.5
5-Sep	5	85,189	0	5,465	0	218	0	5	0	30	121	10.0
6-Sep	76	85,265	1	5,466	3	221	2	7	1	31	120	11.0
7-Sep	46	85,311	6	5,472	3	224	28	35	0	31	118	11.0
8-Sep	152	85,463	3	5,475	1	225	60	95	0	31	115	11.5

[a] Weir pickets were removed from 1100 hours on 9 August through 1400 hours on 10 August due to flood event; interpolated (**bold**) values calculated for 9–10 August.

Appendix H.–Daily and cumulative (cum.) Chilkoot River weir salmon counts by species, and water temperature and gauge heights, 2019.

	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp. (ºC)
7-Jun	2	2	0	0	0	0	0	0	0	0	140	8.0
8-Jun	0	2	0	0	0	0	0	0	0	0	142	8.5
9-Jun	2	4	0	0	0	0	0	0	0	0	139	8.5
10-Jun	0	4	0	0	0	0	0	0	0	0	136	10.0
11-Jun	0	4	0	0	0	0	0	0	0	0	135	8.5
12-Jun	12	16	0	0	0	0	0	0	0	0	146	8.0
13-Jun	0	16	0	0	0	0	0	0	0	0	150	8.0
14-Jun	3	19	0	0	0	0	0	0	0	0	146	9.0
15-Jun	0	19	0	0	0	0	0	0	0	0	144	9.5
16-Jun	5	24	0	0	0	0	0	0	0	0	146	9.0
17-Jun	66	90	0	0	0	0	0	0	1	1	154	8.5
18-Jun	20	110	0	0	0	0	0	0	1	2	165	8.0
19-Jun	153	263	0	0	0	0	0	0	0	2	160	8.0
20-Jun	147	410	0	0	0	0	0	0	5	7	152	8.5
21-Jun	126	536	0	0	0	0	0	0	0	7	153	8.5
22-Jun	407	943	0	0	0	0	0	0	1	8	150	9.0
23-Jun	517	1,460	0	0	0	0	0	0	1	9	148	9.5
24-Jun	381	1,841	0	0	0	0	0	0	2	11	146	11.0
25-Jun	245	2,086	0	0	0	0	0	0	1	12	145	9.0
26-Jun	617	2,703	0	0	0	0	0	0	3	15	150	10.5
27-Jun	506	3,209	0	0	0	0	0	0	2	17	155	12.0
28-Jun	544	3,753	0	0	0	0	0	0	1	18	155	12.5
29-Jun	513	4,266	0	0	0	0	0	0	0	18	154	10.5
30-Jun	195	4,461	0	0	0	0	0	0	0	18	160	11.5
1-Jul	564	5,025	27	27	0	0	0	0	0	18	158	12.5
2-Jul	656	5,681	7	34	0	0	0	0	0	18	158	12.0
3-Jul	797	6,478	5	39	0	0	0	0	1	19	160	12.5
4-Jul	467	6,945	8	47	0	0	0	0	1	20	157	12.5
5-Jul	727	7,672	17	64	0	0	0	0	1	21	156	13.0
6-Jul	1,103	8,775	7	71	0	0	0	0	7	28	157	13.0
7-Jul	764	9,539	43	114	0	0	0	0	3	31	155	12.5
8-Jul	928	10,467	52	166	0	0	0	0	0	31	154	11.5
9-Jul	860	11,327	41	207	0	0	0	0	0	31	148	13.0
10-Jul	817	12,144	13	220	0	0	0	0	0	31	142	12.0

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Date	Sockeye salmon Daily	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 (cm)	Water temp. (ºC)
11-Jul	1,417	13,561	15	235	0	0	0	0	0	31	142	12.0
12-Jul	2,571	16,132	12	247	0	0	0	0	2	33	138	11.0
13-Jul	2,361	18,493	8	255	0	0	0	0	1	34	134	11.0
14-Jul	1,905	20,398	72	327	1	1	0	0	5	39	130	11.0
15-Jul	1,457	21,855	74	401	3	4	0	0	1	40	130	11.5
16-Jul	2,144	23,999	63	464	4	8	0	0	4	44	130	11.0
17-Jul	1,041	25,040	39	503	2	10	0	0	2	46	132	11.5
18-Jul	2,859	27,899	82	585	2	12	0	0	3	49	133	12.0
19-Jul	1,128	29,027	62	647	4	16	0	0	0	49	136	10.5
20-Jul	1,538	30,565	45	692	1	17	0	0	1	50	135	11.0
21-Jul	1,323	31,888	40	732	5	22	0	0	4	54	134	10.5
22-Jul	1,408	33,296	80	812	18	40	0	0	0	54	134	12.0
23-Jul	5,568	38,864	191	1,003	18	58	0	0	0	54	136	10.5
24-Jul	8,762	47,626	215	1,218	16	74	0	0	5	59	135	11.0
25-Jul	13,069	60,695	419	1,637	6	80	0	0	1	60	134	10.5
26-Jul	11,225	71,920	238	1,875	5	85	0	0	1	61	133	11.0
27-Jul	14,723	86,643	553	2,428	13	98	0	0	0	61	134	11.5
28-Jul	12,047	98,690	145	2,573	25	123	0	0	0	61	142	9.0
29-Jul	2,582	101,272	88	2,661	4	127	0	0	0	61	145	9.0
30-Jul	1,401	102,673	476	3,137	2	129	0	0	1	62	142	10.0
31-Jul	4,267	106,940	1,357	4,494	2	131	0	0	0	62	138	10.5
1-Aug	3,518	110,458	1,414	5,908	0	131	0	0	0	62	138	10.0
2-Aug	1,508	111,966	794	6,702	1	132	0	0	0	62	136	10.5
3-Aug	2,123	114,089	582	7,284	1	133	0	0	1	63	135	10.5
4-Aug	1,854	115,943	484	7,768	8	141	0	0	0	63	140	11.5
5-Aug	1,194	117,137	572	8,340	2	143	0	0	0	63	142	11.5
6-Aug	1,452	118,589	359	8,699	2	145	0	0	0	63	144	11.5
7-Aug	907	119,496	189	8,888	0	145	0	0	0	63	150	12.0
8-Aug	529	120,025	147	9,035	1	146	0	0	0	63	149	13.0
9-Aug	806	120,831	410	9,445	9	155	0	0	0	63	140	13.5
10-Aug	408	121,239	95	9,540	0	155	0	0	0	63	135	12.5
11-Aug	1,696	122,935	371	9,911	3	158	0	0	0	63	132	13.0
12-Aug	2,135	125,070	401	10,312	10	168	0	0	0	63	130	12.5
13-Aug	1,454	126,524	362	10,674	5	173	0	0	1	64	134	12.0

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Appendix H.–Page 3 of 3.

Date	Sockeye salmon		Pink salmon		Chum salmon		Coho salmon		Chinook salmon		Water	Water
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	level (cm)	temp. (ºC)
14-Aug	1,041	127,565	317	10,991	1	174	0	0	0	64	132	11.5
15-Aug	1,110	128,675	229	11,220	0	174	0	0	0	64	131	10.5
16-Aug	1,088	129,763	242	11,462	1	175	0	0	0	64	133	ND
17-Aug	658	130,421	374	11,836	1	176	0	0	0	64	135	ND
18-Aug	491	130,912	306	12,142	9	185	0	0	0	64	135	11.0
19-Aug	1,328	132,240	499	12,641	9	194	0	0	0	64	124	11.5
20-Aug	561	132,801	174	12,815	48	242	0	0	0	64	120	11.0
21-Aug	692	133,493	77	12,892	7	249	0	0	0	64	114	11.0
22-Aug	376	133,869	97	12,989	1	250	0	0	0	64	113	10.5
23-Aug	424	134,293	85	13,074	2	252	0	0	0	64	114	10.5
24-Aug	728	135,021	144	13,218	1	253	0	0	0	64	118	10.0
25-Aug	530	135,551	173	13,391	4	257	4	4	0	64	126	9.5
26-Aug	506	136,057	171	13,562	11	268	9	13	0	64	126	9.5
27-Aug	716	136,773	175	13,737	21	289	5	18	0	64	132	10.0
28-Aug	325	137,098	239	13,976	2	291	1	19	0	64	134	10.0
29-Aug	257	137,355	342	14,318	0	291	0	19	0	64	128	9.5
30-Aug	417	137,772	584	14,902	2	293	1	20	0	64	128	10.5
31-Aug	707	138,479	696	15,598	4	297	3	23	0	64	126	10.5
1-Sep	375	138,854	395	15,993	0	297	7	30	0	64	124	10.5
2-Sep	339	139,193	134	16,127	1	298	3	33	0	64	122	9.0
3-Sep	246	139,439	217	16,344	1	299	3	36	0	64	122	10.0
4-Sep	311	139,750	258	16,602	2	301	5	41	0	64	122	10.0
5-Sep	173	139,923	141	16,743	1	302	2	43	0	64	120	10.0
6-Sep	112	140,035	161	16,904	27	329	12	55	0	64	118	10.0
7-Sep	138	140,173	122	17,026	46	375	7	62	0	64	118	11.0
8-Sep	205	140,378	130	17,156	21	396	18	80	0	64	120	11.0

Appendix I.–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 (1976–2016) and genetic stock identification (2017–2019).

	Harvest			Percentile rank			Percent of harvest		
Year	Chilkoot Lake	Chilkat Lake	Other[a]	Chilkoot Lake	Chilkat Lake	Other	Chilkoot Lake	Chilkat Lake	Other
1976	**61,861**	**58,765**	**4,796**	**0.51**	**0.42**	**0.12**	**49%**	**47%**	**4%**
1977	**113,555**	**41,477**	**5,389**	**0.65**	**0.23**	**0.14**	**71%**	**26%**	**3%**
1978	14,264	89,558	4,658	0.12	0.67	0.09	13%	83%	4%
1979	69,864	115,995	7,117	0.58	0.81	0.16	36%	60%	4%
1980	**21,244**	**31,267**	**1,588**	**0.21**	**0.16**	**0.02**	**39%**	**58%**	**3%**
1981	**43,756**	**48,420**	**1,070**	**0.44**	**0.33**	**0.00**	**47%**	**52%**	**1%**
1982	**144,748**	**127,174**	**1,911**	**0.81**	**0.88**	**0.05**	**53%**	**46%**	**1%**
1983	**242,034**	**124,180**	**3,965**	**0.93**	**0.84**	**0.07**	**65%**	**34%**	**1%**
1984	225,634	99,592	9,502	0.88	0.70	0.19	67%	30%	3%
1985	153,533	131,091	18,704	0.84	0.91	0.49	51%	43%	6%
1986	110,114	168,006	12,174	0.60	1.00	0.30	38%	58%	4%
1987	327,323	69,900	18,658	1.00	0.51	0.47	79%	17%	4%
1988	248,640	76,883	26,353	0.95	0.58	0.74	71%	22%	7%
1989	292,830	156,160	25,908	0.98	0.98	0.72	62%	33%	5%
1990	181,260	149,377	31,499	0.86	0.93	0.81	50%	41%	9%
1991	228,607	60,721	24,353	0.91	0.47	0.67	73%	19%	8%
1992	142,471	113,146	33,729	0.79	0.79	0.91	49%	39%	12%
1993	52,080	103,531	19,605	0.47	0.74	0.56	30%	59%	11%
1994	**25,367**	**126,852**	**19,578**	**0.28**	**0.86**	**0.53**	**15%**	**74%**	**11%**
1995	9,637	68,737	10,302	0.09	0.49	0.23	11%	78%	12%
1996	19,882	99,677	30,019	0.19	0.72	0.79	13%	67%	20%
1997	31,822	73,761	13,245	0.35	0.53	0.35	27%	62%	11%
1998	2,838	112,630	19,469	0.02	0.77	0.51	2%	83%	14%
1999	4,604	149,410	9,547	0.05	0.95	0.21	3%	91%	6%
2000	14,622	78,265	16,673	0.14	0.60	0.40	13%	71%	15%
2001	66,355	60,183	21,273	0.53	0.44	0.60	45%	41%	14%
2002	24,200	47,332	10,482	0.26	0.28	0.28	30%	58%	13%
2003	32,446	49,955	12,729	0.40	0.35	0.33	34%	53%	13%
2004	66,498	51,110	33,637	0.56	0.37	0.88	44%	34%	22%
2005	29,276	22,852	13,341	0.33	0.14	0.37	45%	35%	20%
2006	119,201	15,979	10,400	0.67	0.07	0.26	82%	11%	7%
2007	125,199	14,208	17,529	0.74	0.02	0.44	80%	9%	11%
2008	7,491	22,156	17,008	0.07	0.12	0.42	16%	47%	36%
2009	**16,622**	**85,551**	**24,422**	**0.16**	**0.65**	**0.70**	**13%**	**68%**	**19%**
2010	32,064	48,079	20,830	0.37	0.30	0.58	32%	48%	21%
2011	26,766	15,599	21,428	0.30	0.05	0.63	42%	24%	34%
2012	**124,366**	**54,884**	**45,393**	**0.72**	**0.40**	**0.98**	**55%**	**24%**	**20%**
2013	23,111	75,588	23,404	0.23	0.56	0.65	19%	62%	19%
2014	110,487	81,502	42,693	0.63	0.63	0.95	47%	35%	18%
2015	58,568	33,085	39,924	0.49	0.19	0.93	45%	25%	30%
2016	119,843	35,991	33,010	0.70	0.21	0.86	63%	19%	17%
2017	1,933	5,698	32,085	0.00	0.00	0.84	14%	5%	81%
2018	33,969	19,235	28,483	0.42	0.09	0.77	42%	24%	35%
2019	149,586	40,935	51,012	0.81	0.23	1.00	62%	17%	21%
Average[b]	91,131	78,816	18,108				41%	47%	12%
Median[b]	60,214	74,675	18,094				44%	47%	11%

Note: Bold estimates are historical records that have been updated since the last project report by Bednarski et al. (2016).

[a] *Other* includes Chilkat River mainstem spawning stocks (1976–2019).

[b] Average and median values use 1976–2015 data.

Appendix J.–District 15 commercial drift gillnet fishery data used in genetic stock identification analysis and results by statistical week and reporting group, 2017.

Stat. week	Sample size	Geno-typed	Aged only	Not genotyped or aged	Reporting group	Mean	SD	CI 5%	CI 95%
25	300	185	95	20	Chilkat Lake	0.131	0.026	0.091	0.175
					Chilkat Mainstem	0.005	0.010	0.000	0.027
					Chilkoot	0.045	0.016	0.023	0.074
					Other	0.819	0.030	0.767	0.866
26	305	187	95	23	Chilkat Lake	0.114	0.025	0.076	0.157
					Chilkat Mainstem	0.033	0.015	0.011	0.061
					Chilkoot	0.064	0.020	0.035	0.099
					Other	0.790	0.033	0.735	0.842
27	312	185	104	23	Chilkat Lake	0.209	0.032	0.159	0.262
					Chilkat Mainstem	0.062	0.019	0.033	0.096
					Chilkoot	0.065	0.021	0.034	0.101
					Other	0.664	0.038	0.601	0.725
28	190	188	2	0	Chilkat Lake	0.164	0.039	0.103	0.233
					Chilkat Mainstem	0.005	0.010	0.000	0.027
					Chilkoot	0.113	0.033	0.065	0.170
					Other	0.718	0.049	0.634	0.795
29	360	187	152	21	Chilkat Lake	0.057	0.018	0.031	0.089
					Chilkat Mainstem	0.006	0.007	0.000	0.020
					Chilkoot	0.024	0.013	0.007	0.049
					Other	0.912	0.022	0.872	0.946
30	305	183	113	9	Chilkat Lake	0.060	0.019	0.032	0.093
					Chilkat Mainstem	0.014	0.012	0.000	0.037
					Chilkoot	0.035	0.015	0.014	0.061
					Other	0.891	0.026	0.846	0.930
31	240	185	49	6	Chilkat Lake	0.088	0.023	0.053	0.129
					Chilkat Mainstem	0.001	0.003	0.000	0.007
					Chilkoot	0.056	0.020	0.026	0.092
					Other	0.855	0.029	0.804	0.900
32	303	170	111	22	Chilkat Lake	0.365	0.039	0.303	0.429
					Chilkat Mainstem	0.028	0.013	0.010	0.051
					Chilkoot	0.050	0.018	0.024	0.083
					Other	0.558	0.040	0.491	0.624
33	300	184	101	15	Chilkat Lake	0.175	0.031	0.125	0.228
					Chilkat Mainstem	0.005	0.007	0.000	0.020
					Chilkoot	0.085	0.022	0.051	0.124
					Other	0.736	0.037	0.673	0.796
34–40	300	186	98	16	Chilkat Lake	0.136	0.026	0.094	0.181
					Chilkat Mainstem	0.001	0.003	0.000	0.008
					Chilkoot	0.048	0.018	0.021	0.080
					Other	0.815	0.030	0.764	0.862
All	2915	1,840	920	155	Chilkat Lake	0.143	0.010	0.127	0.160
					Chilkat Mainstem	0.013	0.003	0.008	0.019
					Chilkoot	0.049	0.007	0.038	0.060
					Other	0.795	0.011	0.776	0.813

Appendix K.–District 15 commercial drift gillnet fishery data used in genetic stock identification analysis and results by statistical week and reporting group, 2018.

Stat. week	Sample size	Geno-typed	Aged only	Not genotyped or aged	Reporting group	Mean	SD	CI 5%	CI 95%
25	126	121	5	0	Chilkat Lake	0.273	0.043	0.204	0.346
					Chilkat Mainstem	0.061	0.026	0.022	0.109
					Chilkoot	0.178	0.035	0.124	0.237
					Other	0.488	0.048	0.410	0.567
26	326	186	100	40	Chilkat Lake	0.264	0.035	0.208	0.322
					Chilkat Mainstem	0.104	0.024	0.068	0.145
					Chilkoot	0.081	0.022	0.049	0.120
					Other	0.551	0.040	0.485	0.615
27	413	183	195	35	Chilkat Lake	0.240	0.031	0.190	0.293
					Chilkat Mainstem	0.060	0.023	0.025	0.100
					Chilkoot	0.160	0.027	0.118	0.205
					Other	0.540	0.040	0.475	0.606
28	503	186	261	56	Chilkat Lake	0.158	0.028	0.116	0.207
					Chilkat Mainstem	0.023	0.015	0.001	0.050
					Chilkoot	0.268	0.033	0.214	0.323
					Other	0.551	0.038	0.488	0.613
29	390	186	166	38	Chilkat Lake	0.168	0.029	0.122	0.217
					Chilkat Mainstem	0.001	0.003	0.000	0.006
					Chilkoot	0.283	0.035	0.227	0.341
					Other	0.548	0.040	0.483	0.613
30	310	188	89	33	Chilkat Lake	0.208	0.030	0.160	0.259
					Chilkat Mainstem	0.008	0.010	0.000	0.028
					Chilkoot	0.392	0.036	0.332	0.452
					Other	0.392	0.037	0.331	0.454
31	399	187	166	46	Chilkat Lake	0.212	0.029	0.165	0.262
					Chilkat Mainstem	0.003	0.006	0.000	0.015
					Chilkoot	0.503	0.037	0.442	0.562
					Other	0.282	0.035	0.225	0.341
32	300	182	88	30	Chilkat Lake	0.278	0.030	0.230	0.328
					Chilkat Mainstem	0.001	0.002	0.000	0.004
					Chilkoot	0.417	0.035	0.359	0.476
					Other	0.305	0.034	0.251	0.361
33	340	189	114	37	Chilkat Lake	0.262	0.029	0.215	0.311
					Chilkat Mainstem	0.001	0.002	0.000	0.005
					Chilkoot	0.239	0.031	0.189	0.291
					Other	0.499	0.036	0.440	0.558
34–40	300	186	80	34	Chilkat Lake	0.283	0.030	0.234	0.333
					Chilkat Mainstem	0.004	0.006	0.000	0.016
					Chilkoot	0.565	0.034	0.508	0.620
					Other	0.149	0.027	0.107	0.194
All	3,407	1,794	1,264	349	Chilkat Lake	0.235	0.012	0.216	0.255
					Chilkat Mainstem	0.009	0.003	0.005	0.014
					Chilkoot	0.416	0.014	0.393	0.439
					Other	0.340	0.014	0.318	0.363

Appendix L.–District 15 commercial drift gillnet fishery data used in genetic stock identification analysis and results by statistical week and reporting group, 2019.

Stat. week	Sample size	Geno-typed	Aged only	Not genotyped or aged	Reporting group	Mean	SD	CI 5%	CI 95%
25–26	539	187	297	55	Chilkat Lake	0.266	0.052	0.187	0.357
					Chilkat Mainstem	0.191	0.050	0.109	0.273
					Chilkoot	0.165	0.026	0.124	0.211
					Other	0.378	0.039	0.315	0.444
27	418	188	186	44	Chilkat Lake	0.162	0.030	0.116	0.213
					Chilkat Mainstem	0.149	0.032	0.099	0.203
					Chilkoot	0.202	0.028	0.156	0.249
					Other	0.488	0.040	0.422	0.555
28	448	190	212	46	Chilkat Lake	0.208	0.030	0.159	0.259
					Chilkat Mainstem	0.100	0.024	0.062	0.142
					Chilkoot	0.277	0.032	0.225	0.331
					Other	0.416	0.038	0.354	0.478
29	289	188	90	11	Chilkat Lake	0.217	0.030	0.168	0.268
					Chilkat Mainstem	0.125	0.027	0.083	0.171
					Chilkoot	0.493	0.035	0.436	0.550
					Other	0.165	0.030	0.118	0.216
30	350	188	151	11	Chilkat Lake	0.154	0.028	0.111	0.202
					Chilkat Mainstem	0.060	0.020	0.030	0.095
					Chilkoot	0.597	0.035	0.539	0.654
					Other	0.188	0.031	0.139	0.240
31	350	187	141	22	Chilkat Lake	0.135	0.027	0.094	0.181
					Chilkat Mainstem	0.047	0.015	0.025	0.073
					Chilkoot	0.770	0.030	0.719	0.818
					Other	0.049	0.019	0.020	0.083
32	470	186	256	28	Chilkat Lake	0.111	0.023	0.075	0.151
					Chilkat Mainstem	0.020	0.011	0.005	0.041
					Chilkoot	0.787	0.028	0.740	0.830
					Other	0.082	0.020	0.052	0.118
33	330	188	127	15	Chilkat Lake	0.233	0.031	0.184	0.287
					Chilkat Mainstem	0.008	0.010	0.000	0.029
					Chilkoot	0.536	0.034	0.479	0.593
					Other	0.222	0.033	0.170	0.277
34	310	188	101	21	Chilkat Lake	0.201	0.026	0.160	0.244
					Chilkat Mainstem	0.001	0.004	0.000	0.008
					Chilkoot	0.532	0.035	0.475	0.590
					Other	0.266	0.033	0.214	0.321
35–40	299	190	100	9	Chilkat Lake	0.327	0.032	0.275	0.380
					Chilkat Mainstem	0.004	0.007	0.000	0.019
					Chilkoot	0.370	0.034	0.315	0.428
					Other	0.298	0.034	0.242	0.355
All	3,803	1,880	1,661	262	Chilkat Lake	0.169	0.011	0.152	0.189
					Chilkat Mainstem	0.048	0.007	0.038	0.059
					Chilkoot	0.619	0.013	0.597	0.641
					Other	0.163	0.010	0.146	0.180

Note: Gray highlighted rows indicate the GSI estimates did not meet acceptable levels of precision and accuracy to estimate the proportion of mixtures within 10% of the true mixture 90% of the time.

Appendix M.–Annual Chilkoot Lake sockeye salmon escapements based on weir counts, and estimated harvests (commercial, sport, and subsistence), total runs (harvest plus escapement), and harvest rates, 1976–2019.

	Escapement goal			Harvest					
Year	Lower	Upper	Escapement estimate	Commercial	Sport	Subsistence	Total	Total run	Harvest rate (%)
1976	80,000	100,000	71,291	**61,861**	ND	ND	**61,861**	**133,152**	**46%**
1977	80,000	100,000	97,368	**113,555**	400	ND	**113,955**	**211,323**	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	**21,244**	700	ND	**21,944**	**120,617**	18%
1981	60,000	80,000	84,047	**43,756**	1,200	ND	**44,956**	**129,003**	35%
1982	60,000	80,000	103,038	**144,748**	800	ND	**145,548**	**248,586**	59%
1983	60,000	80,000	80,141	**242,034**	600	ND	**242,634**	**322,775**	75%
1984	60,000	80,000	100,781	225,634	1,000	ND	**226,634**	**327,415**	**69%**
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	1,013	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	**25,367**	400	**1,589**	**27,356**	**64,363**	**43%**
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	**475**	2,311	**22,668**	**73,409**	31%
1997	50,500	91,500	44,254	31,822	**478**	**1,781**	**34,081**	**78,335**	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	**27**	115	**4,746**	**24,030**	20%
2000	50,500	91,500	43,555	14,622	**384**	**251**	**15,257**	**58,812**	26%
2001	50,500	91,500	76,283	66,355	**2,344**	1,499	**70,198**	**146,481**	48%
2002	50,500	91,500	58,361	24,200	**1,503**	1,258	**26,961**	**85,322**	32%
2003	50,500	91,500	75,065	32,446	**1,509**	2,091	**36,046**	**111,111**	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	**16,622**	165	892	**17,679**	**51,384**	**34%**
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	**1,976**	**29,715**	**95,630**	31%
2012	38,000	86,000	118,166	**124,366**	1,025	3,080	**128,471**	**246,637**	**52%**
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	**912**	2,222	**61,702**	**133,217**	46%
2016	38,000	86,000	86,721	119,843	215	5,051	125,109	211,830	59%

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Year	Escapement goal Lower	Escapement goal Upper	Escapement estimate	Harvest Commercial	Harvest Sport	Harvest Subsistence	Harvest Total	Total run	Harvest rate (%)
2017	38,000	86,000	43,098	1,933	233	2,102	4,268	47,366	9%
2018	38,000	86,000	85,463	33,969	159	4,406	38,534	123,997	31%
2019	38,000	86,000	140,378	149,586	86	3,673	153,345	293,723	52%
1976–2015 Average			68,013	91,131	799	1,902	93,364	161,378	48%
1976–2015 Median			72,168	60,215	567	1,894	61,782	133,185	47%
1976–2015 Lower Quartile			49,638	23,928	335	1,248	26,659	77,104	33%
1976–2015 Upper Quartile			89,112	129,517	993	2,351	132,981	224,714	60%

Note: Bold estimates are historical records that have been updated since the last project report by Bednarski et al. (2016).

Appendix N.–Historical age composition of the Chilkoot Lake sockeye salmon escapement, weighted by statistical week, 1982–2019.

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

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

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

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		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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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	
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	13,574	2,826	0	0	22,516	5,930	93	1,390	46	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	28,648	5,920	0	0	64,274	6,766	0	106	0	105,713
	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	11,156	1,502	0	0	54,280	4,434	0	215	0	71,515
	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
2016	Escapement by age class	0	5	0	0	0	2,186	362	0	0	73,061	11,024	9	73	0	86,721
	SE of number	0	5	0	0	0	521	133	0	0	1,214	1,126	8	52	0	
	Proportion by age class	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%	0.4%	0.0%	0.0%	84.2%	12.7%	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%	1.4%	1.3%	0.0%	0.1%	0.0%	
	Sample size	0	1	0	0	0	33	9	0	0	1,376	207	1	2	0	1,629
2017	Escapement by age class	117	0	0	0	0	8,702	799	0	55	29,286	3,265	0	737	137	43,098
	SE of number	116	0	0	0	0	867	328	0	38	1,050	644	0	202	92	
	Proportion by age class	0.3%	0.0%	0.0%	0.0%	0.0%	20.2%	1.9%	0.0%	0.1%	68.0%	7.6%	0.0%	1.7%	0.3%	
	SE of %	0.3%	0.0%	0.0%	0.0%	0.0%	2.0%	0.8%	0.0%	0.1%	2.4%	1.5%	0.0%	0.5%	0.2%	
	Sample size	1	0	0	0	0	124	10	0	2	504	43	0	18	3	705

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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
2018	Escapement by age class	0	128	0	0	0	40,331	0	0	24	40,570	3,581	0	819	9	85,463
	SE of number	0	90	0	0	0	2,885	0	0	24	2,857	1,198	0	673	9	
	Proportion by age class	0.0%	0.1%	0.0%	0.0%	0.0%	47.2%	0.0%	0.0%	0.0%	47.5%	4.2%	0.0%	1.0%	0.0%	
	SE of %	0.0%	0.1%	0.0%	0.0%	0.0%	3.4%	0.0%	0.0%	0.0%	3.3%	1.4%	0.0%	0.8%	0.0%	
	Sample size	0	2	0	0	0	205	0	0	1	442	28	0	7	1	686
2019	Escapement by age class	0	0	0	0	0	23,987	557	0	0	113,393	2,034	0	407	0	140,378
	SE of number	0	0	0	0	0	3,141	295	0	0	3,252	966	0	392	0	
	Proportion by age class	0.0%	0.0%	0.0%	0.0%	0.0%	17.1%	0.4%	0.0%	0.0%	80.8%	1.4%	0.0%	0.3%	0.0%	
	SE of %	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	0.2%	0.0%	0.0%	2.3%	0.7%	0.0%	0.3%	0.0%	
	Sample size	0	0	0	0	0	92	4	0	0	700	13	0	2	0	811

Appendix O.–Average length (mid eye to tail fork in mm), standard error (SE), and number of samples (*n*) of male sockeye salmon in the Chilkoot Lake escapement by major age class, 1982–2019. (Dashes indicate age class not present.)

	Age 1.2			Age 1.3			Age 2.2			Age 2.3		
Year	Avg.	SE	*n*	Avg.	SE	*n*	Avg.	SE	*n*	Avg.	SE	*n*
1982	469	4.0	143	591	1.1	675	538	17.5	2	594	2.9	11
1983	456	2.9	132	581	1.0	523	479	22.0	8	580	1.7	189
1984	455	4.1	73	581	0.9	850	457	8.7	5	580	2.2	77
1985	469	2.6	182	578	1.1	598	472	5.4	36	577	2.0	143
1986	470	2.6	254	589	1.0	810	476	5.7	35	590	1.8	213
1987	469	3.1	143	590	1.0	813	465	5.9	33	591	1.5	240
1988	496	4.9	89	587	0.8	1,126	500	5.2	52	585	1.9	176
1989	463	3.7	89	590	0.8	810	474	5.0	84	587	1.2	451
1990	462	6.7	40	589	0.9	739	487	12.4	20	586	1.0	776
1991	479	3.6	161	578	0.9	675	476	6.3	57	577	1.5	316
1992	469	9.0	28	580	1.0	632	460	4.3	77	582	1.6	268
1993	484	7.6	49	583	1.2	412	507	10.6	25	581	1.0	641
1994	460	9.4	27	576	1.1	569	478	12.5	17	579	1.7	250
1995	493	2.8	179	579	2.6	104	501	9.6	15	581	2.8	69
1996	506	4.1	87	600	0.9	833	514	16.4	12	597	3.2	77
1997	505	5.6	36	586	0.9	1,038	508	9.7	8	574	3.3	78
1998	495	5.4	40	579	1.5	291	513	9.0	16	575	1.9	170
1999	488	2.1	403	588	1.1	493	515	4.1	101	584	2.1	174
2000	506	2.7	250	589	1.1	571	501	9.2	36	591	1.6	271
2001	487	4.7	71	588	0.8	990	–	–	–	586	4.1	44
2002	475	3.5	142	592	0.8	1,200	474	7.4	19	596	5.0	32
2003	490	1.4	672	586	1.1	550	489	4.6	65	585	2.4	116
2004	498	2.3	253	580	0.9	801	499	4.0	96	576	2.3	96
2005	484	1.7	407	574	0.8	862	487	4.0	80	569	2.5	92
2006	480	3.1	160	569	0.8	991	493	13.1	14	567	1.9	124
2007	477	3.0	156	577	0.7	1,133	492	15.2	13	576	1.8	185
2008	489	5.4	67	583	1.4	350	553	18.9	4	583	4.8	15
2009	485	1.9	353	581	1.0	660	496	6.5	28	583	7.1	15
2010	480	4.0	103	572	0.7	887	476	4.6	56	567	2.5	101
2011	492	1.8	481	579	0.8	811	503	7.5	35	577	1.5	203
2012	493	5.7	54	583	0.7	1,044	508	9.7	13	577	1.9	124
2013	487	2.1	329	576	1.0	414	494	5.2	50	576	2.3	99
2014	481	1.8	347	576	1.0	732	486	3.9	84	576	3.5	64
2015	460	3.1	175	552	1.0	724	460	7.9	22	552	2.6	60
2016	476	6.5	31	555	1.0	644	474	8.6	7	549	3.0	97
2017	484	3.6	105	559	1.6	266	484	16.8	6	550	6.3	23
2018	477	2.7	176	562	1.5	201	–	–	–	576	5.3	14
2019	479	4.9	54	562	1.5	296	488	16.0	3	537	12.9	5
Average	481			579			491			578		

Appendix P.–Average length (mid eye to tail fork in mm), standard error (SE), and number of samples (*n*) of female sockeye salmon in the Chilkoot Lake escapement by major age class, 1982–2019. (Dashes indicate age class not present.)

	Age 1.2			Age 1.3			Age 2.2			Age 2.3		
Year	Avg.	SE	*n*	Avg.	SE	*n*	Avg.	SE	*n*	Avg.	SE	*n*
1982	465	2.8	177	563	1.0	646	476	12.6	7	562	6.8	5
1983	455	3.8	82	565	0.8	558	473	7.4	17	560	1.4	272
1984	497	6.9	13	562	0.8	798	503	2.5	2	559	2.8	68
1985	507	5.7	14	558	0.9	480	503	6.7	7	552	2.0	115
1986	491	5.7	30	574	0.8	627	510	9.5	12	570	1.7	148
1987	473	5.4	40	576	0.9	714	488	8.4	16	573	2.0	197
1988	497	8.7	28	568	0.7	946	497	8.9	19	564	1.8	174
1989	486	4.3	27	569	0.9	608	494	4.3	46	565	1.2	414
1990	483	8.3	15	566	1.0	538	506	5.8	21	567	1.0	606
1991	485	3.2	126	552	1.0	606	480	3.8	55	553	1.6	278
1992	481	11.8	8	562	0.9	644	492	5.0	41	563	1.4	309
1993	525	16.0	5	567	1.3	323	506	8.1	12	565	0.9	568
1994	511	14.4	8	563	0.7	759	503	10.8	14	561	1.2	321
1995	505	2.5	87	561	2.3	82	516	7.1	8	563	3.4	52
1996	519	3.5	38	579	0.8	884	515	8.7	4	577	2.6	97
1997	526	4.6	10	568	0.8	861	–	–	–	564	2.6	69
1998	479	15.1	7	565	1.3	277	523	8.3	3	563	2.3	117
1999	500	2.3	181	569	1.2	452	509	4.1	62	564	1.9	156
2000	522	4.0	42	578	0.8	723	533	8.7	6	578	1.3	308
2001	508	5.2	41	576	0.6	1,097	528	24.4	4	566	2.7	70
2002	496	4.4	40	577	0.6	1,337	498	13.8	11	566	4.6	39
2003	503	1.3	383	570	0.9	615	508	3.5	44	572	1.9	118
2004	512	1.9	146	568	0.6	1,128	502	3.2	65	566	1.6	124
2005	500	1.9	134	561	0.7	980	499	4.8	26	555	1.8	143
2006	511	4.3	50	554	0.6	1,084	511	13.5	8	555	1.6	143
2007	504	3.6	57	566	0.6	1,199	521	11.6	6	564	1.5	196
2008	510	4.8	36	570	1.0	501	510	30.0	2	569	3.6	29
2009	506	2.2	126	570	0.9	628	511	10.3	7	568	5.8	19
2010	511	5.9	19	562	0.5	1,173	515	4.8	16	559	1.9	121
2011	508	2.2	156	567	0.8	628	510	7.1	15	565	1.4	227
2012	496	4.9	22	563	0.7	1,007	495	5.2	5	556	2.0	110
2013	505	2.2	122	558	1.0	412	509	5.5	21	558	1.8	109
2014	509	2.2	73	558	0.9	770	509	6.1	17	560	2.7	86
2015	476	7.3	36	531	0.9	527	485	15.2	6	536	3.0	40
2016	478	17.5	2	543	0.6	636	535	15.0	2	543	2.0	82
2017	496	6.7	19	547	1.5	238	502	1.7	3	538	3.5	20
2018	490	4.7	29	548	1.2	241	–	–	–	551	4.9	14
2019	478	4.5	38	544	1.2	403	453	0.0	1	532	10.9	8
Average	497			563			503			561		

Appendix Q.–Chilkoot Lake zooplankton abundance summary from 1987 to 2019. All stations were averaged and species combined.

Year	Laboratory location	Stations sampled	Monthly mean density (no./m^2)								May–Sep. mean density (no./m^2)	May–Sep. biomass mg/m^2)
			Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.		
1987	Soldotna	2	ND	74,291	166,794	247,623	131,559	246,859	166,645	124,109	173,425	236
1988	Soldotna	2	ND	129,840	304,596	105,239	76,223	135,953	36,827	3,481	150,370	190
1989	Soldotna	2	ND	50,073	13,001	155,720	15,506	11,505	35,430	11,080	49,161	146
1990	Soldotna	2	ND	113,496	62,426	101,715	37,857	21,035	8,877	9,871	64,214	187
1991	Soldotna	2	ND	20,110	9,493	3,906	6,113	2,853	16,030	ND	8,495	15
1995	Soldotna	4	ND	ND	46,778	36,755	25,081	ND	ND	3,178	ND	ND
1996	Soldotna	4	ND	76,537	76,728	54,180	37,528	10,103	3,354	ND	58,119	174
1997	Soldotna	4	ND	32,320	43,522	8,287	6,818	3,136	4,136	ND	19,038	54
1998	Soldotna	4	118,331	99,399	72,667	23,930	2,547	6,801	3,129	ND	42,557	112
1999	Soldotna	4	ND	22,202	28,163	13,661	12,961	12,854	9,637	ND	17,968	46
2000	Soldotna	4	ND	102,706	67,418	105,175	62,123	22,778	12,738	ND	72,040	223
2001	Soldotna	4	ND	190,588	127,123	102,203	60,516	20,052	7,149	ND	100,096	285
2002	Soldotna	4	ND	148,739	76,142	84,416	44,723	34,841	11,360	ND	77,767	224
2003	Soldotna	4	ND	72,126	58,403	41,696	34,344	27,645	ND	ND	46,245	155
2004	Kodiak	4	322,445	204,279	114,239	103,138	77,528	60,430	41,911	ND	107,217	253
2005	Kodiak	4	569	2,433	3,212	6,392	4,035	3,362	1,675	ND	3,625	9
2006	Kodiak	4	119,545	100,484	54,169	103,498	49,032	53,999	ND	ND	67,155	227
2007	Kodiak	4	ND	106,593	29,610	6,018	8,639	20,080	31,563	ND	18,110	29
2008	Kodiak	2	ND	90,784	181,865	215,996	167,304	94,753	ND	ND	136,239	314
2009	Kodiak	2	ND	29,822	19,910	18,552	19,528	15,666	ND	ND	14,943	43
2010	Kodiak	2	ND	121,519	56,207	43,301	50,582	68,731	119,503	ND	65,176	128
2011	Kodiak	2	ND	79,789	68,963	64,187	111,411	144,698	ND	ND	82,545	212
2012	Kodiak	2	ND	125,212	112,583	18,785	40,160	60,792	137,035	ND	63,135	147
2013	Kodiak	2	ND	81,954	30,298	44,044	52,429	89,129	64,922	ND	47,144	83
2014	Kodiak	2	ND	168,620	147,203	148,561	137,800	137,291	218,926	ND	130,659	451
2015	Kodiak	2	484,972	97,045	211,836[a]	156,308	75,904	30,735	90,338	ND	97,372	321
2016	Kodiak	2	570,131	303,108	143,064	76,159	96,069	151,129	205,638	ND	148,506	570
2017	Kodiak	2	ND	251,825	124,979	173,374	87,876	273,306	ND	ND	182,272	433
2018	Kodiak	2	ND	190,949	255,031	170,487	ND	156,648	ND	ND	193,279	398
2019	Kodiak	2	ND	388,351	186,449	286,806	263,287	326,541	181,525	ND	290,287	555

Notes: The vast majority of species present were *Cyclops* sp. and ovigerous *Cyclops* sp. Copepod nauplii were not included, because they were not enumerated in laboratory samples until 2002 and 2004.

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