Fishery Data Series No. 20-29

Anchor River Chinook Salmon Escapement, 2015

by

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December 2020

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

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

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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December 2020

This investigation was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Project F-10-30 and 31, Job No. S-2-21.

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This document should be cited as follows:
Kerkvliet, C. M., M. D. Booz, and H. I. Dickson. 2020. Anchor River Chinook salmon escapement, 2015. Alaska Department of Fish and Game, Fishery Data Series No. 20-29, Anchorage.

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ABSTRACT

The 2015 Anchor River Chinook salmon (*Oncorhynchus tshawytscha*) escapement (10,241) exceeded the sustainable escapement goal (SEG) range of 3,800–10,000 Chinook salmon. Escapement was more than twice the average of recent low-productivity years (2009–2014) and was more similar to the large escapements from 2003 to 2005. Some preseason emergency orders that restricted the inriver and nearby marine sport fisheries were rescinded as a result of the unexpectedly strong run. Escapement was based on combined counts collected on the north and south forks of the Anchor River using weirs fitted with an underwater video system in the passage chute. The midpoint of the combined Chinook salmon run was 15 June. Daily Chinook salmon counts on the south fork and average south fork river stage were significantly correlated. Age composition was determined from samples collected during weekly beach seining downstream of the weirs. The dominant age class was ocean age 3 (44.6% SE 2.6%). No significant difference was detected between the length of ocean-age-3 males and females, but there was a significant difference in the average length of the sexes for ocean-age-2 and ocean-age-4 fish. There was no significant difference between the sex composition collected from beach seine samples and that observed at the video weirs, but there was a significant difference in the proportion of jacks captured in the beach seine and that observed at the video weirs.

Key words: Anchor River, Chinook salmon, *Oncorhynchus tshawytscha*, steelhead, *Oncorhynchus mykiss*, kelt, emigration, run timing, diel, sustainable escapement goal, stock status, weir, sonar, DIDSON

INTRODUCTION

The Anchor River is located on the southern portion of the Kenai Peninsula (Figure 1) and supports the largest Chinook salmon (*Oncorhynchus tshawytscha*) run in the Lower Cook Inlet Management Area (LCIMA; Booz et al. 2019). There are 3 streams open to sport fishing for Chinook salmon in the LCIMA: Anchor River, Deep Creek, and Ninilchik River. Chinook salmon run timing in these streams is early May through late July with a peak in early to mid-June. Based on scale age data, Anchor River Chinook salmon spend 1 to 4 years feeding in salt water before they return to spawn (Kerkvliet and Booz 2012).

The Anchor River watershed is approximately 587 km^2, with about 266 river kilometers (RKM) of anadromous streams (Table 1). The Anchor River has 2 major forks (south and north forks) and their confluence is located approximately 4.0[1] RKM upstream from the mouth. The south fork watershed is approximately twice the size of the north fork watershed. Because of the Anchor River's small size, geomorphology, and vegetation, water flows can rise quickly and substantially following spring snowmelt or heavy rains.

Since the inception of the Anchor River Chinook salmon escapement project in 2003, the annual Chinook salmon escapement in the Anchor River has ranged from 2,499 in 2014 to 12,016 in 2004 (Table 2). The Anchor River Chinook salmon escapement goal has been refined as annual escapement data have become available (Appendix A2). The goal in place during this project was an SEG of 3,800–10,000 Chinook salmon set in 2010 (Otis et al. 2010) using the full probability spawner–recruit model described in Szarzi et al. (2007) and updated with the most recent escapements and harvests through 2009. The lower end of the SEG was the point estimate for maximum sustained yield and the upper bound was the estimated carrying capacity. The range minimizes the risk of overfishing and allows for liberalization of the harvest when escapements are large.

Anchor River Chinook salmon are primarily harvested during an inriver sport fishery. The inriver sport fishery is restricted by regulation through small daily and seasonal limits, and limits on days and areas open to sport fishing. The annual Chinook salmon catch and harvest in the Anchor River

[1] River kilometer 2.8 for mainstem site was remeasured in 2013 to RKM 4.0.

sport fishery is estimated by the Statewide Harvest Survey (SWHS; Table 3). From 2005 to 2014, the average SWHS Chinook salmon inriver harvest was 841. Inriver harvest rates have ranged from less than 0.8% in 2003 to 21.7% in 2008. Anchor River Chinook salmon are also harvested in the Upper Cook Inlet summer mixed-stock sport troll fishery. In years such as 2013 and 2014 when runs of Lower Cook Inlet Chinook salmon are low, the troll fishery was closed within 1 mile of shore from Bluff Point (lat 59°40.00′ N) north to the mouth of the Ninilchik River (Schuster et al. *In prep*).

Anchor River sport fishing regulations have undergone a series of changes since the early 2000s as escapement assessment has improved (Appendix A3; Kerkvliet et al. 2013). In 2009, the inriver and nearby marine fisheries were restricted by emergency order (EO) in response to low Chinook salmon escapement. Despite the restrictions, the lower bound SEG of 5,000 was not achieved. In 2010, the Alaska Board of Fisheries (BOF) reduced the Anchor River annual limit to 2 Chinook salmon in combination with Deep Creek. Additionally, the BOF extended the conservation zone surrounding the Anchor River mouth from 1 mile north and south to 2 miles north and south from 1 April through 30 June. The other restrictions remained unchanged; the Chinook salmon sport fishery opened for 5 consecutive 3-day weekends (Saturday–Monday) starting the weekend before Memorial Day. The fishery was also open the Wednesday following each weekend. The Chinook salmon escapement estimates will be used in future escapement goal analyses and also to manage the fishery according to the *Policy for the Management of Sustainable Salmon Fisheries* (5 AAC 39.222) and the *Policy for Statewide Escapement Goals* (5 AAC 39.223).

Before 2003, there were problems enumerating the Anchor River Chinook salmon escapement over the entire run. Traditional sonar methods (e.g., split beam sonar) commonly used in large Alaska rivers at the time (e.g., the Kenai River) were not suited for smaller streams like the Anchor River because of periodic low water conditions that are too shallow to insonify. Also, traditional weirs (fixed picket or resistance board weirs), commonly used in small streams, could not be installed in the Anchor River in May and early June because the river was typically too high and swift for installation. Therefore, an annual aerial survey was conducted during peak spawning to index and evaluate Chinook salmon escapement (Appendix A1). However, because of the inherent biases associated with the index counts (e.g., differences in survey conditions and surveyor biases) year-to-year comparisons of Chinook salmon escapement indices were difficult.

Since 2003, the Anchor River Chinook salmon escapement has been monitored annually using a combination of technologies (Table 4, Appendix A1). In 2003, dual-frequency identification sonar (DIDSON) manufactured by Sound Metrics Corporation (SMC) was used to monitor Chinook salmon escapement in the Anchor River (Table 4, Appendix A1; Kerkvliet et al. 2008). The DIDSON was deployed on the mainstem of the Anchor River just below the north and south fork confluence (RKM 4.0) at the upstream end of the fishery (Figure 2).

From 2004 to 2008 and 2010 to 2012, the Chinook salmon escapement was estimated by first using DIDSON in May through early to mid-June, during high water levels, and then a resistance board weir thereafter (Table 4). In 2009, low water levels allowed for the immediate installation of the resistance board weir, which provided the first complete Anchor River Chinook salmon escapement census. In August 2010, an underwater video system was incorporated into the resistance board weir and used to monitor escapement (Kerkvliet and Booz 2018a,b). Starting in 2012, annual Chinook salmon escapement monitoring was ended on August 4 (last complete day was August 3) because only 1% of the run was observed in the remainder of August through mid-September in years when escapement was also monitored for later returning coho salmon.

In 2013, high river flows that changed the channel morphology at the confluence of the north and south forks rendered the mainstem escapement monitoring site unsuitable (Kerkvliet and Booz 2018c). The DIDSON was relocated from RKM 4.0 downstream to RKM 3.7 (Figure 2). Once flows subsided, 2 upstream weir sites were established, 1 each on the south and north forks. The north fork site was located at RKM 5.4 and the south fork site at RKM 4.1 (Figure 3, Table 5). In 2014, the DIDSON was not used for monitoring because stream flows allowed immediate installation of resistance board weirs and underwater video systems at the new sites.

Anchor River Chinook salmon escapement counts based on DIDSON counts are biased low because all sonar images of fish swimming upstream and downstream are assumed to be Chinook salmon even though an unknown portion of the downstream sonar images include postspawning steelhead (*Oncorhynchus mykiss*), known as kelts, emigrating out of the river. In 2009, when the entire Chinook salmon season was monitored with a weir, kelts were also monitored at the sonar-weir site (Kerkvliet and Booz 2012). The midpoint of the 2009 kelt emigration (7 June) was earlier than the midpoint of the Chinook salmon immigration (23 June). Given a typical weir installation date of early to mid-June, and assuming the timing of the 2009 kelt emigration was typical, a large portion of the kelt emigration may occur during the DIDSON operation. Had the DIDSON been used in 2009 during the typical early spring high water period, the negative bias associated with kelt counts would have been up to 17%. However, this estimate of potential bias was based on the second-lowest escapement of Chinook salmon to date. A similar emigration of steelhead during the highest measured Chinook salmon run would translate to a negative bias of about 5%. It is noted that length-based discrimination methods will not work to separate Chinook salmon images from steelhead images due to the substantial overlap in sizes between the species.

OBJECTIVES

OBJECTIVES

1) Estimate the Anchor River Chinook salmon escapement at RKM 4.1 on the south fork and at RKM 5.4 on the north fork from approximately 13 May through 3 August.
2) Estimate the age and sex compositions of the Anchor River Chinook salmon escapement.
3) Census the sex, length (number <508 mm TL), and adipose composition during the video weir operation.

SECONDARY OBJECTIVES

1) Estimate mean length-at-age by sex of the Chinook salmon escapement using lengths from mid eye to tail fork (METF).
2) Examine all Chinook salmon sampled in beach seines for age, sex, and length (METF), and presence of an adipose fin.
3) Determine seasonal and diel[1] run timing of Chinook salmon during weir operations.
4) Measure water depth and temperature throughout the DIDSON and video weir operations.

[1] "Diel" is defined as "of or pertaining to a 24 h period." Source: Dictionary.com website. Available at http://dictionary.reference.com (March 2010).

METHODS

OPERATION DATES AND EQUIPMENT

In 2015, favorable stream levels allowed installation of a floating weir on the north fork at RKM 5.4 (lat 59°46.323′N, long 151°49.935′W) on 10 May and on the south fork at RKM 4.1 (lat 59°46.719′N, long 151°49.107′W) on 16 May (Figure 3, Table 6). Each weir was fitted with an underwater video system in the passage chute to monitor escapement. Both weirs were operated through 3 August. Each week from 21 May to 7 July, a seine was used in the mainstem from RKM 3.7 to 1.7 to capture Chinook salmon for age, sex, and length (ASL) estimation.

South Fork Weir

A 31 m long resistance board weir was installed on 15 May. Picket spacing for the resistance board weir and live boxes was approximately 2.8 cm (1.5 in) to block the passage of all but the smallest ocean-age-1 Chinook salmon. An underwater video system was attached to the upstream edge of the weir about 3 m from the right bank near the thalweg of the river. All bottom irregularities along the base of the resistance board weir were sealed using sandbags, fencing skirt, and heavy grater blades. The weir was visually inspected daily for holes to ensure no fish could migrate past undetected.

During May and June, a "steelhead chute" was formed near the thalweg by weighting the downstream end of a resistance board weir panel with a sandbag. The weight of the sandbag allowed a shallow stream of water that fish could use to swim downstream over the weir. The placement of the sandbag was used to adjust the water depth flowing over the weir panel so that it was deep enough to allow kelts to swim downstream but shallow enough to prevent upstream Chinook salmon migration. No attempt to count steelhead utilizing the chute was made in 2015.

The underwater video system was composed of an underwater camera mounted in a sealed box, a fish passage chute, a power system, and a desktop computer video recording system. The camera box was roughly 80 cm by 90 cm and was constructed with 4.1 mm aluminum. The camera was mounted in the rear and at the bottom of the camera box and was pointed towards the front through the 45 cm by 80 cm glass that was 9.5 mm thick. The inside walls of the passage chute were painted a warm white to help with light reflection. At least six 20 W halogen lights were installed within the camera box for consistent illumination throughout the day. During installation, the camera box was filled with distilled water through a hatch to provide a clearwater lens for the camera and to sink the camera box in place. The hatch was located on the top of the box above the camera and sealed with a rubber gasket and bolts to prevent any river water from entering the box. The camera and light cords were fed through a sealed tube on top of the camera box that extended well above the water line. The fish passage chute was roughly 1 m long, had a removable lid to block out most light, and restricted fish passage down to roughly 20 cm in length. The removable lid allowed the outside of the camera box glass and the inside of the fish passage chute to be cleaned. The backdrop of the fish chute was marked with vertical lines 508 mm apart (from the outside edge to the outside edge of both lines) to allow Chinook salmon to be categorized into 2 size classes. The camera box was attached to the side of the fish passage chute so fish swimming up the chute were in the camera's field of view through the glass pane.

The video system recorded fish passage 24 hours per day using motion detection software through a digital video recorder (DVR) capture card installed into a Dell desktop computer. All video files were recorded at 30 frames per second and written to a 3-terabyte external hard drive. The

computer was stored inside a metal toolbox and powered with a generator and battery system. Video files of motion-detected fish images were reviewed with Watchnet software provided by the DVR capture card manufacturer.

North Fork Weir

A resistance board weir was also used to monitor escapement on the north fork. Picket spacing of the weir and live boxes was approximately 2.8 cm (1.5 in) to block the passage of all but the smallest ocean-age-1 Chinook salmon. All bottom irregularities along the base of the weir were sealed using sandbags. The weir was visually inspected daily for holes to ensure no fish could migrate past undetected.

An underwater video system, as described above, was installed approximately 1.5 m from the right bank near the thalweg. This video system was also operated as described above.

ESCAPEMENT MONITORING

Video recordings were reviewed for each fork. For each hour, fish were identified and tallied by species and their passage direction (upstream or downstream). Net upstream counts of Chinook salmon for each fork were combined to give total escapement.

RUN TIMING

Run timing was assessed at each monitoring site using cumulative daily and hourly counts. The association of daily escapement counts with daily water temperature and river stage was assessed using information contained in the following data sets:

1) Water temperature: Recorded by datalogger every 15 minutes by Cook Inletkeeper (CIK), a citizen-based nonprofit group. The logger was installed approximately 0.1 RKM downstream of the south fork weir site (Mauger 2013). Daily temperatures (average, minimum, and maximum) were averaged from logger readings collected every 15 minutes.
2) River stage: Recorded hourly from the gauge station (USGS 15239900) by the U. S. Geological Survey (USGS). The station is located on the south fork at approximately 11.4 RKM from the mouth of the Anchor River at the New Sterling Highway bridge.

BIOLOGICAL DATA

As video recordings were reviewed, Chinook salmon total length (TL) was assessed using the marks on the background of the fish chute. Chinook salmon ≤508 mm TL were reported as jacks and those >508 mm TL were reported as adults. Sex composition was also assessed from video images at each weir site by examining external characteristics of Chinook salmon. Sex was recorded as unknown if sex could not be determined from external characteristics.

Chinook salmon age, sex, and length (ASL) compositions were estimated from weekly beach seine surveys from Bridge Hole at RKM 3.8 to RKM 1.7 weekly from 21 May through 7 July. The seine was 30.5 m long by 2 m deep with 5.1 cm stretched mesh size. To assess jack composition, seine-captured fish were assigned to a ≤508 mm TL or >508 mm TL size class and tallied. Mid eye to tail fork (METF) length was recorded to the nearest 5 mm to examine size-at-age. To assess age, 3 scales from the preferred area on the fish's left side were collected from each captured Chinook salmon and mounted to a gum card (Welander 1940). Sex was visually determined through external characteristics. The upper lobe of the caudal fin of each Chinook salmon captured in the

beach seines was clipped before releasing to prevent double sampling. The species composition of the beach seine catches was also recorded. Beach seining was terminated for the season near the end of the Chinook salmon migration and after the Dolly Varden catch rates increased.

Ocean age of sampled fish was determined from collected scales using a microfiche reader and methods described by Welander (1940). Age was determined without reference to size, sex, or other data, and this was done twice to estimate within-reader variability. All scale samples that had conflicting ages for the 2 estimates were re-examined to produce a resolved age, which was then used for composition and abundance estimates.

ADIPOSE-FINCLIPPED CHINOOK SALMON

The presence or absence of an adipose fin was assessed via video images of Chinook salmon counted upstream or downstream through the weirs. All Chinook salmon captured during beach seining were examined for the presence or absence of an adipose fin. If a fish was found missing an adipose fin during beach seining, it was sacrificed, and the head was scanned to determine if it possessed a CWT. If no CWT was detected, otoliths were collected so the thermal mark could be read to determine release location. Thermal marks are created on hatchery-produced salmon by performing a series of water temperature changes that results in the deposition of dark protein rings in specific patterns on the otoliths (Loopstra and Hansen 2015); this has been a cost-effective way to mass-mark hatchery-produced Chinook salmon for release sites in Cook Inlet.

DATA ANALYSIS

Escapement and Run Timing

Net daily counts were calculated for the north and south forks separately and then summed to determine total daily escapement for the Anchor River. If counts were missed due to computer malfunction or power failure, the missing counts were interpolated from hourly counts 1 day previous and 1 day after the day in which counts were missing. If counts were also missing during the same hours on previous or subsequent days, an additional day before and after was incorporated into the hourly interpolation.

Chinook salmon run timing was described using cumulative daily counts and associated percentages at the north and south fork weir sites. Diel run timing was evaluated using 24-hour video weir counts.

Regression analysis was used to assess the relationship between counts and river stage height and temperature for the south fork (17 May–4 August), the north fork (11 May–4 August), and the forks combined (17 May–4 August). The dependent variable in the analysis was the daily count of Chinook salmon, with independent variables being time (date), water stage (south fork station), and temperature. A model with both linear and quadratic terms in time was fitted to capture the overall run timing aspect of the data, and stage and temperature were investigated as additional covariates.

Biological Data

Age and sex compositions were estimated from all pooled samples (n) obtained throughout the season. Beach seine samples were taken throughout the run, with similar effort. Pooling the sample should therefore result in a reasonably representative sample of the migration.

The estimated proportion of Chinook salmon of age or sex class k ($\hat{p}_K$) in the escapement (N) was calculated using Equation 1:

$$\hat{p}_k = \frac{n_k}{n} \tag{1}$$

where n_k is the number of Chinook salmon out of n that were of age or sex class k, with estimated variance

$$\text{var}(\hat{p}_k) = \frac{\hat{p}_k(1-\hat{p}_k)}{n-1} \tag{2}$$

The estimated total number of Chinook salmon of age or sex class k was calculated as

$$\hat{N}_k = N\hat{p}_k \tag{3}$$

with variance estimated by

$$\text{var}(\hat{N}_k) = N^2 \text{ var}(\hat{p}_k) \tag{4}$$

Mean length at age and its variance were estimated using standard summary statistics.

The within-reader variability of scale age estimates was calculated using a coefficient of variation (CV) expressed as the ratio of the standard deviation over the mean age (Campana 2001):

$$CV_j = 100\% x \frac{\sqrt{\sum_{i=1}^{R} \frac{(X_{ij} - X_j)^2}{R-1}}}{X_j} \tag{5}$$

where

X_{ij} = the ith age estimate of the jth fish,

X_j = the mean age estimate of the jth fish, and

R = the number of times each fish is aged.

Proportions of Chinook salmon ≤508 mm TL, adipose-finclipped Chinook salmon, and male Chinook salmon calculated from video recordings were compared to the proportions estimated from beach seine samples, respectively. Z-tests were used to test the assumption that the estimated proportions were approximately normally distributed, except for the adipose-finclip comparison (low proportions), for which a Fisher exact test was used.

RESULTS

ESCAPEMENT MONITORING

Chinook Salmon

The 2015 Anchor River Chinook salmon escapement of 10,241 fish exceeded the SEG range of 3,800–10,000 fish (Table 2, Appendix B1). The escapement was based on a net count of 6,527 Chinook salmon counted at the south fork weir and 3,714 Chinook salmon counted at the north fork weir (Table 5). On the south fork, computer malfunction resulted in missing hourly counts for 6 hours on 3 July and 2 hours on 2 August. Because there was little or no fish passage surrounding the 2 August missing hours, no interpolation was necessary for that date. Interpolated south fork counts on 3 July accounted for 48 of the 6,527 fish counted through that weir (Appendix B2). On the north fork, missing video occurred more frequently. Three hours of video were missed on 30 May and 13 hours were missed overnight from 19 June to 20 June. Numerous glitches with the computer and DVR system on the north fork from 21 July through 25 July resulted in 55 hours of missing video. Of the 3,714 Chinook salmon counted through the north fork weir, 145 were interpolated from missing hours (Appendix B3).

Other Species

Nearly 10,000 Dolly Varden passed through the video weirs, of which 9,072 were counted on the south fork. The total numbers of non-Chinook salmon species (Dolly Varden, steelhead, and pink, chum, sockeye, and coho salmon) enumerated moving upstream at the north and south fork weirs in 2015 were greater than the totals in both 2013 and 2014 (Table 5).

RUN TIMING

Run timing was statistically different between the two forks (Kolomogorov-Smirnoff test; $D = 0.102$, $P = 0$). The run to the north fork weir was slightly later than that to the south fork weir (Figure 4); it is noted that the north fork weir is further upstream than the south fork weir. The midpoint of the combined run was 15 June (Figure 5, Appendix B1). The middle 80% of the run on the south fork was counted from 29 May to 7 July (40 days) and the north fork from 31 May to 13 July (44 days). Rain caused the river level to increase 15 cm in the first week of June from about 30 cm to 45 cm on 8 June. As the river level receded in the following days, a total of 1,001 Chinook salmon passed through the north and south forks weirs on 10 and 11 June (Figure 6). A later large pulse of Chinook salmon weir passage occurred on 1 July for the north fork (276 Chinook salmon) and 5 July for the south fork (268 Chinook salmon).

Regression modelling of daily counts (forks combined) revealed a significant effect of both water stage (measured on the south fork) and temperature (Figure 7) in a model containing linear and quadratic effects of date ($P < 0.001$ and 0.013, respectively). The stage coefficient was 10.5 (SE 2.8) and the temperature coefficient was 19.8 (SE 7.8), indicating that for each 1 ft rise in water stage, the daily count increased by 10.5 fish and for each 1°C rise in temperature, the daily count increased by 20 fish. Modelling south fork counts separately indicated significant stage ($P < 0.001$) and temperature ($P = 0.005$) effects, whereas separate modelling of the north fork counts only found stage ($P = 0.03$) to be significant; linear and quadratic effects were present in both analyses.

Diel run timing was bimodal in both forks with the majority of upstream Chinook salmon migration occurring during 2 periods between 0000 to 0359 hours and 1500 and 1959 hours. More

Chinook salmon passed upstream during first period (42% of the total Chinook salmon upstream passage for both forks combined) than the second period (Figure 8). Fish passage during the second period was higher on the north fork (40% of observed Chinook salmon passed upstream between 1500 and 1959 hours) than on the south fork (28% of observed Chinook salmon passed during 1500 and 1959 hours).

BIOLOGICAL DATA

A total of 462 Chinook salmon were captured in beach seine sampling (Table 7), of which 377 had readable scale samples and were used to estimate the age-sex-length composition; sex was not recorded for 1 fish (Table 8). Ocean age 3 was the dominant age class for males and females combined (45%, SE 3%). Ocean age 2 was the dominant age class for males (39%, SE 3%), whereas ocean age 3 was the dominant age class for females (24%, SE 2%). No significant difference was detected between the mean length of ocean-age-3 males and females (males: 763 mm, SE 7; females: 765 mm, SE 4; $z = 0.28$, $P = 0.78$). However, there was a significant difference between average length of ocean-age-2 males and females (males: 610 mm, SE 4; females: 689 mm, SE 10; $z = 7.7$, $P < 0.001$) and ocean-age-4 males and females (males 895 mm, SE 5; females 802 mm, SE 9; $z = -8.8$, $P < 0.001$). The mean coefficient of variation (Equation 5) over all fish for which multiple scale readings were taken was 1.8%.

Of the 462 Chinook salmon measured for TL during beach seining, 69 were ≤508 mm TL (jacks). Of the 10,048 Chinook salmon that passed through the weirs that were examined with underwater video, 878 were ≤508 mm TL. There was a significant difference in the proportion of Chinook salmon ≤508 mm TL in beach seine samples (14.9%) versus that from the video assessment (8.7%) ($z = -3.7$, $P < 0.001$).

The sex of Chinook salmon was determined from video images (n = 8,973) and beach seine samples (n = 461) (Table 8). The estimated male to female ratio was 2.5:1 based on both video and beach seine samples. There was no significant difference between the sex composition for the two sampling methods ($z = 0.157$, $P = 0.88$).

ADIPOSE-FINCLIPPED CHINOOK SALMON

Of the 10,241 Chinook salmon counted migrating upstream through the video weirs, the presence or absence of an adipose fin was examined for 2,182 fish (roughly 21%). Of the examined video weir fish, 4 Chinook salmon did not have an adipose fin. Six of the 462 Chinook salmon captured during beach seining were missing an adipose fin. Proportions were statistically different between beach seine and weir samples (Fisher exact test: $P = 0.003$). The 6 Chinook salmon without an adipose fin that were captured in beach seines were sacrificed and then examined for a coded-wire tag (CWT). No CWTs were detected with use of a wand, so otoliths were collected for thermal mark examination. All otoliths possessed the Cook Inlet release mark from the William Jack Hernandez Sport Fish Hatchery.

DISCUSSION

The 2015 Chinook salmon escapement of 10,241 fish exceeded the sustainable escapement goal (SEG) range (3,800–10,000) (Table 2). Despite the unexpectedly large escapement, angler effort remained low due to preseason restrictions and poor runs in recent years, which resulted in an inriver harvest (344 fish) well below the average harvest (1,496 fish) of other large escapement years (2003–2007) (Table 2). The exploitation rate in 2015 was estimated at 3.2%.

A series of preseason EOs (2-KS-7-01-15; 2-KS-7-02-15, 2 KS-7-03-15, 2-KS-7-05-15) closed the 1st and 5th weekend openings and the 5 Wednesday openings; extended the closed area downstream of the south fork weir site by 1,000 feet; restricted gear to an unbaited single-hook artificial lure; set a combined annual limit at 2 Chinook salmon for Anchor River, Deep Creek, Ninilchik River, and the saltwater areas between the latitude of Bluff Point and the mouth of the Ninilchik River; and extended the closed saltwater area surrounding the Anchor River mouth from 30 June to 15 July (Appendix A3).

By the end of May, strong early season fish passage suggested a larger run than anticipated. Many of the preseason restrictions were lifted by the second week of June when the inseason projection estimated the escapement would reach approximately 9,000 Chinook salmon. This resulted in opening the fifth weekend and Wednesday by EO 2-KS-7-20-15 and opening the saltwater area surrounding the Anchor River mouth on July 1 by EO 2-KS-7-21-15. Because the run continued to build in June and escapement was projected at approximately 9,500 Chinook salmon, EO 2-KS-7-27-15 restored the Cook Inlet annual limit to 5 Chinook salmon.

In 2015, fishing conditions were good throughout the season. Effort was low, but anglers were more successful than in the recent years (2012–2014) when runs were weak. Effort increased throughout the run and effort on the last Wednesday of the 2015 season was more similar to the 5th Wednesday opening in 2008. The Chinook salmon catch in 2015 was the highest since 2011 (Table 3). Chinook salmon harvest remained low, probably due to the preseason restrictions. The 2015 SWHS estimated Chinook salmon harvest from the Anchor River was 344 (SE 103), which resulted in an estimated exploitation of 3.2% (Table 2).

It is notable that the lowest escapement on record in 2014 was followed by the strong 2015 escapement, which was approximately 4 times larger and the strongest since 2005. The 2015 escapement was composed of returns from brood years (BY) 2009–2012, which had escapements that hovered just below or slightly above the lower bound of the SEG range (Table 9). Good survival of younger, predominantly male Chinook salmon was indicated based the 2015 return. Ocean-age-1 and ocean-age-2 fish from BYs 2011 and 2012 accounted for 53% of the escapement, which was above the 2003–2014 average of 38% ocean-age-1 and ocean-age-2 Chinook salmon. The return of ocean-age-4 Chinook salmon in 2015 marked the final adult return from BY 2009 and the sixth year in which production could be fully assessed. The return (3,249 fish) from the 2009 escapement (3,455; SE 0) is near the 1:1 replacement and the largest return per spawner ratio since production could be fully assessed beginning in 2004 (Table 10).

Run timing in 2015 was more similar to the timing of weak runs in recent years (2009–2014) than to the timing of strong runs from 2004 to 2008 (Figure 5). The midpoints of the Chinook salmon run were similar for the north fork and south fork weir sites in 2013 and in 2015 (Figure 4); in 2014, however, the midpoint for the north fork was over a week later than for the south fork. Given that the north fork site is further upstream of the upper boundary of the fishery than the south fork site, it is likely that run timing differences between the sites are influenced by the series of good holding waters between the north fork site and the sport fishery boundary.

Since 2007, daily fish passage through the monitoring site has been compared to river temperature and river level. In general, fish passage has been more consistently correlated with river levels than with river temperatures. The correlation of fish passage and river levels was positive in all years but 2008 and 2014 (Kerkvliet et al. 2012; Kerkvliet and Booz 2012, 2018a-c, 2020). A consistent

negative correlation between river temperature and river level was also found from 2010 to 2014. A similar relationship between river level and river temperature was found for 2015 ($r = -0.77$).

Three regression analyses were performed using the 2015 south fork stage data (collected at approximately 11.4 RKM on the south fork) and combined Chinook salmon count data from the north and south forks. Considering that the south fork drainage is approximately twice the size of the north fork, river levels from the south fork gauge station were considered a reasonable approximation of river levels at the mainstem site. It was also assumed that south fork river levels indexed those on the north fork. It would be more appropriate, however, to establish calibration curves for the north and south forks data that would allow prediction of the north fork stage height from south fork stage height. The regression analyses showed that after adjusting for a quadratic shaped run timing, the coefficients for stage and temperature were both positive for both the combined count and the south fork count analyses[3]. The finding that migration increases with stage height is not surprising because fish hold in deeper pools and channels during low water conditions. However, the finding that increased water temperature also led to increased counts on the south fork and combined forks is an interesting outcome of this first use of regression analysis for Anchor River Chinook salmon and contrasts with the negative correlation between count and temperature found in 2014 (Kerkvliet and Booz 2020). This effect of temperature was not observed for the 2015 north fork analysis.

Although river stage and temperature can influence salmon migration, we also noted larger counts coinciding with fishery openings downstream. Chinook salmon counts through the north and south fork weirs spiked soon after the river opened to sport fishing downstream of the forks on 1 July.

Comparisons of sex and total length (≤508 mm vs. >508 mm) compositions from beach seining samples versus those from the weir were originally designed to test whether the beach seining technique provided an unbiased sample of the escapement. However, because the picket spacing is not sufficient to prevent the smallest fish from passing the weir without being counted and because of the difficulty in assessing sex via the video weir, these comparisons are unworkable. The significant differences in sex composition, proportion of fish ≤508 mm TL, or adipose-finclip compositions between beach seine samples and video weir samples found in some years may therefore be due to either biased beach seining or due to biased weir techniques (or both). Assessing size in video images is not subjective, unlike the assessment of sex. An alternative to using sex composition to assess whether ASL sampling from beach seining is representative of the run is to assess the composition of additional size categories between weir and beach seine samples such that picket spacing (missed counts of small fish) is not a factor.

There was a significant difference in the proportions of adipose-finclipped fish in the beach seine and the weir samples (1% vs 0.2%, respectively). The sacrifice of Chinook salmon missing an adipose fin during beach seine sampling downstream of the weirs accounts for some of this discrepancy. However, the discrepancy may also be due partially to detectability problems with poor image quality at the video weirs. An unexpectedly large escapement made assessing the presence of the fin for each fish an extremely time-consuming task and a census of this feature was not possible. Improved image quality would make adipose fin assessment more efficient, theoretically adding little or no time to enumerating Chinook salmon video passage. Because the presence or absence of an adipose fin via high-quality video image is not subjective, a census of

[3] Interaction effects were not significant in any of the analyses, and only stage was significant for the north fork analysis.

the adipose fin composition at the video weirs may be an additional meaningful analysis to compare beach seine samples to the video weir fish passage.

Evaluating ways to reduce project costs are routinely discussed for the Anchor River escapement monitoring project. Discussions became particularly pertinent in 2013, when high flows rendered the mainstem site unusable and 2 upstream monitoring sites were required instead of 1. The use of video weirs on the north and south forks and the collection of ASL samples by beach seining the mainstem has proven cost-effective and more efficient than a traditional weir, although we still need a better understanding of the differences between the weir and beach seine samples with respect to biological composition. As a result of the efficiencies, no change in staffing size has been needed to operate 2 weir sites. The feasibility of using only the south fork site to monitor escapement has also been discussed as a cost-saving measure. This scenario would be possible only if the south fork represented the majority of the run and a predictable percentage of the total escapement. In 2014, the south fork accounted for 46% of the total Anchor River escapement and 64% of the total in 2015. Based on the first 2 years of fully enumerating the escapement on both forks, escapement monitoring is needed in both locations.

ACKNOWLEDGMENTS

The authors would like to thank the dedicated group of technicians for making the 2015 escapement monitoring a success. This group remained diligent while reviewing 10,000 video files of Chinook salmon and nearly as many of Dolly Varden. In no particular order, we thank Sabrina Larsen, Rosie Robinson, Robert Egan, and Tim Blackmon. We are thankful for the Federal Aid funding (under Project F-10-30 and 31, Job No. S-2-21) to monitor this stock; for support from the Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation with allowing us to move field operations throughout the Anchor River State Recreation Area; and for the water temperature data from Sue Mauger of Cook Inletkeeper. We also thank David Evans, whose biometric support contributed greatly to all phases of this project, and publications staff member Tania Vincent for her help editing and publishing this report.

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TABLES

Table 1.–Drainage characteristics of the north and south forks of the Anchor River.

	Anchor River		
Drainage characteristics	North fork	South fork	Total
Watershed area (km^2)	182	405	587
Wetland area (km^2)	93	189	282
Percent wetland	51	47	48
Stream length (RKM)	149	352	501
Anadromous stream length (RKM)	90	176	266

Source: S. Baird, Research Analyst, Kachemak Bay Research Reserve in Homer, AK, unpublished data, 2006.
Note: "RKM" means river kilometers.

Table 2.–Estimates of Anchor River Chinook salmon escapement, freshwater harvest, total run, and exploitation rate, 2003–2015.

			Escapement [a]		Inriver harvest		Total inriver run [b]	
Year	Escapement goal [a]	Project dates	Estimate	SE	Estimate	SE	Estimate	Exploitation (%)
2003	750–1,500 [c]	May 30–Jul 09	9,238	0 [c]	1,011	157	10,249	9.9 [d]
2004	750–1,500	May 15–Sep 15	12,016	283 [e]	1,561	198	13,577	11.5
2005	No goal	May 13–Sep 09	11,156	229 [e]	1,432	233	12,588	11.4
2006	No goal	May 15–Aug 24	8,945	289 [e]	1,394	197	10,339	13.5
2007	No goal	May 14–Sep 12	9,622	238 [e]	2,081	326	11,703	17.8
2008	5,000	May 13–Sep 12	5,806	169 [e]	1,612	241	7,418	21.7
2009	5,000	May 12–Sep 11	3,455	0 [f]	737	212	4,192	17.6
2010	5,000	May 13–Sep 29	4,449	103 [e]	364	118	4,813	7.6
2011	3,800–10,000	May 13–Sep 21	3,545	0 [e]	573	163	4,118	13.9
2012	3,800–10,000	May 14–Aug 3	4,509	100 [e]	38	100	4,547	0.8
2013	3,800–10,000	May 15–Aug 3	4,401	117 [e]	97	55	4,498	2.2
2014	3,800–10,000	May 5–Aug 3	2,499	0 [f]	203	74	2,702	7.5
2015	3,800–10,000	May 10–Aug 3	10,241	0 [f]	344	103	10,585	3.2
Average								
2009–2014			3,810		335		4,145	8.3
2003–2014			6,637		925		7,562	11.3

Source: Harvest estimates from Alaska Sport Fishing Survey database (Internet) 1996–present. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited August 2015). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

[a] Sustainable escapement goal (SEG) used to manage the fishery. The 2003 and 2004 SEG based on aerial index count (Otis and Hasbrouck 2004). The 2008–2011 SEG is based on a Ricker recruitment model (Szarzi et al. 2007; Otis et al. 2010).

[b] "Total inriver run" is escapement plus freshwater harvest; total does not account for the marine harvest.

[c] Estimate is based on a census of all DIDSON files. Escapement was not fully assessed due to operation dates did not spanning the entire run.

[d] Exploitation may be overestimated in this year because escapement was not fully enumerated.

[e] Estimate is based on expanded DIDSON counts and weir counts.

[f] Escapement is based on weir counts.

Table 3.–Statewide Harvest Survey estimates of Chinook salmon harvest and catch compared to the number of days open to harvest for Anchor River Chinook salmon, 1977–2015

	Chinook salmon				Chinook salmon opening days				
	Harvest				Weekend days [a]			Harvest	
Year	Estimate	SE	Catch estimate	Percent harvest	Before MD [b]	MD or after [b]	Wednesdays	Total days open [c]	Harvest per day
1977	1,077	–	NA	NA	0	8	0	8	135
1978	2,109	–	NA	NA	0	12	0	12	176
1979	1,913	–	NA	NA	0	12	0	12	159
1980	605	–	NA	NA	0	12	0	12	50
1981	1,069	–	NA	NA	0	12	0	12	89
1982	718	–	NA	NA	0	12	0	12	60
1983	1,269	–	NA	NA	0	12	0	12	106
1984	998	–	NA	NA	0	12	0	12	83
1985	672	–	NA	NA	0	12	0	12	56
1986	1,098	–	NA	NA	0	12	0	12	92
1987	761	–	NA	NA	0	12	0	12	63
1988	976	–	NA	NA	0	15	0	15	65
1989	578	–	NA	ND	0	15	0	15	39
1990	1,479	–	4,119	36	0	15	0	15	99
1991	1,047	–	2,540	41	0	15	0	15	70
1992	1,685	–	4,506	37	0	15	0	15	112
1993	2,787	–	6,022	46	0	15	0	15	186
1994	2,478	–	3,890	64	0	15	0	15	165
1995	1,475	–	3,545	42	0	15	0	15	98
1996	1,483	201	6,594	22	0	15	0	15	99
1997	1,563	186	5,289	30	0	15	0	15	104
1998	783	119	2,443	32	0	15	0	15	52
1999	1,409	192	6,903	20	0	15	0	15	94
2000	1,730	193	5,200	33	0	15	0	15	115
2001	889	162	2,415	37	0	15	0	15	59
2002	1,047	192	4,103	26	0	12	0	12	87
2003	1,011	157	4,311	23	0	12	0	12	84

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Table 3.–Page 2 of 2.

Year	Chinook salmon Harvest Estimate	SE	Catch estimate	Percent harvest	Chinook salmon opening days Weekend days [a] Before MD [b]	MD or after [b]	Wednesdays	Harvest Total days open [c]	Harvest per day
2004	1,561	198	5,561	28	0	15	0	15	104
2005	1,432	233	5,028	28	3	12	0	15	95
2006	1,394	197	4,638	30	3	12	0	15	93
2007	2,081	326	9,792	21	3	12	0	15	139
2008	1,486	241	3,245	46	3	12	5	20	74
2009	737	212	2,296	32	3	6	3	12	61
2010	364	118	889	41	3	6	3	12	30
2011	573	163	1,227	47	3	6	3	12	48
2012	38	23	189	20	3	6	0	9	4
2013	97	55	423	23	3	9	0	12	8
2014	203	74	926	22	3	9	0	12	17
2015	344	103	1,159	30	0	9	1	10	34
Averages									
2005–2014	841	164	2,865	31	3	9	1	13	57
1977–2014	1,176	171	3,844 [d]	33	1	12	0	13	86

Source: Alaska Sport Fishing Survey database [Internet]. 1996–present. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited August 2015). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Note: "Harvest" is number of fish kept, "catch" is fish harvested plus released, "NA" means not applicable, and an en dash means not calculated.

[a] Weekend openings consisted of Saturday and Sunday from 1977 to 1987 and Saturday–Monday since 1988.

[b] MD means Memorial Day.

[c] Days open for Chinook salmon harvest (regulatory openings adjusted by emergency orders as needed).

[d] Average for 1990–2014.

Table 4.–Anchor River weir and DIDSON fish counts by species, 1987–1995 and 2003–2012.

Year	Project dates	Location (RKM) [a]	Method	Fish counts						
				Chinook salmon [b]	Dolly Varden [c]	Pink salmon [c]	Chum salmon	Sockeye salmon	Coho salmon [d]	Rainbow trout and steelhead [e]
1987 [f]	Jul 04–Sep 10	2.9	fixed picket weir	204	19,062	2,084	19	33	2,409	136
1988 [f]	Jul 03–Oct 05	2.9	fixed picket weir	245	14,935	777	24	30	2,805	878
1989 [f]	Jul 06–Nov 05	2.9	resistance board weir	95	11,384	4,729	165	212	20,187	769
1990 [f]	Jul 04–Aug 15	2.9	resistance board weir	144	10,427	355	17	39	190	3
1991 [f]	Jul 04–Aug 15	2.9	resistance board weir	39	18,002	1,757	9	46	13	5
1992 [f]	Jul 04–Oct 01	2.9	resistance board weir	129	10,051	992	39	174	4,596	1,261
1993 [f]	Jul 03–Aug 16	2.9	resistance board weir	90	8,262	1,019	12	71	290	1
1994 [f]	Jul 03–Aug 16	2.9	resistance board weir	111	17,259	723	2	61	420	1
1995 [f]	Jul 04–Aug 12	2.9	resistance board weir	112	10,994	1,094	4	73	725	10
2003 [g]	May 30–Jul 09	4.0	DIDSON	9,238 [h]	–	–	–	–	–	–
2004 [g]	May 15–Sep 13	4.0	DIDSON, resist. board weir	12,016 [h,i]	7,846	1,079	79	45	5,728	20
2005 [g]	May 13–Sep 09	4.0	DIDSON, resist. board weir	11,156 [h,i]	5,719	4,916	146	319	18,977	98
2006 [g, j]	May 15–Aug 24	4.0	DIDSON, resist. board weir	8,945 [h,i]	234	954	45	38	10,181	2
2007 [g]	May 14–Sep 12	4.0	DIDSON, resist. board weir	9,622 [h,i]	1,309	3,916	156	200	8,226	325
2008 [g]	May 13–Sep 11	4.0	DIDSON, resist. board weir	5,806 [h,i]	1,344	2,017	66	52	5,951	258
2009 [g]	May 12–Sep 11	4.0	resistance board weir	3,455	1,404	4,975	68	62	2,692	85
2010 [g]	May 13–Sep 29	4.0	DIDSON, resist. board weir	4,449 [h,i]	1,352	972	67	212	6,014	586
2011 [g]	May 13–Sep 21	4.0	DIDSON, resist. board weir	3,545 [h,i]	1,523	2,169	60	47	1,866	137
2012 [g]	May 14–Aug 03	4.0	DIDSON, resist. board weir	4,509 [h,i]	2,125	321	27	6	32	1

[a] River kilometers (RKM) from the mouth of the Anchor River. The mainstem weir locations at RKM 1.6 and 2.8 in prior Anchor River Chinook salmon reports for 2010–2013 were remeasured in 2013 from the mouth of the Anchor River to RKM 2.9 and 4.0, respectively.

[b] Chinook salmon counts represent escapement because there is no harvest above the monitoring site. The run was only partially counted in 1987–1995 due to weir operation dates and location, and in 2003 due to weir operation dates.

[c] Incomplete Dolly Varden and pink salmon counts since 2004 due to weir picket spacing that allows smaller fish to pass through the weir pickets undetected.

[d] Incomplete coho salmon counts because the project operation dates did not span entire run (1991, 1993–1995, 2005–2006, 2012–2015).

[e] Incomplete steelhead counts due to project operation dates or weir location (1987, 1990–1991, 1993–1995, 2004–2009, 2012–2015). Cumulative counts were from July 1 through end of weir operation.

[f] Sources for 1987: Larson et al. (1988); 1988: Larson and Balland (1989); 1989: Larson (1990); 1990: Larson (1991); 1991: Larson (1992); 1992: Larson (1993); 1993: Larson (1994); 1994: Larson (1995); and 1995: Larson (1997); when escapement weir was located approximately 2.9 RKM from mouth.

-continued-

Table 4.–Page 2 of 2.

[g] Sources for 2003–2004: Kerkvliet et al. (2008); 2005–2006: Kerkvliet and Burwen (2010); 2007–2008: Kerkvliet et al. (2012); 2009: Kerkvliet and Booz (2012); 2010–2012: Kerkvliet and Booz (2018a-c).

[h] All DIDSON images and the associated counts were assumed to be Chinook salmon.

[i] Chinook salmon estimates based on combined DIDSON and weir census. If DIDSON was operated in July, counts were apportioned between large fish (Chinook salmon) and small fish (Dolly Varden and pink salmon).

[j] No counts were collected from 19 to 21 August 2006 because the weir washed out due to flooding. The DIDSON was operated again from 22 to 24 August; an estimated 3,292 coho salmon were counted.

Table 5.–Anchor River weir and DIDSON fish counts by species, 2013–2015.

Year	Location	RKM [a]	Fish counts						
			Chinook salmon [b]	Dolly Varden [c]	Pink salmon [c]	Chum salmon	Sockeye salmon	Coho salmon [d]	Rainbow trout and steelhead [d,e]
2013	North fork	5.4	582	537	193	5	2	1	0
	South fork	4.1	1,576	986	757	22	4	0	0
	Mainstem [f]	4.0	2,220						
	Total		4,378	1,523	950	27	6	1	0
2014	North fork	5.4	1,338	682	59	4	2	21	3
	South fork	4.1	1,161	5,924	105	2	1	34	1
	Total		2,499	6,606	164	6	3	55	4
2015	North fork	5.4	3,714	923	263	66	2	16	0
	South fork	4.1	6,527	9,072	1,318	54	28	47	10
	Total		10,241	9,995	1,581	120	30	63	10
Average 2013–2014			6,877	8,129	1,114	33	9	56	4

[a] River kilometers (RKM) from the mouth of the Anchor River.

[b] All DIDSON images and the associated counts were assumed to be Chinook salmon.

[c] Incomplete Dolly Varden and pink salmon counts due to weir picket spacing that allows smaller fish to pass through the weir pickets undetected.

[d] Incomplete coho salmon and steelhead counts because the project operation dates did not span the entire run.

[e] Cumulative counts from July 1 through end of weir operation.

[f] The mainstem monitoring site used from 2003 to 2012 became unusable due to high flows eroding the bank. Once flows allowed weir installation, monitoring was relocated and split into 2 sites upstream, one on each fork.

Table 6.–Annual Chinook salmon monitoring location and gear by date, 1987–1995 and 2003–2015.

	Mainstem DIDSON			Mainstem weir			North fork (RKM 5.4) weir		South fork (RKM 4.1) weir	
Year	RKM [a]	Start	Stop	RKM [a]	Start	Stop	Start	Stop	Start	Stop
1987 [b]	2.9			2.9	4 Jul	10 Sep				
1988 [b]	2.9			2.9	3 Jul	5 Oct				
1989 [b]	2.9			2.9	6 Jul	5 Nov				
1990 [b]	2.9			2.9	4 Jul	15 Aug				
1991 [b]	2.9			2.9	4 Jul	15 Aug				
1992 [b]	2.9			2.9	4 Jul	1 Oct				
1993 [b]	2.9			2.9	3 Jul	16 Aug				
1994 [b]	2.9			2.9	3 Jul	16 Aug				
1995 [b]	2.9			2.9	4 Jul	12 Aug				
2003 [c]	4.0	30 May	9 Jul	4.0						
2004 [c]	4.0	15 May	8 Jun	4.0	8 Jun	7 Jun				
2005 [c]	4.0	13 May	3 Jun	4.0	3 Jun	9 Sep				
2006 [c]	4.0	15 May	13 Jun	4.0	13 Jun	24 Aug				
2007 [c]	4.0	14 May	7 Jun	4.0	7 Jun	12 Sep				
2008 [c]	4.0	13 May	16 Jun	4.0	16 Jun	11 Sep				
2009 [c]	4.0			4.0	12 May	11 Sep				
2010 [c]	4.0	13 May	8 Jun	4.0	8 Jun	29 Sep				
2011 [c]	4.0	13 May	24 May	4.0	24 May	21 Sep				
2012 [c]	4.0	14 May	13 Jun	4.0	13 Jun	3 Aug				
2013 [c,d]	4.0	19 May	19 Jun	4.0			19 Jun	3 Aug	19 Jun	3 Aug
2014 [c]							7 May	3 Aug	14 May	3 Aug
2015							10 May	4 Aug	15 May	4 Aug

Note: Blanks indicate monitoring was not conducted for the particular location, gear, and year.

[a] Mainstem escapement monitoring sites at RKM 1.6 and RKM 2.8 were remeasured in 2013 to RKM 2.9 and RKM 3.9, respectively.

[b] Source: Larson et al. (1988); Larson and Balland (1989); Larson (1990–1995, 1997) when the escapement weir was located approximately 2.9 RKM from the mouth.

[c] Source: Kerkvliet et al. (2008, 2012); Kerkvliet and Burwen (2010); Kerkvliet and Booz (2012, 2018a-c, 2020).

[d] Mainstem monitoring site used from 2003 to 2012 became unusable due to high flows eroding the bank. Once flows allowed weir installation, monitoring was relocated and split into 2 sites upstream, RKM 4.1 on the south fork and a fixed picket weir used at RKM 5.4 on the north fork.

Table 7.–Species composition of beach seine catches from the mainstem Anchor River, 2015.

Sample date	Chinook salmon	Steelhead and rainbow trout
21 May	14	18
28 May	41	9
4 Jun	79	19
10 Jun	65	2
18 Jun	59	1
25 Jun	83	0
2 Jul	89	0
7 Jul	32	0
Total	462	49

Table 8.–The estimated ocean age, sex, and length composition of the Anchor River Chinook salmon escapement, 2015.

		Composition by ocean age [a]					Composition by sex	
Sex		1	2	3	4	Total	Beach seine [b]	Video [c]
Female								
	Number of samples	0	4	92	7	103	131	2,534
	Percent	NA	1	24	2	–	28	28
	SE percent	NA	1	2	1	–	0	1
	Estimated abundance	NA	113	2,499	195	2,530	2,530	2,898
	SE abundance	NA	51	225	72	2	2	51
	Length samples	0	4	92	7	103	0	0
	Mean length (mm)	NA	689	765	802	761	NA	NA
	SE mean length	NA	10	4	9	4	NA	NA
Male								
	Number of samples	51	145	76	2	274	330	6,439
	Percent	14	39	20	1	–	72	72
	SE percent	2	3	2	0	–	0	1
	Estimated abundance	1,383	3,943	2,069	51	7,445	7,445	7,353
	SE abundance	184	256	215	41	2	2	51
	Length samples	51	145	76	2	274	0	0
	Mean length (mm)	396	610	763	895	610	NA	NA
	SE mean length	9	4	7	5	8	NA	NA
All								
	Number of samples	51	149	168	9	377	461	8,973
	Percent	14	40	45	2	100	100	100
	SE percent	2	3	3	1	0	0	0
	Estimated abundance	1,383	4,045	4,567	246	10,241	10,241	10,241
	SE abundance	184	256	266	82	NA	5	NA
	Length samples	51	149	168	9	377	0	0
	Mean length (mm)	396	612	764	823	652	NA	NA
	SE mean length	9	4	4	15	6	NA	NA

Note: NA means not applicable. An en dash means not calculated.

[a] Age, and length-at-age compositions based on samples collected between RKM 3.7 to RKM 1.7 from Chinook salmon captured in beach seines.

[b] Sex composition based on samples collected between RKM 3.7 to 1.7 from Chinook salmon captured in beach seines.

[c] Sex composition based on Chinook salmon examined at video weirs at RKM 5.5 and RKM 4.1.

Table 9.–Anchor River Chinook salmon estimated escapement and freshwater harvest by ocean age composition, 2003–2015.

	Escapement									Freshwater harvest (number of fish)				
		Percent by ocean age				Number of fish by ocean age					Ocean age			
Run year	Estimate	1	2	3	4	1	2	3	4	Estimate	1	2	3	4
2003[a]	9,238	5	23	58	14	471	2,125	5,340	1,275	1,011	52	233	584	140
2004	12,016	9	21	49	22	1,057	2,487	5,840	2,632	1,561	137	323	759	342
2005	11,156	5	24	52	19	558	2,666	5,823	2,108	1,432	72	342	748	271
2006	8,945	6	17	52	25	572	1,476	4,660	2,236	1,394	89	230	726	349
2007	9,622	1	22	53	24	48	2,116	5,138	2,319	2,081	10	458	1,111	502
2008	5,806	4	22	69	5	255	1,266	3,977	302	1,612	71	351	1,104	84
2009	3,455	8	51	37	4	269	1,766	1,268	152	737	57	377	270	32
2010	4,449	7	36	51	6	311	1,606	2,282	249	364	25	131	187	20
2011	3,545	3	50	41	6	113	1,773	1,457	202	573	18	287	236	33
2012	4,509	11	34	50	5	487	1,547	2,273	203	38	4	13	19	2
2013	4,378	20	31	44	5	895	1,377	1,913	206	97	20	30	42	5
2014	2,499	14	37	41	9	339	914	1,018	227	203	28	74	83	18
2015	10,241	14	40	45	2	1,356	3,969	4,481	241	344	46	136	153	8
Average 2003–2014	6,635	8	31	50	12	448	1,760	3,416	1,009	925	49	237	489	150

[a] Escapement was not fully assessed due to operation dates.

Table 10.–Anchor River Chinook salmon return per spawner by brood year, 2003–2009.

	Number of fish			
Brood year	Escapement	Freshwater harvest	Total return	Return per spawner
2003	6,817	1,684	8,501	0.92 [a]
2004	2,831	653	3,484	0.29
2005	4,505	667	5,172	0.46
2006	3,535	426	3,961	0.44
2007	4,563	336	4,898	0.51
2008	3,800	92	3,893	0.67
2009	3,123	126	3,249	0.94
Average 2003–2009	4,168	569	4,737	0.61

[a] Biased high because escapement was not fully assessed due to operation dates.

FIGURES

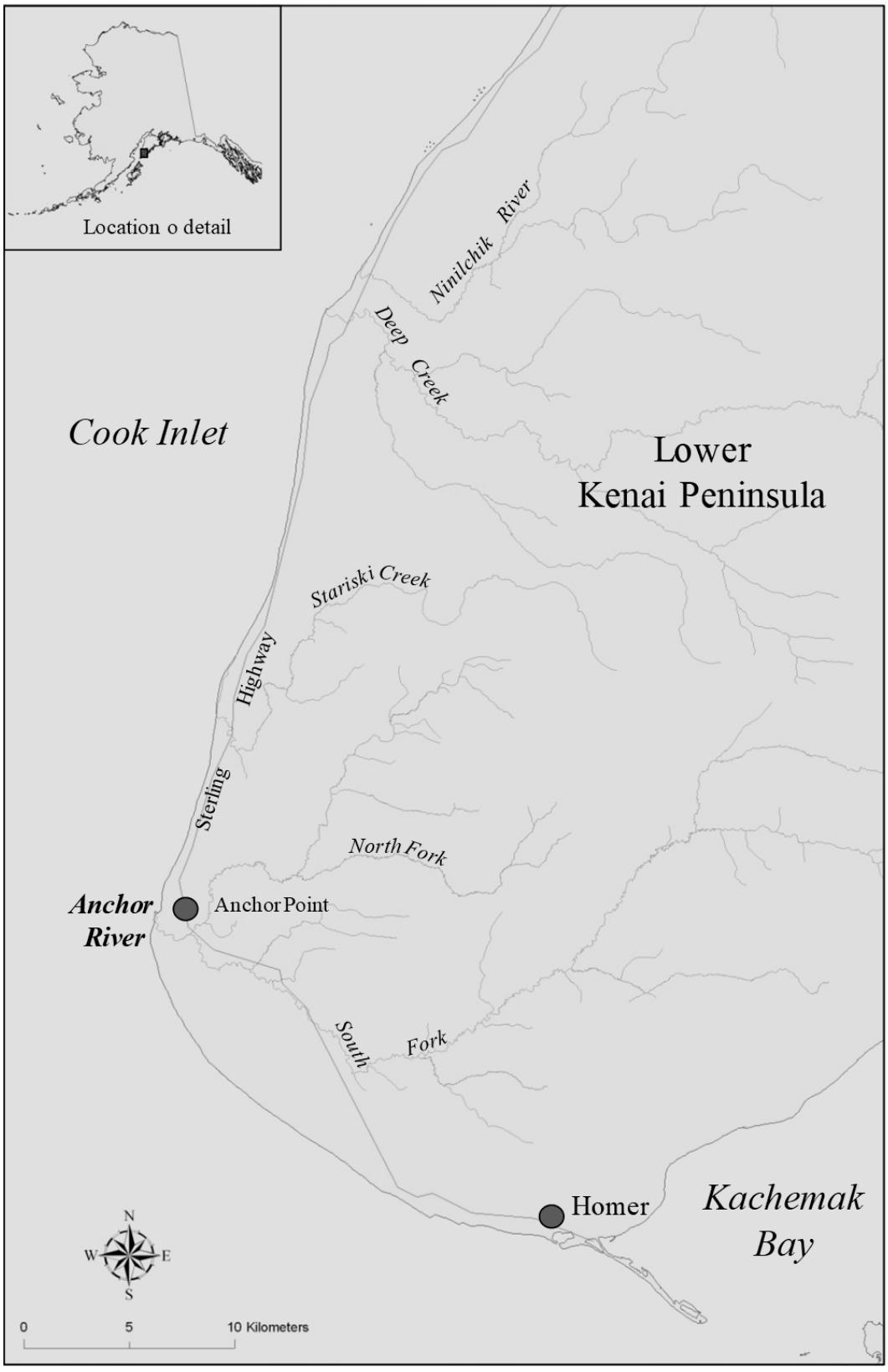

Figure 1.–Location of Anchor River and other roadside tributaries in the Lower Cook Inlet Management Area.

Figure 2.–View of the south fork weir site and its relative location to the 2003–2012 mainstem DIDSON–weir site and Bridge Hole.

Figure 3.–Location of the south and north forks Chinook salmon escapement monitoring weir sites in 2013–2015, Anchor River.

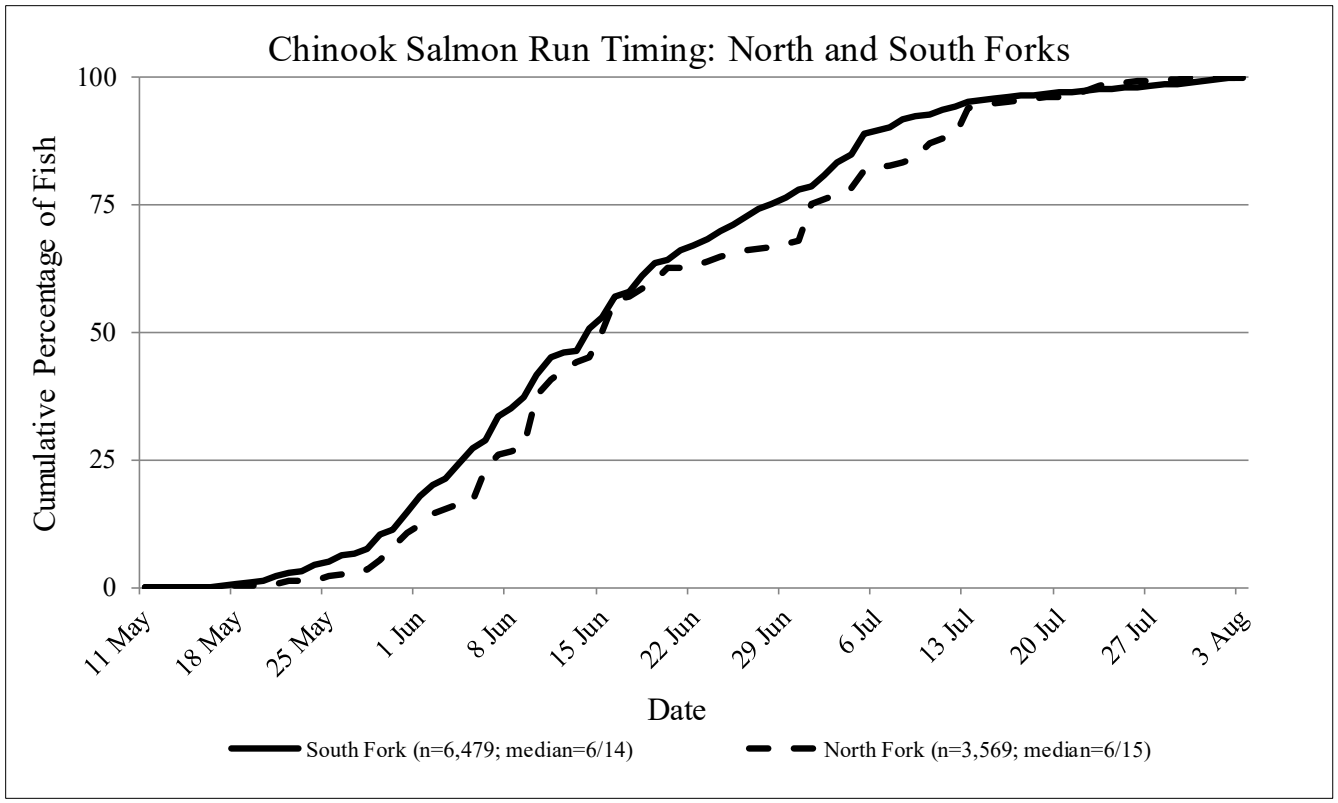

Figure 4.–Anchor River Chinook salmon run timing for 2015 at the north fork weir site (RKM 5.4) and south fork weir site (RKM 4.0).

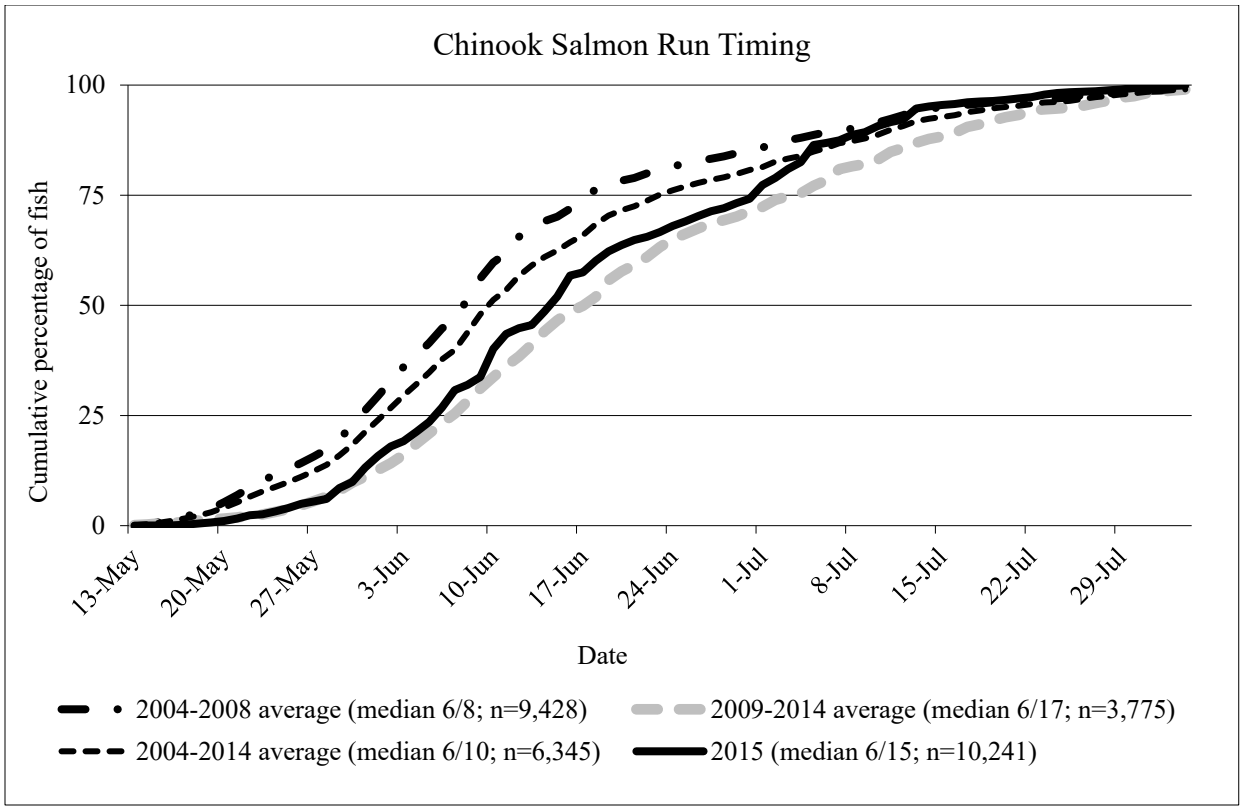

Figure 5.–Anchor River Chinook salmon combined north and south forks run timing for 2015 compared to the 2004–2008, 2009–2014, and 2004–2014 averages.

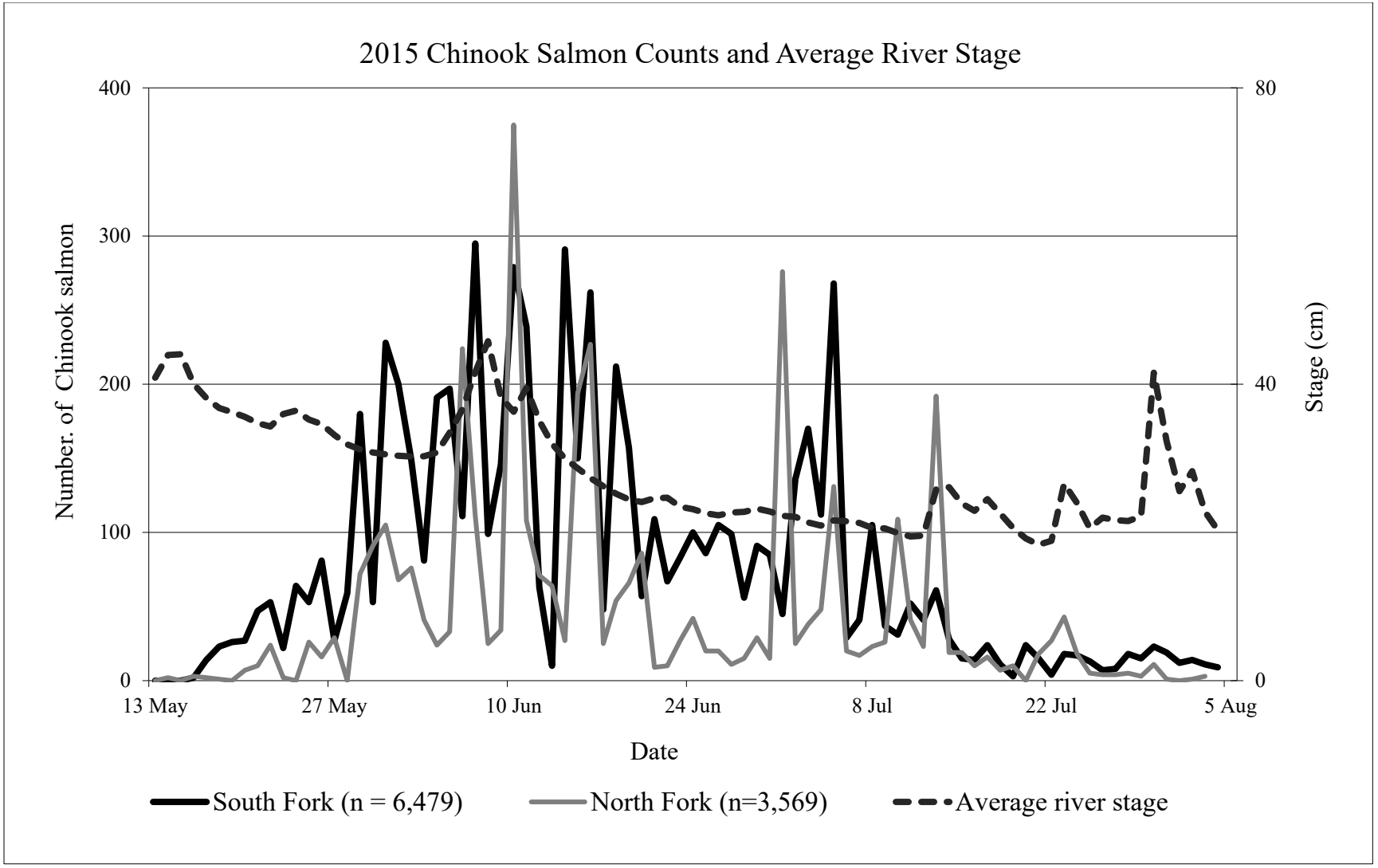

Figure 6.–Daily counts of Chinook salmon at the north and south fork weir sites plotted against daily river stage averages, Anchor River, 2015.

Note: River stage gauge located on south fork at approximately 11.4 RKM.

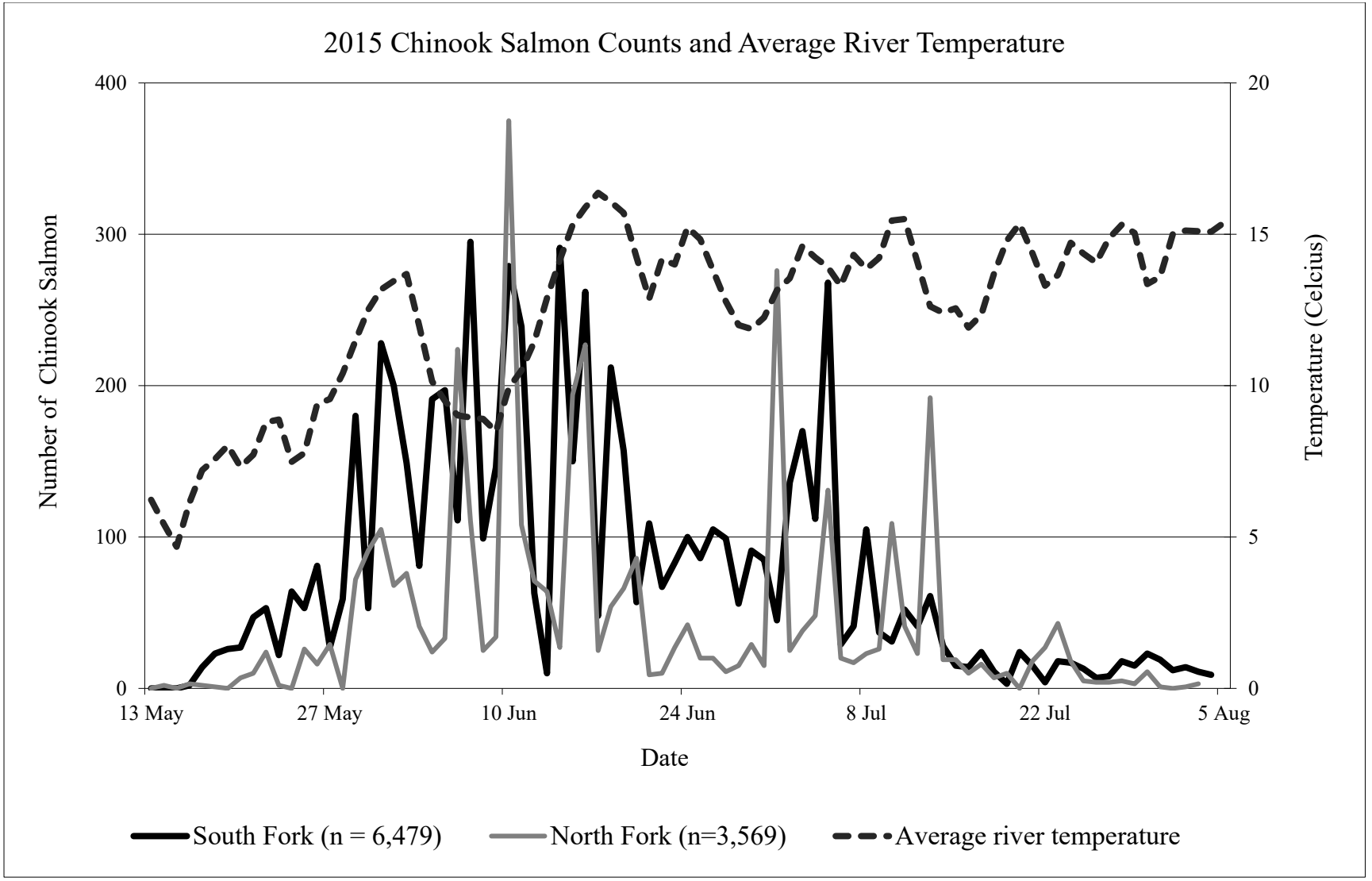

Figure 7.–Daily counts of Chinook salmon at the north and south fork weir sites plotted against daily river temperature averages, Anchor River, 2015.

Note: River temperature collected by Sue Mauger of Cook Inletkeeper 0.1 RKM downstream of the south fork resistance board weir.

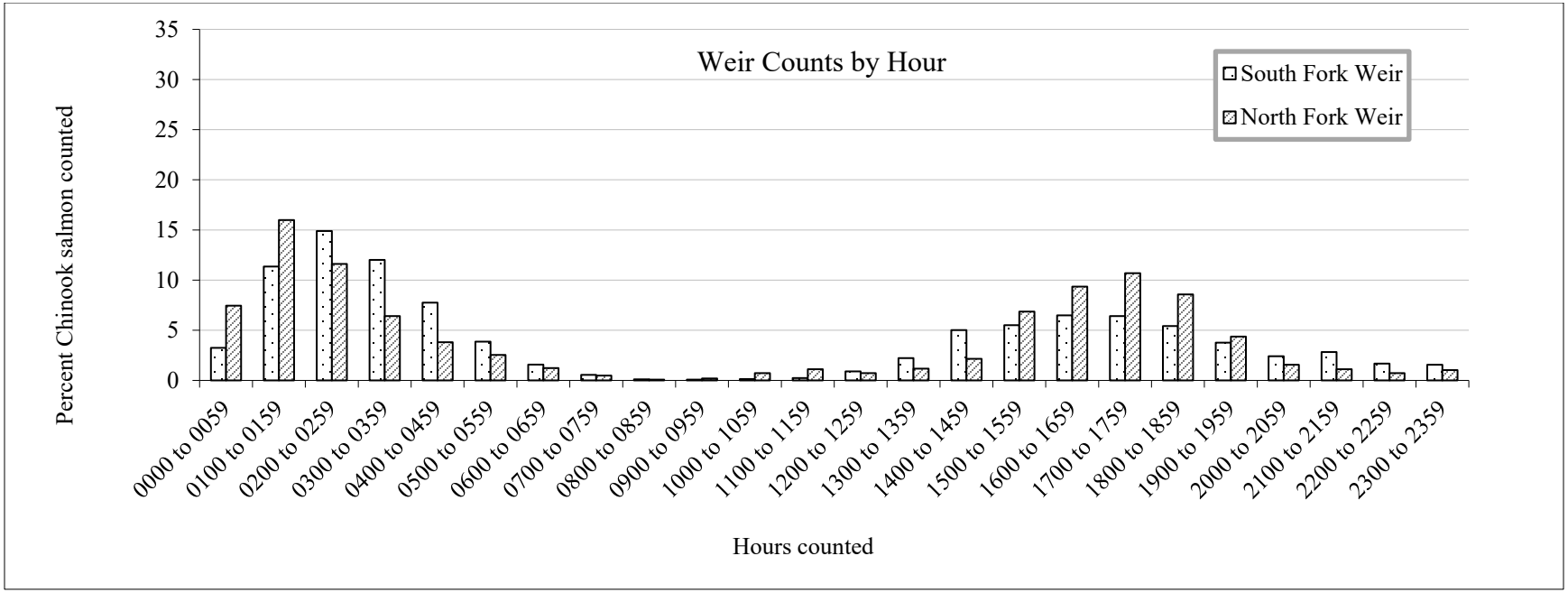

Figure 8.–Percentages of Chinook salmon counted by hour moving upstream through the south and north fork video weirs from 11 May through 3 August 2015.

APPENDIX A: MONITORING TIMELINES FOR ANCHOR RIVER CHINOOK SALMON

Appendix A1.–Timeline of escapement monitoring for Chinook salmon on the Anchor River, 1950–2015.

Year(s)	Escapement monitoring
1950s	Periodic fisheries investigations in the Anchor River were conducted by U.S. Fish and Wildlife Service. Chinook salmon escapement was monitored with weirs at various lower river locations on the north and south forks and the mainstem. Aerial and foot surveys were also conducted.
1962–1969	Annual Chinook salmon escapement was estimated with a combination aerial and ground index survey. Surveys were conducted once annually over a standard length of river. Aerial surveys were done from a fixed-wing aircraft (Super Cub). Foot surveys were conducted within a subsection of the aerial survey from the Sterling Highway Bridge upstream approximately 4 river kilometers (RKM) to forks (assumed to be the confluence). Where the foot survey was conducted, if the foot survey counts were greater than the aerial counts, the total aerial count was expanded by the difference. In 1966, no aerial surveys were conducted due to poor viewing conditions. Note: "standard length" and the location of the Sterling Highway Bridge (old versus new) could not be determined.
1970–1974	The ground index subsection was expanded to approximately 8 RKM from Glanville Lumber to forks. No aerial survey was conducted in 1970 or 1971. Note: "forks" is assumed to be the north and south forks confluence.
1975–1982	Aerial surveys were conducted using rotary-wing aircraft to index Chinook salmon escapement. Surveys were conducted once annually over a standard section of the south fork of the Anchor River. Foot surveys continued as before. Note: "forks" is assumed to be the north and south forks confluence.
1983–1994	The index subsection for combined aerial and foot surveys was reduced back to approximately 4 RKM from Sterling Highway Bridge to forks. Note: "standard length" and the location of the Sterling Highway Bridge (old versus new) could not be determined.
1995–2002	The foot survey was discontinued. Periodic foot surveys were conducted over additional stream reaches such as North Fork, Beaver Creek, and above forks. Aerial surveys continued.
2003	In addition to the aerial survey, the feasibility of using dual-frequency identification sonar (DIDSON) as an escapement monitoring tool was tested on the mainstem of the Anchor River just below the confluence of the north and south forks at RKM 2.8. DIDSON was only operated from 30 May through 9 July, not over the entire run.
2004	Chinook salmon escapement was monitored over the entire run at approximately RKM 2.8 through a combination of DIDSON during periods of high water and resistance board weir during periods of low water. A weir was operated on the north fork to monitor the entire run at approximately RKM 6.2. Aerial surveys of the north fork and south fork index areas were used to compare index to total escapement estimates.
2005–2008	Chinook salmon escapement was monitored over the entire run at approximately RKM 2.8 through a combination of DIDSON during periods of high water and resistance board weir during periods of low water. Aerial surveys were continued through 2008 to compare index to total run estimates.
2009	Chinook salmon escapement was censused using a resistance board weir over the entire run at approximately RKM 2.8 because of low water levels. A foot survey of the historical index area was conducted from the new Sterling Highway Bridge (lat 59.746895, long −151.754319) to the confluence of the North and South Forks (lat 59.772253, long −151.834263).

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Year(s)	Escapement monitoring
2010	Chinook salmon escapement was monitored over the entire run at approximately RKM 2.8 through a combination of DIDSON during periods of high water and resistance board weir during periods of low water. Escapement monitoring in August and September was conducted through a cooperative agreement with USFWS. USFWS monitored escapement using the resistance board weir and an underwater video camera (Anderson and Stillwater Sciences 2011).
2011–2012	Chinook salmon escapement was monitored over the entire run at approximately RKM 2.8 through a combination of DIDSON during periods of high water and resistance board weir fitted with an underwater video camera during periods of low water. In 2011, escapement monitoring in August and September was conducted through a cooperative agreement with USFWS.
2013	Chinook salmon escapement was monitored over the entire run; however, high river flows changed the channel morphology at the RKM 2.8 mainstem site used from 2003 to 2012. During the early high flows, DIDSON was used about 0.3 RKM downstream of the mainstem site at Bridge Hole. Once flows subsided, new weir sites were identified upstream on the north fork at RKM 5.5 and the south fork at RKM 4.1.
2014	Chinook salmon escapement was monitored over the entire run using a fixed picket weir on the north fork at RKM 5.5 and resistance board weir on the south fork at RKM 4.1.
2015	Chinook salmon escapement was monitored over the entire run using resistance board weirs fitted with underwater video cameras on the north fork at RKM 5.5 and the south fork at RKM 4.1.

Note: River kilometer 2.8 for the mainstem site was remeasured in 2013 to RKM 4.0.

Appendix A2.–Timeline of sport harvest monitoring and escapement goals for Chinook salmon on the Anchor River, 1950–2015

Year (s)	Sport harvest assessment
1950s	Periodic fisheries investigations in the Anchor River were conducted by U.S. Fish and Wildlife Service. Chinook salmon harvest was monitored through creel surveys.
1966–1977	Punch cards were used to enforce daily and seasonal limits (Hammarstrom et al. 1985).
1971–1977	Punch card returns were the primary source of harvest data. Effort was estimated by car counts each day at campgrounds and parking areas from 1971 to 1976.
1972–1986	Creel surveys were conducted at the Deep Creek access from 1972 to1986 and 1994 (Nelson 1994, 1995). A creel survey at the Anchor River–Whiskey Gulch access was conducted in 1986 (Nelson 1994).
1976–1983	Age composition of the Chinook salmon harvest was estimated for the Anchor River, Deep Creek, and Ninilchik River (Hammarstrom et al. 1985).
1977 to present	Statewide Harvest Surveys (SWHS) were conducted and produced annual estimates of total catch and harvest for Chinook salmon in the Anchor River.

Year (s)	Escapement goals
1993–1997	The first biological escapement goal (BEG) of 1,790 Chinook salmon was adopted in 1993. The BEG was the average of the expanded estimates from aerial and foot survey index counts conducted from 1966 to 1969 and from 1972 to 1991.
1998–2000	In 1998, the BEG was rescaled to a range of 1,050–2,200 Chinook salmon and was based on historical aerial survey counts and their relationship to sport harvest. The escapement range was approximated with a median aerial survey count of 1,211 Chinook salmon. The upper end of the range was the value that 20% of the annual aerial counts were above. The lower end was the value that 40% of the annual aerial counts were below (Szarzi and Begich 2004: page 22).
2001–2004	In 2001, the sustainable escapement goal (SEG) of 750 to 1500 Chinook salmon was adopted. The SEG was the 25th and 75th percentiles of the annual aerial counts from 1976 through 2000 (Szarzi and Begich 2004: page 22). During the Alaska Board of Fisheries (BOF) meeting in February 1999, in response to the guidelines established in the *Sustainable Salmon Fisheries Policy*, BOF designated Anchor River Chinook salmon as a stock of "management concern" defined in the policy as "a concern arising from a chronic inability, despite use of specific management measures, to maintain escapements for a salmon stock within the bounds of the SEG, BEG, [optimal escapement goal] OEG, or other specified management objectives for the fishery" (5 AAC 39.222 [f] [21]) (Szarzi and Begich 2004: page 25).
2005–2007	In 2005, the SEG was repealed and no new goal was adopted in anticipation that SF would collect sufficient escapement data with the DIDSON–weir project to recommend an escapement goal (Szarzi et al. 2007).
2008–2010	ADF&G adopted a lower bound SEG of 5,000 Chinook salmon. The SEG was based on a full probability spawner-recruit model that incorporated aerial survey data and SWHS harvest estimates from 1977 to 2007, and the total escapement estimates and age composition data collected from the DIDSON–weir project from 2003 to 2007 (Szarzi et al. 2007)
2011–2015	ADF&G adopted an SEG range of 3,800–10,000 Chinook salmon in fall of 2010. The SEG was based on a full probablility spawner–recruit model and was updated with escapement and harvest data through 2009. The lower bound of the SEG is the point estimate of SMSY The upper bound is the estimated point of carrying capacity (Otis et al. 2010).

Appendix A3.–Timeline of the freshwater fishing regulations and emergency orders (EOs) for Chinook salmon on the Anchor River, 1960–2015

Closed areas for Chinook salmon	
Year	Chinook salmon fishing regulations
1960–present	Salmon fishing closed upstream of the confluence of the north and south forks.
1996–present	The area above "forks" was closed to all fishing until August 1 to protect spawning salmon.
Recording requirements	
Year	Chinook salmon fishing regulations
1966–1980	A Chinook salmon punch card was required by all anglers, including those under 16 years of age.
1980–2013	Anglers recorded Chinook salmon harvest on the back of a sport fishing license or harvest card.
Open season for Chinook salmon by regulation	
Year	Chinook salmon fishing regulations
1960	May 7 to December 31.
1961	May 7 to July 1 only.
1962–1963	May 7 to July 8 only.
1964–1965	Closed.
1966	May 28–June 26 and limited to weekends and holidays or until 500 Chinook salmon 20 inches (in) or longer was attained among the Anchor River, Deep Creek, Ninilchik, and Kenai Rivers.
1967	May 27–June 11 opened continuously or until 500 Chinook salmon 20 in or longer was attained among the Anchor River, Deep Creek, Ninilchik, and Kenai Rivers.
1968	May 25–June 9 opened continuously or until 500 Chinook salmon 20 in or longer was attained among the Anchor River, Deep Creek, Ninilchik, and Kenai Rivers. .
1969	May 24–June 8 opened continuously or until 200 Chinook salmon 20 in or longer was attained among the Anchor River, Deep Creek, Ninilchik, and Kenai Rivers.
1970	May 30–June14 opened continuously or until 200 Chinook salmon 20 in or longer was attained among the Anchor River, Deep Creek, Ninilchik, and Kenai Rivers.
1971	Beginning on the Memorial Day weekend for 2 consecutive 2-day weekends (Saturday and Sunday). Quota eliminated.
1972	Beginning on the Memorial Day weekend for 2 consecutive 2-day weekends.
1973–1975	Beginning on the Memorial Day weekend for 3 consecutive 2-day weekends.
1976–1977	Beginning on the Memorial Day weekend for 4 consecutive 2-day weekends.
1978–1988	Beginning on the Memorial Day weekend for 4 consecutive 3-day weekends (weekends include Monday).
1989–2001	Beginning on the Memorial Day weekend for 5 consecutive 3-day weekends (weekends include Monday).
2002–2004	Beginning on the Memorial Day weekend for 4 consecutive 3-day weekends (weekends include Monday).
2005–2007	Beginning on the 3-day weekend before the Memorial Day weekend and for 4 consecutive 3-day weekends.
2008–present	Beginning on the 3-day weekend before the Memorial Day weekend and for 4 consecutive 3-day weekends and also the Wednesdays following each weekend opening.

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Bag, possession, and season limits	
Year	Chinook salmon fishing regulations
1960	Bag and possession limit: 3 salmon over 16 inches in length, of which not more than 2 could be Chinook salmon 20 inches or more in length.
1961–1962	Bag and possession limit: 3 salmon over 20 inches in length, of which not more than 1 could be Chinook salmon 20 inches or more in length.
1963	Bag and possession limit: salmon 16 inches or more in length; 6 coho salmon; 3 pink, chum or sockeye salmon; or 1 Chinook salmon.
1964–1965	Closed.
1966–1978	Bag and possession limit: 1 Chinook salmon 20 inches or more in length. Bag and possession limit: 10 Chinook salmon less than 20 inches long. Season limit: 2 Chinook salmon 20 inches or more in length.
1979–1985	Bag and possession limit: 1 Chinook salmon 20 inches or more in length. Bag and possession limit: 10 Chinook salmon less than 20 inches long. Season limit: 5 Chinook salmon 20 inches or more in length.
1986–1995	Bag limit: 1 Chinook salmon 16 inches or more in length. Bag and possession limit: 10 Chinook salmon less than 16 inches long. Season limit: 5 Chinook salmon 16 inches or more in length.
1996–1998	Bag limit: 1 Chinook salmon 16 inches or more in length. Bag and possession limit: 10 Chinook salmon less than 16 inches long. Season limit: 2 Chinook salmon 16 inches or more in length from Deep Creek or the Anchor River combined. After harvesting a Chinook salmon 16 inches or more in length from Deep Creek or the Anchor River, an angler may not fish in either drainage for the rest of that day.
1996–1998	Bag limit: 1 Chinook salmon 16 inches or more in length. Bag and possession limit: 10 Chinook salmon less than 16 inches long. Season limit: 2 Chinook salmon 16 inches or more in length from Deep Creek or the Anchor River combined. After harvesting a Chinook salmon 16 inches or more in length from Deep Creek or the Anchor River, an angler may not fish in either drainage for the rest of that day.
1999–2007	Bag limit: 1 Chinook salmon 20 inches or more in length. Bag and possession limit: 10 Chinook salmon less than 20 inches long. Season limit: 2 Chinook salmon 20 inches or more in length from Deep Creek or the Anchor River combined. After harvesting a Chinook salmon 20 inches or more in length from Deep Creek or the Anchor River an angler may not fish in either drainage for the rest of that day.
2008–2010	Bag limit: 1 Chinook salmon 20 inches or more in length. Bag and possession limit: 10 Chinook salmon less than 20 inches length. Season limit: 5 Chinook salmon 20 inches or more in length.
2011–2013	Bag limit: 1 Chinook salmon 20 inches or more in length. Bag and possession limit: 10 Chinook salmon less than 20 in length. Season limit: 2 Chinook salmon 20 inches or more in length from Deep Creek or the Anchor River combined. After harvesting a Chinook salmon 20 inches or more in length from Deep Creek or the Anchor River an angler may not fish in either drainage for the rest of that day.

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Bag, possession, and season limits

Year	Chinook salmon fishing regulations
2014–2015	Bag limit: 1 Chinook salmon 20 inches or more in length. Bag and possession limit: 10 Chinook salmon less than 20 inches long. Season limit: 2 Chinook salmon 20 inches or more in length from Deep Creek or the Anchor River combined. After harvesting a Chinook salmon 20 inches or more in length from the Anchor River an angler may not fish in either the Anchor River, Deep Creek, or the Ninilchik River for the rest of that day.

Emergency orders (EOs)

Year	Chinook salmon fishing regulations
1971	EO extended the Chinook salmon fishery on Anchor River and Deep Creek an additional 2-day weekend due to low catches (Nelson 1972)
1972	EO extended the Chinook salmon fishery on Anchor River and Deep Creek an additional 2-day weekend due to low catches (Nelson 1972).
1988	EO 2-KS-1-04-88 extended the Chinook salmon fishery on Anchor River and Deep Creek an additional weekend. Highly turbid river conditions early in the season depressed angler success rates and managers' expectations (D. C. Nelson, unpublished[a]).
2004	EO 2-KS-7-07-04 opened the Anchor River Chinook salmon fishery from 12:00 AM on Saturday, June 26 through 11:59 PM on June 28 from the mouth of the Anchor River to 600 ft downstream of the confluence of the north and south forks. Bag limit: 1 Chinook salmon per day.
2009	EO 2-KS-7-08-09 closed the Anchor River drainage from its mouth upstream to the north and south forks to fishing and increased the closed area in the salt waters of Cook Inlet at the mouth of the Anchor River from 2 miles to 4 miles beginning 12:01 AM on Saturday, June 6, through 11:59 PM on Tuesday, June 30.
2010	EO 2-KS-7-10-10 prohibited the use of bait in the Anchor River, Deep Creek, and Ninilchik River drainages and increased the closed area in the salt waters of Cook Inlet at the mouth of the Anchor River from 1 to 2 miles north and south of the Anchor River mouth and 1 mile offshore beginning 12:01 AM on Saturday, June 5, through 11:59 PM on Wednesday, June 30. EO 2-KS-7-15-10 prohibited the retention of Chinook salmon in the Anchor River drainage from its mouth upstream to the junction of the north and south forks beginning 12:01AM on Saturday, June 12, through 11:59 PM on Wednesday, June 30. Chinook salmon may not be possessed or retained; Chinook salmon caught may not be removed from the water and must be released immediately. EO 2-KS-7-10-10 which prohibited the use of bait in the Anchor River, Deep Creek, and Ninilchik River drainages remained in effect. EO 2-KS-7-28-10 closed the salt waters of Cook Inlet at the mouth of the Anchor River to all sport fishing from 2 miles north and south of the Anchor River mouth and 1 mile offshore beginning 12:01 AM on Thursday, July 1, through 11:59 PM on Saturday, July 31. EO 2-KS-7-36-10 rescinded EO 2-KS-7-28-10 issued June 29. Effective 12:01 AM on Tuesday, July 13, the salt waters of Cook Inlet at the mouth of the Anchor River from 2 miles north and south of the Anchor River mouth and 1 mile offshore were open to all sport fishing.

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Emergency orders (EOs)

Year	Chinook salmon fishing regulations
2011	EO 2-KS-7-06-11 prohibited the use of bait in the Anchor River, Deep Creek, and Ninilchik River drainages beginning June 11 through 11:50 PM, Wednesday, June 22. EO 2-KS-7-07-11 closed the waters of the Anchor River drainage from its mouth upstream to the junction of the North and South forks to sport fishing beginning 12:01 AM, Wednesday, June 15 through 11:59 PM, Thursday, June 30. EO 2-KS-7-16-11 required the use of only 1 unbaited, single-hook, artificial lure in the flowing waters of the Anchor River drainage, and closed the salt waters of Cook Inlet at the mouth of the Anchor River to all sport fishing from 2 miles north and south of the Anchor River mouth and 1 mile offshore beginning 12:01 AM, Friday, July 1 through 11:59 PM, Sunday, July 31.
2012	EO 2-KS-7-08-12 closed waters of the Anchor River drainage from its mouth upstream to the junction of the north and south forks to sport fishing each Wednesday during the Chinook salmon season beginning 12:01 AM, Saturday, May 19. In addition, this EO also decreases the waters of the Anchor River drainage open to sport fishing by relocating the ADF&G regulatory marker downstream approximately 1,000 feet below the junction of the north and south forks beginning 12:01 AM, Saturday, May 19 through 11:59 PM, Tuesday, July 31. EO 2-KS-7-09-12 limits sport fishing gear to only 1 unbaited, single-hook, artificial lure when fishing in the Anchor River, Deep Creek, and Ninilchik River drainages beginning 12:01 AM, Saturday, June 2 through 11:59 PM, Wednesday, June 20. EO 2-KS-7-10-12 closes waters of the Anchor River drainage from its mouth upstream to the junction of the north and south forks to sport fishing beginning 12:01 AM., Saturday, June 9 through 11:59 PM, Saturday, June 30. EO 2-KS-7-13-12 prohibited sport fishing within 1 mile of shore in the salt waters of Cook Inlet south of the latitude of the mouth of the Ninilchik River to the latitude of Bluff Point beginning 12:01 AM, Friday, June 15 through 11:59 PM, Saturday, June 30. EO 2-KS-7-21-12 closed waters of the Anchor River and Ninilchik River, from the mouth upstream approximately 2 miles to ADF&G markers, to sport fishing for any species of fish, beginning 12:01 AM, Sunday, July 1 through 11:59 PM, Sunday, July 15. EO 2-KS-7-22-12 limited sport fishing gear to only 1 unbaited, single-hook, artificial lure when fishing in the Ninilchik River, Deep Creek, Stariski Creek, and Anchor River drainages beginning 12:01 AM, Sunday, July 1 through 11:59 PM, Tuesday, July 31. EO 2-KS-7-23-12 prohibited the retention of Chinook salmon while sport fishing within 1 mile of shore in the salt waters of Cook Inlet south of the latitude of the mouth of the Ninilchik River to the latitude of Bluff Point beginning 12:01 AM, Sunday, July 1 through 11:59 PM, Sunday, July 15. Catch-and-release fishing for Chinook salmon is allowed, but Chinook salmon may not be retained or possessed. Chinook salmon that are caught may not be removed from the water and must be released immediately. EO 2-KS-7-41-12 prohibited the retention of Chinook salmon while sport fishing within 1 mile of shore in the salt waters of Cook Inlet south of the latitude of the mouth of the Ninilchik River to the latitude of Bluff Point beginning 12:01 AM, Monday, July 16 through 11:59 PM, Tuesday, July 31. Catch-and-release fishing for Chinook salmon is allowed, but Chinook salmon may not be retained or possessed. Chinook salmon that are caught may not be removed from the water and must be released immediately.

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Emergency orders (EOs)	
Year	Chinook salmon fishing regulations
2013	EO 2-KS-7-03-13 closed waters of the Anchor River drainage from its mouth upstream to the junction of the north and south forks to sport fishing each Wednesday during the Chinook salmon season and decreased the waters of the Anchor River drainage open to sport fishing by relocating the ADF&G regulatory marker downstream approximately 1,000 feet below the junction of the north and south forks. This EO was effective from 12:01 AM, Wednesday, May 1, through 11:59 PM, Sunday, June 30. EO 2-KS-7-03-13 closed waters of the Anchor River drainage from its mouth upstream to the junction of the north and south forks to sport fishing each Wednesday during the Chinook salmon season and decreased the waters of the Anchor River drainage open to sport fishing by relocating the ADF&G regulatory marker downstream approximately 1,000 feet below the junction of the north and south forks. This EO was effective from 12:01 AM, Wednesday, May 1, through 11:59 PM, Sunday, June 30. EO 2-KS-7-04-13 established a combined annual limit of 2 Chinook salmon 20 inches or greater in length for fish harvested in the Anchor River, Deep Creek, Ninilchik River, and all marine waters south of the latitude of the mouth of the Ninilchik River (lat 60°03.99′N) to the latitude of Bluff Point (lat 59°40.00′ N). In addition, a person who takes and retains a Chinook salmon 20 inches or greater in length from either Deep Creek, Anchor River, or Ninilchik River may not sport fish in any of those drainages for the rest of that day. This EO was effective from 12:01 AM, Wednesday, May 1, through 11:59 PM, Sunday, June 30. Any Chinook salmon caught in these waters and recorded before Wednesday, May 1 on the harvest portion of an Alaska sport fishing license or harvest record card did not count against the 2 Chinook salmon annual limit after 12:01 AM, Wednesday, May 1, but did count against the Cook Inlet annual limit of 5 Chinook salmon. EO 2-KS-7-05-13 limited sport fishing gear to only 1 unbaited, single-hook, artificial lure when fishing in the Anchor River, Deep Creek, or Ninilchik River drainages beginning 12:01 AM, Wednesday, May 1, through 11:59 PM, Sunday, June 30. EO 2-KS-7-17-13 superseded EO 2-KS-7-03-13 and EO 2-KS-7-06-13 issued April 18. This EO closed waters of the Anchor River, Deep Creek, Ninilchik River and Stariski Creek, from the mouth upstream approximately 2 miles to ADF&G markers, or to clearly recognizable physical features, to sport fishing for any species of fish, beginning 12:01 AM, Saturday, June 15, through 11:59 PM, Monday, July 15. EO 2-KS-7-18-13 superseded EO 2-KS-7-04-13, issued April 18. This EO prohibited Chinook salmon fishing (including catch-and-release) while sport fishing within 1 mile of shore in the salt waters of Cook Inlet south of the latitude of the mouth of the Ninilchik River (lat 60°03.99′N) to the latitude of Bluff Point (lat 59°40.00′N). Chinook salmon incidentally caught while fishing for other fish may not be removed from the water and must be released immediately. This EO was effective from12:01 AM, Saturday, June 15, through 11:59 PM, Monday, July 15.
2014	EO 2-KS-7-01-14 closed the Anchor River drainage to sport fishing each Wednesday during the Chinook salmon season and reduced the waters of the Anchor River open to sport fishing during the Chinook salmon season. Under this EO, waters open to sport fishing extended from the mouth to the downstream side of the Old Sterling Highway Bridge approximately 550 feet below the junction of the north and south forks. This EO was effective from 12:01 AM, Thursday, May 1, through 11:59 PM, Monday, June 30.

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Emergency orders (EOs)	
Year	Chinook salmon fishing regulations
2014	EO 2-KS-7-02-14 established a combined annual limit of 2 Chinook salmon 20 inches or greater in length in the Anchor River, Deep Creek, Ninilchik River, and all marine waters south of the latitude of the mouth of the Ninilchik River (lat 60°03.99′N) to the latitude of Bluff Point (lat 59°40.00′N). This emergency order was effective from 12:01 AM, Thursday, May 1, through 11:59 PM, Monday, June 30. Chinook salmon harvested in these waters and recorded before Thursday, May 1, and after Monday, June 30, do not count against the 2–Chinook salmon annual limit after 12:01 AM, Thursday, May 1, but do count against the Cook Inlet annual limit of 5 Chinook salmon. EO 2-KS-7-03-14 restricted sport fishing gear in the Anchor River, Deep Creek, and Ninilchik river drainages to only 1 unbaited, single-hook, artificial lure beginning 12:01 AM, Thursday, May 1, through 11:59 PM, Monday, June 30. EO 2-KS-7-16-14 superseded EO 1-KS-7-01-14 issued 27 February 2014. This EO closed waters of the Anchor River drainage from its mouth upstream to the junction of the north and south forks to sport fishing; and prohibited Chinook salmon fishing (including catch-and-release) while sport fishing within 1 mile of shore in the salt waters of Cook Inlet south of the latitude of the mouth of the Ninilchik River (lat 60°03.99′N) to the latitude of Bluff Point (lat 59°40.00′N). Chinook salmon incidentally caught while fishing for other fish may not be removed from the water and must be released immediately. This EO was effective from 12:01 AM, Friday, June 13, through 11:59 PM, Monday, June 30. EO 2-KS-7-43-14 prohibited sport fishing for Chinook salmon in the salt waters of Cook Inlet north of the latitude of Bluff Point beginning 12:02 AM, Saturday, July 26, through 11:59 PM, Thursday, July 31. Chinook salmon could not be retained or possessed. Chinook salmon caught while fishing for other species could not be removed from the water and had to be released immediately.
2015	EO 2-KS-7-01-15 closed the first and fifth opening weekend and the 5 Wednesday openings in May and June for the Anchor River drainage and decreased the waters of the Anchor River drainage open to sport fishing to the downstream side of the Old Sterling Highway Bridge approximately 550 feet below the junction of the north and south forks. This EO was effective from 12:01 AM, Wednesday, April 1, 2015, through 11:59 PM, Tuesday, June 30, 2015. EO 2-KS-7-02-15 limited sport fishing gear to only 1 unbaited, single-hook, artificial lure when fishing in the Anchor River, Deep Creek, or Ninilchik River drainages. This EO was effective from 12:01 AM, Wednesday, April 1, 2015, through 11:59 PM, Tuesday, June 30, 2015. EO 2-KS-7-03-15 established a combined annual limit of 2 Chinook salmon 20 inches or greater in length for fish harvested in Anchor River, Deep Creek, Ninilchik River, and all marine water south of the latitude of the mouth of the Ninilchik River (lat 59°40.00′N). This EO was effective from 12:01 AM, Wednesday, April 1, 2015, through 11:59 PM, Tuesday, June 30, 2015. EO 2-KS-7-04-15 extended the date by 2 weeks of the closed saltwater area surrounding the Anchor River mouth and the special harvest areas north to lat 59°92.98′N, located approximately 1 mile south of Stariski Creek and south to Bluff Point (lat 59°40.00′N). This EO was effective from 12:01 AM, Wednesday, July 1, 2015, through 11:59 PM, Wednesday, July 15, 2015.

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Emergency orders (EOs)	
Year	Chinook salmon fishing regulations
2015	EO 2-KS-7-20-15 superseded EO 2-KS-7-01-15 and allowed sport fishing during the last opening weekend from June 13 to 15, and the fifth Wednesday, June 17, for the Anchor River drainage. The preseason actions that restricted gear and established a combined annual limit of 2 Chinook salmon 20 inches or greater in length for fish harvested in the Anchor River, Deep Creek, and Ninilchik River and all marine waters south of the latitude of the mouth of the Ninilchik River to the latitude of Bluff Point remained in effect. This EO was effective from 12:01 AM, Saturday, June 13, through 11:59 PM, Tuesday, June 30, 2015. EO 2-KS-7-21-15 rescinded EO 2-KS-7-04-15, which extended the closed saltwater area surrounding the Anchor River mouth and the special harvest areas through 15 July. The affected waters surround the Anchor River mouth and the special harvest areas north to lat 59°52.98′N located approximately 1 mile south of Stariski Creek and south to Bluff Point (lat 59°40.00′N). The preseason actions that restricted gear and established a combined annual limit of 2 Chinook salmon 20 inches or greater in length for fish harvested in the Anchor River, Deep Creek, and Ninilchik River and all marine waters south of the latitude of the mouth of the Ninilchik River to the latitude of Bluff Point still remained in effect. This EO was effective from 12:01 AM, Wednesday, July 1, 2015 through 11:59 PM, Wednesday, July 15, 2015. EO 2-KS-7-27-15 rescinded EO 2-KS-7-03-15 and restored the Cook Inlet annual limit of 5 Chinook salmon 20 inches or greater in length for fish harvested in the Ninilchik River and all marine waters south of the latitude of the mouth of the Ninilchik River (lat 60°03.99′N) to the latitude of Bluff Point (lat 59°40.00′N). This EO was effective from 12:01 AM, Saturday, 20 June 2015. Any Chinook salmon recorded before Saturday, June 20, of the harvest portion of an Alaska sport fishing license or harvest record card counted toward the Cook Inlet annual limit.

[a] Nelson, D. C. *Unpublished*. A review of Alaska's Kenai Peninsula east side beach recreational razor clam (Siliqua patula, Dixon) fishery, 1965-1980. Alaska Department of Fish and Game, Division of Sport Fish, Soldotna, Alaska.

APPENDIX B: ANCHOR RIVER ESCAPEMENT COUNTS

Appendix B1.–Combined daily ("day") escapement counts and cumulative ("cum.") counts and percent of total from the south and north fork monitoring sites of Chinook, pink, chum, sockeye, and coho salmon, and Dolly Varden at the Anchor River sonar-weir site, 2015.

	Chinook			Dolly Varden			Pink			Chum			Sockeye			Coho		
Date	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%
11 May	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 May	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 May	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14 May	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 May	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16 May	5	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17 May	16	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 May	24	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19 May	26	74	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20 May	34	108	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21 May	57	165	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22 May	77	242	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23 May	24	266	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24 May	64	330	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 May	79	409	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26 May	97	506	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27 May	56	562	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28 May	59	621	6	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
29 May	252	873	9	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
30 May	144	1,017	10	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0
31 May	333	1,350	13	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Jun	268	1,618	16	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Jun	225	1,843	18	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Jun	122	1,965	19	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Jun	215	2,180	21	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Jun	230	2,410	24	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
6 Jun	335	2,745	27	0	10	0	0	0	0	0	0	0	1	1	3	0	0	0
7 Jun	406	3,151	31	0	10	0	0	0	0	0	0	0	1	2	7	0	0	0
8 Jun	124	3,275	32	0	10	0	0	0	0	0	0	0	0	2	7	0	0	0
9 Jun	180	3,455	34	0	10	0	0	0	0	0	0	0	0	2	7	0	0	0

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Appendix B1.–Page 2 of 3.

	Chinook			Dolly Varden			Pink			Chum			Sockeye			Coho		
Date	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%
10 Jun	654	4,109	40	2	12	0	0	0	0	0	0	0	0	2	7	0	0	0
11 Jun	347	4,456	44	1	13	0	0	0	0	0	0	0	0	2	7	0	0	0
12 Jun	134	4,590	45	0	13	0	0	0	0	0	0	0	1	3	10	0	0	0
13 Jun	74	4,664	46	0	13	0	0	0	0	0	0	0	1	4	13	0	0	0
14 Jun	318	4,982	49	2	15	0	0	0	0	0	0	0	1	5	17	0	0	0
15 Jun	344	5,326	52	0	15	0	0	0	0	0	0	0	0	5	17	0	0	0
16 Jun	489	5,815	57	2	17	0	0	0	0	0	0	0	0	5	17	0	0	0
17 Jun	73	5,888	57	4	21	0	0	0	0	0	0	0	0	5	17	0	0	0
18 Jun	266	6,154	60	3	24	0	0	0	0	0	0	0	0	5	17	0	0	0
19 Jun	223	6,377	62	10	34	0	0	0	0	0	0	0	0	5	17	0	0	0
20 Jun	143	6,520	64	4	38	0	0	0	0	0	0	0	0	5	17	0	0	0
21 Jun	118	6,638	65	3	41	0	0	0	0	0	0	0	0	5	17	0	0	0
22 Jun	77	6,715	66	0	41	0	0	0	0	0	0	0	0	5	17	0	0	0
23 Jun	110	6,825	67	1	42	0	0	0	0	0	0	0	0	5	17	0	0	0
24 Jun	142	6,967	68	0	42	0	1	1	0	1	1	1	0	5	17	0	0	0
25 Jun	106	7,073	69	10	52	1	2	3	0	1	2	2	0	5	17	0	0	0
26 Jun	125	7,198	70	4	56	1	0	3	0	0	2	2	0	5	17	0	0	0
27 Jun	110	7,308	71	17	73	1	1	4	0	1	3	3	0	5	17	0	0	0
28 Jun	71	7,379	72	11	84	1	0	4	0	1	4	3	0	5	17	0	0	0
29 Jun	120	7,499	73	8	92	1	0	4	0	0	4	3	0	5	17	0	0	0
30 Jun	100	7,599	74	9	101	1	0	4	0	0	4	3	0	5	17	0	0	0
1 Jul	321	7,920	77	30	131	1	1	5	0	1	5	4	0	5	17	0	0	0
2 Jul	161	8,081	79	32	163	2	5	10	1	6	11	9	0	5	17	0	0	0
3 Jul [a]	208	8,289	81	48	211	2	11	21	1	0	11	9	0	5	17	0	0	0
4 Jul	160	8,449	83	46	257	3	10	31	2	2	13	11	0	5	17	0	0	0
5 Jul	399	8,848	86	67	324	3	18	49	3	2	15	13	0	5	17	0	0	0
6 Jul	49	8,897	87	69	393	4	12	61	4	6	21	18	0	5	17	0	0	0
7 Jul	58	8,955	87	116	509	5	18	79	5	4	25	21	0	5	17	0	0	0
8 Jul	128	9,083	89	473	982	10	137	216	14	3	28	23	0	5	17	0	0	0
9 Jul	63	9,146	89	260	1,242	12	16	232	15	2	30	25	0	5	17	0	0	0

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	Chinook			Dolly Varden			Pink			Chum			Sockeye			Coho		
Date	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%
10 Jul	140	9,286	91	250	1,492	15	9	241	15	6	36	30	0	5	17	0	0	0
11 Jul	93	9,379	92	384	1,876	19	58	299	19	5	41	34	0	5	17	0	0	0
12 Jul	64	9,443	92	617	2,493	25	51	350	22	4	45	38	0	5	17	0	0	0
13 Jul	253	9,696	95	394	2,887	29	104	454	29	7	52	43	0	5	17	0	0	0
14 Jul	47	9,743	95	975	3,862	39	108	562	36	6	58	48	2	7	23	0	0	0
15 Jul	34	9,777	95	526	4,388	44	79	641	41	3	61	51	1	8	27	0	0	0
16 Jul	24	9,801	96	255	4,643	46	8	649	41	9	70	58	0	8	27	0	0	0
17 Jul	40	9,841	96	317	4,960	50	21	670	42	7	77	64	0	8	27	0	0	0
18 Jul	18	9,859	96	513	5,473	55	26	696	44	4	81	68	0	8	27	0	0	0
19 Jul	13	9,872	96	189	5,662	57	25	721	46	0	81	68	0	8	27	0	0	0
20 Jul	24	9,896	97	432	6,094	61	103	824	52	1	82	68	0	8	27	0	0	0
21 Jul	33	9,929	97	320	6,414	64	79	903	57	1	83	69	0	8	27	2	2	3
22 Jul	31	9,960	97	295	6,709	67	64	967	61	0	83	69	0	8	27	1	3	5
23 Jul	61	10,021	98	462	7,171	72	110	1,077	68	4	87	73	0	8	27	2	5	8
24 Jul	35	10,056	98	1,008	8,179	82	105	1,182	75	2	89	74	0	8	27	0	5	8
25 Jul	18	10,074	98	430	8,609	86	58	1,240	78	3	92	77	0	8	27	0	5	8
26 Jul	11	10,085	98	274	8,883	89	20	1,260	80	3	95	79	0	8	27	1	6	10
27 Jul	12	10,097	99	252	9,135	91	8	1,268	80	0	95	79	1	9	30	0	6	10
28 Jul	23	10,120	99	156	9,291	93	41	1,309	83	4	99	83	0	9	30	1	7	11
29 Jul	18	10,138	99	86	9,377	94	37	1,346	85	4	103	86	1	10	33	3	10	16
30 Jul	34	10,172	99	34	9,411	94	43	1,389	88	4	107	89	1	11	37	4	14	22
31 Jul	20	10,192	100	86	9,497	95	30	1,419	90	3	110	92	1	12	40	4	18	29
1 Aug	12	10,204	100	183	9,680	97	44	1,463	93	2	112	93	3	15	50	5	23	37
2 Aug	15	10,219	100	157	9,837	98	67	1,530	97	3	115	96	4	19	63	11	34	54
3 Aug	14	10,233	100	70	9,907	99	36	1,566	99	4	119	99	7	26	87	14	48	76
4 Aug	8	10,241	100	88	9,995	100	15	1,581	100	1	120	100	4	30	100	15	63	100

[a] Interpolated counts on the south fork from 1400 to 2100 hours.

Appendix B2.–Daily ("day") escapement counts and cumulative ("cum.") counts and percent of total of Chinook, pink, chum, sockeye, and coho salmon, and Dolly Varden at the south fork monitoring site on the Anchor River, 2015.

	Chinook			Dolly Varden			Pink			Chum			Sockeye			Coho		
Date	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%
11 May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14 May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16 May	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17 May	14	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 May	23	39	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19 May	26	65	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20 May	27	92	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21 May	47	139	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22 May	53	192	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23 May	22	214	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24 May	64	278	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 May	53	331	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26 May	81	412	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27 May	27	439	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28 May	59	498	8	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
29 May	180	678	10	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
30 May	53	731	11	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0
31 May	228	959	15	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Jun	200	1,159	18	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Jun	149	1,308	20	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Jun	81	1,389	21	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Jun	191	1,580	24	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Jun	197	1,777	27	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
6 Jun	111	1,888	29	0	8	0	0	0	0	0	0	0	1	1	4	0	0	0
7 Jun	295	2,183	33	0	8	0	0	0	0	0	0	0	1	2	7	0	0	0
8 Jun	99	2,282	35	0	8	0	0	0	0	0	0	0	0	2	7	0	0	0
9 Jun	146	2,428	37	0	8	0	0	0	0	0	0	0	0	2	7	0	0	0

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	Chinook			Dolly Varden			Pink			Chum			Sockeye			Coho		
Date	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%
10 Jun	279	2,707	41	2	10	0	0	0	0	0	0	0	0	2	7	0	0	0
11 Jun	239	2,946	45	1	11	0	0	0	0	0	0	0	0	2	7	0	0	0
12 Jun	63	3,009	46	0	11	0	0	0	0	0	0	0	1	3	11	0	0	0
13 Jun	10	3,019	46	0	11	0	0	0	0	0	0	0	1	4	14	0	0	0
14 Jun	291	3,310	51	2	13	0	0	0	0	0	0	0	1	5	18	0	0	0
15 Jun	150	3,460	53	0	13	0	0	0	0	0	0	0	0	5	18	0	0	0
16 Jun	262	3,722	57	2	15	0	0	0	0	0	0	0	0	5	18	0	0	0
17 Jun	48	3,770	58	4	19	0	0	0	0	0	0	0	0	5	18	0	0	0
18 Jun	212	3,982	61	3	22	0	0	0	0	0	0	0	0	5	18	0	0	0
19 Jun	157	4,139	63	10	32	0	0	0	0	0	0	0	0	5	18	0	0	0
20 Jun	57	4,196	64	4	36	0	0	0	0	0	0	0	0	5	18	0	0	0
21 Jun	109	4,305	66	3	39	0	0	0	0	0	0	0	0	5	18	0	0	0
22 Jun	67	4,372	67	0	39	0	0	0	0	0	0	0	0	5	18	0	0	0
23 Jun	83	4,455	68	1	40	0	0	0	0	0	0	0	0	5	18	0	0	0
24 Jun	100	4,555	70	0	40	0	1	1	0	1	1	2	0	5	18	0	0	0
25 Jun	86	4,641	71	9	49	1	2	3	0	1	2	4	0	5	18	0	0	0
26 Jun	105	4,746	73	3	52	1	0	3	0	0	2	4	0	5	18	0	0	0
27 Jun	99	4,845	74	10	62	1	1	4	0	1	3	6	0	5	18	0	0	0
28 Jun	56	4,901	75	10	72	1	0	4	0	1	4	7	0	5	18	0	0	0
29 Jun	91	4,992	76	8	80	1	0	4	0	0	4	7	0	5	18	0	0	0
30 Jun	85	5,077	78	9	89	1	0	4	0	0	4	7	0	5	18	0	0	0
1 Jul	45	5,122	78	30	119	1	1	5	0	1	5	9	0	5	18	0	0	0
2 Jul	136	5,258	81	30	149	2	4	9	1	2	7	13	0	5	18	0	0	0
3 Jul [a]	170	5,428	83	45	194	2	7	16	1	0	7	13	0	5	18	0	0	0
4 Jul	112	5,540	85	38	232	3	4	20	2	0	7	13	0	5	18	0	0	0
5 Jul	268	5,808	89	60	292	3	10	30	2	2	9	17	0	5	18	0	0	0
6 Jul	29	5,837	89	57	349	4	11	41	3	6	15	28	0	5	18	0	0	0
7 Jul	41	5,878	90	112	461	5	15	56	4	3	18	33	0	5	18	0	0	0
8 Jul	105	5,983	92	459	920	10	137	193	15	1	19	35	0	5	18	0	0	0
9 Jul	37	6,020	92	252	1,172	13	13	206	16	0	19	35	0	5	18	0	0	0
10 Jul	31	6,051	93	240	1,412	16	8	214	16	5	24	44	0	5	18	0	0	0

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	Chinook			Dolly Varden			Pink			Chum			Sockeye			Coho		
Date	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%
11 Jul	52	6,103	94	350	1,762	19	50	264	20	5	29	54	0	5	18	0	0	0
12 Jul	41	6,144	94	594	2,356	26	33	297	23	1	30	56	0	5	18	0	0	0
13 Jul	61	6,205	95	373	2,729	30	84	381	29	3	33	61	0	5	18	0	0	0
14 Jul	28	6,233	95	960	3,689	41	100	481	36	1	34	63	2	7	25	0	0	0
15 Jul	15	6,248	96	499	4,188	46	75	556	42	2	36	67	1	8	29	0	0	0
16 Jul	14	6,262	96	205	4,393	48	7	563	43	2	38	70	0	8	29	0	0	0
17 Jul	24	6,286	96	272	4,665	51	18	581	44	0	38	70	0	8	29	0	0	0
18 Jul	11	6,297	96	382	5,047	56	21	602	46	0	38	70	0	8	29	0	0	0
19 Jul	3	6,300	97	34	5,081	56	17	619	47	0	38	70	0	8	29	0	0	0
20 Jul	24	6,324	97	432	5,513	61	103	722	55	1	39	72	0	8	29	0	0	0
21 Jul	15	6,339	97	299	5,812	64	75	797	60	0	39	72	0	8	29	2	2	4
22 Jul	4	6,343	97	290	6,102	67	64	861	65	0	39	72	0	8	29	0	2	4
23 Jul	18	6,361	97	431	6,533	72	61	922	70	4	43	80	0	8	29	0	2	4
24 Jul	17	6,378	98	913	7,446	82	89	1,011	77	0	43	80	0	8	29	0	2	4
25 Jul	13	6,391	98	423	7,869	87	56	1,067	81	2	45	83	0	8	29	0	2	4
26 Jul	7	6,398	98	249	8,118	89	19	1,086	82	1	46	85	0	8	29	0	2	4
27 Jul	8	6,406	98	231	8,349	92	8	1,094	83	0	46	85	0	8	29	0	2	4
28 Jul	18	6,424	98	114	8,463	93	39	1,133	86	4	50	93	0	8	29	0	2	4
29 Jul	15	6,439	99	76	8,539	94	29	1,162	88	0	50	93	0	8	29	1	3	6
30 Jul	23	6,462	99	24	8,563	94	13	1,175	89	1	51	94	1	9	32	1	4	9
31 Jul	19	6,481	99	62	8,625	95	21	1,196	91	0	51	94	1	10	36	3	7	15
1 Aug	12	6,493	99	165	8,790	97	34	1,230	93	0	51	94	3	13	46	5	12	26
2 Aug	14	6,507	100	129	8,919	98	48	1,278	97	2	53	98	4	17	61	10	22	47
3 Aug	11	6,518	100	67	8,986	99	25	1,303	99	1	54	100	7	24	86	11	33	70
4 Aug	9	6,527	100	86	9,072	100	15	1,318	100	0	54	100	4	28	100	14	47	100

[a] Interpolated counts from 1400 to 2100 hours.

Appendix B3.–Daily ("day") escapement counts and cumulative ("cum.") counts and percent of total of Chinook, pink, chum, sockeye, and coho salmon, and Dolly Varden at the north fork monitoring site on the Anchor River, 2015.

	Chinook			Dolly Varden			Pink			Chum			Sockeye			Coho		
Date	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%
11 May	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 May	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 May	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14 May	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 May	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16 May	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17 May	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 May	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19 May	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20 May	7	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21 May	10	26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22 May	24	50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23 May	2	52	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24 May	0	52	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 May	26	78	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26 May	16	94	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27 May	29	123	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28 May	0	123	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29 May	72	195	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30 May	91	286	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31 May	105	391	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Jun	68	459	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Jun	76	535	14	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Jun	41	576	16	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Jun	24	600	16	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Jun	33	633	17	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
6 Jun	224	857	23	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Jun	111	968	26	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
8 Jun	25	993	27	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
9 Jun	34	1,027	28	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0

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	Chinook			Dolly Varden			Pink			Chum			Sockeye			Coho		
Date	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%
10 Jun	375	1,402	38	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
11 Jun	108	1,510	41	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
12 Jun	71	1,581	43	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
13 Jun	64	1,645	44	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
14 Jun	27	1,672	45	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
15 Jun	194	1,866	50	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
16 Jun	227	2,093	56	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
17 Jun	25	2,118	57	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
18 Jun	54	2,172	58	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
19 Jun[a]	66	2,238	60	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
20 Jun[b]	86	2,324	63	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
21 Jun	9	2,333	63	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
22 Jun	10	2,343	63	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
23 Jun	27	2,370	64	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
24 Jun	42	2,412	65	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
25 Jun	20	2,432	65	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
26 Jun	20	2,452	66	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
27 Jun	11	2,463	66	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0
28 Jun	15	2,478	67	7	11	1	0	0	0	0	0	0	0	0	0	0	0	0
29 Jun	29	2,507	68	1	12	1	0	0	0	0	0	0	0	0	0	0	0	0
30 Jun	15	2,522	68	0	12	1	0	0	0	0	0	0	0	0	0	0	0	0
1 Jul	276	2,798	75	0	12	1	0	0	0	0	0	0	0	0	0	0	0	0
2 Jul	25	2,823	76	0	12	1	1	1	0	4	4	6	0	0	0	0	0	0
3 Jul	38	2,861	77	2	14	2	4	5	2	0	4	6	0	0	0	0	0	0
4 Jul	48	2,909	78	3	17	2	6	11	4	2	6	9	0	0	0	0	0	0
5 Jul	131	3,040	82	8	25	3	8	19	7	0	6	9	0	0	0	0	0	0
6 Jul	20	3,060	82	7	32	3	1	20	8	0	6	9	0	0	0	0	0	0
7 Jul	17	3,077	83	12	44	5	3	23	9	1	7	11	0	0	0	0	0	0
8 Jul	23	3,100	83	4	48	5	0	23	9	2	9	14	0	0	0	0	0	0
9 Jul	26	3,126	84	14	62	7	3	26	10	2	11	17	0	0	0	0	0	0
10 Jul	109	3,235	87	8	70	8	1	27	10	1	12	18	0	0	0	0	0	0

-continued-

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	Chinook			Dolly Varden			Pink			Chum			Sockeye			Coho		
Date	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%	Day	Cum.	%
11 Jul	41	3,276	88	10	80	9	8	35	13	0	12	18	0	0	0	0	0	0
12 Jul	23	3,299	89	34	114	12	18	53	20	3	15	23	0	0	0	0	0	0
13 Jul	192	3,491	94	23	137	15	20	73	28	4	19	29	0	0	0	0	0	0
14 Jul	19	3,510	95	21	158	17	8	81	31	5	24	36	0	0	0	0	0	0
15 Jul	19	3,529	95	15	173	19	4	85	32	1	25	38	0	0	0	0	0	0
16 Jul	10	3,539	95	27	200	22	1	86	33	7	32	48	0	0	0	0	0	0
17 Jul	16	3,555	96	50	250	27	3	89	34	7	39	59	0	0	0	0	0	0
18 Jul	7	3,562	96	45	295	32	5	94	36	4	43	65	0	0	0	0	0	0
19 Jul	10	3,572	96	131	426	46	8	102	39	0	43	65	0	0	0	0	0	0
20 Jul	0	3,572	96	155	581	63	0	102	39	0	43	65	0	0	0	0	0	0
21 Jul[c]	18	3,590	97	21	602	65	4	106	40	1	44	67	0	0	0	0	0	0
22 Jul[d]	27	3,617	97	5	607	66	0	106	40	0	44	67	0	0	0	1	1	6
23 Jul[e]	43	3,660	99	31	638	69	49	155	59	0	44	67	0	0	0	2	3	19
24 Jul[f]	18	3,678	99	95	733	79	16	171	65	2	46	70	0	0	0	0	3	19
25 Jul[g]	5	3,683	99	7	740	80	2	173	66	1	47	71	0	0	0	0	3	19
26 Jul	4	3,687	99	25	765	83	1	174	66	2	49	74	0	0	0	1	4	25
27 Jul	4	3,691	99	21	786	85	0	174	66	0	49	74	1	1	50	0	4	25
28 Jul	5	3,696	100	42	828	90	2	176	67	0	49	74	0	1	50	1	5	31
29 Jul	3	3,699	100	10	838	91	8	184	70	4	53	80	1	2	100	2	7	44
30 Jul	11	3,710	100	10	848	92	30	214	81	3	56	85	0	2	100	3	10	63
31 Jul	1	3,711	100	24	872	94	9	223	85	3	59	89	0	2	100	1	11	69
1 Aug	0	3,711	100	18	890	96	10	233	89	2	61	92	0	2	100	0	11	69
2 Aug	1	3,712	100	28	918	99	19	252	96	1	62	94	0	2	100	1	12	75
3 Aug	3	3,715	100	3	921	100	11	263	100	3	65	98	0	2	100	3	15	94
4 Aug	-1[h]	3,714	100	2	923	100	0	263	100	1	66	100	0	2	100	1	16	100

[a] Interpolated counts from 0000 to 0800 hours.

[b] Interpolated counts from 0300 to 0800 hours.

[c] Interpolated counts from 0000 to 1000, 1500 to 1600, and 2000 to 2359 hours.

[d] Interpolated counts from 0000 to 1000 and 1700 to 2330 hours.

[e] Interpolated counts from 0130 to 1300 hours.

[f] Interpolated counts from 2000 to 2359 hours.

[g] Interpolated counts from 0000 to 0830 hours.

[h] One Chinook salmon passed downstream through the fish passage chute.

APPENDIX C: DAILY RIVER STAGE AND TEMPERATURE FOR ANCHOR RIVER, 2015

Appendix C1.–Daily river stage average for the south fork Anchor River, 2015.

	Daily river stage average (cm) [a]					
Day	April	May	Jun	Jul	Aug	Sep
1	73.8	52.0	30.4	22.2	25.6	14.9
2	64.1	50.2	30.2	22.1	28.3	14.8
3	47.8	48.3	30.3	21.4	22.8	19.8
4	34.7	44.9	30.8	20.9	20.3	33.3
5	27.9	47.0	33.5	21.6	18.9	30.5
6	26.1	43.7	36.6	21.5	18.2	24.8
7	90.1	42.7	41.6	21.3	17.5	29.8
8	54.8	46.8	45.8	20.6	17.0	28.0
9	44.9	54.6	38.2	20.5	17.9	31.9
10	42.7	50.6	36.3	19.9	19.3	28.9
11	42.8	44.1	39.5	19.5	17.8	26.9
12	37.0	43.2	35.1	19.6	17.0	30.0
13	29.2	40.9	31.9	25.8	16.4	29.6
14	28.5	44.0	30.0	26.1	16.0	43.7
15	28.9	44.0	28.7	23.9	17.4	44.6
16	38.0	40.0	27.3	22.9	21.7	35.4
17	42.0	38.1	26.2	24.5	27.2	32.6
18	60.4	36.8	25.2	22.6	28.9	38.4
19	98.1	36.2	24.4	20.6	23.4	46.9
20	68.1	35.6	24.1	19.2	20.4	41.4
21	47.0	34.8	24.6	18.3	19.0	36.8
22	42.2	34.3	24.7	18.9	18.7	34.1
23	43.3	36.0	23.5	26.6	17.4	30.6
24	42.8	36.4	23.1	24.0	16.5	27.9
25	44.7	35.2	22.6	20.6	16.0	26.4
26	50.4	34.6	22.3	22.0	16.1	26.3
27	47.4	33.2	22.7	21.7	16.5	30.1
28	60.2	31.9	22.8	21.5	15.4	44.9
29	61.7	31.2	23.2	22.2	15.1	78.2
30	66.3	30.8	22.8	41.6	15.6	78.7
31		30.5		32.4	15.3	

Source: USGS National Water Information System, retrieved on 2017-01-22 13:22:30 EDT (nadww01) from http://waterdata.usgs.gov/ak/nwis/uv/?site_no=15239900&PARAmeter_cd=00065,00060

[a] Stage data were collected at gauge station USGS 15239900, located approximately 11.4 RKM on the south fork, Anchor River.

Appendix C2.–Daily river temperature average (°C), Anchor River, 2015.

	Daily temperature average (°C)											
	May			June			July			August		
Day	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
1	4.4	2.3	6.8	13.5	11.1	15.9	13.1	10.2	16.2	15.0	12.1	18.2
2	4.6	2.7	6.1	13.7	11.8	16.0	13.5	12.0	15.4	15.1	12.6	17.7
3	4.8	2.9	6.9	12.0	10.7	13.4	14.6	11.0	18.7	15.1	12.1	18.2
4	5.9	3.3	8.7	10.1	9.3	11.2	14.2	13.6	16.2	15.1	13.0	17.3
5	5.5	4.8	7.2	9.5	8.3	11.0	13.9	12.4	15.5	15.4	13.3	18.0
6	4.5	4.0	5.2	9.0	8.1	9.8	13.3	12.2	14.5	15.0	12.2	17.7
7	4.9	3.5	6.6	8.9	7.0	11.1	14.3	12.4	17.2	15.8	13.0	18.7
8	5.4	4.4	6.5	8.9	7.3	10.3	13.9	12.8	15.0	14.8	13.6	16.3
9	6.1	4.8	7.8	8.5	7.7	9.2	14.2	11.9	17.2	14.4	13.5	15.3
10	5.3	3.9	6.4	9.9	7.7	12.9	15.5	13.0	18.5	14.4	12.4	17.1
11	5.6	4.1	7.2	10.5	8.8	12.6	15.5	12.0	19.2	14.1	11.4	17.0
12	6.5	3.7	9.8	11.4	8.8	14.6	14.1	12.8	16.4	14.2	11.3	17.0
13	6.2	4.7	7.6	12.9	9.7	16.4	12.6	12.0	13.5	13.9	11.5	16.5
14	5.4	5.1	6.2	14.1	10.8	17.7	12.4	10.8	14.5	13.8	11.5	16.2
15	4.7	4.4	5.1	15.3	11.9	18.8	12.6	11.2	14.0	13.0	12.5	14.5
16	6.1	3.5	9.4	15.9	12.8	19.0	11.9	11.3	12.7	12.5	11.6	13.3
17	7.2	6.0	8.2	16.4	13.4	19.6	12.3	10.8	14.2	12.2	11.7	12.8
18	7.6	5.3	10.1	16.1	13.2	19.1	13.7	11.2	16.9	13.0	11.1	15.4
19	8.0	6.7	9.7	15.7	13.2	18.2	14.8	11.7	18.3	13.1	10.8	15.6
20	7.3	6.3	8.2	14.2	13.5	15.6	15.3	12.1	18.8	12.8	10.4	15.0
21	7.7	6.4	9.7	12.9	12.0	13.9	14.4	12.5	16.4	13.0	11.2	15.0
22	8.8	6.5	11.2	14.2	11.3	17.9	13.3	12.6	14.9	12.4	9.9	15.0
23	8.9	8.1	9.8	14.0	11.2	16.8	13.7	11.6	16.3	12.5	10.2	14.8
24	7.5	6.4	8.5	15.2	12.7	18.4	14.7	11.9	18.0	12.0	9.6	14.4
25	7.8	6.6	8.9	14.8	13.0	17.0	14.4	13.1	15.6	13.5	11.7	16.1
26	9.4	7.0	12.6	13.8	12.6	15.1	14.1	12.4	16.0	13.2	12.0	14.8
27	9.6	6.8	12.4	12.8	11.7	13.8	14.9	12.2	18.1	13.4	11.8	15.8
28	10.4	7.7	13.4	12.0	11.2	12.8	15.3	13.3	17.8	11.6	9.3	13.9
29	11.5	8.3	15.0	11.9	10.8	12.9	15.0	13.9	16.6	10.0	8.9	11.4
30	12.5	9.4	15.9	12.3	10.2	14.3	13.4	11.5	14.9	9.7	7.9	12.3
31	13.2	10.5	16.2				13.6	10.8	16.7	9.7	7.7	12.2

Source: Temperature data collected by Sue Mauger of Cook Inletkeeper 0.1 RKM downstream of the south fork resistance board weir.