Fishery Data Series No. 22-31

Stock Assessment Study of Chilkoot Lake Sockeye Salmon, 2020–2021

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)

Measures (fisheries)

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

Mathematics, statistics

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

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ABSTRACT

In 2020 and 2021, 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 60,218 fish in 2020 and 98,672 fish in 2021, which fell within or exceeded the sustainable escapement goal range of 38,000–86,000 fish. Age-1.2 male sockeye salmon in 2020 were larger than the 1982–2019 average, whereas both male and female fish of other ages fell below this average. Genetic stock identification was conducted to determine the stock composition of sockeye salmon harvested annually in the District 15 commercial drift gillnet fishery. Estimated commercial harvests of Chilkoot Lake sockeye salmon were 24,878 fish in 2020, and 50,219 fish in 2021. Estimated harvest rates (including subsistence and excluding sport harvests) were 32% in 2020 and 35% in 2021, and Chilkoot Lake sockeye salmon accounted for an estimated 50% (2020) and 59% (2021) of the annual commercial sockeye salmon harvest in District 15. The estimated fall sockeye salmon fry population at Chilkoot Lake was 66% below average in 2020 (no surveys were conducted in 2021). Average May–September zooplankton density and biomass at Chilkoot Lake were above average in 2020 and below average in 2021.

Keywords: Chilkoot Lake, Chilkoot River, commercial harvest, District 15 Commercial drift gillnet fishery, escapement, enumeration weir, genetic stock identification, hydroacoustic survey, limnology, *Oncorhynchus nerka*, sockeye salmon, sustainable escapement goal, zooplankton

INTRODUCTION

The Chilkoot and Chilkat sockeye salmon (*Oncorhynchus nerka*) runs in northern Southeast Alaska, near the town of Haines, are 2 of the largest 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 was 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, 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. 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 183,000 fish from 1976 to 2019 of which an average 74,000 fish originated from Chilkat Lake, 90,000 originated from Chilkoot Lake, and 20,000 were of mixed stock origin (Appendix G). 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 years 1985–2019 averaged 2,100 fish per year (Appendix J).

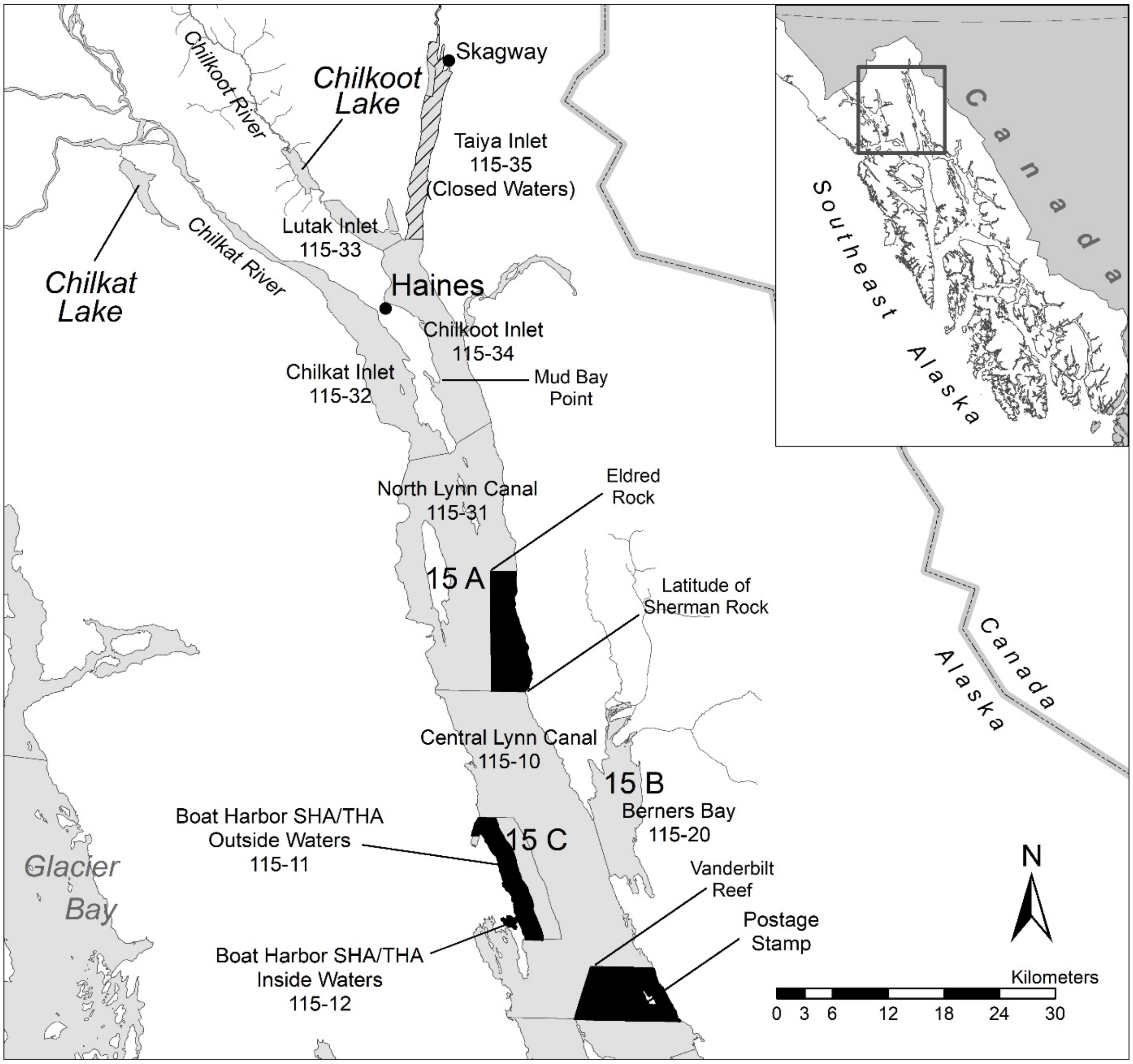

Figure 1.–Haines Management Area with sections and statistical areas for the District 15 commercial drift gillnet fishery. Early in the 2018–2021 seasons, the fishery was restricted to the black shaded areas in accordance with management actions implemented in the 2018 Chilkat River Chinook salmon action plan (Lum and Fair 2018) and subsequent Southeast Alaska drift gillnet fishery management plans (Gray et al. 2019; Thynes et al. 2020a, 2021) that were designed to reduce commercial harvest of Chilkat River Chinook salmon (*O. tshawytscha*).

Stock composition of the sockeye salmon harvest in the mixed stock District 15 commercial drift gillnet fishery was estimated using scale pattern analysis through 2016 and genetic stock identification since 2017 (Bednarski et al. 2017). The Alaska Department of Fish and Game (ADF&G) initiated a scale pattern analysis program in 1980 (McPherson 1990; McPherson et al. 1992) to estimate the contribution of Chilkat and Chilkoot sockeye salmon stocks based on consistent differences in freshwater scale patterns (Stockley 1950; Bergander 1974). 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 salmon counting weir on the Chilkoot River since 1976 (Bachman and Sogge 2006; Bachman et al. 2013 and 2014; Bednarski et al. 2016; Ransbury et al. 2021b). 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 from 1976 through 1993 but declined to an average of only 28,000 fish from 1994 to 1999. Weir counts have since rebounded to an average of 73,000 sockeye salmon from 2000 to 2021. 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; Ransbury et al. 2021b). Those studies have been used to assess potential sockeye salmon production from the lake (Barto 1996).

The Chilkoot Lake sockeye salmon run has been managed for at least 5 different escapement goals since 1976. Informal goals of 80,000–100,000 fish (1976–1980) and 60,000–80,000 fish (1981–1989; Bergander et al. 1988) were replaced in 1990 by a biological escapement goal of 50,500–91,500 sockeye salmon (McPherson 1990). The goal was divided into separate goals for early (16,500–31,500 fish) and late runs (34,000–60,000 fish). In 2006, the escapement goal was rounded to 50,000–90,000 sockeye salmon and classified as a sustainable escapement goal due to uncertainty in escapement levels based on weir counts (Geiger et al. 2005). Early- and late-run goals were eliminated and replaced with weekly cumulative escapement targets based on historical run timing. The current sustainable escapement goal of 38,000–86,000 sockeye salmon, along with weekly escapement targets, was established in 2009 based on an updated stock-recruit analysis by Eggers et al. (2009). ADF&G recommended maintaining the current sustainable escapement goal and weekly escapement targets following subsequent reviews by Brenner et al. (2018) and Heinl et al. (2021).

The primary purpose of the sockeye salmon stock assessment program was to estimate the 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 (Figure 1; Zeiser et al. 2020b, Zeiser et al. 2020c, Ransbury et al. 2021a), was used inseason to manage the

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[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.

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 Catalog No. 115-33-10200-0010; 59° 21′16” N, 135° 35′42″ W) is located at the head of Lutak Inlet, approximately 16 km northeast of the city of Haines, Alaska (Figures 1 and 2). It is glacially turbid, has a surface area of 7.2 km^2 (1,734 acres), a mean depth of 55 m, a maximum depth of 89 m, and a total volume of 382.4 × 106 m^3. The Chilkoot River originates at glacier terminuses east of the Takshanuk 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.

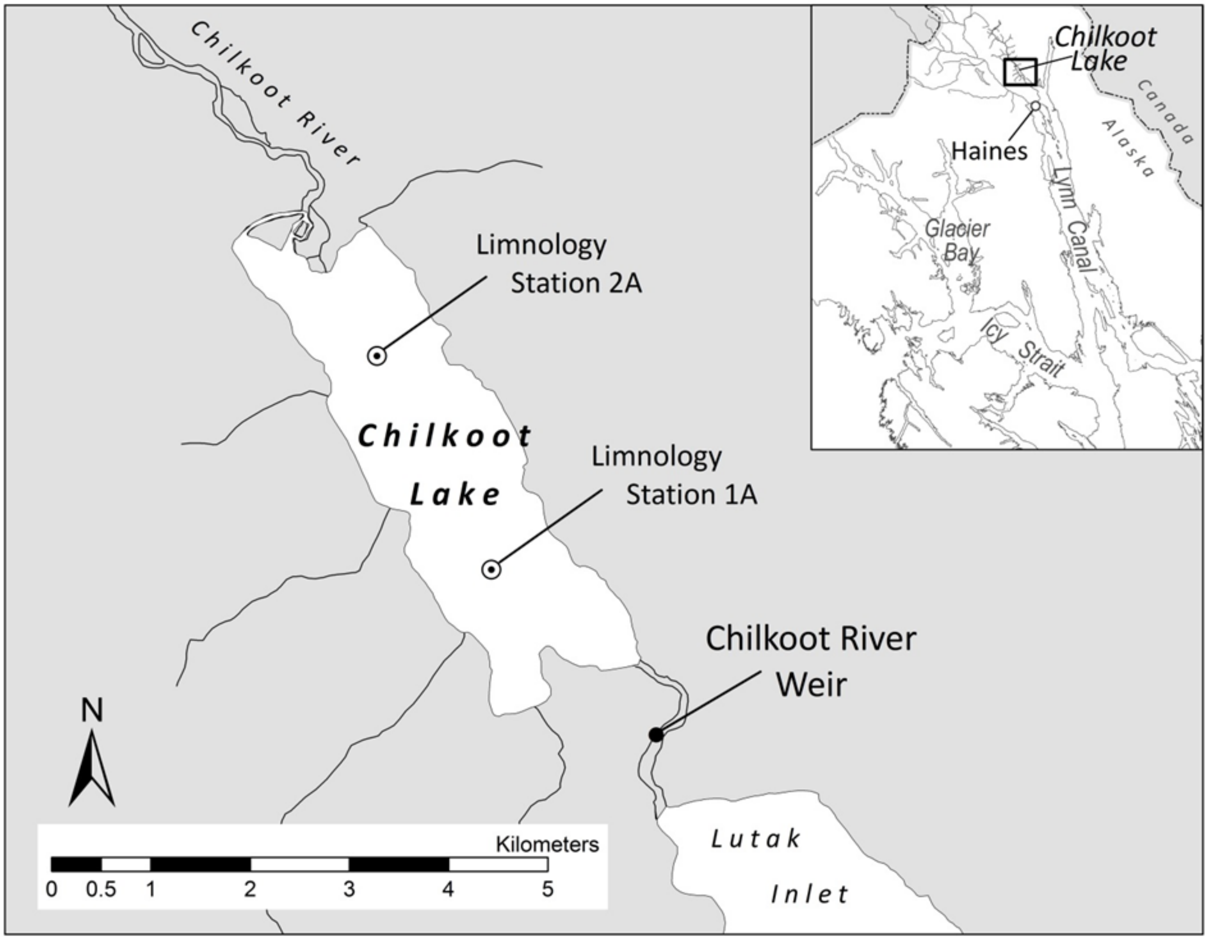

Figure 2.–Map showing Lutak Inlet, Chilkoot Lake, and the location of the limnology stations and salmon counting weir.

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 Lake sockeye salmon escapement such that the estimated proportions are within 5% of the true value with at least 95% probability.
3. Estimate the weekly stock composition of the sockeye salmon harvest in the District 15 commercial drift gillnet fishery using genetic stock identification, such that the estimates are within 7% of the true value with at least 90% probability.
4. 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 2 June to 8 September in 2020, and 7 June to 11 September in 2021. 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 recovery box, counting station, and sampling station 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 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 a.m. each day. Stream height (cm) was measured on a stadia rod, and water temperature (°C) was measured with a 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, therefore upstream salmon passage had to be estimated for days the weir was inoperable. Estimates were assumed to be zero if passage was likely negligible based on historical or inseason data. Otherwise, estimates for missed passage were calculated following methods used at the Kogrukluk River weir in western Alaska (Hansen and Blain 2013). When the weir was not operated for all of 1 day, an estimate for that day ($\hat{n}_i$) was calculated as the average of the number of fish counted on the 2 days before (n_b and $n_{b\text{-}1}$) and the 2 days after (n_a and n_{a+1}) the missed day:

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

When the weir was not operated for a period of 2 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 (including jack sockeye salmon; i.e., fish <350 mm from mid eye to tail fork) 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 would be met, even if age could not be determined from the scales of 30% of the sampled fish. In addition, 3 scales were sampled from each fish to increase the proportion of readable scales.

Up to 10 sockeye salmon were sampled each day for matched scale, sex, and length (70 fish/week). This weekly sample was more than sufficient to meet the objective criteria because the total seasonal sample was more than the 665 samples required. This sample size also met seasonal requirements for estimating sex composition because only 385 samples (assuming no data loss) would be needed to achieve the precision criteria (within 5% of the true value 95% of the time) (Thompson 2002). All sampled fish were measured from mid eye to tail fork [METF] to the nearest 5 mm, and the sex was determined from examination of external dimorphic sexual maturation characteristics such as snout and kype development, belly shape, and shape of vent opening. Three scales were collected from the "preferred area" of each sampled fish (i.e., the left side of the fish, 2 scale rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin; INPFC 1963).

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 saltwater 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

Stock composition of the sockeye salmon harvest in the District 15 commercial drift gillnet fishery was estimated annually 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 (Zeiser et al. 2020a); however, reporting groups were reduced to Chilkat Lake, Chilkoot Lake, and Other for postseason reporting. Stock composition was estimated for each statistical week using a Bayesian mixed stock analysis approach as implemented in the R package rubias[2] (Moran and Anderson 2019; R Development Core Team 2021), which compared 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 major contributing 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, and 3.3). MAGMA was used to analyze stock composition in the first 10 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 35–41, which accounted for 7.6% and 34.4% of the sockeye salmon harvest during 2020 and 2021, respectively.

The District 15 commercial drift gillnet fishery began by regulation at 12:00 noon on the third Sunday of June. Openings were then conducted weekly starting at 12:00 noon on Sunday. Each week typically began with a 48-hour opening with the possibility of an extension depending on fishery performance. Commercial harvest data for District 15, stratified by statistical week, were obtained from the Region 1 Commercial Fisheries Database. ADF&G statistical weeks begin on Sunday at 12:01 a.m. 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 at fish processing facilities in Excursion Inlet, Juneau, and Petersburg (Reynolds Manney et al. 2020). Sampling was stratified by statistical week, and sampling effort spanned the first 10 weeks of the fishery, as approximately 94% of the sockeye salmon harvest occurs during that period (2010–2019 average). Sampling goals for 2020 and 2021 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 samples were collected from Petersburg. The target sample size for each statistical week was set at a minimum of 200 and a maximum of 300 paired tissues and scales. 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 areas 115-11 and 115-12) were not sampled, including sockeye salmon on tenders with fish mixed from traditional and terminal harvest (harvest code 12) fisheries. The Boat Harbor THA was designated to manage and harvest hatchery chum salmon returning to the Boat Harbor release site as outlined in the *Boat Harbor Terminal Harvest Area Management Plan* (5 AAC 33.386).

[2] R Development Core Team. 2021. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. http://www.R-project.org/.

The THA encompasses a portion of Section 15-C in central Lynn Canal (Figure 1) through which mixed stocks of sockeye salmon must migrate, and sockeye salmon are harvested incidentally in the terminal fishery. There are no hatchery sockeye salmon released inside Boat Harbor or anywhere else in District 15. Over the 10-year period 2010–2019, an average 18% (range: 9–33%) of sockeye salmon harvested in central Lynn Canal (statistical areas 115-10, 115-11, and 115-12) were harvested in the Boat Harbor THA. Since 2018, all sockeye salmon samples have been identified as harvest code 11. To be consistent, future stock composition analyses will need to include the entire sockeye salmon harvest in Lynn Canal, harvest codes 11 and 12 combined, for years prior to 2018.

Sampling protocols were designed to ensure 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.

A 2.5 cm piece of the pelvic fin was removed from each sampled fish and placed on a Whatman filter paper card for dry preservation. Matched scale, length, and sex data were also collected from each sampled fish as described above for escapement samples. Samples and associated inventory data were shipped on a weekly basis to the Region 1 Scale Aging Laboratory in Douglas. Samples were then shipped to the ADF&G Gene Conservation Laboratory in Anchorage for analysis. Scale samples were analyzed at the ADF&G Region I Scale Aging Laboratory in Douglas following procedures described above for escapement samples.

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 2 sets of Fluidigm 192.24 Dynamic Array 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 analysis (QC) 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 were estimated as half the rate of discrepancies. If there were many discrepancies, a duplicate check was performed to determine whether 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, identifying and removing the following: 1) individuals missing >20% of their genotype data (markers), because this is indicative of low-quality DNA (80% rule; Dann et al. 2012); 2) duplicate individuals; and 3) non-sockeye salmon.

Stock composition for each stratum was estimated inseason using the R package rubias (Moran and Anderson 2019). 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 was estimated seasonally through a MAGMA model. Weekly and seasonal estimates were provided by age group using MAGMA. This method required 2 sets of parameters: 1) a vector of stock compositions summing to one 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 MAGMA algorithm, all fish with unknown origin or age were stochastically assigned to a population or age group, 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.

The MAGMA 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.

JUVENILE SOCKEYE SALMON ABUNDANCE

Hydroacoustic and midwater trawl sampling methods were used to estimate abundance of small pelagic fish in Chilkoot Lake. To control year-to-year variation in our estimates, acoustic surveys were conducted annually along the same 12 transects (2 from each of 6 sampling sections of the lake) that were randomly chosen in 2002 as permanent transects (Riffe 2006). Hydroacoustic surveys were conducted annually between late October and early November.

Hydroacoustic sampling was conducted after sunset, and all transects were sampled in the same night. A Biosonics DT-X scientific echosounder (430 kHz, 7.3° split-beam transducer) with Biosonics Visual Acquisition version 5.0 software was used to collect data. 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:

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

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

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

with variance

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

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 13 of 17 years from 2004 to 2020 (Table 9; Zeiser et al. 2020a).

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

Midwater trawl surveys were not conducted in 2015–2018, 2020, or 2021, because sockeye salmon fry accounted for the vast majority of fish captured in prior years (median = 99%; *n* = 26 years; Bednarski et al. 2016). In addition, species apportionment may be biased if the relative catchability of each species is not the same. Threespine stickleback (*Gasterosteus aculeatus*) are more susceptible to capture than sockeye salmon fry (Enzenhofer and Hume 1989; Bednarski and Heinl 2010), and larger fish (e.g., age-1 sockeye salmon fry) can more easily avoid the trawl net (Hyatt et al. 2005). Although caution was required in interpreting sampling results, midwater trawls conducted at Chilkoot Lake in 2019 confirmed that the vast majority of small pelagic fish in the lake were sockeye salmon fry and that species composition in the lake had not changed since 2014.

LIMNOLOGICAL ASSESSMENT

Basic limnological data, including zooplankton, light, and temperature sampling, were collected monthly on or around the 15th from May through September. Since 2008, all limnological sampling was conducted at 2 primary stations marked by anchored buoys in the lake (station 1A at 59° 20.81′ N, 135° 35.79′ W; station 2A at 59° 21.88′ N, 135° 36.64′ W; Figure 2). Results were averaged between stations by month and season, and the season was standardized to a May–September average to be comparable over all years.

Light and Temperature Profiles

Light penetration measurements were used to estimate the euphotic zone depth of the lake, defined as the depth at which light (photosynthetically available radiation at 400–700 nanometers) 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 equaled 1% of the subsurface recording. Measurements of underwater light intensity were used to determine vertical light extinction coefficients and algal compensation depths. The natural log (ln) of the ratio of light intensity (*I*) just below the surface (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 (meters per unit of time) at which light dims with increasing depth, was estimated as the slope of the regression of ln(I_0/I_z) versus depth, and euphotic zone depth 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 euphotic zone depth.

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. Samples were analyzed at the ADF&G Kodiak Limnology Lab using methods detailed in the ADF&G Limnology Field and Laboratory Manual (Koenings et al. 1987). Results were averaged between stations by month and season.

RESULTS

ESCAPEMENT

2020

In 2020, 60,218 sockeye, 30,954 pink, 759 chum, 156 coho, and 45 Chinook salmon (*O. tshawytscha)* were enumerated through the Chilkoot River weir between 2 June and 8 September (statistical weeks 23–37; Table 1; Figure 3; Appendices D and E). There were no high-water events this season, but a hole was discovered in the pickets of the weir on 21 July that allowed fish to pass uncounted for approximately 24 hours. An interpolation of 1,187 sockeye salmon (2% of the total weir count) was calculated to estimate passage during this 1 day. Weekly sockeye salmon escapements were below the lower-bound escapement goal targets for the first 7 weeks of the season, rose above the lower-bound target beginning in statistical week 30, and remained between the upper- and lower-bound targets from week 31 to week 37. The total sockeye salmon escapement of 60,218 fish exceeded the lower bound of the sustainable escapement goal range of 38,000–86,000 fish (Table 1; Figure 3). The pink salmon escapement of 30,954 fish was above the long-term (1976–2019) average of 26,205 fish (Appendix D).

2021

In 2021, 98,672 sockeye, 48,213 pink, 1,241 chum, 221 coho, and 20 Chinook salmon were enumerated through the Chilkoot River weir between 6 June and 11 September (statistical weeks 24–37; Table 2; Figure 3; Appendices D and F). A high-water event during 25 June–3 July required removing pickets from the weir, which allowed fish to pass uncounted for approximately 9 days. An interpolation of 518 sockeye salmon (0.5% of the total weir count) was calculated to estimate sockeye salmon passage during those 9 days. A second high-water event during 13–15 August also required removing pickets from the weir, which allowed fish to pass uncounted for approximately 72 hours. An interpolation of 2,213 sockeye salmon (2% of the total weir count) was calculated to estimate 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, rose above the lower-bound targets beginning in statistical week 30, remained between upper- and lower-bound targets from week 31 to week 34, and exceeded upper-bound targets from week 35 to week 37. The total sockeye salmon escapement of 98,672 fish exceeded the upper bound of the sustainable escapement goal range of 38,000–86,000 fish (Table 2; Figure 3). The pink salmon escapement of 48,213 fish was above the long-term (1976–2019) average of 26,205 fish (Appendix D).

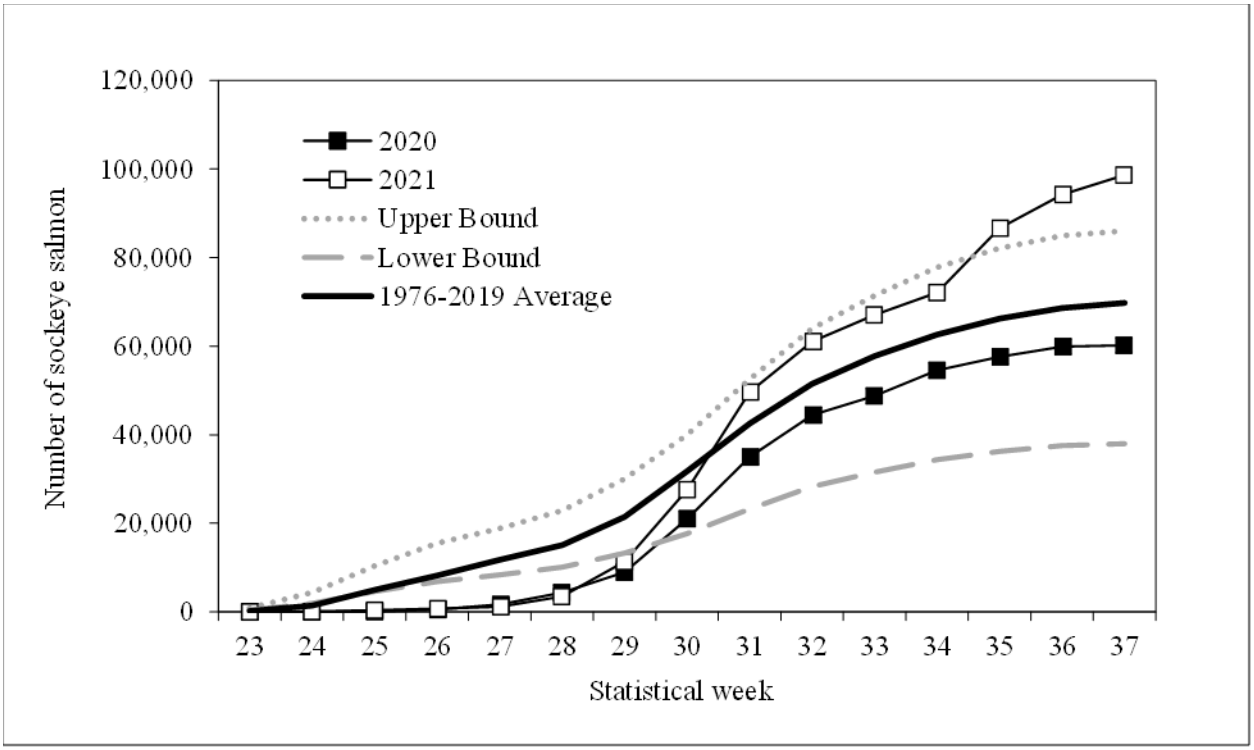

Figure 3.–Weekly cumulative escapement of sockeye salmon through the Chilkoot River weir compared to the 1976–2019 average and upper and lower bounds of the weekly escapement goal targets. (Targets based on Eggers et al. 2009.)

Table 1.–Weekly escapement of sockeye salmon through the Chilkoot River weir compared to weekly management targets and sustainable escapement goal range, 2020.

	Escapement		Escapement goal[a]	
Statistical week	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
23	0	0	378	856
24	19	19	1,924	4,354
25	60	79	4,593	10,396
26	452	531	6,852	15,508
27	1,158	1,689	8,333	18,858
28	2,668	4,357	10,102	22,863
29	4,649	9,006	13,286	30,069
30	12,065	21,071	17,689	40,032
31	13,881	34,952	23,236	52,587
32	9,496	44,448	28,267	63,973
33	4,334	48,782	31,565	71,437
34	5,795	54,577	34,371	77,787
35	3,013	57,590	36,275	82,096
36	2,316	59,906	37,524	84,923
37	312	60,218	38,000	86,000

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

Table 2.–Weekly escapement of sockeye salmon through the Chilkoot River weir compared to weekly management targets and sustainable escapement goal range, 2021.

	Escapement		Escapement goal [a]	
Statistical week	Weekly	Cumulative	Cumulative lower bound	Cumulative upper bound
23 [b]	–	–	378	856
24	66	66	1,924	4,354
25	289	355	4,593	10,396
26	369	724	6,852	15,508
27	414	1,138	8,333	18,858
28	2,344	3,482	10,102	22,863
29	7,876	11,358	13,286	30,069
30	16,285	27,643	17,689	40,032
31	21,973	49,616	23,236	52,587
32	11,442	61,058	28,267	63,973
33	6,035	67,093	31,565	71,437
34	5,041	72,134	34,371	77,787
35	14,541	86,675	36,275	82,096
36	7,551	94,226	37,524	84,923
37	4,446	98,672	38,000	86,000

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

[b] Weir installed after statistical week 23.

COMMERCIAL HARVEST ESTIMATE

2020

In 2020, 50,220 sockeye salmon were harvested in the District 15 commercial drift gillnet fishery. A total of 3,914 sockeye salmon were sampled, of which 1,666 fish (about 3% of the commercial harvest) were genotyped for use in genetic stock identification analysis. Chilkoot Lake sockeye salmon accounted for an estimated 50% of the total harvest, all weeks combined, or approximately 24,878 fish (90% CI = 23,849–25,915 fish; Table 3; Appendices G and H). The Chilkoot Lake sockeye salmon harvest was dominated by age-1.3 fish (84%), followed by age-1.2 fish (11%), and age-2.3 fish (3%). The total run was estimated to be 89,087 fish including the estimated subsistence harvest of 3,991 fish. Sport harvest is unknown due to lack of survey responses as a result of Covid-19 restrictions. The total harvest rate of Chilkoot Lake sockeye salmon, excluding sport harvest, was estimated to be 32% (Appendix J).

2021

In 2021, 84,649 sockeye salmon were harvested in the District 15 commercial drift gillnet fishery. A total of 3,719 sockeye salmon were sampled, of which 1,761 fish (about 2% of the commercial harvest) were genotyped for use in genetic stock identification analysis. Chilkoot Lake sockeye salmon accounted for an estimated 59% of the total harvest, all weeks combined, or approximately 50,219 fish (90% CI = 48,358–52,015 fish; Table 4; Appendices G and I). The Chilkoot Lake sockeye salmon harvest was dominated by age-1.3 fish (87%), followed by age-1.2 fish (10%), age-2.2 fish (2%), and age-2.3 fish (1%). The total run was estimated to be 152,098 fish including the estimated subsistence harvest of 3,207 fish. Sport harvest data have not been released for 2021 at this time. The total harvest rate of Chilkoot Lake sockeye salmon, excluding sport harvest, was estimated to be 35% (Appendix J).

Table 3.–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, 2020.

		Estimated stock composition			Estimated Chilkoot Lake harvest and CI		
Statistical week	Commercial harvest	Chilkoot Lake	Chilkat Lake	Other [a]	Harvest	Lower 90%	Upper 90%
26–27	1,700	13%	7%	80%	220	158	291
28	3,163	31%	13%	57%	965	793	1,142
29	4,090	41%	12%	47%	1,670	1,438	1,905
30	5,162	26%	13%	61%	1,358	1,100	1,623
31	5,410	44%	17%	39%	2,368	2,050	2,678
32	11,066	76%	11%	13%	8,411	7,848	8,934
33	6,821	48%	21%	31%	3,269	2,897	3,646
34	8,993	49%	21%	29%	4,427	3,894	4,957
35–39 [b]	3,815	57%	41%	1%	2,188	1,990	2,387
Total	50,220	50%	17%	33%	24,878	23,849	25,915

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

[b] Harvest proportions and numbers for statistical weeks 35–39 were estimated using the proportions from the last statistical week with genetic samples, in this case statistical week 35.

Table 4.–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, 2021.

		Estimated stock composition			Estimated Chilkoot Lake harvest and CI		
Statistical week	Commercial harvest	Chilkoot Lake	Chilkat Lake	Other [a]	Harvest	Lower 90%	Upper 90%
26–27	1,989	8%	8%	84%	165	105	234
28	4,414	17%	10%	73%	750	540	976
29	3,397	20%	6%	74%	690	533	856
30	4,854	34%	8%	58%	1,656	1,383	1,935
31	9,569	40%	10%	49%	3,860	3,292	4,427
32	18,116	65%	12%	24%	11,699	10,690	12,695
33	6,110	64%	23%	13%	3,936	3,581	4,275
34	7,033	96%	3%	1%	6,763	6,572	6,907
35–41 [b]	29,167	71%	15%	14%	20,701	19,361	21,979
Total	84,649	59%	12%	28%	50,219	48,358	52,015

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

[b] Harvest proportions and numbers for statistical weeks 35–41 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

2020

In 2020, the sockeye salmon escapement was composed primarily of age-1.3 (75.5%) and age-1.2 (17.7%) fish (Table 5; Appendix K). The remainder of the escapement (6.8%) was composed of age-1.1, age-2.2, age-1.4, and age-2.3 fish. The mean length of age-1.3 fish was 561 mm for males and 537 mm for females, and the mean length of age-1.2 fish was 482 mm for males and 479 mm for females (Table 6; Appendices L and M).

Table 5.–Age composition of the Chilkoot Lake sockeye salmon escapement weighted by statistical week, 2020.

Brood year	2017	2016	2015	2015	2014	2014	
Age class	1.1	1.2	1.3	2.2	1.4	2.3	Total
Sample size	3	98	554	7	4	24	690
Escapement	450	10,682	45,439	673	393	2,582	60,218
Escapement SE	277	1,150	1,288	308	244	613	
Percent	0.7%	17.7%	75.5%	1.1%	0.7%	4.3%	
Percent SE	0.5%	1.9%	2.1%	0.5%	0.4%	1.0%	

Table 6.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2020. (A dash indicates age/sex class not present in samples.)

Brood year	2017	2016	2015	2014	2015	2014	
Age	1.1	1.2	1.3	1.4	2.2	2.3	Total
Male							
Sample size	3	49	207	1	3	14	277
Mean length (mm)	357	482	561	560	450	565	496
SE	16.7	5.7	2.1	0.0	13.2	7.7	
Female							
Sample size	–	49	343	3	4	10	409
Mean length (mm)	–	479	537	547	481	539	516.6
SE	–	4.8	1.3	22.0	18.5	6.8	
All Fish							
Sample size	3	98	550	4	7	24	705
Mean length (mm)	357	481	549	554	466	552	493
SE	16.7	3.7	1.2	15.9	12.8	5.9	1.5

2021

In 2021, the sockeye salmon escapement was composed primarily of age-1.3 (72.9%) and age-1.2 (23.1%) fish (Table 7; Appendix K). The remainder of the escapement (4%) was composed of age-0.3, age-2.2, age-1.4, and age-2.3 fish. The mean length of age-1.3 fish was 554 mm for males and 532 mm for females, and the mean length of age-1.2 fish was 463 mm for males and 462 mm for females (Table 8; Appendices L and M).

Table 7.–Age composition of the Chilkoot Lake sockeye salmon escapement weighted by statistical week, 2021.

Brood year	2017	2017	2016	2016	2015	2015	
Age class	0.3	1.2	1.3	2.2	1.4	2.3	Total
Sample size	2	165	525	17	1	3	713
Escapement	400	22,795	71,906	3,266	5	300	98,672
Escapement SE	284	1,902	2,025	922	5	257	
Percent	0.4%	23.1%	72.9%	3.3%	0.0%	0.3%	
Percent SE	0.3%	1.9%	2.1%	0.9%	0.0%	0.3%	

Table 8.–Average length (mid eye to tail fork) of Chilkoot Lake sockeye salmon by age class and sex, 2021. (A dash indicates age/sex class not present in samples.)

Brood year	2017	2017	2016	2015	2016	2015	
Age	0.3	1.2	1.3	1.4	2.2	2.3	Total
Male							
Sample size	1	80	261	1	8	2	353
Mean length (mm)	390	463	554	625	489	560	514
SE	0.0	4.5	1.5	0.0	15.7	25.0	
Female							
Sample size	1	83	264	–	9	1	288
Mean length (mm)	555	462	532	–	481	535	526
SE	0	3.2	1.3	–	10.9	0.0	
All Fish							
Sample size	2	163	525	1	17	3	711
Mean length (mm)	473	463	543	625	485	548	523
SE	82.5	2.7	1.1	0.0	9.1	16.7	1.7

FRY POPULATION ESTIMATE

Hydroacoustic surveys were conducted at Chilkoot Lake on 9 December 2020 and 26 October 2021 (Table 9). The 2020 estimate of 279,263 fish (CV = 27%) was the smallest since 2007 and about 69% below average (1987–2019 average = 901,398 fish). The precision of pelagic fish estimates in 2020 did not meet the objective for a CV ≤ 15%. The 2021 hydroacoustic survey was conducted, but due to a malfunction in the sonar device the data were considered unusable. No trawl surveys were conducted. We assumed that sockeye salmon fry accounted for 100% of the pelagic fish population in 2020, but small numbers of other species were likely also present (Table 9).

Table 9.–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, 1987–2021.

	Trawl samples					Hydroacoustic estimates		
Year	Total fish	Sockeye	Stickleback	Other	Percent 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[a]	ND	ND	ND	ND	ND	ND	ND	ND
1993[a]	ND	ND	ND	ND	ND	ND	ND	ND
1994[a]	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	0	1	100%	1,389,712	4%	1,384,903
2003	139	138	1	0	99%	1,384,754	NA	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
2020	ND	ND	ND	ND	ND	279,263	27%	279,263
2021[b]	ND	ND	ND	ND	ND	ND	ND	ND

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

[b] No fish population estimate was obtained in 2021 due to sonar malfunction.

LIMNOLOGICAL ASSESSMENT

Light and Temperature Profiles

Euphotic zone depth was examined as an average of the measurements from both sampling stations on a given day. The seasonal (May–October) euphotic zone depth averaged 4.4 m in 2020 and 5.1 m in 2021 (Appendix N). In both years, the euphotic zone depth in Chilkoot Lake was deepest at the beginning of the sampling season, gradually became shallower as the season progressed, and increased again in September–October. In 2020, the average euphotic zone depth ranged from 6.7 m in June to 2.6 m in August and averaged 4.4 m for the season (Table 10). In 2021, the average euphotic zone depth ranged from 13.8 m in May to 1.2 m in August and averaged 5.1 m for the season. In both 2020 and 2021, no thermoclines (the depths at which temperature change was >1ºC per m) were detected (Figure 4). The maximum lake surface temperatures recorded for each season occurred at station 2A at 11.5ºC on 15 July 2020 and 11.4ºC on 16 August 2021.

Table 10.–Euphotic zone depths (m) in Chilkoot Lake, 2020 and 2021.

Year	Date	Station 1A	Station 2A	Average
2020	May	ND	ND	ND
	16-Jun	6.8	6.6	6.7
	15-Jul	4.7	4.6	4.7
	13-Aug	2.3	2.9	2.6
	15-Sep	3.4	3.5	3.5
	15-Oct	4.8	4.6	4.7
	Avg (Jun-Oct)	4.4	4.4	4.4
2021	14-May	13.6	13.9	13.8
	15-Jun	4.2	7.0	5.6
	14-Jul	3.5	2.4	3.0
	16-Aug	1.6	0.8	1.2
	15-Sep	3.1	1.0	2.1
	October	ND	ND	ND
	Avg (May–Sep)	5.2	5.0	5.1

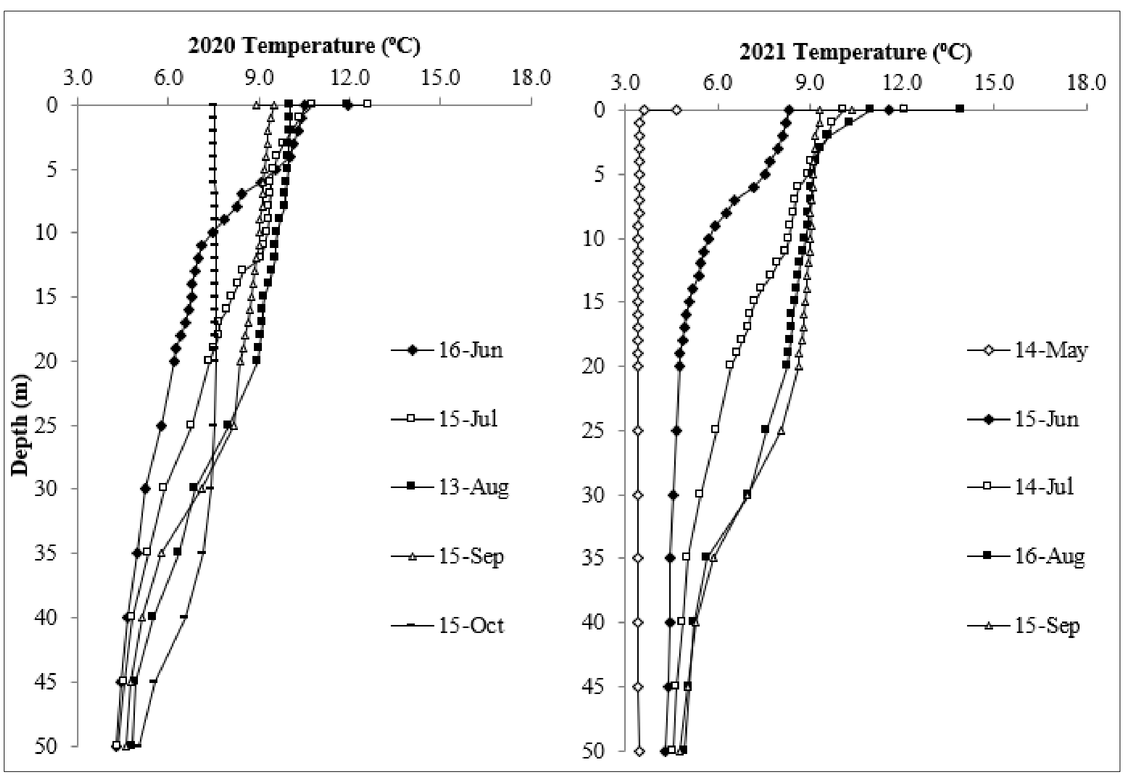

Figure 4.–Water temperature profiles by date (averaged between stations 1A and 2A) at Chilkoot Lake, 2020 and 2021.

Zooplankton Composition

Zooplankton samples from Chilkoot Lake were composed predominantly of copepods (*Cyclops*) in both years. Not including nauplii, *Cyclops* species accounted for 88% of seasonal mean density in 2020 and 69% in 2021 (Tables 11 and 12). The Cladoceran *Bosmina* accounted for only 4% of the seasonal mean biomass in 2020 and less than 1% in 2021. Seasonal mean zooplankton density and biomass were above the long-term average in 2020, and below the long-term average in 2021 for the first time since 2013 (Figure 5; Appendix O). No zooplankton samples were collected in May 2020, 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 11).

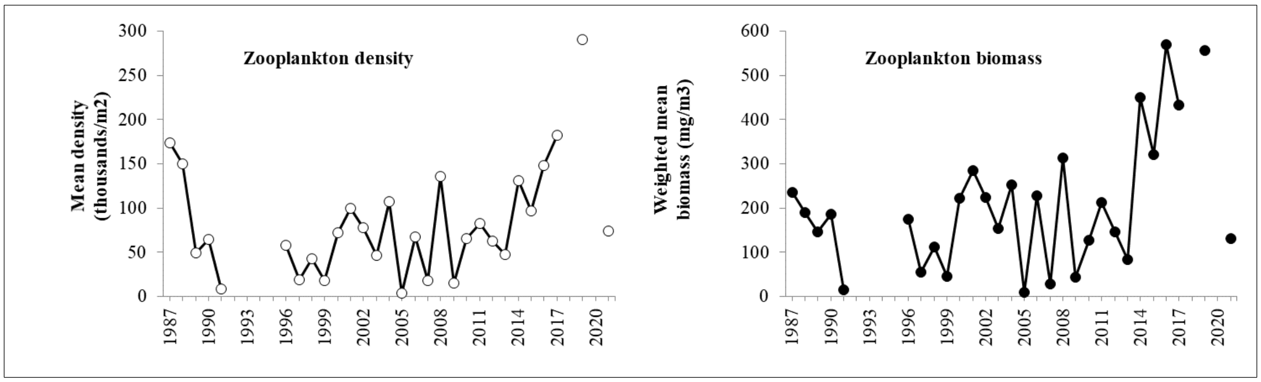

Figure 5.–Annual seasonal (May–September) mean zooplankton density and biomass in Chilkoot Lake, 1987–2021. Estimates not included for 1992–1994 (no samples were collected), 1995 (no samples collected in May or September), 2018 (no samples collected in August), or 2020 (no samples collected in May).

Table 11.–Mean density of zooplankton per m^2 of lake surface area by sampling date and taxon in Chilkoot Lake in 2020 and 2021. Density estimates were the average of 2 sampling stations. Ovigerous (ovig.) individuals were separated from non-egg bearing individuals. A dash indicates the taxon was not present in samples.

		Macrozooplankton density (number/m^2) by sampling date						Seasonal Mean	
Year	Taxon/Date	May	16-Jun	15-Jul	13-Aug	15-Sep	15-Oct	Density	% Density
2020	*Bosmina*	ND	–	–	2,038	9,785	7,302	6,375	4%
	Ovig. Bosmina	ND	–	–	–	–	170	34	<1%
	Daphnia longiremus	ND	–	340	170	–	340	283	<1%
	Cyclops	ND	121,583	102,564	71,489	101,885	278,655	135,235	88%
	Ovig. Cyclops	ND	170	–	2,208	998	849	845	<1%
	Nauplii	ND	3,396	509	1,868	19,294	40,414	13,096	9%
	Total	ND	125,149	103,413	77,772	131,962	327,730	153,205	
		14-May	15-Jun	14-Jun	16-Aug	15-Sep	Oct	Density	% Density
2021	*Bosmina*	–	–	255	425	–	ND	136	<1%
	Ovig. Bosmina	–	–	–	106	–	ND	21	<1%
	Cyclops	72,593	62,914	49,414	19,422	35,447	ND	47,958	65%
	Ovig. Cyclops	–	2,887	7,472	2,250	2,759	ND	3,074	4%
	Nauplii	23,242	4,033	3,481	1,719	81,932	ND	22,882	31%
	Total	95,835	69,834	60,621	23,922	120,139	ND	74,070	

Table 12.–Mean length and biomass of zooplankton by sampling date and taxon in Chilkoot Lake in 2020 and 2021. 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 in samples.

		Macrozooplankton length (mm) by sampling date						Seasonal Mean (weighted)		
Year	Taxon/Date	May	16-Jun	15-Jun	13-Aug	15-Sep	15-Oct	Length (mm)	Biomass (mg/m^2)	% Biomass
2020	*Bosmina*	ND	–	–	–	0.40	0.37	0.35	4	1%
	Ovig. Bosmina	ND	–	–	–	–	0.47	0.47	–	<1%
	Daphnia longiremus	ND	–	0.80	1.36	–	–	0.99	–	<1%
	Cyclops	ND	0.89	0.97	1.10	0.64	0.63	0.78	283	97%
	Ovig. Cyclops	ND	1.16	–	1.32	1.27	1.34	1.29	5	2%
	Total								293	
		14-May	15-Jun	14-Jul	16-Aug	15-Sep	Oct	Length (mm)	Biomass (mg/m^2)	% Biomass
2021	*Bosmina*	–	–	0.34	0.33	–	ND	0.33	–	<1%
	Ovig. Bosmina	–	–	–	0.45	–	ND	0.45	–	<1%
	Cyclops	0.78	0.78	0.95	1.00	0.63	ND	0.83	115	87%
	Ovig. Cyclops	–	1.17	–	1.22	1.17	ND	1.22	17	13%
	Total								131	

DISCUSSION

Chilkoot Lake sockeye salmon escapements met or exceeded the current escapement goal range of 38,000–86,000 fish in 2020 and 2021. However, total runs (escapement plus District 15 fishery harvest) in 2020 (89,087 fish) and 2021 (152,098 fish) fell below the historical average (1976–2019) of 162,039 fish. Harvest rates on Chilkoot Lake sockeye salmon (including commercial and subsistence, but excluding sport harvest due to lack of data) were 32% in 2020 and 35% in 2021, which were well below the long-term average of 57%. Reported subsistence harvests in 2020 (3,991 fish) and 2021 (3,207 fish as of 2 May 2022) were both above the historical average (1985–2019) of 2,120 fish. Sport fish harvest estimates were not available for 2020 due to a lack of survey responses, and 2021 data have not been released (Figure 6; Appendix J).

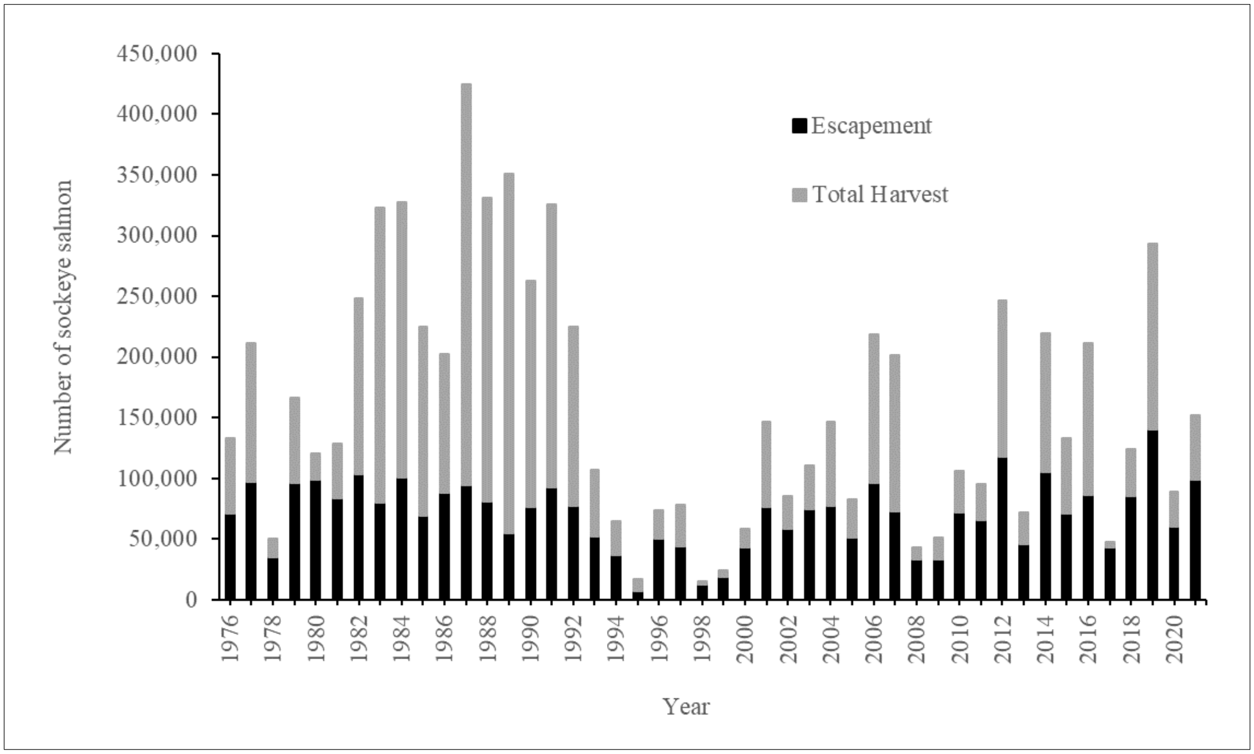

Figure 6.–Estimated total runs (escapement plus District 15 fishery harvest) of Chilkoot Lake sockeye salmon, 1976–2021. District 15 harvest includes commercial, sport, and subsistence harvests.

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) unaccounted for incidental commercial fishing mortality (Patterson et al. 2017); (4) variability in the commercial harvest estimates through the weight-to-numbers conversion on fish tickets; (5) although known (and reported; Appendix H and I), the error around the estimate of the District 15 commercial drift gillnet fishery harvest of Chilkoot Lake sockeye salmon not being incorporated into the run estimate; and (6) unaccounted for commercial harvest of Chilkoot sockeye salmon outside of District 15. Much of this uncertainty is probably minimal, with the potential 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. Additional time and area restrictions beyond those prescribed in the action plan were implemented starting in 2019 (Thynes et al. 2020b).

Management actions taken to reduce harvest of Chilkat River Chinook salmon during 2018–2021 limited opportunity to harvest hatchery chum and wild sockeye salmon. During years of high Chilkoot Lake sockeye salmon abundance, additional time and area in Section 15-A was normally granted north of the latitude of Mud Bay Point (Figure 1) to provide more opportunity to harvest fish surplus to escapement needs. Due to Chilkat River Chinook salmon conservation measures outlined in the action and management plans (Lum and Fair 2018; Thynes et al. 2020b), restrictions could not be liberalized in Section 15-A until after the fifth week of the fishery (statistical weeks 29 in 2020 and 30 in 2021). In 2020, the lower bound of the Chilkoot Lake sockeye salmon sustainable escapement goal range was achieved on 3 August (statistical week 32) and extra fishing time and area in Lutak Inlet was warranted. Beginning in statistical week 35, the fishery was open to the Chilkoot River terminus for up to 5 days a week. The final estimated escapement was 60,218 fish, within the sustainable escapement goal range of 38,000–86,000 sockeye salmon. In 2021, the lower bound of the Chilkoot Lake sockeye salmon escapement goal range was achieved on 29 July and additional time and area was warranted. By 8 August (statistical week 33) sockeye salmon counts through the Chilkoot River weir were approaching the upper bound of the escapement goal range, so fishing was open from the Katzehine River flats light to the Chilkoot River terminus for 5 days to harvest surplus Chilkoot River sockeye salmon. Chilkoot Lake sockeye salmon escapement exceeded the upper bound of the weekly management targets during statistical week 35 and reached the upper bound of the escapement goal range by the end of that same statistical week.

REDUCED SIZE AND GROWTH OF SOCKEYE SALMON

During 2020 and 2021, 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 (1982–2019), with the exception of age-1.2 males in 2020 (Appendices L and M). Age-2.2 male sockeye salmon in 2020 were the smallest ever recorded, age-1.2 females and age-1.3 males in 2021 were the second smallest ever recorded, and age-1.3 males in 2020 were the third smallest ever recorded. Over the past 7 years, the average size of age-1.3 and age-2.3 fish of both sexes were generally the smallest of the entire time series since 1982.

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; Ransbury et al. 2021b; Fish and Piston 2022) was thought to be a product of anomalously warm sea surface temperatures that persisted throughout the Gulf of Alaska from fall 2013 through much of 2016 (Bond et al. 2015; Di Lorenzo and Mantua 2016; Walsh et al. 2018) and in 2018 and 2019[3] (Amaya et al. 2020) suggesting that continued decreases in the size and number of Chilkoot Lake sockeye salmon may occur in future years. Although the reason for the decline in size at age is not well understood, it may be related to a variety of environmental, geographic, and anthropogenetic factors (Lewis et al. 2015; Cline et al. 2019; Connors et al. 2020; Oke et al. 2020).

Hydroacoustic data were unusable for 2021 due to sonar malfunctions, and thus predictions were not made for that year. Biomass and density of zooplankton were above the historical average in 2020, and below in 2021 (Figure 5). Although there has been no relationship (adjusted $R^2 = < 0.01$; p-value = 0.66) between the size of the spawning escapement in the parent year and the fall fry population one year later, there is a weak positive correlation (adjusted $R^2 = 0.24$; p-value < 0.01) between the size of the fall fry population and subsequent adult returns (Figure 9). We assumed that all sockeye salmon fry were 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. The estimated fall fry population in 2020 (279,000 fish) was the smallest in 13 years and only 34% of the long-term average of 833,000 fish. Past fall fry population estimates in the range of 200,000–400,000 fish have produced total returns in the range of 26,000–119,000 fish, well below the long-term average of 163,000 fish, and thus we could expect below-average returns of age-1.2 fish in 2023 and age-1.3 fish in 2024. It is also notable that the below-average 2020 fry population was largely a product of the 2019 escapement (140,378 fish), which was the largest recorded since stock assessment work began in the 1970s.

[3] https://apps-afsc.fisheries.noaa.gov/REFM/REEM/ecoweb/pdf/archive/2019GOAecosys.pdf (Accessed 1 June 2022).

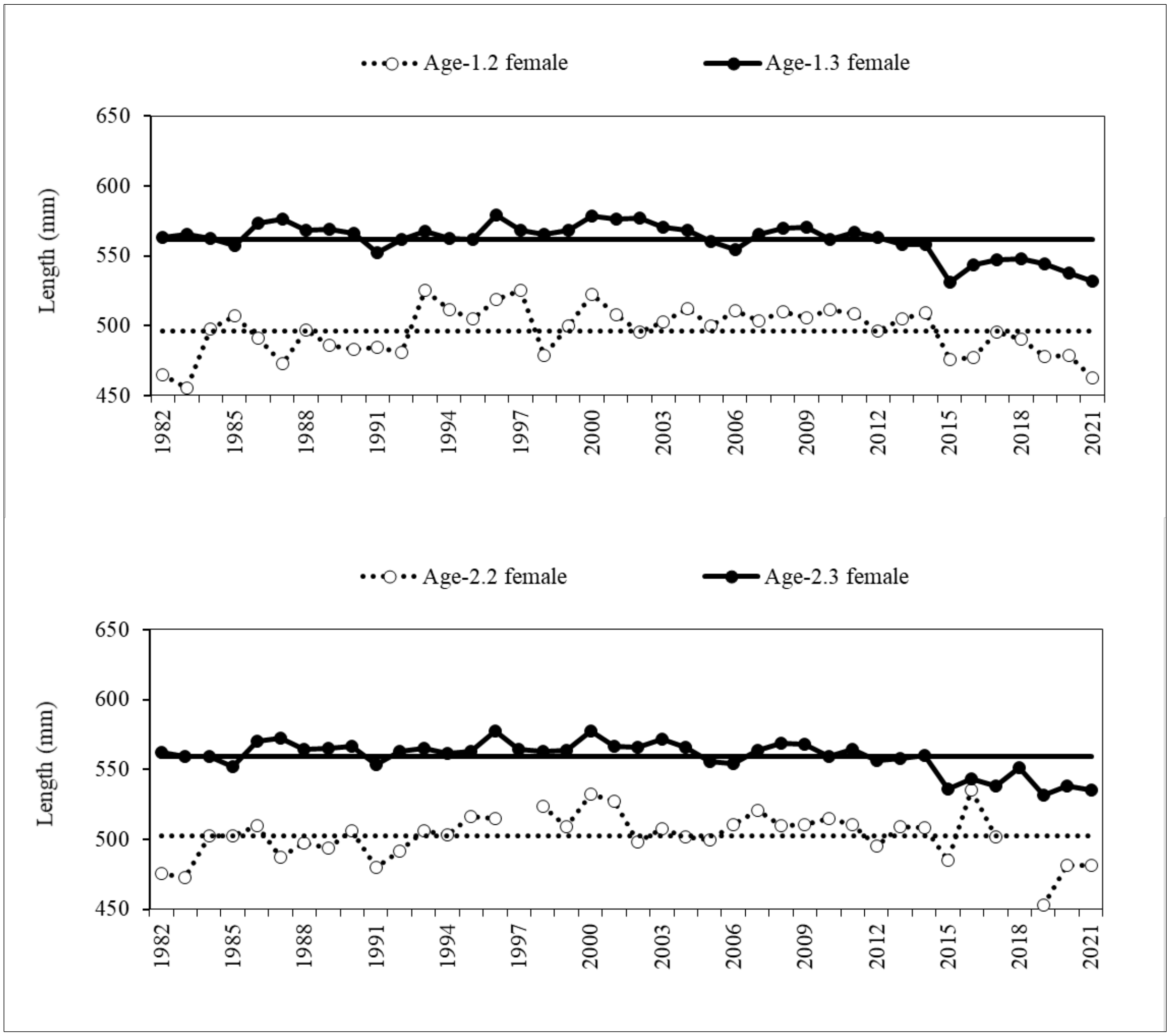

Figure 7.–Average annual female sockeye salmon lengths from mid eye to tail fork (mm) by sex and age for the major age classes (ages 1.2, 1.3, 2.2, and 2.3) in the Chilkoot Lake escapement compared to the 1982–2021 averages (horizontal lines).

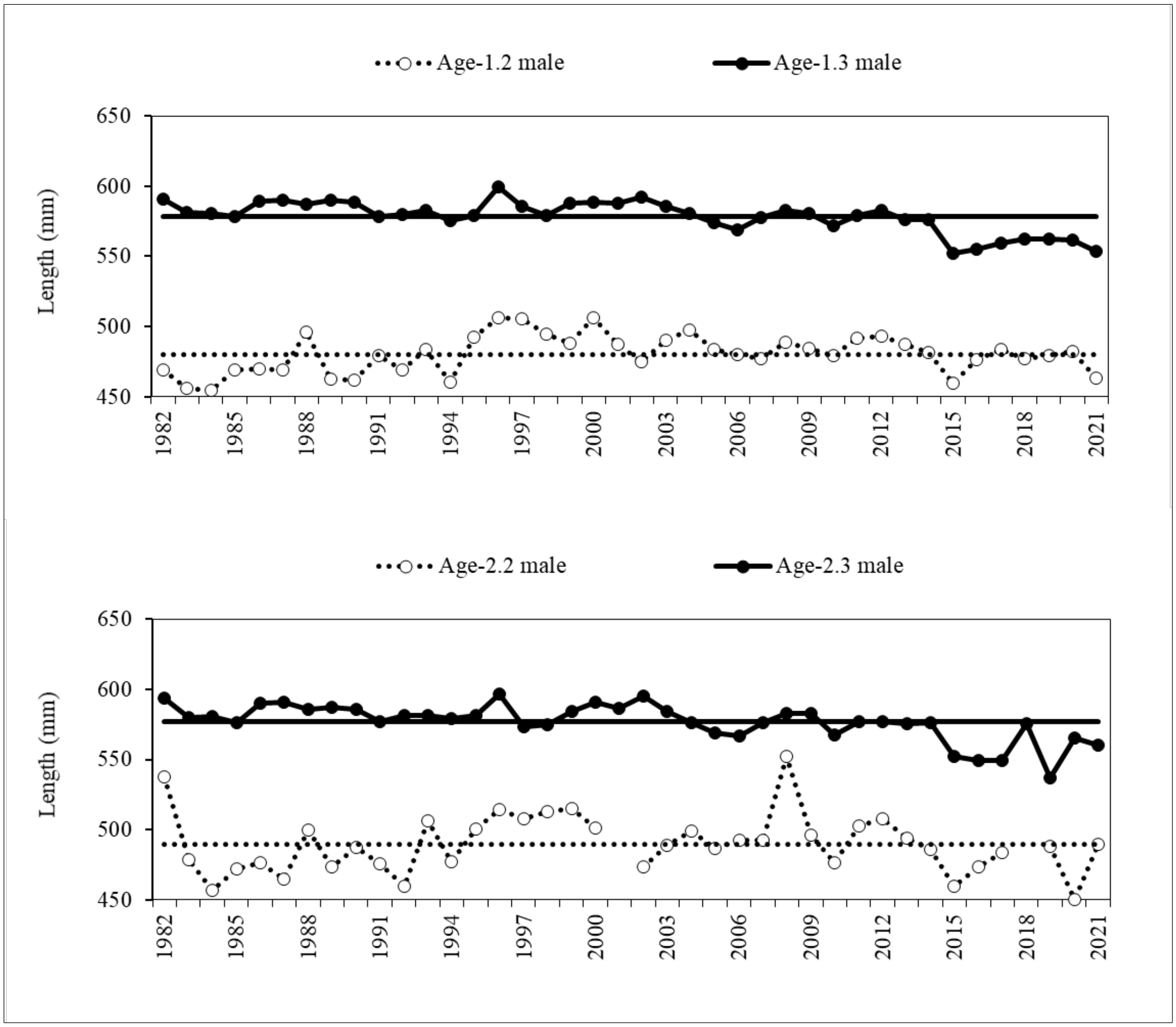

Figure 8.–Average annual male sockeye salmon lengths from mid eye to tail fork (mm) by sex and age for the major age classes (ages 1.2, 1.3, 2.2, and 2.3) in the Chilkoot Lake escapement compared to the 1982–2021 averages (horizontal lines).

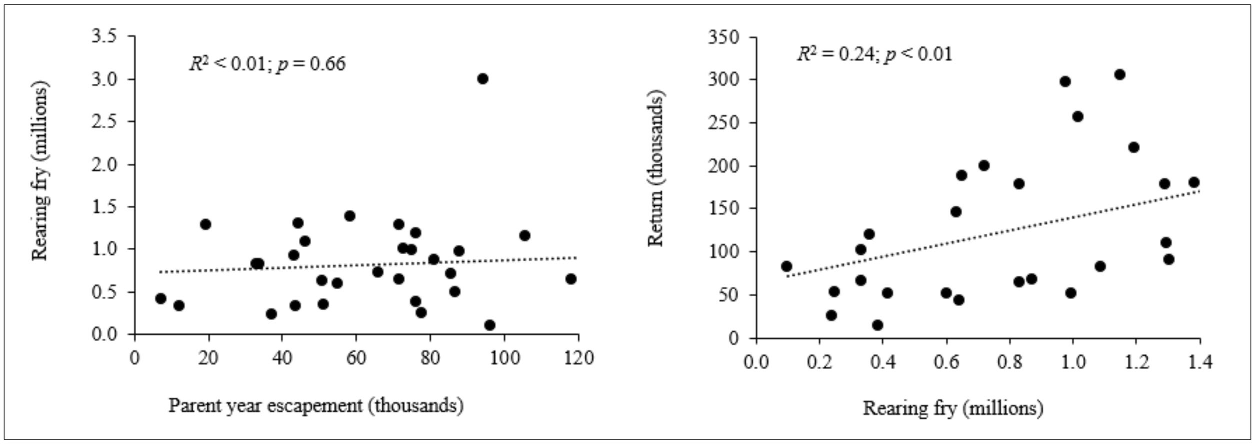

Figure 9.–Comparison of Chilkoot Lake sockeye salmon parent year escapement (1986–1990; 1994–2019) to the rearing fry population (1987–1991; 1995–2020) 1 year later (left), and comparison of the rearing fry population (1987–1991; 1995–2016) to the subsequent adult return, brood years 1986–1990; 1994–2015 (right). No hydroacoustic surveys were conducted during 1992–1994, and sonar malfunctions rendered data unusable in 2021. 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:

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

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

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

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

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

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

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

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

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

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

Appendix B.–ADF&G statistical weeks, 2020 and 2021.

Statistical week	2020		2021	
	Beginning	Ending	Beginning	Ending
23	31-May	6-Jun	30-May	5-Jun
24	7-Jun	13-Jun	6-Jun	12-Jun
25	14-Jun	20-Jun	13-Jun	19-Jun
26	21-Jun	27-Jun	20-Jun	26-Jun
27	28-Jun	4-Jul	27-Jun	3-Jul
28	5-Jul	11-Jul	4-Jul	10-Jul
29	12-Jul	18-Jul	11-Jul	17-Jul
30	19-Jul	25-Jul	18-Jul	24-Jul
31	26-Jul	1-Aug	25-Jul	31-Jul
32	2-Aug	8-Aug	1-Aug	7-Aug
33	9-Aug	15-Aug	8-Aug	14-Aug
34	16-Aug	22-Aug	15-Aug	21-Aug
35	23-Aug	29-Aug	22-Aug	28-Aug
36	30-Aug	5-Sep	29-Aug	4-Sep
37	6-Sep	12-Sep	5-Sep	11-Sep
38	13-Sep	19-Sep	12-Sep	18-Sep
39	20-Sep	26-Sep	19-Sep	25-Sep
40	27-Sep	3-Oct	26-Sep	2-Oct
41	4-Oct	10-Oct	3-Oct	9-Oct
42	11-Oct	17-Oct	10-Oct	16-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. 2020a).

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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Appendix C.–Page 2 of 7.

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

-continued-

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, 1976–2021. (Numbers in bold are historical records that have been updated since the last report by Ransbury et al. [2021b].)

Year	Date in	Date out	Sockeye	Pink	Chum	Coho	Chinook
1976	29-May	4-Nov	**71,291**	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	**96,122**	NA	253	899	ND
1980	15-Jun	4-Oct	**98,673**	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	**92,375**	2,588	357	4,000	0
1992	2-Jun	26-Sep	**77,601**	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	1,050	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	**75,065**	55,424	498	15	12
2004	3-Jun	12-Sep	**77,660**	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-Mar	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

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Year	Date in	Date out	Sockeye	Pink	Chum	Coho	Chinook
2020	2-Jun	8-Sep	60,218	30,954	759	156	45
2021	6-Jun	11-Sep	98,672	48,213	1,241	221	20
Average [a]	2-Jun	25-Sep	69,914	26,205	385	608	28

[a] Average values use 1976–2019 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, 2020.

	Sockeye salmon		Chinook salmon		Coho salmon		Pink salmon		Chum salmon		Water	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Level (cm)	Temp. (ºC)
2-Jun	0	0	0	0	0	0	0	0	0	0	150	6.5
3-Jun	0	0	0	0	0	0	0	0	0	0	146	6.0
4-Jun	0	0	0	0	0	0	0	0	0	0	144	6.0
5-Jun	0	0	0	0	0	0	0	0	0	0	142	6.0
6-Jun	0	0	1	1	0	0	0	0	0	0	140	6.5
7-Jun	0	0	0	1	0	0	0	0	0	0	142	7.0
8-Jun	1	1	0	1	0	0	0	0	0	0	152	6.0
9-Jun	5	6	0	1	0	0	0	0	0	0	150	6.5
10-Jun	0	6	0	1	0	0	0	0	0	0	146	8.5
11-Jun	7	13	0	1	0	0	0	0	0	0	146	8.0
12-Jun	0	13	0	1	0	0	0	0	0	0	146	7.0
13-Jun	6	19	0	1	0	0	0	0	0	0	150	8.0
14-Jun	2	21	0	1	0	0	0	0	0	0	160	8.0
15-Jun	8	29	0	1	0	0	0	0	0	0	170	9.5
16-Jun	0	29	0	1	0	0	0	0	0	0	164	8.5
17-Jun	17	46	0	1	0	0	0	0	0	0	159	8.5
18-Jun	7	53	0	1	0	0	0	0	0	0	155	8.5
19-Jun	22	75	0	1	0	0	0	0	0	0	158	8.5
20-Jun	4	79	0	1	0	0	0	0	0	0	162	8.5
21-Jun	2	81	0	1	0	0	0	0	0	0	168	7.5
22-Jun	8	89	0	1	0	0	0	0	0	0	160	8.0
23-Jun	10	99	0	1	0	0	0	0	0	0	154	8.0
24-Jun	22	121	0	1	0	0	0	0	0	0	150	8.0
25-Jun	175	296	0	1	0	0	0	0	0	0	143	8.0
26-Jun	185	481	0	1	0	0	0	0	0	0	143	8.0
27-Jun	50	531	1	2	0	0	0	0	0	0	141	8.5
28-Jun	64	595	0	2	0	0	0	0	0	0	145	8.5
29-Jun	117	712	1	3	0	0	0	0	0	0	152	8.0
30-Jun	106	818	1	4	0	0	0	0	0	0	152	9.0
1-Jul	66	884	4	8	0	0	0	0	3	3	150	9.0
2-Jul	115	999	1	9	0	0	0	0	0	3	151	9.0
3-Jul	351	1,350	1	10	0	0	0	0	0	3	154	8.0
4-Jul	339	1,689	0	10	0	0	0	0	2	5	154	9.0
5-Jul	515	2,204	3	13	0	0	11	11	6	11	154	9.5

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	Sockeye salmon		Chinook salmon		Coho salmon		Pink salmon		Chum salmon		Water	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Level (cm)	Temp. (ºC)
6-Jul	570	2,774	1	14	0	0	15	26	6	17	152	10.5
7-Jul	273	3,047	1	15	0	0	17	43	8	25	148	10.5
8-Jul	222	3,269	0	15	0	0	16	59	3	28	146	9.5
9-Jul	256	3,525	1	16	0	0	24	83	1	29	149	9.5
10-Jul	377	3,902	0	16	0	0	16	99	1	30	150	11.0
11-Jul	455	4,357	0	16	0	0	10	109	1	31	149	10.5
12-Jul	398	4,755	4	20	0	0	25	134	2	33	146	9.0
13-Jul	563	5,318	0	20	0	0	35	169	2	35	145	9.5
14-Jul	566	5,884	2	22	0	0	18	187	0	35	145	9.5
15-Jul	501	6,385	1	23	0	0	14	201	0	35	154	9.5
16-Jul	472	6,857	4	27	0	0	31	232	2	37	158	10.0
17-Jul	1,298	8,155	2	29	0	0	70	302	0	37	150	9.5
18-Jul	851	9,006	4	33	0	0	44	346	0	37	149	9.5
19-Jul	812	9,818	0	33	0	0	28	374	8	45	158	10.0
20-Jul	1,750	11,568	0	33	0	0	43	417	30	75	159	9.5
21-Jul [a]	**1,187**	12,755	0	33	0	0	35	452	17	92	170	9.5
22-Jul	1,146	13,901	1	34	0	0	26	478	11	103	160	10.0
23-Jul	1,021	14,922	1	35	0	0	42	520	18	121	150	10.5
24-Jul	3,658	18,580	4	39	0	0	140	660	23	144	149	10.0
25-Jul	2,491	21,071	0	39	0	0	42	702	56	200	156	9.5
26-Jul	830	21,901	1	40	0	0	13	715	10	210	160	9.5
27-Jul	602	22,503	2	42	0	0	19	734	6	216	172	9.0
28-Jul	882	23,385	0	42	0	0	36	770	8	224	160	9.5
29-Jul	2,374	25,759	0	42	0	0	67	837	9	233	148	10.0
30-Jul	1,227	26,986	0	42	0	0	111	948	9	242	148	10.0
31-Jul	3,000	29,986	1	43	0	0	168	1,116	15	257	149	10.0
1-Aug	4,966	34,952	2	45	0	0	127	1,243	22	279	150	10.5
2-Aug	2,007	36,959	0	45	0	0	130	1,373	13	292	160	10.5
3-Aug	2,153	39,112	0	45	0	0	436	1,809	13	305	157	10.5
4-Aug	1,753	40,865	0	45	0	0	792	2,601	14	319	148	9.5
5-Aug	1,462	42,327	0	45	0	0	572	3,173	13	332	148	10.5
6-Aug	537	42,864	0	45	0	0	368	3,541	11	343	149	10.0
7-Aug	911	43,775	0	45	0	0	888	4,429	18	361	142	9.5
8-Aug	673	44,448	0	45	0	0	602	5,031	17	378	142	10.0

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	Sockeye salmon		Chinook salmon		Coho salmon		Pink salmon		Chum salmon		Water	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Level (cm)	Temp. (ºC)
9-Aug	857	45,305	0	45	0	0	144	5,175	34	412	148	9.5
10-Aug	813	46,118	0	45	0	0	96	5,271	16	428	168	9.0
11-Aug	415	46,533	0	45	0	0	71	5,342	9	437	165	9.5
12-Aug	912	47,445	0	45	0	0	2,005	7,347	14	451	150	9.5
13-Aug	216	47,661	0	45	0	0	545	7,892	8	459	140	10.0
14-Aug	370	48,031	0	45	0	0	1,232	9,124	16	475	139	10.0
15-Aug	751	48,782	0	45	0	0	1,643	10,767	18	493	137	10.0
16-Aug	676	49,458	0	45	0	0	805	11,572	25	518	140	10.0
17-Aug	742	50,200	0	45	0	0	1,223	12,795	19	537	140	9.5
18-Aug	1,020	51,220	0	45	0	0	1,903	14,698	25	562	140	10.0
19-Aug	680	51,900	0	45	0	0	1,793	16,491	13	575	138	9.5
20-Aug	1,267	53,167	0	45	0	0	2,913	19,404	27	602	135	10.5
21-Aug	835	54,002	0	45	0	0	4,256	23,660	19	621	138	10.0
22-Aug	575	54,577	0	45	0	0	979	24,639	17	638	140	10.0
23-Aug	304	54,881	0	45	1	1	779	25,418	8	646	140	10.0
24-Aug	433	55,314	0	45	0	1	638	26,056	7	653	141	10.0
25-Aug	423	55,737	0	45	0	1	433	26,489	7	660	140	10.0
26-Aug	608	56,345	0	45	0	1	990	27,479	5	665	140	10.0
27-Aug	184	56,529	0	45	0	1	239	27,718	8	673	140	10.0
28-Aug	545	57,074	0	45	1	2	518	28,236	17	690	135	10.5
29-Aug	516	57,590	0	45	0	2	503	28,739	11	701	138	10.0
30-Aug	369	57,959	0	45	0	2	209	28,948	10	711	135	9.5
31-Aug	226	58,185	0	45	2	4	278	29,226	5	716	140	9.0
1-Sep	580	58,765	0	45	26	30	255	29,481	3	719	142	9.0
2-Sep	421	59,186	0	45	13	43	321	29,802	8	727	142	9.5
3-Sep	345	59,531	0	45	7	50	337	30,139	10	737	140	9.5
4-Sep	241	59,772	0	45	18	68	269	30,408	2	739	140	9.5
5-Sep	134	59,906	0	45	17	85	171	30,579	6	745	130	9.5
6-Sep	90	59,996	0	45	16	101	122	30,701	5	750	130	9.5
7-Sep	83	60,079	0	45	23	124	116	30,817	5	755	120	9.5
8-Sep	139	60,218	0	45	32	156	137	30,954	4	759	120	9.5

[a] Hole found in weir; interpolated (**bold**) value was calculated for 21 July.

Appendix F.–Daily and cumulative (cum.) Chilkoot River weir salmon counts by species, and water temperature and gauge heights, 2021.

	Sockeye salmon		Chinook salmon		Coho salmon		Pink salmon		Chum salmon		Water	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Level (cm)	Temp. (ºC)
6-Jun	0	0	0	0	0	0	0	0	0	0	160	7.0
7-Jun	0	0	0	0	0	0	0	0	0	0	152	7.0
8-Jun	2	2	0	0	0	0	0	0	0	0	150	7.0
9-Jun	10	12	0	0	0	0	0	0	0	0	159	7.0
10-Jun	12	24	0	0	0	0	0	0	0	0	160	6.5
11-Jun	13	37	0	0	0	0	0	0	0	0	160	6.5
12-Jun	29	66	0	0	0	0	0	0	0	0	162	7.0
13-Jun	22	88	0	0	0	0	0	0	0	0	160	7.0
14-Jun	35	123	0	0	0	0	0	0	0	0	160	7.0
15-Jun	13	136	0	0	0	0	0	0	0	0	165	7.5
16-Jun	46	182	0	0	0	0	0	0	0	0	171	7.5
17-Jun	84	266	0	0	0	0	0	0	3	3	153	8.0
18-Jun	59	325	0	0	0	0	0	0	0	3	161	8.0
19-Jun	30	355	0	0	0	0	0	0	0	3	154	7.0
20-Jun	79	434	1	1	0	0	0	0	1	4	160	7.0
21-Jun	23	457	0	1	0	0	0	0	0	4	168	9.0
22-Jun	64	521	0	1	0	0	0	0	0	4	173	7.5
23-Jun	67	588	1	2	0	0	0	0	1	5	164	7.5
24-Jun	32	620	0	2	0	0	0	0	0	5	161	7.0
25-Jun [a]	**51**	671	0	2	0	0	0	0	0	5	179	7.0
26-Jun [a]	**53**	724	0	2	0	0	0	0	0	5	180	7.0
27-Jun [a]	**54**	778	0	2	0	0	0	0	0	5	180	7.0
28-Jun [a]	**56**	834	0	2	0	0	0	0	0	5	185	8.0
29-Jun [a]	**58**	892	0	2	0	0	0	0	0	5	190	8.0
30-Jun [a]	**59**	951	0	2	0	0	0	0	0	5	185	8.0
1-Jul [a]	**61**	1,012	0	2	0	0	0	0	0	5	177	8.0
2-Jul [a]	**62**	1,074	0	2	0	0	0	0	0	5	175	9.0
3-Jul [a]	**64**	1,138	0	2	0	0	0	0	0	5	169	9.0
4-Jul	37	1,175	0	2	0	0	0	0	0	5	161	9.0
5-Jul	94	1,269	0	2	0	0	3	3	2	7	165	9.0
6-Jul	324	1,593	0	2	0	0	5	8	1	8	165	9.0
7-Jul	1,143	2,736	6	8	0	0	2	10	1	9	163	9.0
8-Jul	338	3,074	0	8	0	0	0	10	1	10	156	9.0
9-Jul	237	3,311	0	8	0	0	0	10	0	10	152	8.0

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	Sockeye salmon		Chinook salmon		Coho salmon		Pink salmon		Chum salmon		Water	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Level (cm)	Temp. (ºC)
10-Jul	171	3,482	0	8	0	0	3	13	4	14	155	9.0
11-Jul	94	3,576	1	9	0	0	11	24	3	17	149	8.0
12-Jul	162	3,738	0	9	0	0	4	28	0	17	142	8.0
13-Jul	587	4,325	0	9	0	0	15	43	5	22	150	8.5
14-Jul	813	5,138	2	11	0	0	13	56	13	35	150	8.0
15-Jul	373	5,511	3	14	0	0	28	84	8	43	154	8.0
16-Jul	1,667	7,178	0	14	0	0	60	144	46	89	149	9.5
17-Jul	4,180	11,358	0	14	0	0	280	424	96	185	147	10.0
18-Jul	2,518	13,876	0	14	0	0	133	557	19	204	150	10.0
19-Jul	811	14,687	0	14	0	0	76	633	17	221	150	9.0
20-Jul	725	15,412	0	14	0	0	150	783	11	232	150	10.0
21-Jul	1,821	17,233	2	16	0	0	170	953	46	278	152	10.0
22-Jul	3,899	21,132	0	16	0	0	130	1,083	45	323	150	9.0
23-Jul	2,673	23,805	0	16	0	0	117	1,200	31	354	146	10.0
24-Jul	3,838	27,643	0	16	0	0	166	1,366	70	424	142	10.0
25-Jul	2,914	30,557	0	16	0	0	429	1,795	46	470	145	10.0
26-Jul	3,415	33,972	0	16	0	0	123	1,918	22	492	142	10.0
27-Jul	2,407	36,379	0	16	0	0	124	2,042	20	512	139	10.0
28-Jul	1,351	37,730	0	16	0	0	121	2,163	0	512	134	10.0
29-Jul	1,251	38,981	0	16	0	0	34	2,197	10	522	133	10.5
30-Jul	6,417	45,398	0	16	0	0	167	2,364	41	563	133	9.5
31-Jul	4,218	49,616	1	17	0	0	210	2,574	5	568	136	11.0
1-Aug	3,090	52,706	0	17	0	0	291	2,865	7	575	145	11.5
2-Aug	2,622	55,328	0	17	0	0	749	3,614	10	585	150	11.0
3-Aug	1,129	56,457	0	17	0	0	741	4,355	21	606	149	11.0
4-Aug	1,905	58,362	0	17	0	0	664	5,019	3	609	144	10.5
5-Aug	1,683	60,045	0	17	0	0	681	5,700	2	611	144	10.0
6-Aug	713	60,758	0	17	0	0	471	6,171	1	612	149	11.0
7-Aug	300	61,058	0	17	0	0	278	6,449	0	612	160	10.0
8-Aug	271	61,329	0	17	0	0	134	6,583	4	616	154	10.0
9-Aug	748	62,077	0	17	0	0	292	6,875	7	623	150	10.0
10-Aug	817	62,894	0	17	0	0	226	7,101	4	627	150	9.5
11-Aug	948	63,842	0	17	0	0	90	7,191	0	627	155	9.5
12-Aug	1,526	65,368	0	17	0	0	206	7,397	8	635	151	9.5

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	Sockeye salmon		Chinook salmon		Coho salmon		Pink salmon		Chum salmon		Water	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Level (cm)	Temp. (ºC)
13-Aug [b]	**987**	66,355	**0**	17	0	0	**167**	7,564	**3**	638	171	9.5
14-Aug [b]	**738**	67,093	**0**	17	0	0	**186**	7,750	**3**	641	190	9.5
15-Aug [b]	**488**	67,581	**0**	17	1	1	**204**	7,954	**2**	643	158	9.5
16-Aug	277	67,858	0	17	0	1	159	8,113	3	646	150	9.5
17-Aug	200	68,058	0	17	1	2	287	8,400	0	646	145	9.5
18-Aug	1,074	69,132	0	17	0	2	564	8,964	0	646	140	9.5
19-Aug	1,435	70,567	0	17	1	3	1,231	10,195	23	669	140	9.0
20-Aug	756	71,323	0	17	0	3	2,056	12,251	19	688	138	9.0
21-Aug	811	72,134	0	17	0	3	2,889	15,140	30	718	135	9.5
22-Aug	1,723	73,857	0	17	2	5	3,040	18,180	42	760	132	9.5
23-Aug	3,524	77,381	1	18	1	6	4,771	22,951	70	830	130	9.5
24-Aug	1,405	78,786	0	18	3	9	2,655	25,606	30	860	128	9.5
25-Aug	1,109	79,895	2	20	1	10	1,910	27,516	11	871	130	9.5
26-Aug	4,125	84,020	0	20	0	10	2,963	30,479	21	892	130	10.0
27-Aug	1,370	85,390	0	20	0	10	863	31,342	12	904	132	10.0
28-Aug	1,285	86,675	0	20	4	14	2,126	33,468	15	919	136	9.5
29-Aug	2,719	89,394	0	20	0	14	1,212	34,680	12	931	146	10.0
30-Aug	1,059	90,453	0	20	3	17	1,550	36,230	14	945	140	10.0
31-Aug	605	91,058	0	20	0	17	1,411	37,641	32	977	134	10.0
1-Sep	995	92,053	0	20	0	17	1,427	39,068	34	1,011	130	10.0
2-Sep	537	92,590	0	20	1	18	830	39,898	18	1,029	128	10.0
3-Sep	901	93,491	0	20	2	20	1,396	41,294	29	1,058	130	10.0
4-Sep	735	94,226	0	20	5	25	1,451	42,745	17	1,075	138	10.0
5-Sep	1,547	95,773	0	20	1	26	1,433	44,178	4	1,079	140	10.0
6-Sep	1,230	97,003	0	20	19	45	495	44,673	71	1,150	146	9.0
7-Sep	552	97,555	0	20	16	61	346	45,019	21	1,171	142	9.0
8-Sep	364	97,919	0	20	18	79	848	45,867	24	1,195	138	9.0
9-Sep	415	98,334	0	20	41	120	1,397	47,264	24	1,219	135	10.0
10-Sep	178	98,512	0	20	57	177	513	47,777	13	1,232	130	10.0
11-Sep	160	98,672	0	20	44	221	436	48,213	9	1,241	138	10.0

[a] Weir pickets were removed from 0000 hours on 25 June through 1130 hours on 3 July due to flood event; interpolated (**bold**) values were calculated for 25 June–3 July.

[b] Weir pickets were removed from 1000 hours on 13 August through 1430 hours on 15 August due to flood event; interpolated (**bold**) values were calculated for 13–15 August.

Appendix G.–Estimated commercial harvest of Chilkoot Lake, Chilkat Lake, and other sockeye salmon stocks in the District 15 commercial drift gillnet fishery based on scale pattern analysis (1976–2016) and genetic stock identification (2017–2021).

	Harvest			Percentile rank			Percent of harvest			
Year	Chilkoot Lake	Chilkat Lake	Other [a]	Chilkoot Lake	Chilkat Lake	Other [a]	Chilkoot Lake	Chilkat Lake	Other [a]	Total harvest
1976	61,861	58,765	4,796	0.51	0.42	0.12	49%	47%	4%	125,422
1977	113,555	41,477	5,389	0.65	0.26	0.14	71%	26%	3%	160,420
1978	14,264	89,558	4,658	0.12	0.67	0.09	13%	83%	4%	108,480
1979	69,864	115,995	7,117	0.58	0.81	0.16	36%	60%	4%	192,976
1980	21,244	31,267	1,588	0.21	0.16	0.02	39%	58%	3%	54,099
1981	43,756	48,420	1,070	0.44	0.33	0.00	47%	52%	1%	93,247
1982	144,748	127,174	1,911	0.79	0.88	0.05	53%	46%	1%	273,833
1983	242,034	124,180	3,965	0.93	0.84	0.07	65%	34%	1%	370,179
1984	225,634	99,592	9,502	0.88	0.70	0.19	67%	30%	3%	334,728
1985	153,533	131,091	18,704	0.84	0.91	0.49	51%	43%	6%	303,328
1986	110,114	168,006	12,174	0.60	1.00	0.30	38%	58%	4%	290,294
1987	327,323	69,900	18,658	1.00	0.51	0.47	79%	17%	4%	415,881
1988	248,640	76,883	26,353	0.95	0.58	0.74	71%	22%	7%	351,876
1989	292,830	156,160	25,908	0.98	0.98	0.72	62%	33%	5%	474,898
1990	181,260	149,377	31,499	0.86	0.93	0.81	50%	41%	9%	362,136
1991	228,607	60,721	24,353	0.91	0.47	0.67	73%	19%	8%	313,681
1992	142,471	113,146	33,729	0.77	0.79	0.91	49%	39%	12%	289,346
1993	52,080	103,531	19,605	0.47	0.74	0.56	30%	59%	11%	175,216
1994	25,367	126,852	19,578	0.28	0.86	0.53	15%	74%	11%	171,796
1995	9,637	68,737	10,302	0.09	0.49	0.23	11%	78%	12%	88,676
1996	19,882	99,677	30,019	0.19	0.72	0.79	13%	67%	20%	149,578
1997	31,822	73,761	13,245	0.35	0.53	0.35	27%	62%	11%	118,828
1998	2,838	112,630	19,469	0.02	0.77	0.51	2%	83%	14%	134,937
1999	4,604	149,410	9,547	0.05	0.95	0.21	3%	91%	6%	163,561
2000	14,622	78,265	16,673	0.14	0.60	0.40	13%	71%	15%	109,560
2001	66,355	60,183	21,273	0.53	0.44	0.60	45%	41%	14%	147,811
2002	24,200	47,332	10,482	0.26	0.28	0.28	30%	58%	13%	82,014
2003	32,446	49,955	12,729	0.40	0.35	0.33	34%	53%	13%	95,130
2004	66,498	51,110	33,637	0.56	0.37	0.88	44%	34%	22%	151,245
2005	29,276	22,852	13,341	0.33	0.14	0.37	45%	35%	20%	65,469
2006	119,201	15,979	10,400	0.67	0.07	0.26	82%	11%	7%	145,580
2007	125,199	14,208	17,529	0.74	0.02	0.44	80%	9%	11%	156,936
2008	7,491	22,156	17,008	0.07	0.12	0.42	16%	47%	36%	46,655
2009	16,622	85,551	24,422	0.16	0.65	0.70	13%	68%	19%	126,595
2010	32,064	48,079	20,830	0.37	0.30	0.58	32%	48%	21%	100,973
2011	26,766	15,599	21,428	0.30	0.05	0.63	42%	24%	34%	63,793
2012	124,366	54,884	45,393	0.72	0.40	0.98	55%	24%	20%	224,643
2013	23,111	75,588	23,404	0.23	0.56	0.65	19%	62%	19%	122,103
2014	110,487	81,502	42,693	0.63	0.63	0.95	47%	35%	18%	234,682
2015	58,568	33,085	39,924	0.49	0.19	0.93	45%	25%	30%	131,577
2016	119,843	35,991	33,010	0.70	0.21	0.86	63%	19%	17%	188,844
2017	1,933	5,698	32,085	0.00	0.00	0.84	**5%**	**14%**	81%	39,716
2018	33,969	19,235	28,483	0.42	0.09	0.77	42%	24%	35%	81,688

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	Harvest			Percentile rank			Percent of harvest			
Year	Chilkoot Lake	Chilkat Lake	Other [a]	Chilkoot Lake	Chilkat Lake	Other [a]	Chilkoot Lake	Chilkat Lake	Other [a]	Total harvest
2019	149,586	40,935	51,012	0.81	0.23	1.00	62%	17%	21%	241,533
2020	24,878	8,776	16,566	0.27	0.01	0.39	50%	17%	33%	50,220
2021	50,219	10,336	24,094	0.46	0.01	0.67	59%	12%	28%	84,649
Average [b]	89,786	73,966	19,748				42%	44%	14%	
Median [b]	60,214	69,319	19,087				44%	42%	12%	

Note: Bold estimates are historical records that have been updated since the last project report (Ransbury et al. 2021b).

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

[b] Average and median values use 1976–2019 data.

Appendix H.–District 15 commercial drift gillnet fishery data used in genetic stock identification analysis and results by statistical week and reporting group, 2020.

Stat. week	Sample size	Genotyped	Aged only	Not genotyped or aged	Reporting group	Mean	SD	CI5%	CI95%
26–27	537	187	272	78	Chilkat Lake	0.072	0.018	0.045	0.103
					Chilkat Mainstem	0.088	0.022	0.054	0.126
					Chilkoot	0.130	0.024	0.093	0.171
					Other	0.711	0.034	0.654	0.765
28	498	187	232	79	Chilkat Lake	0.129	0.025	0.090	0.173
					Chilkat Mainstem	0.108	0.022	0.074	0.146
					Chilkoot	0.305	0.034	0.251	0.361
					Other	0.458	0.038	0.397	0.520
29	504	185	256	63	Chilkat Lake	0.123	0.022	0.088	0.162
					Chilkat Mainstem	0.057	0.016	0.032	0.085
					Chilkoot	0.408	0.035	0.352	0.466
					Other	0.412	0.036	0.354	0.470
30	554	184	276	94	Chilkat Lake	0.126	0.023	0.090	0.166
					Chilkat Mainstem	0.065	0.017	0.039	0.096
					Chilkoot	0.263	0.031	0.213	0.314
					Other	0.546	0.036	0.487	0.605
31	344	186	118	40	Chilkat Lake	0.170	0.028	0.125	0.218
					Chilkat Mainstem	0.031	0.018	0.000	0.062
					Chilkoot	0.438	0.035	0.379	0.495
					Other	0.361	0.039	0.300	0.425
32	397	186	159	52	Chilkat Lake	0.110	0.021	0.079	0.146
					Chilkat Mainstem	0.002	0.003	0.000	0.009
					Chilkoot	0.760	0.030	0.709	0.807
					Other	0.128	0.026	0.088	0.172
33	480	184	205	91	Chilkat Lake	0.214	0.026	0.172	0.257
					Chilkat Mainstem	0.001	0.003	0.000	0.007
					Chilkoot	0.479	0.033	0.425	0.534
					Other	0.306	0.033	0.252	0.362
34	260	184	64	12	Chilkat Lake	0.214	0.030	0.166	0.263
					Chilkat Mainstem	0.011	0.011	0.000	0.033
					Chilkoot	0.492	0.036	0.433	0.551
					Other	0.283	0.036	0.226	0.343
35–39	340	183	114	43	Chilkat Lake	0.411	0.032	0.360	0.464
					Chilkat Mainstem	0.003	0.004	0.000	0.012
					Chilkoot	0.574	0.032	0.521	0.626
					Other	0.012	0.009	0.002	0.029
all	3,914	1,666	1,696	552	Chilkat Lake	0.175	0.010	0.159	0.191
					Chilkat Mainstem	0.027	0.005	0.020	0.035
					Chilkoot	0.495	0.013	0.475	0.516
					Other	0.303	0.012	0.283	0.323

Appendix I.–District 15 commercial drift gillnet fishery data used in genetic stock identification analysis and results by statistical week and reporting group, 2021.

Stat Week	Sample Size	Genotyped	Aged Only	Not genotyped or aged	ReportingGroup	Mean	SD	CI5%	CI95%
26–27	743	185	450	108	Chilkat Lake	0.080	0.021	0.049	0.117
					Chilkat Mainstem	0.010	0.011	0.000	0.031
					Chilkoot	0.083	0.020	0.053	0.118
					Other	0.828	0.028	0.779	0.872
28	456	182	213	61	Chilkat Lake	0.100	0.027	0.059	0.147
					Chilkat Mainstem	0.065	0.023	0.030	0.106
					Chilkoot	0.170	0.030	0.122	0.221
					Other	0.666	0.038	0.602	0.727
29	420	190	179	51	Chilkat Lake	0.061	0.021	0.031	0.098
					Chilkat Mainstem	0.039	0.019	0.012	0.073
					Chilkoot	0.203	0.029	0.157	0.252
					Other	0.697	0.036	0.637	0.754
30	394	184	179	31	Chilkat Lake	0.081	0.022	0.048	0.121
					Chilkat Mainstem	0.020	0.013	0.003	0.044
					Chilkoot	0.341	0.034	0.285	0.399
					Other	0.557	0.038	0.496	0.619
31	398	184	176	38	Chilkat Lake	0.105	0.024	0.067	0.147
					Chilkat Mainstem	0.054	0.019	0.026	0.088
					Chilkoot	0.403	0.036	0.344	0.463
					Other	0.438	0.038	0.376	0.500
32	398	188	173	37	Chilkat Lake	0.119	0.023	0.083	0.159
					Chilkat Mainstem	0.031	0.016	0.009	0.060
					Chilkoot	0.646	0.034	0.590	0.701
					Other	0.205	0.031	0.155	0.258
33	290	185	85	20	Chilkat Lake	0.226	0.030	0.178	0.277
					Chilkat Mainstem	0.036	0.015	0.015	0.064
					Chilkoot	0.644	0.034	0.586	0.700
					Other	0.094	0.024	0.058	0.136
34	200	181	10	9	Chilkat Lake	0.028	0.012	0.011	0.051
					Chilkat Mainstem	0.001	0.002	0.000	0.005
					Chilkoot	0.962	0.015	0.934	0.982
					Other	0.010	0.008	0.001	0.025
35–41	420	282	102	36	Chilkat Lake	0.151	0.021	0.118	0.187
					Chilkat Mainstem	0.006	0.005	0.000	0.016
					Chilkoot	0.710	0.027	0.664	0.754
					Other	0.133	0.022	0.099	0.171
all	3,719	1,761	1,567	391	Chilkat Lake	0.122	0.010	0.106	0.139
					Chilkat Mainstem	0.024	0.005	0.016	0.032
					Chilkoot	0.593	0.013	0.571	0.614
					Other	0.261	0.012	0.242	0.281

Appendix J.–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, 1976–2021.

	Escapement goal			Harvest					Harvest
Year	Lower	Upper	Escapement estimate	Commercial	Sport	Subsistence	Total	Total run	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	1,001	155,634	224,775	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	828	249,768	331,042	75%
1989	60,000	80,000	54,900	292,830	900	1,831	295,561	350,461	84%
1990	50,500	91,500	76,119	181,260	2,600	2,207	186,067	262,186	71%
1991	50,500	91,500	92,375	228,607	600	4,348	233,555	325,930	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	73,294	31%
1997	50,500	91,500	44,254	31,822	478	1,781	34,081	78,328	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	24,024	20%
2000	50,500	91,500	43,555	14,622	384	251	15,257	58,785	26%
2001	50,500	91,500	76,283	66,355	2,344	1,499	70,198	146,393	48%
2002	50,500	91,500	58,361	24,200	1,503	1,258	26,961	85,299	32%
2003	50,500	91,500	75,065	32,446	1,509	2,091	36,046	111,074	32%
2004	50,500	91,500	77,660	66,498	889	1,766	69,153	146,737	47%
2005	50,500	91,500	51,178	29,276	566	1,427	31,269	82,365	38%
2006	50,000	90,000	96,203	119,201	520	2,279	122,000	218,191	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	42,683	23%
2009	38,000	86,000	33,705	16,622	165	892	17,679	51,321	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	95,356	31%
2012	38,000	86,000	118,166	124,366	1,025	3,080	128,471	246,606	52%
2013	38,000	86,000	46,329	23,111	204	2,439	25,754	72,066	36%
2014	38,000	86,000	105,713	110,487	318	3,231	114,036	219,660	52%
2015	38,000	86,000	71,515	58,568	912	2,222	61,702	132,956	46%
2016	38,000	86,000	86,721	119,843	215	5,051	125,109	211,784	59%

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	Escapement goal			Harvest					Harvest
Year	Lower	Upper	Escapement estimate	Commercial	Sport	Subsistence	Total	Total run	Rate (%)
2017	38,000	86,000	43,098	1,933	233	2,102	4,268	47,260	9%
2018	38,000	86,000	85,463	33,969	159	4,406	38,534	123,878	31%
2019	38,000	86,000	140,378	149,586	86	3,673	153,345	293,709	52%
2020	38,000	86,000	60,218	24,878	ND [a]	3,991	28,869	89,087	32%
2021	38,000	86,000	98,672	50,219	ND [a]	3,207	53,426	152,098	35%
1976–2019 Average			69,914	89,786	739	2,100	92,162	162,039	57%
1976–2019 Median			73,872	60,215	510	1,976	61,782	133,054	46%
1976–2019 Lower quartile			49,638	23,928	300	1,343	26,659	77,069	35%
1976–2019 Upper quartile			89,112	129,517	958	2,668	132,981	224,700	59%

[a] Not enough survey responses to estimate harvest for Chilkoot Lake and Chilkoot River sport harvest in 2020 due to Covid-19 restrictions. 2021 data were not available.

Appendix K.–Historical age composition of the Chilkoot Lake sockeye salmon escapement, weighted by statistical week, 1982–2021. (Dashes indicate age class was not present in samples.)

		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	–	65	–	–	19,342	560	–	139	80,980	914	–	972	–	103,038
	SE of number	65	–	65	–	–	938	185	–	98	989	244	–	243	–	
	Proportion by age class	0.10%	–	0.10%	–	–	18.80%	0.50%	–	0.10%	78.60%	0.90%	–	0.90%	–	
	SE of %	0.10%	–	0.10%	–	–	0.90%	0.20%	–	0.10%	1.00%	0.20%	–	0.20%	–	
	Sample size	1	–	1	–	–	320	9	–	2	1,322	16	–	16	–	1,687
1983	Escapement by age class	–	84	42	–	–	9,852	1,352	–	95	48,435	20,043	–	238	–	80,141
	SE of number	–	59	42	–	–	637	279	–	69	972	837	–	118	–	
	Proportion by age class	–	0.10%	0.10%	–	–	12.30%	1.70%	–	0.10%	60.40%	25.00%	–	0.30%	–	
	SE of %	–	0.10%	0.10%	–	–	0.80%	0.30%	–	0.10%	1.20%	1.00%	–	0.10%	–	
	Sample size	–	2	1	–	–	214	25	–	2	1,081	461	–	4	–	1,790
1984	Escapement by age class	–	–	–	–	–	4,712	345	–	–	86,112	8,635	–	977	–	100,781
	SE of number	–	–	–	–	–	525	132	–	–	921	751	–	279	–	
	Proportion by age class	–	–	–	–	–	4.70%	0.30%	–	–	85.40%	8.60%	–	1.00%	–	
	SE of %	–	–	–	–	–	0.50%	0.10%	–	–	0.90%	0.70%	–	0.30%	–	
	Sample size	–	–	–	–	–	86	7	–	–	1,649	145	–	15	–	1,902
1985	Escapement by age class	–	46	–	–	–	8,132	1,661	45	–	45,675	11,517	–	1,857	208	69,141
	SE of number	–	46	–	–	–	552	252	45	–	876	700	–	342	93	
	Proportion by age class	–	0.10%	–	–	–	11.80%	2.40%	0.10%	–	66.10%	16.70%	–	2.70%	0.30%	
	SE of %	–	0.10%	–	–	–	0.80%	0.40%	0.10%	–	1.30%	1.00%	–	0.50%	0.10%	
	Sample size	–	1	–	–	–	198	43	1	–	1,078	258	–	39	5	1,623
1986	Escapement by age class	–	43	–	–	–	11,398	1,934	–	–	59,561	14,425	67	493	102	88,024
	SE of number	–	42	–	–	–	627	289	–	–	906	718	67	144	59	
	Proportion by age class	–	0.00%	–	–	–	12.90%	2.20%	–	–	67.70%	16.40%	0.10%	0.60%	0.10%	
	SE of %	–	0.00%	–	–	–	0.70%	0.30%	–	–	1.00%	0.80%	0.10%	0.20%	0.10%	
	Sample size	–	1	–	–	–	284	47	–	–	1,438	361	1	12	3	2,147
1987	Escapement by age class	–	–	–	–	–	7,706	2,074	–	–	62,153	21,773	79	283	139	94,208
	SE of number	–	–	–	–	–	537	294	–	–	915	811	79	132	80	
	Proportion by age class	–	–	–	–	–	8.20%	2.20%	–	–	66.00%	23.10%	0.10%	0.30%	0.10%	
	SE of %	–	–	–	–	–	0.60%	0.30%	–	–	1.00%	0.90%	0.10%	0.10%	0.10%	
	Sample size	–	–	–	–	–	185	49	–	–	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	–	–	–	–	–	3,265	2,103	–	–	63,381	11,060	52	1,115	299	81,274
	SE of number	–	–	–	–	–	317	263	–	–	705	592	51	196	107	
	Proportion by age class	–	–	–	–	–	4.00%	2.60%	–	–	78.00%	13.60%	0.10%	1.40%	0.40%	
	SE of %	–	–	–	–	–	0.40%	0.30%	–	–	0.90%	0.70%	0.10%	0.20%	0.10%	
	Sample size	–	–	–	–	–	117	72	–	–	2,074	350	1	38	9	2,661
1989	Escapement by age class	–	–	–	–	–	1,743	2,169	–	–	30,584	19,213	304	649	238	54,900
	SE of number	–	–	–	–	–	178	226	–	–	680	657	102	146	96	
	Proportion by age class	–	–	–	–	–	3.20%	4.00%	–	–	55.70%	35.00%	0.60%	1.20%	0.40%	
	SE of %	–	–	–	–	–	0.30%	0.40%	–	–	1.20%	1.20%	0.20%	0.30%	0.20%	
	Sample size	–	–	–	–	–	116	130	–	–	1,419	866	14	31	10	2,586
1990	Escapement by age class	–	–	–	–	–	1,227	1,006	11	–	35,537	36,830	64	736	708	76,119
	SE of number	–	–	–	–	–	185	180	10	–	806	807	46	161	150	
	Proportion by age class	–	–	–	–	–	1.60%	1.30%	0.00%	–	46.70%	48.40%	0.10%	1.00%	0.90%	
	SE of %	–	–	–	–	–	0.20%	0.20%	0.00%	–	1.10%	1.10%	0.10%	0.20%	0.20%	
	Sample size	–	–	–	–	–	55	41	1	–	1,277	1,382	3	27	29	2,815
1991	Escapement by age class	–	–	–	–	–	12,537	4,648	–	–	50,513	24,249	100	158	169	92,375
	SE of number	–	–	–	–	–	870	538	–	–	1,236	1,104	62	53	74	
	Proportion by age class	–	–	–	–	–	13.60%	5.00%	–	–	54.70%	26.30%	0.10%	0.20%	0.20%	
	SE of %	–	–	–	–	–	0.90%	0.60%	–	–	1.30%	1.20%	0.10%	0.10%	0.10%	
	Sample size	–	–	–	–	–	287	112	–	–	1,283	596	3	9	7	2,297
1992	Escapement by age class	–	–	–	–	–	1,824	4,028	56	17	52,400	18,410	105	419	342	77,601
	SE of number	–	–	–	–	–	448	428	31	16	894	765	64	119	115	
	Proportion by age class	–	–	–	–	–	2.40%	5.20%	0.10%	0.00%	67.50%	23.70%	0.10%	0.50%	0.40%	
	SE of %	–	–	–	–	–	0.60%	0.60%	0.00%	0.00%	1.20%	1.00%	0.10%	0.20%	0.10%	
	Sample size	–	–	–	–	–	36	118	3	1	1,277	577	3	14	10	2,039
1993	Escapement by age class	–	–	–	19	–	1,560	901	–	–	18,693	30,396	91	180	239	52,080
	SE of number	–	–	–	18	–	207	149	–	–	541	560	43	76	84	
	Proportion by age class	–	–	–	0.00%	–	3.00%	1.70%	–	–	35.90%	58.40%	0.20%	0.30%	0.50%	
	SE of %	–	–	–	0.00%	–	0.40%	0.30%	–	–	1.00%	1.10%	0.10%	0.10%	0.20%	
	Sample size	–	–	–	1	–	54	37	–	–	739	1,224	5	6	9	2,075

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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	
1994	Escapement by age class	–	–	–	–	–	671	549	23	48	24,876	10,573	22	194	50	37,007
	SE of number	–	–	–	–	–	112	98	23	34	392	378	21	56	24	
	Proportion by age class	–	–	–	–	–	1.80%	1.50%	0.10%	0.10%	67.20%	28.60%	0.10%	0.50%	0.10%	
	SE of %	–	–	–	–	–	0.30%	0.30%	0.10%	0.10%	1.10%	1.00%	0.10%	0.20%	0.10%	
	Sample size	–	–	–	–	–	35	32	1	2	1,328	571	1	12	4	1,986
1995	Escapement by age class	–	–	–	–	–	3,360	298	–	–	2,176	1,219	–	78	46	7,177
	SE of number	–	–	–	–	–	129	67	–	–	139	114	–	40	27	
	Proportion by age class	–	–	–	–	–	46.80%	4.20%	–	–	30.30%	17.00%	–	1.10%	0.60%	
	SE of %	–	–	–	–	–	1.80%	0.90%	–	–	1.90%	1.60%	–	0.60%	0.40%	
	Sample size	–	–	–	–	–	267	23	–	–	186	121	–	5	4	606
1996	Escapement by age class	–	–	–	–	–	3,365	517	23	11	43,232	3,559	–	35	–	50,741
	SE of number	–	–	–	–	–	338	145	22	10	461	308	–	18	–	
	Proportion by age class	–	–	–	–	–	6.60%	1.00%	0.00%	0.00%	85.20%	7.00%	–	0.10%	–	
	SE of %	–	–	–	–	–	0.70%	0.30%	0.00%	0.00%	0.90%	0.60%	–	0.00%	–	
	Sample size	–	–	–	–	–	128	16	1	1	1,737	176	–	4	–	2,063
1997	Escapement by age class	–	–	–	–	–	1,022	183	–	23	39,858	3,114	8	45	–	44,254
	SE of number	–	–	–	–	–	146	65	–	23	286	244	8	31	–	
	Proportion by age class	–	–	–	–	–	2.30%	0.40%	–	0.10%	90.10%	7.00%	0.00%	0.10%	–	
	SE of %	–	–	–	–	–	0.30%	0.10%	–	0.10%	0.60%	0.60%	0.00%	0.10%	–	
	Sample size	–	–	–	–	–	47	8	–	1	1,902	150	1	2	–	2,111
1998	Escapement by age class	15	–	–	–	–	631	268	–	–	7,478	3,753	13	165	13	12,335
	SE of number	15	–	–	–	–	86	57	–	–	189	177	13	44	13	
	Proportion by age class	0.10%	–	–	–	–	5.10%	2.20%	–	–	60.60%	30.40%	0.10%	1.30%	0.10%	
	SE of %	0.10%	–	–	–	–	0.70%	0.50%	–	–	1.50%	1.40%	0.10%	0.40%	0.10%	
	Sample size	1	–	–	–	–	47	20	–	–	570	288	1	13	1	941
1999	Escapement by age class	–	–	–	–	–	5,934	1,597	–	–	8,550	3,136	–	34	34	19,284
	SE of number	–	–	–	–	–	203	124	–	–	212	163	–	16	18	
	Proportion by age class	–	–	–	–	–	30.80%	8.30%	–	–	44.30%	16.30%	–	0.20%	0.20%	
	SE of %	–	–	–	–	–	1.10%	0.60%	–	–	1.10%	0.80%	–	0.10%	0.10%	
	Sample size	–	–	–	–	–	585	164	–	–	945	331	–	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	–	–	–	–	24	6,678	1,041	–	–	25,864	9,903	–	29	15	43,555
	SE of number	–	–	–	–	24	359	160	–	–	468	377	–	20	15	
	Proportion by age class	–	–	–	–	0.10%	15.30%	2.40%	–	–	59.40%	22.70%	–	0.10%	0.00%	
	SE of %	–	–	–	–	0.10%	0.80%	0.40%	–	–	1.10%	0.90%	–	0.00%	0.00%	
	Sample size	–	–	–	–	1	295	42	–	–	1,306	581	–	2	1	2,228
2001	Escapement by age class	–	–	–	–	–	3,565	50	–	157	68,859	3,600	–	53	–	76,283
	SE of number	–	–	–	–	–	436	29	–	62	606	437	–	52	–	
	Proportion by age class	–	–	–	–	–	4.70%	0.10%	–	0.20%	90.30%	4.70%	–	0.10%	–	
	SE of %	–	–	–	–	–	0.60%	0.00%	–	0.10%	0.80%	0.60%	–	0.10%	–	
	Sample size	–	–	–	–	–	113	4	–	7	2,106	114	–	1	–	2,345
2002	Escapement by age class	–	–	–	–	–	4,989	800	–	–	50,880	1,400	–	292	–	58,361
	SE of number	–	–	–	–	–	382	155	–	–	441	181	–	85	–	
	Proportion by age class	–	–	–	–	–	8.50%	1.40%	–	–	87.20%	2.40%	–	0.50%	–	
	SE of %	–	–	–	–	–	0.70%	0.30%	–	–	0.80%	0.30%	–	0.10%	–	
	Sample size	–	–	–	–	–	182	30	–	–	2,540	71	–	13	–	2,836
2003	Escapement by age class	–	–	–	–	–	42,648	2,594	–	–	24,883	4,776	–	132	33	75,065
	SE of number	–	–	–	–	–	960	326	–	–	905	458	–	60	32	
	Proportion by age class	–	–	–	–	–	56.80%	3.50%	–	–	33.10%	6.40%	–	0.20%	0.00%	
	SE of %	–	–	–	–	–	1.30%	0.40%	–	–	1.20%	0.60%	–	0.10%	0.00%	
	Sample size	–	–	–	–	–	1,078	110	–	–	1,174	238	–	10	1	2,611
2004	Escapement by age class	–	–	–	–	–	11,846	5,738	–	–	54,309	5,732	–	36	–	77,660
	SE of number	–	–	–	–	–	611	460	–	–	770	414	–	25	–	
	Proportion by age class	–	–	–	–	–	15.30%	7.40%	–	–	69.90%	7.40%	–	0.00%	–	
	SE of %	–	–	–	–	–	0.80%	0.60%	–	–	1.00%	0.50%	–	0.00%	–	
	Sample size	–	–	–	–	–	399	161	–	–	1,929	220	–	2	–	2,711
2005	Escapement by age class	–	–	–	–	–	11,048	2,242	–	–	32,908	4,909	–	71	–	51,178
	SE of number	–	–	–	–	–	433	228	–	–	508	326	–	38	–	
	Proportion by age class	–	–	–	–	–	21.60%	4.40%	–	–	64.30%	9.60%	–	0.10%	–	
	SE of %	–	–	–	–	–	0.80%	0.40%	–	–	1.00%	0.60%	–	0.10%	–	
	Sample size	–	–	–	–	–	542	106	–	–	1,843	235	–	4	–	2,730

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Appendix K.–Page 5 of 7.

Year	Weighted by stat. week	Age class														Total
		0.1	1.1	2.1	3.1	0.2	1.2	2.2	3.2	0.3	1.3	2.3	3.3	1.4	2.4	
2006	Escapement by age class	–	–	–	–	–	8,492	817	–	22	76,211	10,578	–	48	34	96,203
	SE of number	–	–	–	–	–	582	187	–	21	839	653	–	48	34	
	Proportion by age class	–	–	–	–	–	8.80%	0.80%	–	0.00%	79.20%	11.00%	–	0.10%	0.00%	
	SE of %	–	–	–	–	–	0.60%	0.20%	–	0.00%	0.90%	0.70%	–	0.00%	0.00%	
	Sample size	–	–	–	–	–	211	22	–	1	2,076	269	–	1	1	2,581
2007	Escapement by age class	–	–	–	–	–	7,128	618	–	–	55,604	8,908	–	421	–	72,678
	SE of number	–	–	–	–	–	483	150	–	–	658	493	–	116	–	
	Proportion by age class	–	–	–	–	–	9.80%	0.80%	–	–	76.50%	12.30%	–	0.60%	–	
	SE of %	–	–	–	–	–	0.70%	0.20%	–	–	0.90%	0.70%	–	0.20%	–	
	Sample size	–	–	–	–	–	214	19	–	–	2,387	383	–	17	–	3,020
2008	Escapement by age class	–	–	–	–	–	3,405	330	–	55	26,672	1,403	–	1,213	39	33,117
	SE of number	–	–	–	–	–	427	154	–	31	552	282	–	255	23	
	Proportion by age class	–	–	–	–	–	10.30%	1.00%	–	0.20%	80.50%	4.20%	–	3.70%	0.10%	
	SE of %	–	–	–	–	–	1.30%	0.50%	–	0.10%	1.70%	0.90%	–	0.80%	0.10%	
	Sample size	–	–	–	–	–	103	6	–	3	851	44	–	47	3	1,057
2009	Escapement by age class	–	–	–	–	–	9,539	647	–	–	22,801	615	–	103	–	33,705
	SE of number	–	–	–	–	–	386	119	–	–	399	115	–	45	–	
	Proportion by age class	–	–	–	–	–	28.30%	1.90%	–	–	67.60%	1.80%	–	0.30%	–	
	SE of %	–	–	–	–	–	1.10%	0.40%	–	–	1.20%	0.30%	–	0.10%	–	
	Sample size	–	–	–	–	–	479	35	–	–	1,288	34	–	5	–	1,841
2010	Escapement by age class	–	–	–	–	–	4,269	2,922	34	–	58,284	6,099	–	48	–	71,657
	SE of number	–	–	–	–	–	554	466	25	–	883	619	–	30	–	
	Proportion by age class	–	–	–	–	–	6.00%	4.10%	0.00%	–	81.30%	8.50%	–	0.10%	–	
	SE of %	–	–	–	–	–	0.80%	0.60%	0.00%	–	1.20%	0.90%	–	0.00%	–	
	Sample size	–	–	–	–	–	122	72	3	–	2,070	223	–	3	–	2,493
2011	Escapement by age class	–	–	–	–	–	20,450	1,421	–	4	32,475	11,301	136	120	8	65,915
	SE of number	–	–	–	–	–	786	253	–	4	829	635	64	66	7	
	Proportion by age class	–	–	–	–	–	31.00%	2.20%	–	0.00%	49.30%	17.10%	0.20%	0.20%	0.00%	
	SE of %	–	–	–	–	–	1.20%	0.40%	–	0.00%	1.30%	1.00%	0.10%	0.10%	0.00%	
	Sample size	–	–	–	–	–	637	50	–	1	1,441	431	7	4	1	2,572

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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
2012	Escapement by age class	–	–	–	–	–	2,730	449	–	–	102,954	11,803	–	230	–	118,166
	SE of number	–	–	–	–	–	473	157	–	–	1,116	1,024	–	86	–	
	Proportion by age class	–	–	–	–	–	2.30%	0.40%	–	–	87.10%	10.00%	–	0.20%	–	
	SE of %	–	–	–	–	–	0.40%	0.10%	–	–	0.90%	0.90%	–	0.10%	–	
	Sample size	–	–	–	–	–	76	18	–	–	2,078	240	–	11	–	2,423
2013	Escapement by age class	–	–	–	–	–	13,574	2,826	–	22,516	5,930	93	1,390	46	46,329	
	SE of number	–	–	–	–	–	800	445	–	0	876	566	102	261	59	
	Proportion by age class	–	–	–	–	–	29.30%	6.10%	–	0.00%	48.60%	12.80%	0.20%	3.00%	0.10%	
	SE of %	–	–	–	–	–	1.70%	1.00%	–	0.00%	1.90%	1.20%	0.20%	0.60%	0.10%	
	Sample size	–	–	–	–	–	452	71	–	0	826	208	1	58	1	1,617
2014	Escapement by age class	–	–	–	–	–	28,648	5,920	–	–	64,274	6,766	–	106	–	105,713
	SE of number	–	–	–	–	–	1,314	677	–	–	1,403	678	–	54	–	
	Proportion by age class	–	–	–	–	–	27.10%	5.60%	–	–	60.80%	6.40%	–	0.10%	–	
	SE of %	–	–	–	–	–	1.20%	0.60%	–	–	1.30%	0.60%	–	0.10%	–	
	Sample size	–	–	–	–	–	421	101	–	–	1,503	150	–	5	–	2,181
2015	Escapement by age class	–	–	–	–	–	11,156	1,502	–	0	54,280	4,434	–	215	0	71,515
	SE of number	–	–	–	–	–	749	301	–	9	885	503	–	105	6	
	Proportion by age class	–	–	–	–	–	15.60%	2.10%	–	0.00%	75.90%	6.20%	–	0.30%	0.00%	
	SE of %	–	–	–	–	–	1.10%	0.40%	–	0.00%	1.20%	0.70%	–	0.10%	0.00%	
	Sample size	–	–	–	–	–	211	28	–	1	1,253	100	–	3	1	1,597
2016	Escapement by age class	–	5	–	–	–	2,186	362	–	–	73,061	11,024	9	73	–	86,721
	SE of number	–	5	–	–	–	521	133	–	–	1,214	1,126	8	52	–	
	Proportion by age class	–	0.00%	–	–	–	2.50%	0.40%	–	–	84.20%	12.70%	0.00%	0.10%	–	
	SE of %	–	0.00%	–	–	–	0.60%	0.20%	–	–	1.40%	1.30%	0.00%	0.10%	–	
	Sample size	–	1	–	–	–	33	9	–	–	1,376	207	1	2	–	1,629
2017	Escapement by age class	117	–	–	–	–	8,702	799	–	55	29,286	3,265	–	737	137	43,098
	SE of number	116	–	–	–	–	867	328	–	38	1,050	644	–	202	92	
	Proportion by age class	0.30%	–	–	–	–	20.20%	1.90%	–	0.10%	68.00%	7.60%	–	1.70%	0.30%	
	SE of %	0.30%	–	–	–	–	2.00%	0.80%	–	0.10%	2.40%	1.50%	–	0.50%	0.20%	
	Sample size	1	–	–	–	–	124	10	–	2	504	43	–	18	3	705

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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	
2018	Escapement by age class	–	128	–	–	–	40,331	–	–	24	40,570	3,581	–	819	9	85,463
	SE of number	–	90	–	–	–	2,885	–	–	24	2,857	1,198	–	673	9	
	Proportion by age class	–	0.10%	–	–	–	47.20%	–	–	0.00%	47.50%	4.20%	–	1.00%	0.00%	
	SE of %	–	0.10%	–	–	–	3.40%	–	–	0.00%	3.30%	1.40%	–	0.80%	0.00%	
	Sample size	–	2	–	–	–	205	–	–	1	442	28	–	7	1	686
2019	Escapement by age class	–	–	–	–	–	23,987	557	–	–	113,393	2,034	–	407	–	140,378
	SE of number	–	–	–	–	–	3,141	295	–	–	3,252	966	–	392	–	
	Proportion by age class	–	–	–	–	–	17.10%	0.40%	–	–	80.80%	1.40%	–	0.30%	–	
	SE of %	–	–	–	–	–	2.20%	0.20%	–	–	2.30%	0.70%	–	0.30%	–	
	Sample size	–	–	–	–	–	92	4	–	–	700	13	–	2	–	811
2020	Escapement by age class	–	450	–	–	–	10682	673	–	–	45439	2582	–	393	–	60218
	SE of number	–	277	–	–	–	1150	308	–	–	1288	613	–	244	–	
	Proportion by age class	–	0.75%	–	–	–	17.74%	1.12%	–	–	75.46%	4.29%	–	0.65%	–	
	SE of %	–	0.46%	–	–	–	1.91%	0.51%	–	–	2.14%	1.02%	–	0.40%	–	
	Sample size	–	3	–	–	–	98	7	–	–	554	24	–	4	–	690
2021	Escapement by age class	–	–	–	–	–	22795	3266	–	400	71906	300	–	5	–	98672
	SE of number	–	–	–	–	–	1902	922	–	284	2025	257	–	5	–	
	Proportion by age class	–	–	–	–	–	23.10%	3.31%	–	0.41%	72.87%	0.30%	–	0.01%	–	
	SE of %	–	–	–	–	–	1.93%	0.93%	–	0.29%	2.05%	0.26%	–	0.00%	–	
	Sample size	–	–	–	–	–	165	17	–	2	525	3	–	1	–	713

Appendix L.–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, 1982–2021. (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
2020	482	5.7	49	561	2.1	207	450	13.2	3	565	7.7	14
2021	463	4.5	80	554	1.5	261	489	15.7	8	560	25.0	2
Average	480			578			490			577		

Appendix M.–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, 1982–2021. (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	41	563	1.4	309
1993	525	16	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	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	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	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	1	532	10.9	8
2020	479	4.8	49	537	1.3	343	481	18.5	4	539	6.8	10
2021	462	3.2	83	532	1.3	264	481	10.9	9	535	0.0	1
Average	496			562			502			559		

Appendix N.–Monthly and seasonal mean euphotic zone depths (EZD) and water temperatures at Chilkoot Lake. All entries are averages of data from stations 1A and 2A. Annual averages were not included for years missing more than one month of data.

	EZD (m)							Water temperature (ºC) at 1.0 m depth						
Year	May	June	July	Aug	Sept	Oct	Mean	May	June	July	Aug	Sept	Oct	Mean
1987	13.9	11.7	4.2	4.1	3.8	2.8	5.3	3.1	6.5	10.8	11.1	8.0	5.8	7.5
1988	7.6	8.7	6.9	5.4	5.6	7.6	7.0	6.0	10.5	9.6	10.2	8.4	8.0	8.8
1989	13.3	6.6	2.4	2.1	2.8	3.3	5.1	6.9	9.0	14.4	11.4	9.4	6.5	9.6
1990	13.5	5.0	3.3	2.7	2.3	2.0	4.8	4.1	8.9	10.3	10.5	9.2	7.0	8.3
1991	7.2	7.6	2.5	3.9	3.0	4.7	4.8	3.5	7.7	9.4	9.5	8.1	6.4	7.4
–														
2001	12	9	5	4	5	5	6.4	ND	ND	ND	ND	ND	ND	ND
2002	13	6	6	4	4.9	5.7	6.6	ND	ND	ND	ND	ND	ND	ND
2003	14.0	4.2	2.4	1.4	1.9	2.9	4.5	ND	ND	ND	ND	ND	ND	ND
2004	8.2	2.7	3.1	1.9	1.3	1.4	3.1	ND	ND	ND	ND	ND	ND	ND
2005	8.7	ND	3.9	ND	2.4	ND	ND	9.5	ND	12.6	ND	10.3	ND	ND
2006	13.0	13.7	8.7	5.9	5.3	7.2	9.0	7.7	11.0	13.1	11.2	9.8	ND	10.5
2007	12.6	6.4	4.2	6.2	4.6	8.4	7.1	4.3	9.2	10.5	13.7	8.6	6.7	8.8
2008	12.1	10.5	6.4	4.4	15.4	ND	9.8	6.3	8.6	7.7	12.3	8.4	ND	8.7
2009	13.7	5.7	3.6	2.3	2.5	3.8	5.3	5.6	9.4	10.6	10.7	9.1	7.9	8.9
2010	12.8	7.3	5.8	3.2	4.0	7.8	6.8	6.7	7.8	8.7	11.2	11.8	6.3	8.7
2011	22.2	7.3	3.9	4.9	ND	5.5	8.8	5.3	11.2	13.7	10.7	ND	7.0	9.6
2012	16.4	10.4	5.5	5.5	9.5	ND	9.5	3.8	9.0	10.3	12.9	8.0	ND	8.8
2013	12.4	6.2	3.9	2.5	2.5	3.4	5.2	4.3	11.1	13.8	12.4	9.5	7.0	9.7
2014	16.6	6.9	3.1	2.2	3.8	4.2	6.1	5.0	9.4	11.8	10.8	10.9	7.0	9.1
2015	7.9	5.3	3.0	3.5	3.2	3.6	4.4	12.8	10.8	11.7	11.9	9.1	7.1	10.5
2016	8.3	4.9	3.6	2.7	3.5	6.4	4.9	10.0	11.5	12.8	11.7	9.8	6.7	10.4
2017	13.9	5.7	5.3	4.0	3.4	4.1	6.1	7.1	7.8	10.4	10.4	10.0	7.1	8.8
2018	11.2	11.6	3.7	2.3	2.7	ND	6.3	5.2	10.0	11.5	11.5	10.9	ND	9.8
2019	2.2	ND	1.8	1.6	1.4	4.2	2.2	8.0	10.1	13.6	14.4	10.2	6.9	10.5
2020	ND	6.7	4.7	2.6	3.5	4.7	4.4	ND	10.4	10.4	10.0	9.4	7.5	9.5
2021	13.8	5.6	3.0	1.2	2.1	ND	5.1	3.5	8.2	9.8	10.3	9.3	ND	8.2
Average (1987–2019)	12.1	7.4	4.3	3.5	4.2	4.7	6.0	6.1	9.4	11.3	11.5	9.4	6.9	9.2
Average (2020–2021)	13.8	6.2	3.9	1.9	2.8	4.7	4.8	3.5	9.3	10.1	10.2	9.4	7.5	8.9

Appendix O.–Chilkoot Lake zooplankton abundance summary from 1987 to 2021. All stations were averaged and species combined.

Year	Laboratory Location	Stations Sampled [a]	Monthly mean density (no./m^2) Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	May–Sep. mean density (no./m^2)	May–Sep. Biomass (mg/m^2)
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

-continued-

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.		
2019	Kodiak	2	ND	388,351	186,449	286,806	263,287	326,541	181,525	ND	290,287	555
2020	Kodiak	2	ND	ND	125,149	103,413	77,772	131,962	327,730	ND	109,574	283
2021	Kodiak	2	ND	95,835	69,834	60,621	23,922	120,139	ND	ND	74,070	132

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

[a] Since 2008, all limnological sampling has been conducted at 2 stations, 1A and 2A (Figure 2).

[b] 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.