Fishery Manuscript No. 24-01

Review of Salmon Escapement Goals in Upper Cook Inlet, Alaska, 2023

by

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January 2024

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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January 2024

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This document should be cited as follows:
McKinley, T. R., J. W. Erickson, T. Eskelin, N. DeCovich, and H. Hamazaki. 2024. Review of salmon escapement goals in Upper Cook Inlet, Alaska, 2023. Alaska Department of Fish and Game, Fishery Manuscript No. 24-01, Anchorage.

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TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

Page

LIST OF TABLES

Table **Page**

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The Alaska Department of Fish and Game interdivisional escapement goal review committee reviewed 28 Pacific salmon (*Oncorhynchus* spp.) escapement goals for the major river systems in Upper Cook Inlet. Escapement goals were reviewed for 13 Chinook salmon, 1 chum salmon, 4 coho salmon, and 9 sockeye salmon stocks. The committee findings to the Commercial Fisheries and Sport Fish division directors are that the Campbell Creek Chinook salmon goal be updated and that all other escapement goals remain the same.

Keywords: Upper Cook Inlet, escapement goal, biological escapement goal, BEG, sustainable escapement goal, SEG, sockeye salmon, *Oncorhynchus nerka*, Chinook salmon, *O. tshawytscha*, coho salmon, *O. kisutch*, chum salmon, *O. keta*, Alaska Board of Fisheries

INTRODUCTION

Upper Cook Inlet (UCI), Alaska, supports 5 species of Pacific salmon (*Oncorhynchus* spp.). The UCI commercial fisheries management unit consists of that portion of Cook Inlet north of Anchor Point and is divided into Central and Northern Districts (Figure 1). The Central District is approximately 120 km (75 miles) long, averages 50 km (32 miles) in width, and is further divided into 6 subdistricts. The Northern District is 80 km (50 miles) long, averages 32 km (20 miles) in width, and is divided into 2 subdistricts. Commercial salmon fisheries primarily target sockeye salmon (*O. nerka*) with secondary catches of Chinook (*O. tshawytscha*), coho (*O. kisutch*), chum (*O. keta*), and pink (*O. gorbuscha*) salmon. Sport fishery management is divided into Northern Kenai Peninsula, Northern Cook Inlet, and Anchorage management areas. Upper Cook Inlet provides subsistence, commercial, personal use, and sport fishing opportunities for all 5 species of Pacific salmon.

The Alaska Department of Fish and Game (ADF&G) reviews escapement goals for UCI salmon stocks on a schedule corresponding to the Alaska Board of Fisheries (BOF) 3-year cycle for considering area regulatory proposals. Management of these stocks is based on achieving escapements for each system within a specific escapement goal range or above a lower bound. Escapement refers to the annual estimated number of fish in the spawning salmon stock and is affected by a variety of factors including exploitation, predation, disease, and physical and biological changes in the environment.

This report describes UCI salmon escapement goals reviewed in 2022 and presents information from the previous 3 years in the context of these goals. The purpose of this report is to document the review of UCI salmon escapement goals and the escapement goal review committee's (Table 1) findings to the Commercial Fisheries and Sport Fish division directors. Many salmon escapement goals in UCI have been set and evaluated at regular intervals since statehood (Fried 1994). Due to the thoroughness of previous analyses by Bue and Hasbrouck,[1] Clark et al. (2007), Hasbrouck and Edmundson (2007), Fair et al. (2007, 2010, 2013), Erickson et al. (2017), and McKinley et al. (2020), this review reanalyzed only those goals that could potentially result in a substantially different escapement goal, or goals that should be eliminated or established.

ADF&G reviews escapement goals based on the *Policy for the Management of Sustainable Salmon Fisheries* (SSFP; 5 AAC 39.222) and the *Policy for Statewide Salmon Escapement Goals* (EGP; 5 AAC 39.223). The BOF adopted these policies into regulation during the 2000/2001 Upper Cook

[1] Bue, B. G. and J. J. Hasbrouck. *Unpublished.* Escapement goal review of salmon stocks of Upper Cook Inlet. Alaska Department of Fish and Game, Report to the Alaska Board of Fisheries, November 2001 (and February 2002), Anchorage. Subsequently referred to as Bue and Hasbrouck (*Unpublished*).

Inlet BOF cycle meeting to ensure that the state's salmon stocks are conserved, managed, and developed using the sustained yield principle. For this review, there are 2 important terms defined in the SSFP:

> 5 AAC 39.222 (f)(3) "*biological escapement goal*" or "BEG" means the escapement that provides the greatest potential for maximum sustained yield; the BEG will be the primary management objective for the escapement unless an optimal escapement or inriver run goal has been adopted; the BEG will be developed from the best available biological information, and should be scientifically defensible on the basis of available biological information; the BEG will be determined by ADF&G and will be expressed as a range based on factors such as salmon stock productivity and data uncertainty; ADF&G will seek to maintain evenly distributed salmon escapements within the bounds of a BEG.

> 5 AAC 39.222 (f)(36) "*sustainable escapement goal*" or "SEG" means a level of escapement, indicated by an index or an escapement estimate, that is known to provide for sustained yield over a 5- to 10-year period, used in situations where a BEG cannot be estimated or managed for; the SEG is the primary management objective for the escapement, unless an optimal escapement or inriver run goal has been adopted by the BOF; the SEG will be developed from the best available biological information and should be scientifically defensible on the basis of that information; the SEG will be determined by ADF&G and will take into account data uncertainty and will be stated as either an "SEG range" or "lower bound SEG"; ADF&G will seek to maintain escapements within the bounds of the SEG range or above the level of a lower bound SEG.

During the 2022 review, the committee evaluated escapement goals for Chinook, chum, coho, and sockeye salmon stocks:

- Chinook salmon: Alexander, Campbell, and Crooked Creeks; Deshka, Yentna, Eastside Susitna, Talkeetna, Chuitna, Chulitna, Kenai (early- and late-run), Little Susitna (weir- and aerial-based), and Theodore Rivers
- Chum salmon: Clearwater Creek
- Coho salmon: Fish and Jim Creeks; and Deshka and Little Susitna Rivers
- Sockeye salmon: Fish and Packers Creeks; Chelatna, Judd, and Larson Lakes; and Kasilof, Kenai, and Russian (early- and late-run) Rivers

There are no pink salmon stocks in UCI that have escapement goals.

In March 2022, ADF&G established an escapement goal review committee, consisting of Division of Commercial Fisheries and Division of Sport Fish personnel (Table 1). The committee formally met several times between March 2022 and March 2023 to review escapement goals and develop findings. The committee recommended the appropriate type of escapement goal (BEG or SEG) and provided an analysis for escapement goals. All committee recommendations are reviewed by ADF&G regional and headquarters staff prior to adoption as escapement goals per the SSFP and EGP.

OBJECTIVES

Objectives of the 2022 review were as follows:

1) Review existing goals to determine whether they were still appropriate given the following:

a) new data collected since the last review
b) current assessment techniques
c) current management practices

2) Review the methods used to establish the existing goals to determine whether alternative methods should be investigated.
3) Consider any new stocks for which there may be sufficient data to develop a goal.
4) Present findings on new goals if appropriate and eliminate existing goals that are no longer appropriate.

METHODS

Available escapement, harvest, and age data for each stock were compiled from research reports, management reports, and historical databases. The committee determined the appropriate goal type (BEG or SEG) for each salmon stock with an existing goal and considered other monitored exploited stocks without an existing goal. The committee evaluated the type, quality, and quantity of data for each stock to determine the appropriate type of escapement goal as defined in regulation. Escapement goals for salmon are often based on stock-recruitment relationships (e.g., Beverton and Holt 1957; Ricker 1954) representing the productivity of the stock and estimated carrying capacity. In this review, the information sources for stock-recruitment models are spawner-return data. However, specific methods to determine escapement goals vary in their technical complexity and are largely determined by the quality and quantity of the available data. Thus, escapement goals are evaluated and revised over time as improved methods of assessment and goal setting are developed, and when new information about the stock becomes available.

DATA AVAILABLE TO DEFINE ESCAPEMENT GOALS

For this review, only those analyses that could potentially result in a substantially different escapement goal were updated. Except Kenai River Chinook salmon, recent return data through 2022 were used for all stocks in this review. Kenai River Chinook salmon data were updated through 2021 because the analysis was completed before the 2022 data was finalized and available. Estimates or indices of salmon escapement were obtained with a variety of methods such as foot and aerial surveys, mark–recapture experiments, weir counts, and hydroacoustics (sonar). Weirs tend to be the most reliable assessment tool, providing a count of the total number of fish that passed some point in a river or stream. Depending on site characteristics, mark–recapture and sonar projects typically provide the next most reliable abundance estimates. Differences in methods among years can affect the comparability and reliability of data. In some systems, harvests occur upstream of the counting location; in these systems, estimates of harvest and sometimes catch-and-release mortality are subtracted to estimate escapement. Data available for all UCI Chinook, chum, coho, and sockeye salmon stocks with escapement goals are found in Appendices A–D.

Chinook Salmon

Susitna River

There are 15 tributaries in the Susitna River drainage in which adult Chinook salmon have been monitored annually with single aerial surveys, multiple aerial surveys, or weirs. In 2019, a comprehensive analysis of all relevant stock assessment data was conducted in the context of an integrated state-space model of historical run abundance and stock dynamics (Reimer and

DeCovich 2020). For this review, the model used to develop these goals was updated with data available through 2022. Details of the type of abundance data typically collected for each of the 4 Susitna River stocks are given in their respective sections below, and the comparison of model outputs between 2019 and 2022 is provided in the results section of this report. Details on available data on age, marine harvest, and inriver sport harvest are found in (Reimer and DeCovich 2020).

Deshka River Stock

Prior to 1995, the Deshka River Chinook salmon escapement was monitored annually by a single aerial survey conducted after the sport fishery had taken place. Due to the popularity of the fishery and declining escapement indices in the early and mid-1990s, a weir was installed in 1995. The weir has continued to provide accurate inseason data about escapement as well as the biological composition of the escapement (Appendix A2; Lescanec 2017). Aerial surveys were also conducted in some years.

Eastside Susitna Stock

Aerial survey data are available for 6 spawning aggregations within the Eastside Susitna stock: Goose, Little Willow, Willow, Montana, and Sheep Creeks, and the North Fork of the Kashwitna River (Appendix A3). Goose and Sheep Creeks are semi-glacial and are often too cloudy to count; Goose Creek was last successfully surveyed in 2020 and Sheep Creek in 2018. One of the strengths of the model used is the ability to account for missing data (Reimer and DeCovich 2020). Surveyed areas cover the known major spawning areas for this stock.

For the escapement goal analysis, Willow Creek survey counts were combined with Deception Creek (a tributary of Willow Creek) counts. Chinook salmon that spawn in the mainstem of Willow Creek are predominantly wild fish, whereas runs to Deception Creek include hatchery-reared fish. Deception Creek represents the only hatchery component to the Susitna River drainage Chinook salmon runs. This program, however, has been discontinued; the last stocking occurred in 2018. The majority of the returns from the final stocking would have been observed with the conclusion of the 2023 escapement (5-year-old fish).

Talkeetna River Stock

Aerial survey data are available for 2 spawning aggregations (Clear [Chunilna] and Prairie Creeks) in the Talkeetna River stock (Appendix A4). Survey conditions are often favorable for these 2 creeks and they represent the major spawning areas for Chinook salmon in the Talkeetna River drainage. One other tributary (Iron Creek) has been shown to support some spawning habitat (DeCovich et al. 2020) but this is a glacial system and, therefore, not flown during annual survey flights.

Yentna River Stock

Aerial survey data are available for 4 spawning aggregations within the Yentna River stock: Lake, Cache, and Peters Creeks and the Talachulitna River (Appendix A5). Numerous small spawning populations, which together are a significant portion of the total, are too diffuse to be enumerated by aerial survey. Cache Creek has substantial mining activity and complete counts are sometimes not available because of cloudy water from holding ponds draining into the main channel.

Anchorage Area Stocks

Campbell Creek

Escapements for Chinook salmon stocks in the Anchorage area are conducted via foot surveys (Appendix A1). Counts of Chinook salmon from these surveys are used as an index of abundance in Bird, Campbell, Rabbit, and Ship Creeks, as well as Eagle River. Campbell Creek is the only Chinook salmon stock in this area that has an escapement goal. No age, sex, or length data are collected, and the existing fishery is a very small (unassessed) harvest, youth-only fishery (Baumer and Blain-Roth 2020).

Northern Kenai Peninsula Stocks

Kenai River Early- and Late-Runs

The Kenai River has 2 Chinook salmon stocks, classified as early- and late-runs, that are assessed using hydroacoustics (Appendix A12, Appendix A13; Key et al. 2023). An associated gillnetting program is used to sample Chinook salmon to estimate age, sex, and size composition (Perschbacher 2022). A sampling program of the catch in the adjacent commercial Eastside set gillnet commercial fishery has generated stock-specific estimates of harvest since 2010 (Eskelin and Barclay 2022). The current large fish SEGs for Kenai River early- and late-run Chinook salmon (2,800–5,600 and 13,500–27,000, respectively) were adopted in 2017. The 2017 escapement goals were assessed using 1986–2015 abundances, harvests, and age data for Chinook salmon 75 cm mid eye to tail fork length (METF) and longer (Fleischman and Reimer 2017). There are 6 years of additional data since the 1986–2015 analysis, so an updated stock-recruit analysis was warranted.

Other Chinook salmon Stocks

Escapements for most Chinook salmon stocks assessed in West Cook Inlet and Knik Arm have been monitored annually since the late 1970s by single aerial or foot surveys. Such surveys provide an index of escapement. The indices provide information about the relative levels of escapement for the Chuitna (Appendix A8) and Theodore (Appendix A9) Rivers.

Aerial surveys via helicopter have been conducted for Chinook salmon on the Little Susitna River in most years since 1983. Additionally, a weir for counting Chinook salmon was operated in 1988, 1994, 1995, and 2014–2022 (Appendix A10).

A weir is also operated annually on Crooked Creek on the Kenai Peninsula to count and sample Chinook salmon (Appendix A11; Lipka et al. 2020).

Chum Salmon

Peak aerial fixed-wing surveys are used to index escapement of chum salmon in Clearwater Creek, the only chum salmon stock in UCI that has an escapement goal (SEG; Tobias et al. 2013). Aerial survey data are available from 1971 to 2022 (Appendix B1), except 1972 and 1988, when escapement was not monitored.

Coho Salmon

Coho salmon escapements have been monitored with a single foot survey on McRoberts Creek (a tributary of Jim Creek) from 1985 to 2022 (Appendix C3). Weirs are operated on Fish Creek (Appendix C2), and the Little Susitna (Appendix C4) and Deshka (Appendix C1) Rivers to assess escapement for each stock (Oslund et al. 2020). On the Little Susitna River, estimates of harvest from the ADF&G statewide harvest survey (SWHS)[2] have been used in conjunction with weir counts to estimate escapement.

Sockeye Salmon

Kasilof and Kenai River sockeye salmon escapement goals are primarily based on data from sonar projects, harvest estimates, and age data. Sonar was used to estimate sockeye salmon abundance passing specific locations in these rivers because the size of the channels and high glacial turbidity precludes visual enumeration (Glick and Willette 2018). In clearwater systems of UCI that are assessed, fish are counted with weirs or video cameras. Weirs are used to count and sample adult sockeye salmon escapements in the Susitna River drainage (Chelatna, Judd, and Larson Lakes; Fair et al. 2013), Russian River (Lipka et al. 2020), and Fish Creek (Oslund et al. 2020). Packers Creek escapement has been counted with both video cameras and weirs. From 2009 to 2022, a video camera was operated at Packers Creek to estimate sockeye salmon escapement (Shields and Frothingham 2018), although equipment complications prevented complete counts in 2010–2013 and 2016–2017.

The Kasilof River sockeye salmon escapement goal is based on reconstructions of the total return by brood year and the total number of sockeye salmon spawning (wild and hatchery) within the watershed. Hatchery-reared sockeye salmon juveniles were stocked annually in the Kasilof River drainage from 1976 to 2004; returning hatchery adults were not removed from Kasilof River sockeye salmon total return estimates. The last adults returned in 2010 from the last Tustumena Lake fry release (Shields and Dupuis 2013). Escapement is estimated by subtracting the number of sockeye salmon harvested in sport fisheries upstream of the sonar site and, when applicable, the number of sockeye salmon removed for hatchery broodstock from the sockeye salmon sonar count. The sonar was operated near the Tustumena Lake outlet from 1968 to 1982, and immediately upstream of the Sterling Highway bridge at river kilometer (RKM) 12.1 since 1983.

The current Kenai River late-run sockeye salmon escapement goal (750,00–1,300,0000) is based on reconstructions of the total return by brood year and the number of sockeye salmon spawning within the watershed. Prior to the 2016 review (Erickson et al. 2017), the escapement was estimated by subtracting the number of sockeye salmon harvested in sport fisheries upstream of the sonar site and the number of hatchery-produced sockeye salmon passing the Hidden Lake weir from the sockeye salmon sonar count (RKM 30.9; Tobias et al. 2013). For this review and the prior review, the number of hatchery-produced sockeye salmon passing the Hidden Lake weir was not subtracted from the sockeye salmon sonar count because hatchery-produced Hidden Lake fish were not enumerated in the commercial, sport, or personal use harvests, and their contribution to Kenai River sockeye salmon sonar estimates was very small (1981–2014 average: 1.5%). The number of sockeye salmon harvested in sport fisheries upstream of the sonar site is estimated annually using the SWHS and creel surveys (1994, 1995) conducted during the fishery (Schwager-King 1995; King 1997).

Commercial catch statistics are compiled from ADF&G fish ticket information. The majority of sockeye salmon returning to UCI are caught in mixed-stock fisheries (Shields and Dupuis 2017). Prior to 2005, a weighted age composition apportionment model estimated stock-specific harvests of sockeye salmon in commercial gillnet fisheries (Tobias and Tarbox 1999). This method assumes

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

age-specific exploitation rates are equal among stocks in the gillnet fishery (Bernard 1983) and is dependent upon accurate and precise escapement estimates for all contributing stocks. Since 2006, the primary means for estimating stock-specific sockeye salmon harvests has been the use of genetic markers (Habicht et al. 2007; Barclay et al. 2010; Eskelin and Barclay 2023). Age composition of the sockeye salmon harvest is estimated annually using a stratified systematic sampling design (Tobias et al. 2013). Estimates of sport harvest originate from the SWHS conducted annually by the Division of Sport Fish.

Dual frequency identification sonar (DIDSON)-adjusted historical escapement estimates for Kasilof and Kenai River sockeye salmon were used to construct brood tables for these 2 stocks using the weighted age composition apportionment model (Tobias and Tarbox 1999) beginning with brood year 1968. Genetic stock-specific harvest estimates (2006–2021) were incorporated into the brood tables (Barclay et al. 2010; Eskelin and Barclay 2023) by assuming that the age composition of stock-specific harvests was the same as stock-specific escapements (i.e., no age-dependent gear selectivity).

ESCAPEMENT GOAL DEVELOPMENT

Stock-Recruitment Analyses

When possible, we used a Ricker (1954) stock–recruitment (S–R) model to estimate escapement that maximizes sustainable yields to develop spawning escapement goals. Hilborn and Walters (1992), Quinn and Deriso (1999), and the Chinook Technical Committee of the Pacific Salmon Commission (CTC 1999) provide clear descriptions of the Ricker model and diagnostics to assess model fit.

Evaluation of Susitna River Chinook Salmon Escapement Goals

Reference Points and Optimal Yield Profiles

A state-space model was developed to generate annual abundance estimates for 4 Susitna River Chinook salmon stocks and fit S–R relationships for use in developing escapement goal findings based on estimates of maximum sustainable yield (MSY; Reimer and DeCovich 2020). Model fitting involved finding parameter values that could have plausibly resulted in the observed data. Optimum yield profiles (OYP) were used to quantify the yield (of prospective escapement goals), taking into consideration the uncertainty about the true abundance and productivity of the stock.

Escapement Goals Standardized to S_{MSY}

To compare escapement goals from this study to goals for other Alaska stocks, we divided the lower and upper bounds of 21 published goals for Alaska Chinook salmon (Munro and Brenner 2023) by point estimates of the number of spawners needed to generate maximum sustainable yield (S_{MSY}) associated with each stock and escapement goal range, thereby expressing all goal ranges in terms of multiples of S_{MSY}. These values were used to provide a graphical comparison of the goals for each of the 4 Susitna River Chinook salmon stock goals with the existing goals for 21 other Alaskan Chinook salmon stocks (e.g., see tick marks on Figure 2).

Evaluation of Kenai River Early- and Late-run Chinook Salmon Escapement Goals

Reference Points and Optimal Yield Profiles

A state-space model was fit to 1986–2021 abundance, harvest, and age data for early- and late-run Kenai River Chinook salmon 75 cm METF and longer. Estimates of population parameters from the state-space model took the measurement errors in escapements *S* and recruitments *R* into account. The individual data pairs of *S* and *R* were weighted differentially, depending on the certainty with which the individual values of *S* and *R* were known. Stock–recruitment relationships were explored for use in escapement goal recommendations based on estimates of MSY. Optimal yield profiles were used to quantify the yield of escapement goal ranges, taking into consideration the uncertainty about the true abundance and productivity of each stock. Methods used in the updated analysis were the same as in Fleischman and Reimer (2017) except that in the updated (1986–2021) model, to reconstruct the early runs, late-run Chinook salmon abundance was not included as an index of early-run abundance, although it was included in the previous 1986–2015 model.

Escapement Goals Standardized to S_{MSY}

To compare escapement goals from this study to goals for other Alaska stocks, we divided the lower and upper bounds of 21 published goals for Alaska Chinook salmon (Munro and Volk 2016) by point estimates of S_{MSY} associated with each goal range, thereby expressing all goal ranges in terms of multiples of S_{MSY}.

Evaluation of Kenai and Kasilof Rivers Sockeye Salmon Escapement Goals

For the Kasilof and Kenai River sockeye salmon stocks, we tested all S–R models for serial correlation of residuals and corrected them when necessary. We applied the classic Ricker, Autoregressive Ricker, and Beverton-Holt models S–R models (Hasbrouck et al. 2022) to examine stock productivity and evaluate the existing escapement goal for Kenai River sockeye salmon.

For Kasilof River sockeye salmon, we updated the time series through 2015 brood year and compared the parameter estimates of the Ricker, Autoregressive Ricker, and Beverton-Holt models to those from the previous analysis (brood years 1968–2012). Similarly, the Kenai River sockeye salmon brood table was extended through the 2015 brood year and the parameter estimates for the 3 models were compared to the parameter estimates for brood years 1979–2012 (Hasbrouck et al. 2022).

<u>Classic Ricker model</u>

$$R_t = S_t \ exp\left[\alpha - \beta S_t\right] + \varepsilon_t \tag{1}$$

where R_t is number of recruits, S_t is number of spawners, α is a density-independent parameter, β is a density-dependent parameter, ε indicates process error, and *t* indicates the brood year. The Ricker model (Ricker 1954) assumes over-compensative density-dependent effects that produce lower recruits after a certain number of spawners has been exceeded.

<u>Autoregressive Ricker model</u>

$$R_t = S_t \ exp\left[\alpha - \beta S_t\right] + \varphi \varepsilon_{t-1} \tag{2}$$

where φ is a lag-1 autoregressive parameter. In this autoregressive Ricker model, process errors are not independent, but serially dependent on process error from the previous brood year.

Beverton–Holt model

$$R_t = \frac{\alpha S_t}{1+\beta S_t} + \varepsilon_t \tag{3}$$

The Beverton–Holt model (Beverton and Holt 1957) assumes compensative density-dependence that would produce constant recruits after a certain number of spawners has been exceeded.

In all 3 models above, log-normal error structure was assumed. All models were fitted using Bayesian modeling software.[3] Data were transformed so that all the estimated model parameters would fall into a similar range between zero and 10. Model parameter priors were set to a uniform distribution of range between zero and 10. The starting value of the model was randomly selected by the model default. The model was run for 100,000 iterations, of which the first 20,000 were thrown away (i.e., burned in), and samples were taken every 10th iteration (i.e., thinning by 10). For selection of the best model, Deviance Information Criterion (DIC) was calculated. DIC is a Bayesian equivalent of Akaike's Information Criterion (AIC; Akaike 1973). As a rule of thumb, a difference of DIC less than 5 between models is not considered definitive for model selection (Carlin and Louis 2009).

The Kasilof River escapement goal was developed from the Ricker Autoregressive model and the Kenai River escapement goal was developed from the classic Ricker model. For this analysis, we examined the effect of 3 additional brood years for parameterization and model fit.

Percentile Approach

Many salmon stocks in UCI currently have SEGs that were developed with the Percentile Approach (Clark et al. 2014). This approach is used to establish SEGs for stocks that lack sufficient stock productivity information. For the Percentile Approach, the percentiles of observed escapements (whether estimates or indices) and consideration for contrast in the escapement data, exploitation of the stock, as well as measurement error in the assessment, are used to choose escapement goal ranges. Percentile ranking is the percent of all observed escapement values that fall below a particular value. To calculate percentiles, escapement data are ranked from the smallest to the largest value, with the smallest value set as the 0th percentile (i.e., none of the escapement values are less than the smallest). The percentiles of all remaining escapement values are cumulative, or a summation of $1/(n-1)$, where n is the number of escapement values. Contrast in the escapement data is the maximum observed escapement divided by the minimum observed escapement. Clark et al. (2014) provided a comprehensive evaluation of the Percentile Approach and recommended the following 3 tiers for stocks with low to moderate (<0.40) average harvest rates:

- Tier 1 – high contrast (>8) and high measurement error (aerial and foot surveys) with low to moderate average harvest rates (<0.40), the 20th to 60th percentiles
- Tier 2 – high contrast (>8) and low measurement error (weirs, towers) with low to moderate average harvest rates (<0.40), the 15th to 65th percentiles
- Tier 3 – low contrast (≤8) with low to moderate average harvest rates (<0.40), the 5th to 65th percentiles

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[3] Hamazaki. T. 2023. Pacific salmon escapement goal analyses: https://hamachan.shinyapps.io/Spawner_Recruit_Bayes/.

They also recommended not using the Percentile Approach for stocks with average harvest rates ≥0.40 or those that have both very low contrast (≤4) and high measurement error. For a more comprehensive review and analysis of the Percentile Approach, see Clark et al. (2014).

Risk Analysis

Prior to this review, Campbell Creek Chinook salmon was the only goal based on the risk analysis method (Bernard et al. 2009). The risk analysis method is used to develop lower bound SEGs for stocks that are passively managed and have coincidental (nondirected) harvests.

RESULTS AND DISCUSSION

The escapement goal committee reviewed 28 salmon escapement goals for the UCI management area, and reported findings to the Commercial Fisheries and Sport Fish division directors of a change to 1 goal (Campbell Creek Chinook salmon; Table 2). Munro and Brenner (2023) provide a comprehensive review of goal performance from the 2014 to 2022 escapements (see Table 3 for summary of current escapement goals and escapements from 2019 through 2022).

CHINOOK SALMON

Susitna River drainage

Deshka River

The estimate of S_{MSY} for the Deshka River stock increased by approximately 1,000 fish (8%) after adding data from 2019 through 2022, which has caused the optimum yield profile (OYP) probabilities to be roughly symmetric for the existing goal range (Table 4, Figure 2). Given the inclusion of 3 additional years of data and the resulting OYP, there is an 80% probability of achieving at least 80% of MSY at the lower end of the goal (versus 90% from the 2020 analysis; McKinley et al. 2020) and an 85% probability of achieving at least 80% of MSY at the upper end of the current escapement goal (versus 75% from the 2020 analysis). These probabilities are within ranges typically acceptable for escapement goal ranges. Also, the process error associated with this analysis is very large and has increased since the initial 2020 escapement goal analysis; the increase in S_{MSY} is driven by the increased process error. Hence, no change to the goal of 9,000–18,000 fish is warranted (Table 2). Escapement data and total run estimates are provided in Appendix A2.

Eastside Susitna River

The estimate of S_{MSY} for the Eastside Susitna River stock increased by approximately 1,600 fish when adding data from 2019 through 2022. The OYP probabilities selected in setting this stock goal in 2020 were extremely conservative and remain so (Table 4, Figure 3). Given the inclusion of 3 additional years of data and the resulting OYP, there is a 91% probability of achieving at least 80% of MSY at the lower end of the goal (versus 96% from the 2020 analysis; McKinley et al. 2020) and a 36% probability of achieving at least 80% of MSY at the upper end of the current SEG (versus 19% from the 2020 analysis). These probabilities are within ranges typically acceptable for escapement goal ranges. As with the results for the Deshka River stock, the process error associated with the results for this stock increased since the last board meeting, and again, are largely responsible for the increase in the estimate of S_{MSY}. Hence no change to the goal of 13,000–25,000 fish is warranted (Table 2). Aerial survey counts for 5 streams within this stock, total run, and escapements are provided in Appendix A3.

Talkeetna River

The estimates of S_{MSY} and the OYP for the Talkeetna River Chinook salmon stock are nearly unchanged from the 2020 estimates (Table 4, Figure 4; compare McKinley et al. 2020). Hence, no change to the goal of 9,000–17,500 fish is warranted (Table 2). Aerial survey counts for 2 streams within this stock, total run, and escapements are provided in Appendix A4.

Yentna River

The estimates of S_{MSY} and the OYP for the Yentna River Chinook salmon stock are nearly unchanged from the 2020 estimates (Table 4, Figure 5; compare McKinley et al. 2020). Hence, no change to the goal of 13,000–22,000 fish is warranted (Table 2). Aerial survey counts for 3 streams within this stock, total run, and escapements are provided in Appendix A5.

A new assessment project was added in 2022 that uses sonar technology to count Chinook salmon in Lake Creek. In 2022, passage estimates from this project were added to the model that estimates escapement to the Yentna River.

Anchorage Area

Campbell Creek

Foot survey data for the escapement in Campbell Creek have been collected sporadically since 1958. Data from 1982 to present were used for the escapement goal established in 2011 as survey methodology prior to 1982 was inconsistent.

In 1993, ADF&G established an escapement threshold of 250 Chinook salmon for Campbell Creek, prior to any legal harvests. In 2002, an SEG of 50–700 Chinook salmon was established. As part of the escapement goal review after the 2004 season, it was decided that because there was no fishery, the goal should be eliminated. However, at the January 2005 UCI BOF meeting, a youth-only fishery was created. The previous escapement goal was then reinstated prior to the 2008 season. In the 2011 UCI escapement goal review, a risk-based SEG of 380 Chinook salmon was established.

This review also used the survey data beginning in 1982 (1982–2022). An attempt was made to update the goal with the risk analysis (Bernard et al. 2009) used for developing the SEG in 2011(Fair et al. 2010); however, difficulties arose due to missing data, and possible autocorrelation that would require interpolation for the missing data. Hence, the Percentile Approach (developed after the 2011 goal was established; Clark et al. 2014) was used. Because this stock fits the Tier 1 percentile criteria (high contrast, high measurement error, low harvest rates), the 20th percentile was used and resulted in a lower bound SEG of 340 Chinook salmon.

Northern Kenai Peninsula

Kenai River Early- and Late-run

Plausible Ricker S–R relationships that could have generated the reconstructed data for early-run Chinook salmon 75 cm METF and longer are diverse (Figure 6: light lines), often deviating substantially from the median Ricker relationship (Figure 6: heavy dashed line). The early-run estimate of S_{MSY} (4,139, CV = 0.36; Table 5) in the updated 1986–2021 (data years) analysis is approximately 850 fish larger (26%) than the estimate of S_{MSY} (3,283) from the previous 1986–2015 analysis (Fleischman and Reimer 2017). The difference in S_{MSY} is driven by the removal from the model of late-run abundance as an index of early-run abundance. The updated OYP suggests approximately 84% and 75% probabilities of achieving at least 80% of *MSY* at the lower and upper bounds of the current SEG for the early run (2,800–5,600; Figure 8), a change from approximate 97% and 47% probabilities at the lower and upper bounds from the 1986–2015 analysis (Fleischman and Reimer 2017). Although the new analysis suggests the current SEG is less conservative than was thought based on the 1986–2015 analysis, the committee acknowledged the change was driven by early-run spawner–recruit pairs reconstructed from a single index of abundance. Given this uncertainty and that the current goal continues to provide high probabilities of maximizing sustained yield, the committee findings are for no change to the Kenai River early-run Chinook salmon SEG.

The estimate of S_{MSY} for late-run Chinook salmon 75 cm METF and longer from the updated 1986–2021 (data years) analysis is 18,392 (Table 5; Figure 7), which is similar to the estimate of S_{MSY} from the 1986–2015 analysis (18,477; Fleischman and Reimer 2017). The updated OYP suggests approximately 86% and 60% probabilities of achieving at least 80% of *MSY* at the lower and upper bounds of the current SEG (13,500–27,500; Figure 9). The updated analysis suggests the current goal continues to provide high probabilities of maximizing sustained yield therefore the committee findings are for no change to the Kenai River late-run Chinook salmon SEG.

SOCKEYE SALMON

Fish Creek

The current SEG (15,000–45,000) for Fish Creek sockeye salmon was established in 2017. For this review, the committee updated the escapement time series (Appendix D2) through 2022. The analysis excluded years with incomplete counts (2021 and 2022) and years influenced by hatchery production (1972–1978, 2012–2015). The Percentile Approach (Clark et al. 2014) was applied to the updated data set. The committee assumed the average harvest rates had remained consistent with the harvest rates (37%) reported in the previous analysis (McKinley et al. 2020). Because this stock fits the Tier 2 percentile criteria (high contrast, low measurement error, low to moderate harvest rates), the updated estimates for the 15th and 65th percentiles (15,630–57,000) were similar to the existing SEG range (15,000–45,000). The committee findings were for no change to the current goal.

For this review, the committee also attempted to conduct a stock–recruit analysis based on a preliminary brood table. The committee concluded the brood table had significant errors and inconsistencies that could not be addressed in a timely manner to properly conduct a stock–recruit analysis. The committee recommends a run-reconstruction be completed prior to the next review cycle so a stock–recruit analysis can be conducted. The run reconstruction will need to incorporate historical estimates of personal use, commercial, and sport harvest as well as hatchery production.

Kasilof River

ADF&G implemented the current BEG of 140,000–320,000 in 2020. Since 1968, Kasilof River sockeye salmon escapement has ranged from approximately 39,000 to 968,000 and return per spawner values ranged from approximately 0.72 to 8.36 (Appendix D4).

For this review, the committee updated the escapement time series and incorporated production data through 2022. The committee then examined the fit of 3 stock-recruit models to data from brood years 1968–2015 (i.e., all available spawner-return data). Updated point estimates of S_{MSY} from the 3 models ranged from a low of 228,000 for the Ricker Autoregressive model with a 1-year lag (AR1) to a high of 351,000 for the Beverton-Holt model (Table 6). The best fitting model based on smallest deviation information criteria (DIC) was the AR1 model (Table 6). The addition of 3 years of data did little to change the AR1 spawner recruit relationship (Figure 10). The committee findings are for no change to the BEG range of 140,000–320,000 fish.

Kenai River

ADF&G implemented the current SEG range of 750,000–1,300,000 in 2020. The goal is based on DIDSON–ARIS (adaptive resolution imaging sonar) estimates of inriver abundance subtracting inriver harvests above the sonar site. Over the past 55 years (1968–2012), Kenai River late-run sockeye salmon escapements ranged from approximately 73,000 to 2,027,000 and return per spawner estimates ranged from approximately 1.13 to 12.69.

Following the methods of Hasbrouck et al. (2022), the classic Ricker model with data from brood years 1979 through 2015 resulted in a S_{MSY} of 1,131,000 sockeye salmon, which is very similar to the estimates of Hasbrouck et al (2022) and a reanalysis of the 1979–2012 time series (Table 7). These results are consistent with those reported previously (Clark et al. 2007; Erickson et al. 2017). The addition of 3 years of data also did little to change the Ricker spawner–recruit relationship (Figure 11). Based on the updated analyses of 3 stock–recruit models, the committee findings are for no change to the SEG of 750,000–1,300,000 fish.

SUMMARY

The escapement goal committee reviewed the UCI salmon escapement goals with the findings to revise the SEG for Campbell Creek Chinook salmon. The committee findings are that all other goals for UCI salmon stocks remain *status quo* (Table 2). Through their respective time frames, data in the appendices were used in the review of escapement goals and development of escapement goals of UCI salmon stocks in 2001 (Bue and Hasbrouck *Unpublished*), 2004 (Clark et al. 2007; Hasbrouck and Edmundson 2007), 2007 (Fair et al. 2007), 2010 (Fair et al. 2010), 2013 (Fair et al. 2013), 2016 (Erickson et al. 2017), 2020 (McKinley et al. 2020), and in this review.

ACKNOWLEDGEMENTS

The authors wish to thank the members of the escapement goal committee and participants in the escapement goal review. We also recognize all the hard work both in the field and from the office that has gone into collecting the vast amount of data upon which these goals are based.

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TABLES

Table 1.–List of members on the Alaska Department of Fish and Game Upper Cook Inlet salmon escapement goal committee who assisted with the 2022/2023 escapement goal review.

Name	Position	Division affiliation
Escapement Goal Committee		
Robert Begich	Area Research Biologist	Sport Fish
Nick DeCovich	Area Research Biologist	Sport Fish
Jack Erickson	Regional Research Biologist	Commercial Fisheries
Tony Eskelin	Area Research Biologist	Sport Fish
Adam Reimer	Chief Fisheries Scientist	Sport Fish
Tim McKinley	Regional Research Biologist	Sport Fish
Andrew Munro	Fisheries Scientist	Commercial Fisheries
Bill Templin	Chief Fisheries Scientist	Commercial Fisheries
Other Participants		
Jay Baumer	Area Management Biologist/Regional Management Biologist	Sport Fish
Brittany Blain	Area Management Biologist	Sport Fish
Jason Dye	Regional Supervisor	Sport Fish
Rick Green	Special Assistant to the Commissioner	Commissioners Office
Hamachan Hamazaki	Regional Biometrician	Commercial Fisheries
Sam Ivey	Area Management Biologist	Sport Fish
Bert Lewis	Regional Supervisor	Commercial Fisheries
Colton Lipka	Area Management Biologist	Commercial Fisheries
Matt Miller	Regional Management Biologist	Sport Fish
Aaron Poetter	Regional Management Biologist	Commercial Fisheries
Adam St. Saviour	Area Research Biologist	Sport Fish
Tania Vincent	Research Biologist	Sport Fish

Table 2.–Summary of current escapement goals and recommended escapement goals for salmon stocks in Upper Cook Inlet, 2023.

	Current escapement goal			Recommended escapement goal							
System	Goal	Type	Year adopted	Range or lower bound	Type	Data	Action	Contrast	Harvest rate	Measurement error	Tier
Chinook Salmon											
Susitna River Drainage											
Yentna River	13,000–22,000	SEG	2020	13,000–22,000	SEG	SR model	No change	–	–	–	–
	16,000–22,000	OEG	2020								
Deshka River	9,000–18,000	BEG	2020	9,000–18,000	BEG	SR model	No change	–	–	–	–
Talkeetna River	9,000–17,500	SEG	2020	9,000–17,500	SEG	SR model	No change	–	–	–	–
Eastside Susitna R.	13,000–25,000	SEG	2020	13,000–25,000	SEG	SR model	No change	–	–	–	–
Chulitna River	1,200–2,900	SEG	2020	1,200–2,900	SEG	SAS	No change	13.5	<0.40	High	T1
Alexander Creek	1,900–3,700	SEG	2020	1,900–3,700	SEG	SAS	No change	6.1	<0.40	High	T3
West Cook Inlet and Knik Arm											
Chuitna River	1,000–1,500	SEG	2020	1,000–1,500	SEG	SAS	No change	17.2	<0.40	High	T1
Theodore River	500–1,000	SEG	2020	500–1,000	SEG	SAS	No change	123.3	<0.40	High	T1
Little Susitna R. weir[a]	2,100-4,300	SEG	2017	2,100–4,300	SEG	Weir	No change	3	<0.40	Low	T3
Little Susitna R. aerial[a]	700–1,500	SEG	2020	700–1,500	SEG	SAS	No change	6	<0.40	High	T3
Anchorage											
Campbell Creek	380	LB SEG	2011	340	LB SEG	SFS	Update	16.5	<0.40	High	T1
Northern Kenai Peninsula											
Crooked Creek	700–1,400	SEG	2020	700–1,400	SEG	Weir	No Change	3.6	<0.40	Low	T3
Kenai R. early-run	2,800–5,600 [b]	SEG	2017	2,800–5,600 [b]	SEG	Sonar		–	–	–	–
large fish	3,900–6,600 [b]	OEG	2017								
Kenai R. late-run	13,500–27,000 [b]	SEG	2017	13,500–27,000 [b]	SEG	Sonar	No change	–	–	–	–
large fish	15,000–30,000 [b]	OEG	2020								
Chum Salmon											
Clearwater Creek	3,500–8,000	SEG	2017	3,500–8,000	SEG	PAS	No change	28	0.26	High	T1
Coho Salmon											
Susitna River Drainage											
Deshka River	10,200–24,100	SEG	2017	10,200–24,100	SEG	Weir	No change	–	–	–	–
Knik Arm											
Fish Creek (Knik)	1,200–6,000	SEG	2020	1,200–6,000	SEG	Weir	No change	52.3	<0.40	Low	T2
Jim Creek	250–700	SEG	2020	250–700	SEG	SFS	No change	422.9	<0.40	High	T1
Little Susitna River[c]	9,200–17,700	SEG	2002	9,200–17,700	SEG	Weir	No change	15.9	<0.40	Low	T2

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Table 2.–Page 2 of 2.

System	Current escapement goal: Goal	Type	Year adopted	Recommended escapement goal: Range or lower bound	Type	Data	Action	Contrast	Harvest rate	Measurement error	Tier
Sockeye salmon											
Susitna River											
Chelatna Lake	20,000–45,000	SEG	2017	20,000–45,000	SEG	Weir	No change	4.8	0.407	Low	T3
Judd Lake	15,000–40,000	SEG	2017	15,000–40,000	SEG	Weir	No change	4.5	0.407	Low	T3
Larson Lake	15,000–35,000	SEG	2017	15,000–35,000	SEG	Weir	No change	6.4	0.407	Low	T3
Cook Inlet and Knik Arm											
Fish Creek	15,000–45,000	SEG	2017	15,000–45,000	SEG	Weir	No change	55.7	0.37	Low	T2
Packers Creek	15,000–30,000	SEG	2008	15,000–30,000	SEG	Weir	No change	17.8	Unknown	Low	[d]
Northern Kenai Peninsula											
Kasilof River	140,000–320,000 140,000–370,000	BEG OEG	2020 2020	140,000–320,000	BEG	Sonar	No change	–	–	–	–
Kenai River	750,000–1,300,000	SEG	2020	750,000–1,300,000	SEG	Sonar	No change	–	–	–	–
Russian River early-run	22,000–42,000	BEG	2011	22,000–42,000	BEG	Weir	No change	–	–	–	–
Russian River late-run	44,000–85,000	SEG	2020	44,000–85,000	SEG	Weir	No change	5.1	>0.40	Low	[d]

Note: SEG = sustainable escapement goal, BEG = biological escapement goal. PAS = peak aerial survey, SAS = single aerial survey, and SFS means single foot survey. SR model = stock-recruit model. Shaded cells indicate new recommendations. An en dash = not applicable.

[a] The Little Susitna Chinook stock has 2 escapement goals; the current aerial survey goal, and weir-based goal. The weir-based goal takes precedent unless water levels preclude a complete weir count, in which case the aerial survey goal would be used to assess whether escapements were sufficient.

[b] Fish 75 cm mid eye to tail fork (METF) or longer.

[c] Based on escapement (weir count minus harvest above weir).

[d] 25th and 75th percentiles were used.

Table 3.–Current escapement goals and escapements observed from 2019 through 2022 for Chinook, chum, coho, and sockeye salmon stocks of Upper Cook Inlet.

		Current escapement goal		Escapements[b]			
System	Escapement data[a]	Type (BEG, SEG)	Range	2019	2020	2021	2022
Chinook salmon							
Alexander Creek	SAS	SEG	1,900–3,700	1,297	596	288	NS
Campbell Creek	SFS	LB SEG	380	393	154	339[e]	423[e]
Chuitna River	SAS	SEG	1,000–1,500	2,115	869	806	NS
Chulitna River	SAS	SEG	1,200–2,900	2,765	845	1,535	NS
Crooked Creek	Weir	SEG	650–1,700	1,444	830	594	735
Deshka River	Weir	BEG	9,000–18,000	9,705	10,638	18,674	5,440
Eastside Susitna River	SR model	SEG	13,000–25,000	11,578	13,815	15,208	7,654
Kenai River early run	Sonar	SEG	2,800-5,600				
Kenai River early- run	Sonar	OEG	3,900–6,600	4,055	2.443	4,024	2,047
Kenai River late run	Sonar	SEG	13,500–27,000	11,709			
Kenai River late run	Sonar	OEG	15,000–30,000		11,854	12,238	13,911
Little Susitna River (aerial)	SAS	SEG	700–1,500	NS	558	889	NS
Little Susitna River (weir)	Weir	SEG	2,100-4,300	3,666	2,445	3,121	2,288
Talkeetna River	SR model	SEG	9,000–17,500	11,352	7,279	9,107	4,288
Theodore River	SAS	SEG	500–1,000	201	111	38	NS
Yentna River	SR model	SEG	13,000–22,000	21,435	14,850	18,890	16,583
Yentna River	SR model	OEG	16,000–22,000	21,435	14,850	18,890	16,583
Chum salmon							
Clearwater Creek	PAS	SEG	3,500–8,000	9,600	3,970	9,440	4,681
Coho salmon							
Deshka River	Weir	SEG	10,200–24,100	10,445	5,638[e]	3,431[e]	3,137[e]
Fish Creek	Weir	SEG	1,200–6,000	3,025	4,555[e]	6462[e]	NS
Jim Creek (McRoberts Creek)[c]	SFS	SEG	250–700	162	735	1,499	1,899
Little Susitna River[d]	Weir	SEG	9,200–17,700	4,229[e]	10,765	10,923	3,162[e]

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Table 3.–Page 2 of 2.

System	Escapement data[a]	Current escapement goal: Type (BEG, SEG)	Current escapement goal: Range	Escapements[b] 2019	2020	2021	2022
Sockeye salmon							
Chelatna Lake	Weir	SEG	20,000–45,000	26,303	NS	NS	NS
Fish Creek (Knik)	Weir	SEG	15,000–45,000	75,411	64,408	99,324[e]	58,330[e]
Judd Lake	Weir	SEG	15,000–40,000	44,145	31,219	49,440	38,369
Kasilof River	Sonar	BEG	140,000–320,000				
		OEG	140,000–370,000	374,109	540,872	521,859	968,149
Kenai River[f]	Sonar	SEG	750,000–1,300,000	1,457,031	1,605,627	2,006,290	1,206,003
Larson Lake	Weir	SEG	15,000–35,000	9,699	12,074	21,993	17,436
Packers Creek	Weir	SEG	15,000–30,000	7,719[e]	15,903[e]	19,975	15,451
Russian River early run	Weir	BEG	22,000–42,000	125,942	27,103	46,976	61,098
Russian River late run	Weir	SEG	44,000–85,000	64,585	78,832	123,950	124,561

Note: BEG = biological escapement goal, SEG = sustainable escapement goal, LB SEG = lower bound SEG. NS means no survey.

[a] SAS means single aerial survey, PAS means peak aerial survey, and SFS means single foot survey.

[b] Fish required to meet broodstock needs, in addition to meeting escapement goal, include 250 Chinook salmon at Crooked Creek and 10,000 sockeye salmon at the Kasilof River.

[c] Foot survey of McRoberts Creek only, upon which the SEG is based.

[d] Little Susitna River escapement is the weir count minus sport harvest above the weir.

[e] Incomplete count.

[f] Hidden Lake enhancement passing the weir were not subtracted from the escapement.

Table 4.–State-space model (Reimer and DeCovich 2020) parameter estimates for Susitna River Chinook salmon by stock, using updated data through calendar years 1979–2017.

Parameter	Deshka River (95% CI)	Eastside Susitna (95% CI)	Talkeetna River (95% CI)	Yentna River (95% CI)
ln(α)	0.77 (0.10–1.67)	0.89 (0.22–1.70)	0.72 (0.12–1.59)	1.33 (0.67–2.0)
α	2.2 (1.10–5.3)	2.4 (1.25–5.5)	2.1 (1.13–4.9)	3.8 (1.95–7.4)
β	3.8e-05 (1.5e-05–7.2e-05)	3.3e-05 (1.2e-05–5.9e-05)	4.2e-05 (1.4e-05–8.8e-05)	4.3e-05 (2.3e-05–6.9e-05)
ϕ	0.21 (-0.34–0.68)	0.73 (0.25–0.93)	0.35 (-0.32–0.93)	0.41 (-0.16–0.87)
σw	0.98 (0.71–1.41)	0.45 (0.27–0.74)	0.73 (0.29–1.16)	0.52 (0.31–0.82)
Dage	27.2 (19.6–36.7)	27.2 (19.6–36.7)	27.2 (19.6–36.7)	27.2 (19.6–36.7)
Dcomp	NA	144 (78.0– 201)	110 (27.7– 200)	54.2 (27.8–96.8)
Bsurvey	NA	144 (78.0– 201)	110 (27.7–200)	54.2 (27.8–96.8)
SMSR	26,191 (13,816–65,838)	30,575 (16,984–84,008)	23,768 (11,412–70,869)	23,108 (14,574–43,465)
SEQ	34,697 (22,956–66,741)	34,919 (18,458–72,529)	25,468 (15,278–54,732)	35,091 (25,627–50,214)
SMSY	13,849 (9,474–26,950)	14,461 (8,196–30,529)	10,710 (6,487–22,730)	13,717 (10,064–20,079)
UMSY	0.54 (0.29–0.81)	0.48 (0.23–0.75)	0.46 (0.22–0.74)	0.60 (0.40–0.77)

Note: See Reimer and Decovich (2020) methods section for parameter definitions.

Table 5.–State-space model (Fleischman and Reimer 2017) parameter estimates for early- and late-run Kenai River Chinook salmon, using updated data through calendar years 1986–2021.

Parameter	Early run[a]	Late run[a]
β	1.48e-04 (0.25)	2.84e-05 (0.30)
σ_w	0.42 (0.19)	0.31 (0.17)
ln(α)	1.3 (0.48)	1.1 (0.52)
α	3.7 (2.8)	2.9 (1.4)
ϕ	0.84 (0.13)	0.87 (0.11)
S_{EQ}	10,919 (0.57)	45,341 (0.59)
S_{MSR}	6,756 (0.31)	35,207 (0.41)
S_{MSY}	4,139 (0.36)	18,392 (0.43)
U_{MSY}	0.62 (0.27)	0.53 (0.30)
π_1	0.38 (0.06)	0.25 (0.06)
π_2	0.56 (0.04)	0.69 (0.03)
π_3	0.05 (0.18)	0.06 (0.14)
D	12.9 (0.20)	20.7 (0.20)
p_{MR}	0.80 (0.05)	0.78 (0.02)
q_{NCPUE}	1.92e-04 (0.10)	1.72e-04 (0.11)
q_{NASB}	0.62 (0.09)	0.75 (0.11)
q_{SCPUE}	3.06e-06 (0.14)	1.64e-06 (0.09)
σ_{NCPUE}	0.34 (0.20)	0.42 (0.20)
σ_{NASB}	0.22 (0.35)	0.31 (0.28)
σ_{SCPUE}	0.28 (0.23)	0.24 (0.21)
q_{CCPUE}	NA	0.01 (0.08)
σ_{CCPUE}	NA	0.32 (0.17)

Note: See Fleischman and Reimer (2017) methods section for parameter definitions. NA = not available.

[a] Coefficient of variation of parameter estimates are in parentheses.

Table 6.–Parameter and reference point estimates in thousands of fish (95% credible intervals in parentheses) from 3 spawner-recruit models fit to Kasilof River sockeye salmon data.

Parameter	Ricker	Autoregressive	Beverton-Holt
Brood years 1968–2012 (McKinley et al. 2020)			
ln(α)	1.721 (1.470–1.998)	2.050 (1.668–2.588)	1.812 (1.477–2.267)
β	0.211 (0.115–0.321)	0.332 (0.220–0.457)	0.357 (0.134–0.832)
ϕ	NA	0.622 (0.367–0.881)	NA
S_{MSY}	310 (221–517)	221 (169–309)	412 (246–837)
S_{EQ}	817 (608–1,310)	623 (485–855)	1,431 (979–2,631)
DIC	1,261.0	1,236.4	1,263.6
Brood years 1968–2015			
ln(α)	1.767 (1.531–2.028)	2.030 (1.676–2.502)	1.887 (1.532–2.380)
β	0.238 (0.153–0.336)	0.318 (0.220–0.428)	0.447 (0.190–1.029)
ϕ	NA	0.604 (0.375–0.845)	NA
S_{MSY}	280 (214–400)	228 (181–306)	351 (218–622)
S_{EQ}	743 (592–1,031)	640 (520–840)	1,256 (905–2,002)
DIC	1,343.1	1,315.8	1,347.5

Notes: DIC are for comparing models with the same dataset. NA means not available.

Table 7.–Parameter and reference point estimates in thousands of fish (95% credible intervals in parentheses) from 3 spawner-recruit models fit to Kenai River late-run sockeye salmon data.

Parameter	Ricker	Autoregressive	Beverton-Holt
Brood years 1979–2012 (Hasbrouck et al. 2022)			
ln(α)	1.860 (1.395–2.351)	1.751 (1.103–2.343)	2.892 (1.792–3.635)
β	0.057 (0.016–0.99)	0.045 (0.003–0.097)	0.417 (0.071–0.957)
ϕ	NA	0.156 (-0.105–0.756)	NA
S_{MSY}	1,212 (784–3,629)	1,464 (801– >12,000)	778 (511–2,100)
S_{EQ}	3,274 (2,291–8,971)	3,870 (2,317– >12,000)	>12,000 (>12,000– >12,000)
DIC	1,079.6	1081.1	1,077.70
Brood years 1979–2015			
ln(α)	1.846 (1.441–2.351)	1.623 (1.018–2.271)	3.000 (1.767–3.040)
β	0.604 (0.245–1.047)	0.360 (0.051–0.944)	3.000 (0.770–5.000)
ϕ	NA	0.293 (-0.052–0.782)	NA
S_{MSY}	1,131 (745–2,405)	1,698 (798–10,261)	911 (672–1,902)
S_{EQ}	3,062 (2,186–6,058)	4,358 (2,286–24,952)	4,259 (3,344–9,979)
DIC	1,174.9	1,175.4	1,172.10

Notes: DIC are for comparing models with the same dataset. NA means not available.

FIGURES

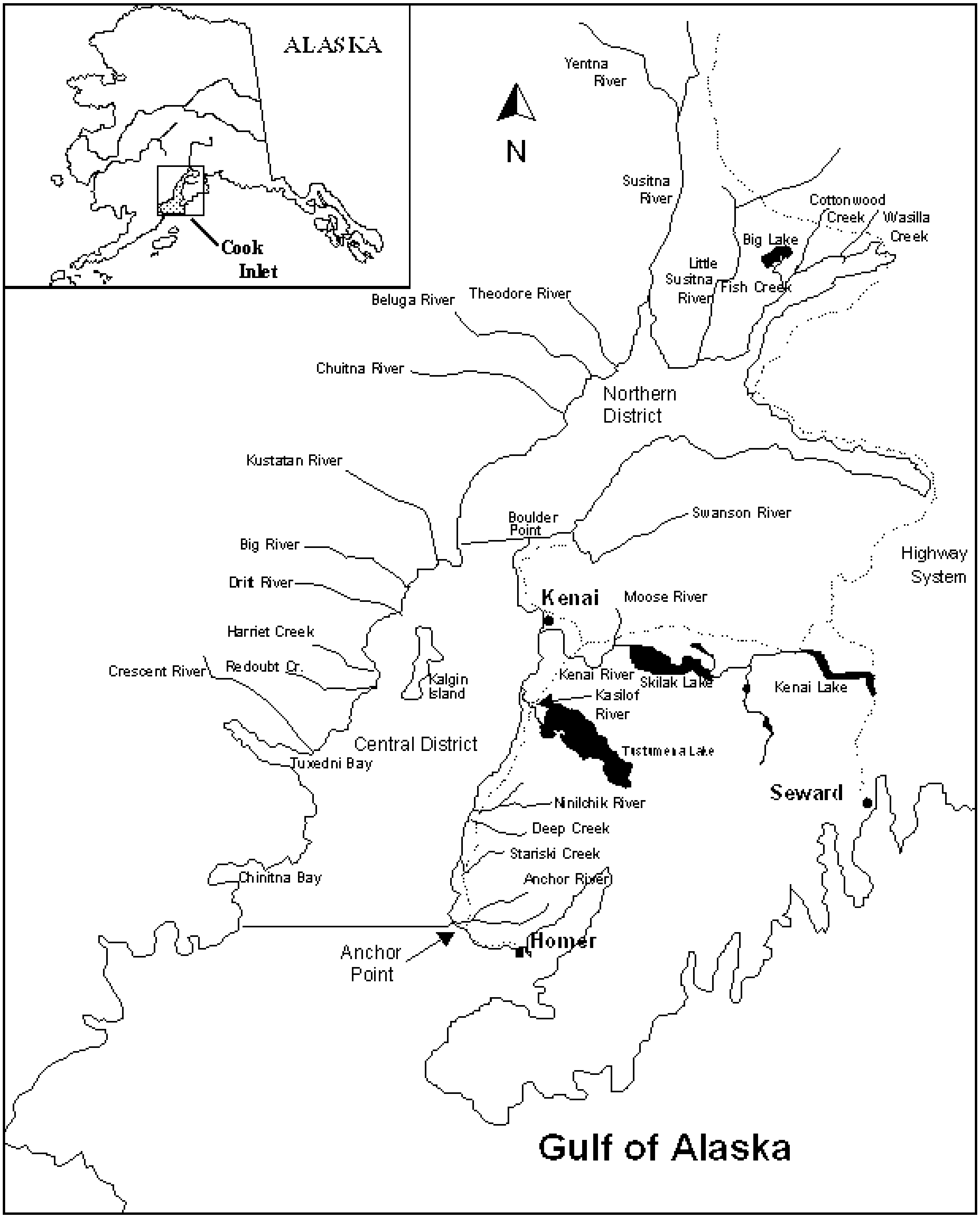

Figure 1.–Map of Upper Cook Inlet showing locations of the Northern and Central Districts and the primary salmon spawning drainages.

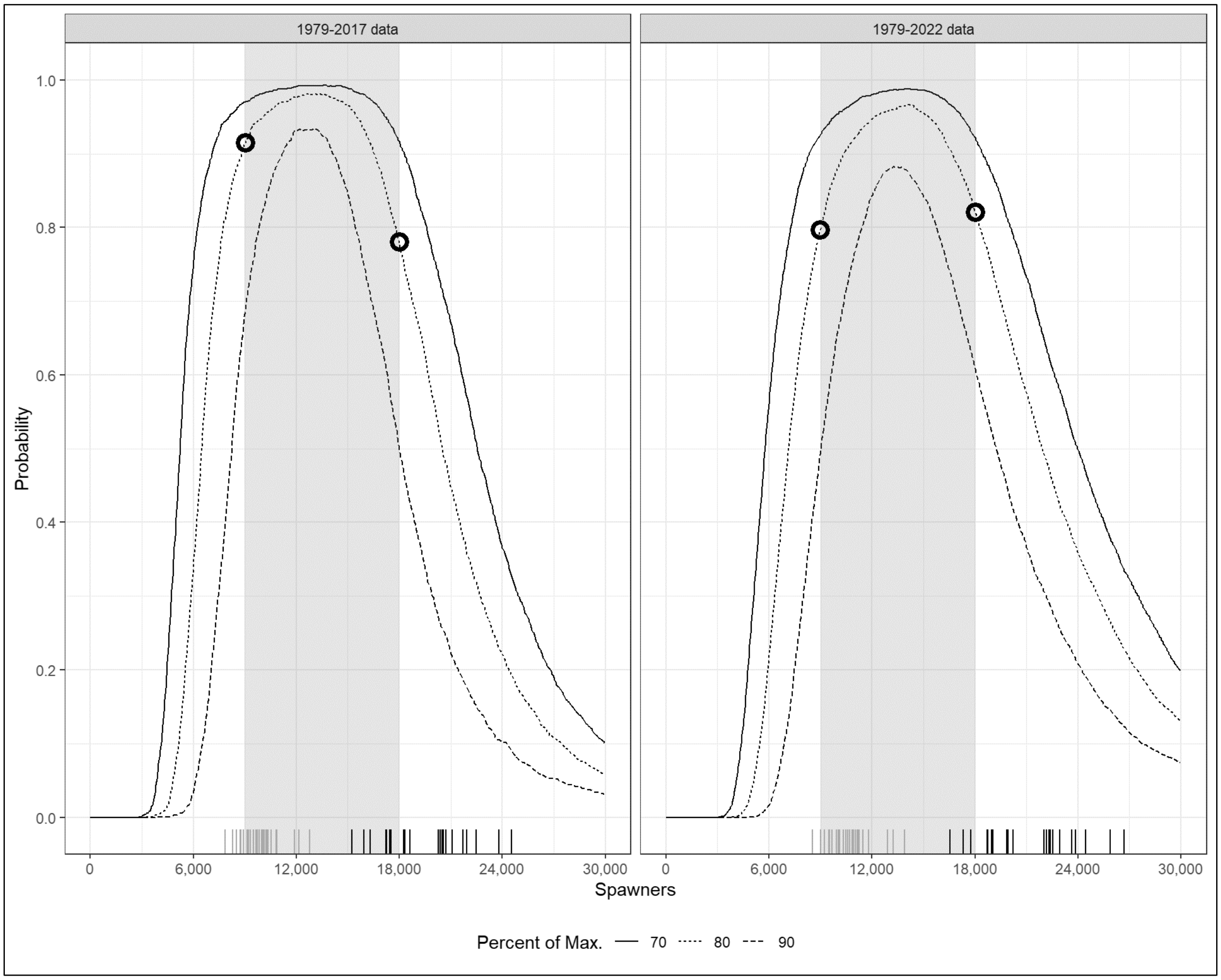

Figure 2.–Optimal yield profiles (OYP) for the Deshka River Chinook salmon stock from the initial 2019 analysis and the 2022 version that includes an additional 4 years of data. Profiles show the probability that a specified spawning abundance will result in specified fractions (70%, 80%, and 90%) of maximum sustained yield.

Note: In both figures, the gray shaded areas bracket the same, current escapement goal range; grey and black marks along the *x*-axis show comparable lower and upper bounds, respectively, scaled by S_{MSY} ratios for other Alaskan Chinook salmon stocks.

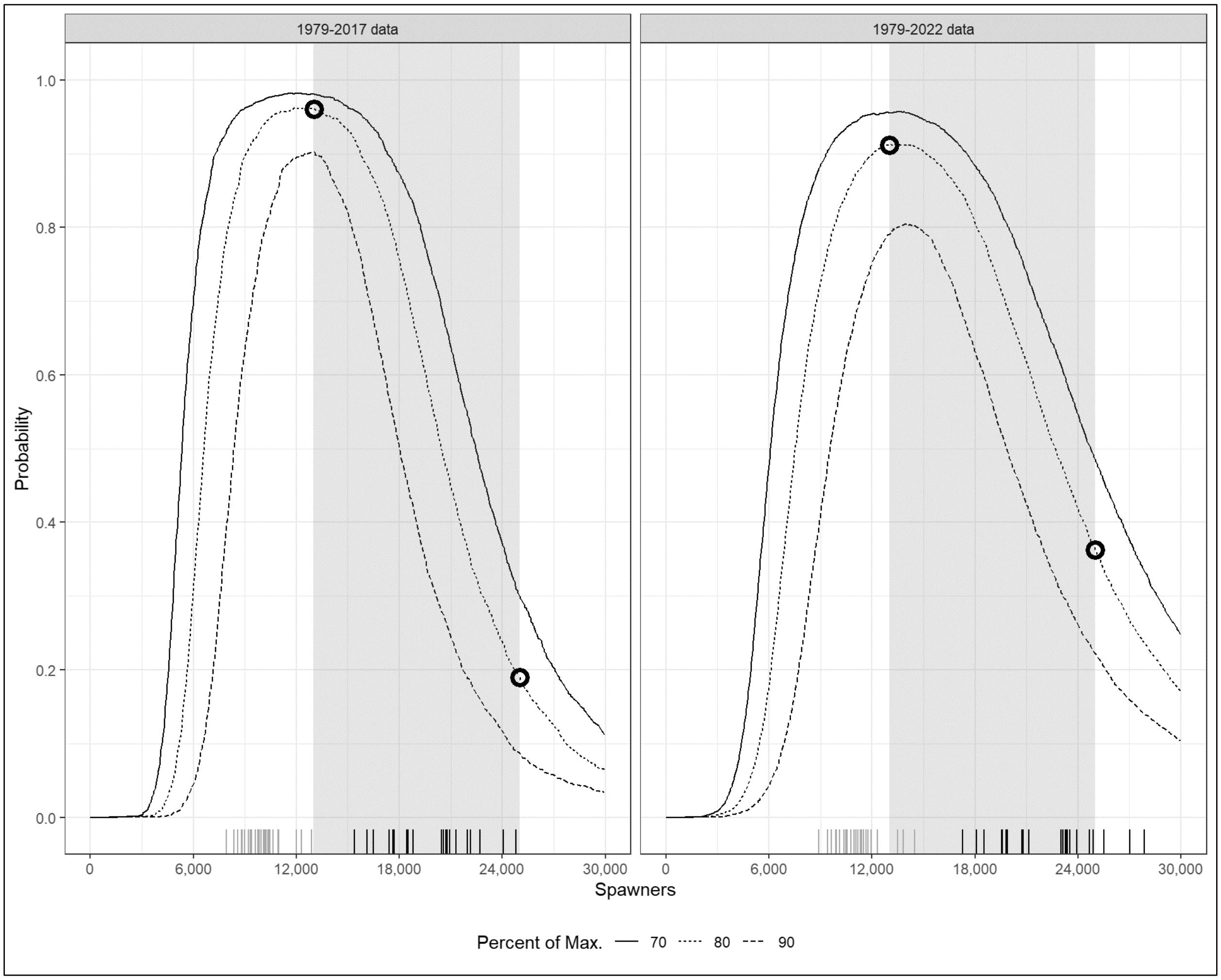

Figure 3.–Optimal yield profiles (OYP) for the Eastside Susitna Chinook salmon stock from the initial 2019 analysis and the 2022 version that includes an additional 4 years of data. Profiles show the probability that a specified spawning abundance will result in specified fractions (70%, 80%, and 90% line) of maximum sustained yield.

Note: In both figures, the gray shaded areas bracket the same, current escapement goal range; grey and black marks along the *x*-axis show comparable lower and upper bounds, respectively, scaled by S_{MSY} ratios for other Alaskan Chinook salmon stocks.

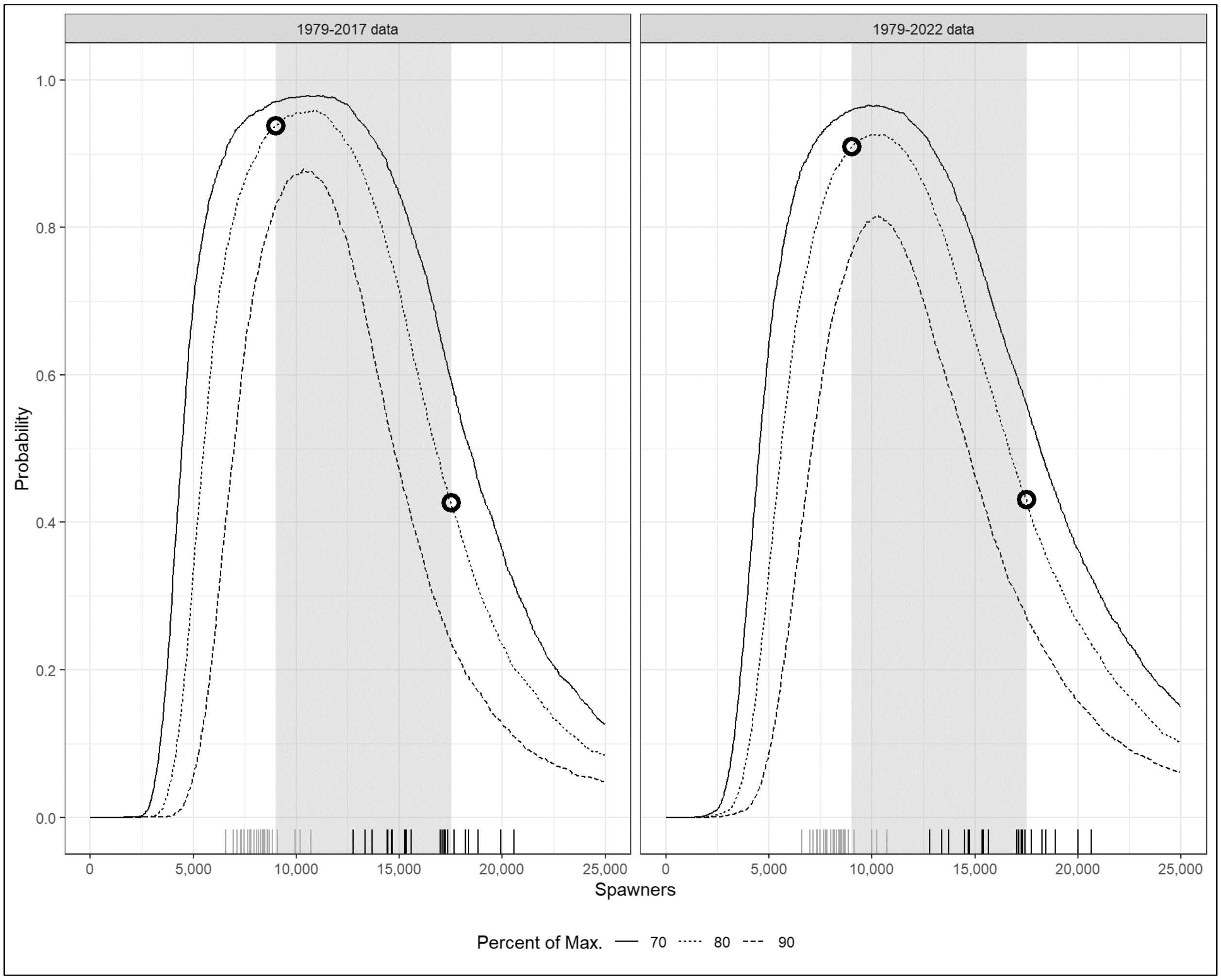

Figure 4.–Optimal yield profiles (OYP) for the Talkeetna River Chinook salmon stock from the initial 2019 analysis and the 2022 version that includes an additional 4 years of data. Profiles show the probability that a specified spawning abundance will result in specified fractions (70%, 80%, and 90% line) of maximum sustained yield.

Note: In both figures, the gray shaded areas bracket the same, current escapement goal range; grey and black marks along the *x*-axis show comparable lower and upper bounds, respectively, scaled by S_{MSY} ratios for other Alaskan Chinook salmon stocks.

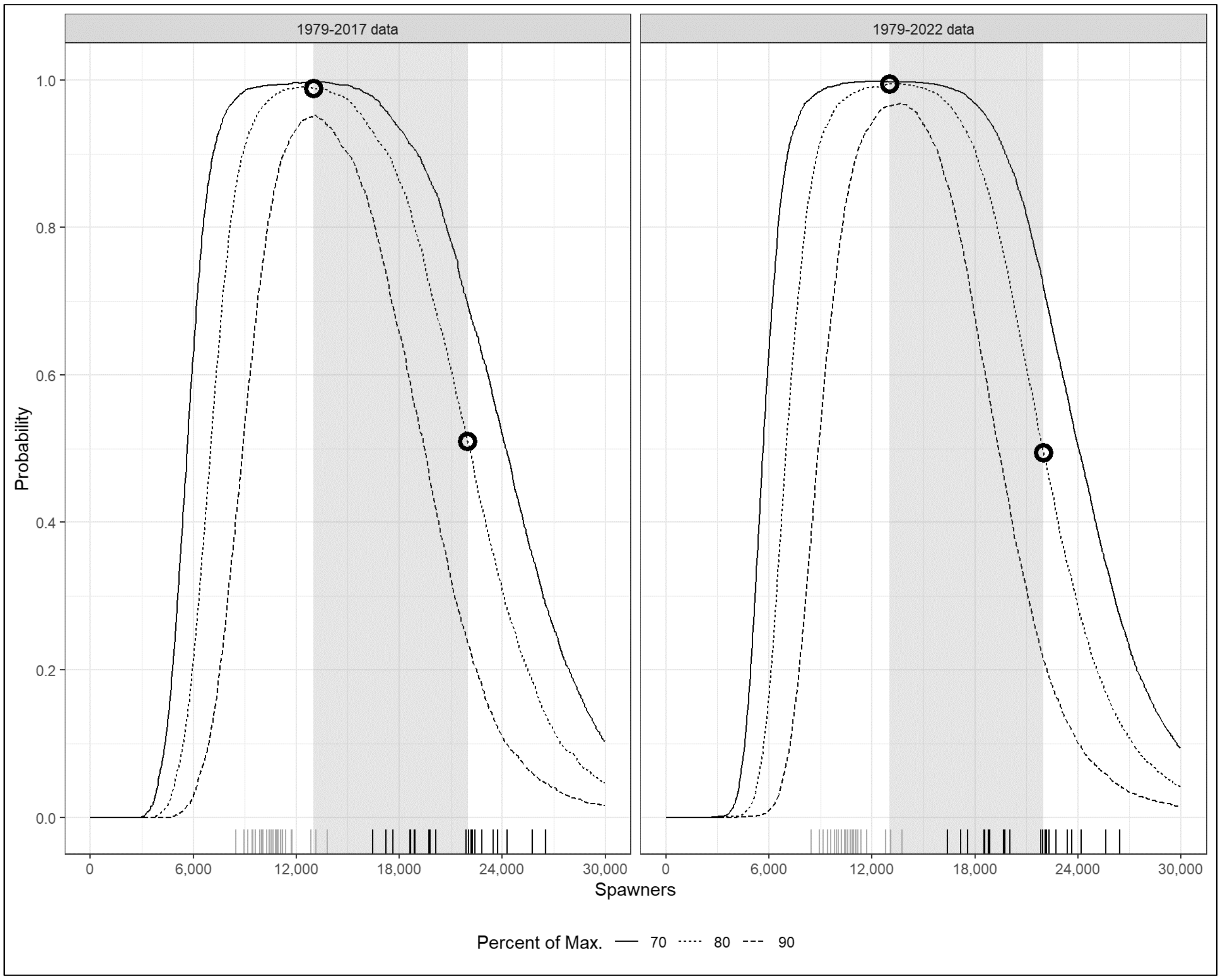

Figure 5.–Optimal yield profiles (OYP) for the Yentna River Chinook salmon stock from the initial 2019 analysis and the 2022 version that includes an additional 4 years of data. Profiles show the probability that a specified spawning abundance will result in specified fractions (70%, 80%, and 90% line) of maximum sustained yield.

Note: In both figures, the gray shaded areas bracket the same, current escapement goal range; grey and black marks along the *x*-axis show comparable lower and upper bounds, respectively, scaled by S_{MSY} ratios for other Alaskan Chinook salmon stocks.

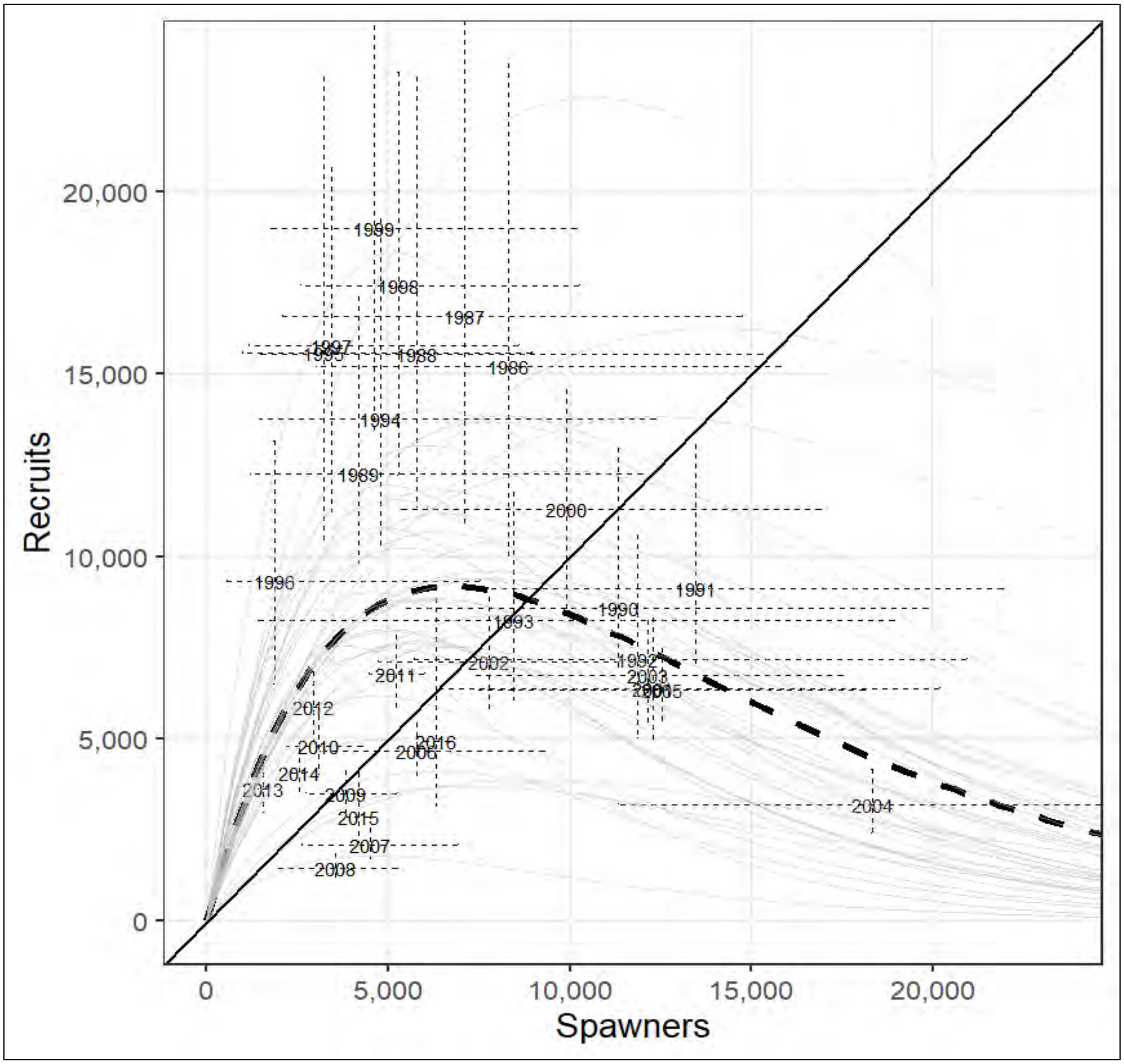

Figure 6.–Plausible spawner–recruit relationships for Kenai River early-run Chinook salmon 75 cm METF and longer, as derived from an age-structured state-space model fitted to abundance, harvest, and age data for brood years 1986–2016.

Note: Posterior medians of R and S are plotted as brood year labels with 90% credibility intervals plotted as light dashed lines. The heavy dashed line is the Ricker relationship constructed from ln(α) and β posterior medians. Ricker relationships are also plotted (light grey lines) for 40 paired values of ln(α) and β sampled from the posterior probability distribution, representing plausible Ricker relationships that could have generated the observed data. Recruits replace spawners (R = S) on the diagonal line.

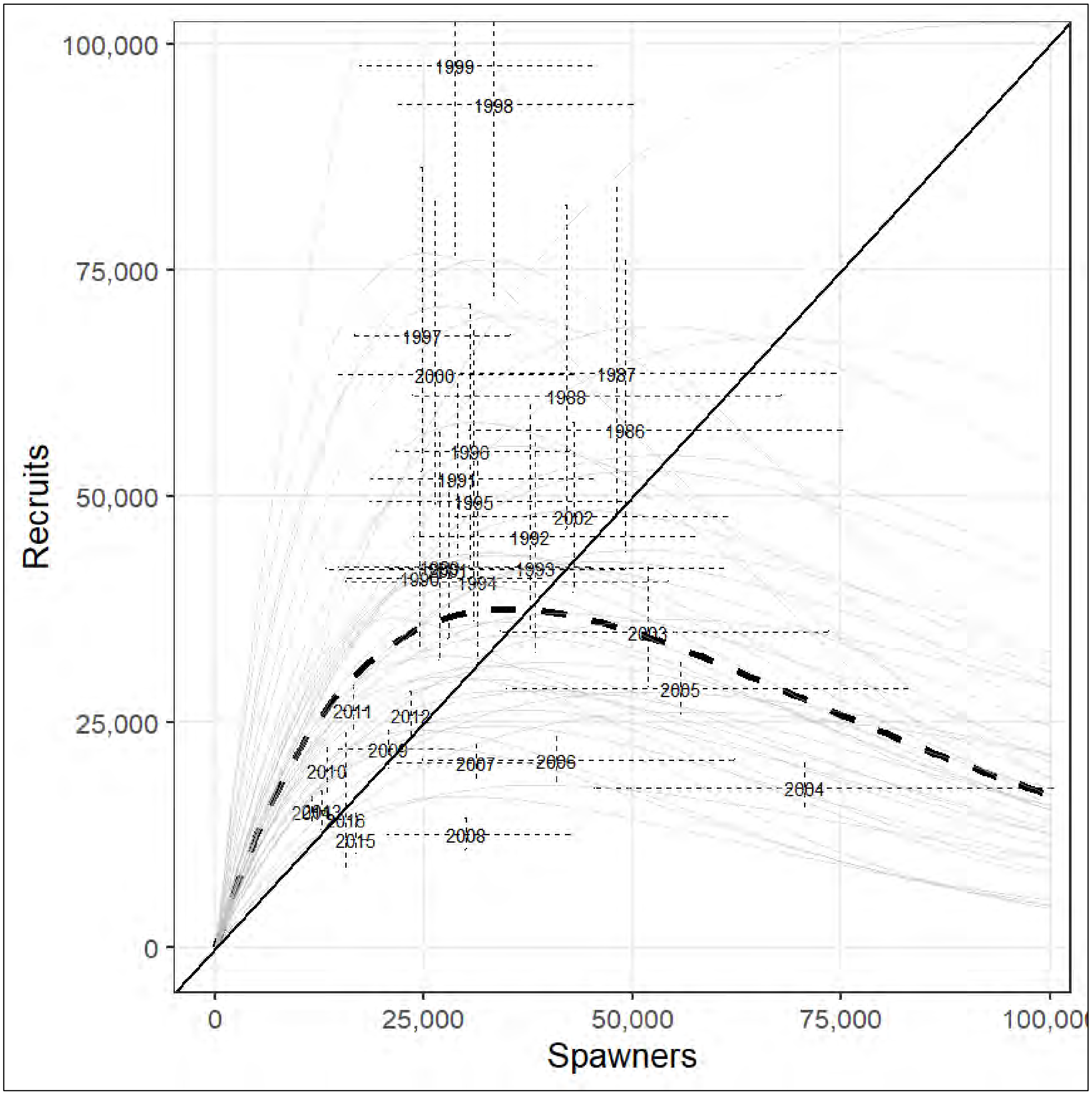

Figure 7.–Plausible spawner–recruit relationships for Kenai River late-run Chinook salmon 75 cm METF and longer, as derived from an age-structured state-space model fitted to abundance, harvest, and age data for brood years 1986–2016.

Note: Posterior medians of R and S are plotted as brood year labels with 90% credibility intervals plotted as light dashed lines. The heavy dashed line is the Ricker relationship constructed from ln(α) and β posterior medians. Ricker relationships are also plotted (light grey lines) for 40 paired values of ln(α) and β sampled from the posterior probability distribution, representing plausible Ricker relationships that could have generated the observed data. Recruits replace spawners (R = S) on the diagonal line.

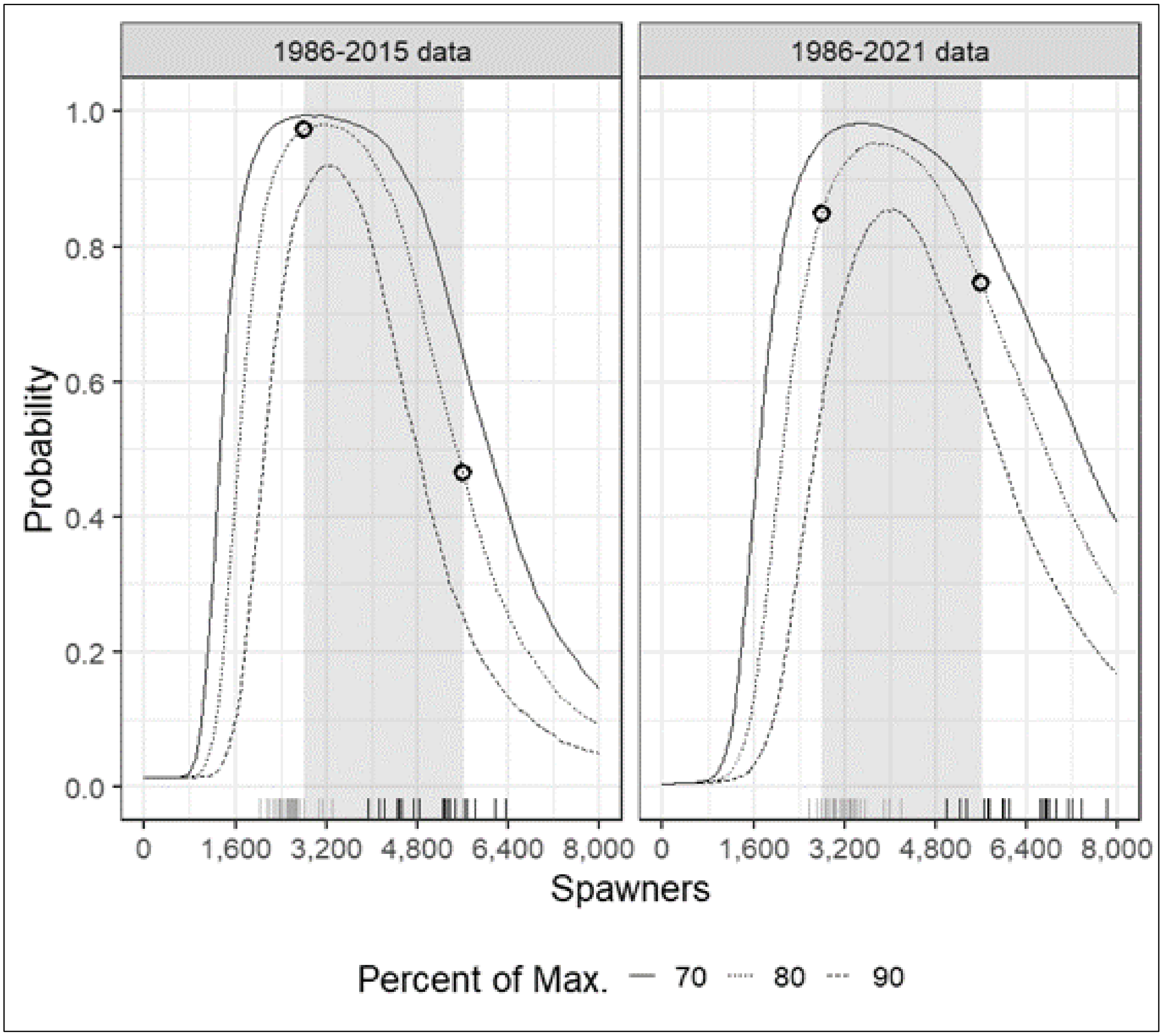

Figure 8.–Optimal yield profile (OYP) plot for Kenai River early-run Chinook salmon 75 cm METF and longer showing probability that a specified spawning abundance will result in 80% of maximum sustained yield.

Note: In both figures, the gray shaded areas bracket the current goal range; grey and black marks along the *x*-axis show comparable lower and upper bounds, respectively, scaled by S_{MSY} ratios for other Alaskan Chinook salmon stocks.

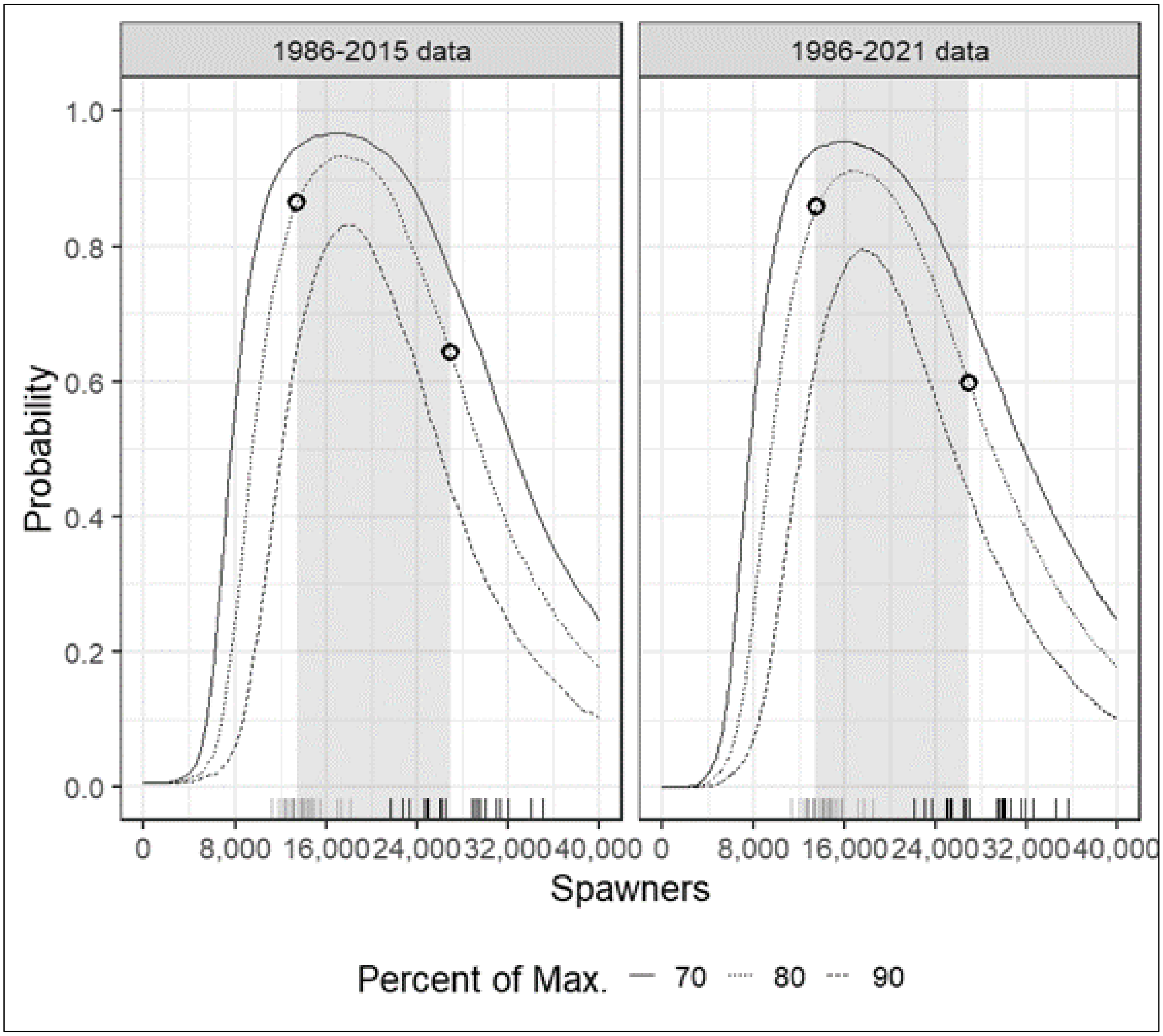

Figure 9.–Optimal yield profile (OYP) plot for Kenai River late-run Chinook salmon 75 cm METF and longer showing probability that a specified spawning abundance will result in 80% of maximum sustained yield.

Note: In both figures, the gray shaded areas bracket the current goal range; grey and black marks along the *x*-axis show comparable lower and upper bounds, respectively, scaled by S_{MSY} ratios for other Alaskan Chinook salmon stocks.

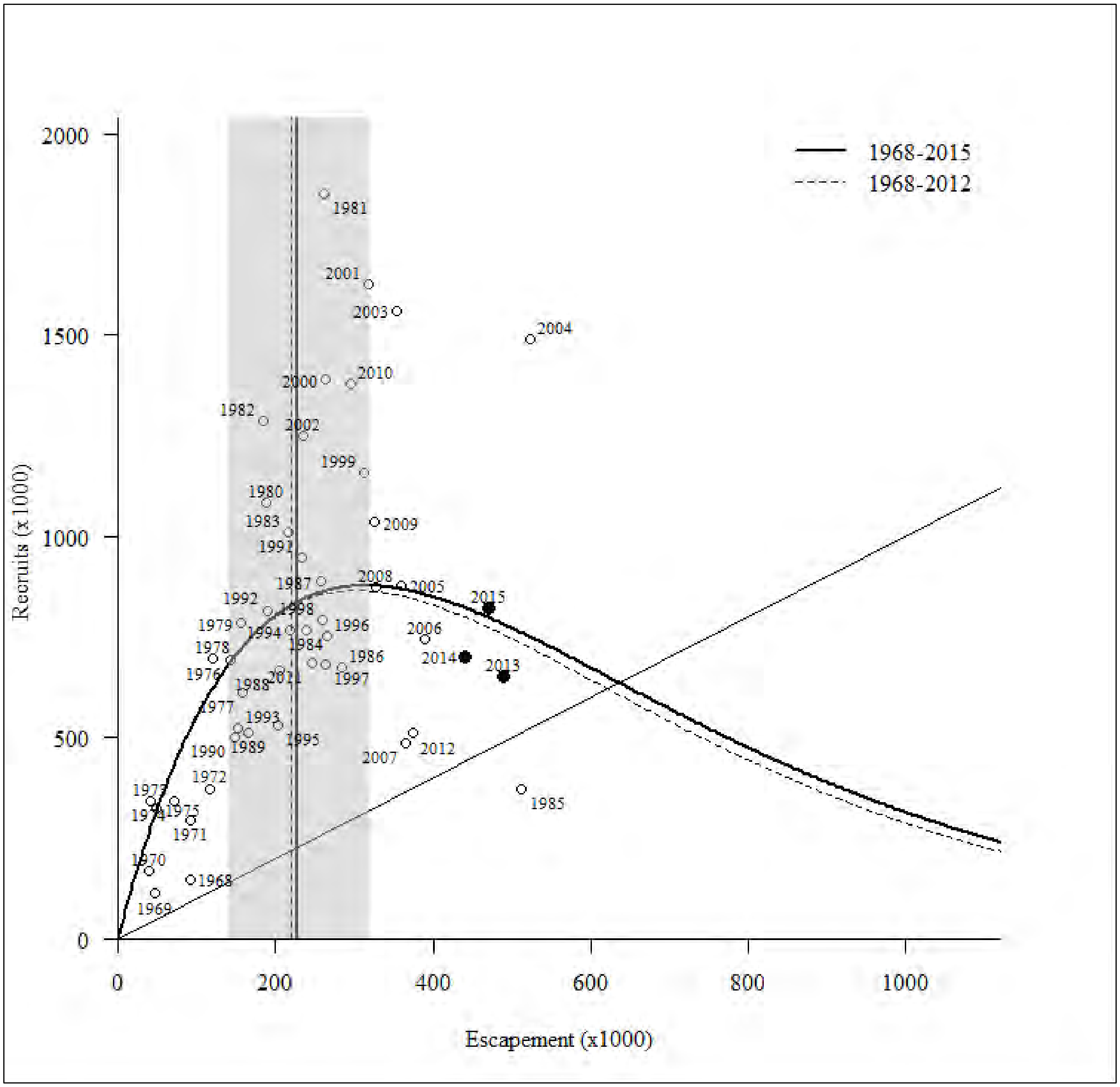

Figure 10.–Autoregressive Ricker spawner–recruit models fit to Kasilof River sockeye salmon return per spawner data, brood years 1968–2012 and 1968–2015.

Note: Vertical lines identify S_{MSY} for each model. Shaded area is the current escapement goal (140,000–320,000).

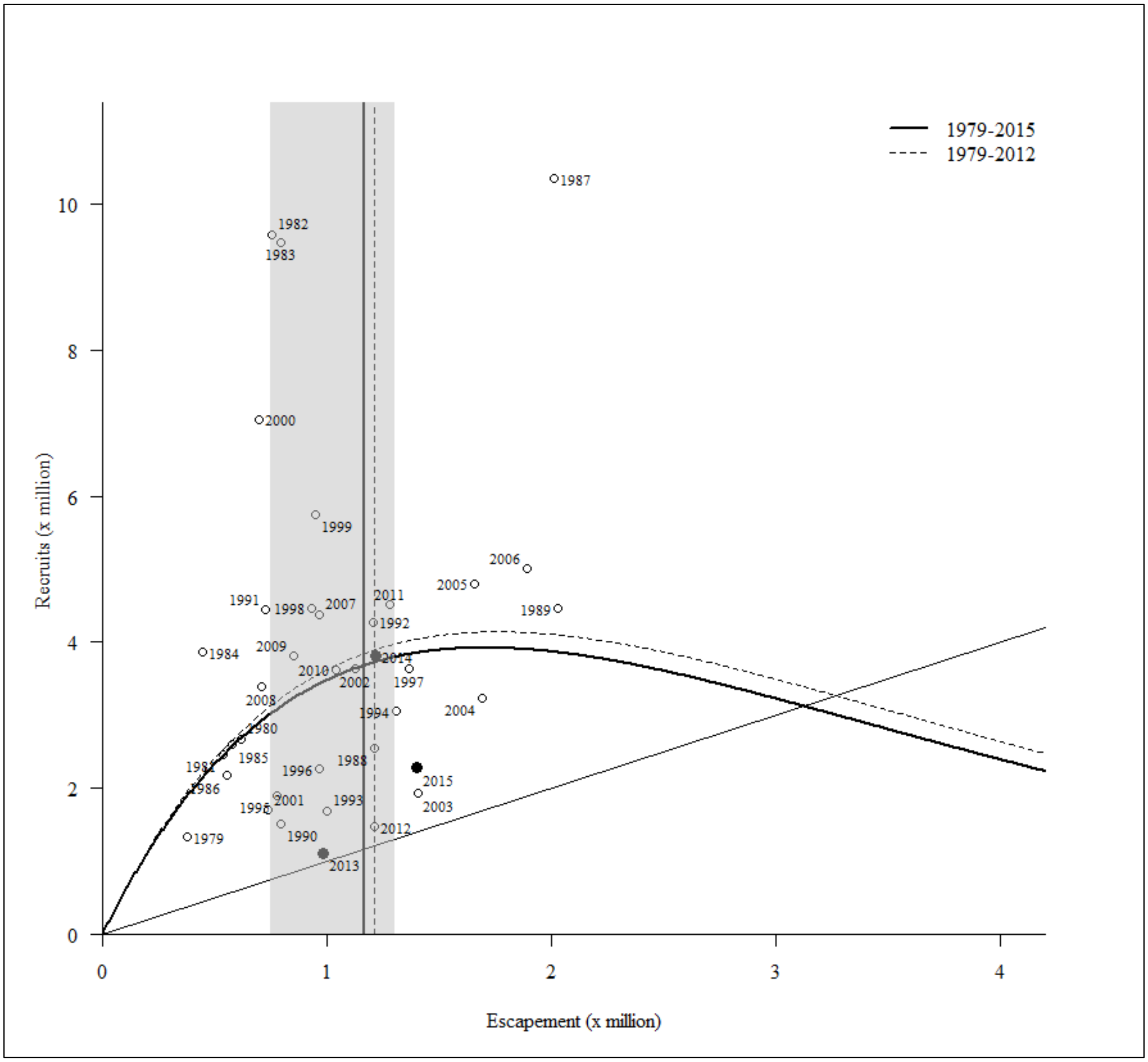

Figure 11.–Ricker spawner–recruit models fit to Kenai River sockeye salmon return per spawner data, brood years 1979–2012 and 1979–2015.

Note: Vertical lines identify S_{MSY} for each model. Shaded area is the current escapement goal (750,000–1,300,000).

APPENDIX A: SUPPORTING INFORMATION FOR UPPER COOK INLET CHINOOK SALMON ESCAPEMENT GOALS

Appendix A1.–Data available for analysis of Campbell Creek Chinook salmon escapement goal.

Year	Escapement [a]	Year	Escapement [a]
1982	68	2003	745
1983	NS	2004	964
1984	423	2005	1,097
1985	NS	2006	1,052
1986	733	2007	588
1987	571	2008	439
1988	NS	2009	554
1989	218	2010	290
1990	458	2011	260
1991	590	2012	NS
1992	931	2013	NS
1993	937	2014	274
1994	1,076	2015	654
1995	734	2016	544
1996	369	2017	475
1997	1,119	2018	287
1998	761	2019	393
1999	1,035	2020	154
2000	591	2021	339
2001	717	2022	423
2002	744		

[a] Escapement not surveyed or monitored during years with NS.

Appendix A2.–Data available for analysis of Deshka River Chinook salmon escapement goal and total run estimates.

Year	Aerial survey[a]	Weir escapement[b]	Total run	Year	Aerial survey[a]	Weir escapement[b]	Total run
1974	5,279	–	ND	1999	12,904	29,088	33,316
1975	4,737	–	ND	2000	NS	33,965	41,085
1976	21,693	–	ND	2001	NS	27,966	33,778
1977	39,642	–	ND	2002	8,749	28,535	32,718
1978	24,639	–	ND	2003	NS	39,257	46,112
1979	27,385	–	45,610	2004	28,778	56,659	65,829
1980	NS	–	37,355	2005	11,495	36,433	44,337
1981	NS	–	37,814	2006	6,499	29,922	37,067
1982	16,000	–	41,072	2007	6,712	17,594	23,872
1983	19,237	–	44,004	2008	NS	7,284	9,666
1984	16,892	–	44,366	2009	3,954	11,641	13,057
1985	18,151	–	39,209	2010	NS	18,223	21,247
1986	21,080	–	46,011	2011	7,522	18,553	22,464
1987	15,028	–	41,562	2012	NS	13,952	15,492
1988	19,200	–	48,811	2013	8,686	18,378	20,038
1989	NS	–	38,923	2014	NS	16,099	16,917
1990	18,166	–	39,946	2015	NS	23,627	26,738
1991	8,112	–	29,015	2016	NS	22,099	24,904
1992	7,736	–	25,892	2017	NS	11,034	13,612
1993	5,769	–	17,389	2018	2,977	8,549	ND
1994	2,665	–	8,278	2019	NS	9,705	ND
1995	5,150	10,048	10,345	2020	NS	10,638	ND
1996	6,343	14,349	14,883	2021	NS	18,674	ND
1997	19,047	35,587	35,549	2022	NS	5,440	ND
1998	15,556	–	32,338				

Note: ND indicates no available data.

[a] Escapement not surveyed or monitored during years with NS.

[b] Sport fish harvest above the weir was subtracted from weir count. Weir operations began in 1995. En dash indicates no weir count.

Appendix A3.– Eastside Susitna River Chinook salmon single aerial survey (SAS) index counts, total run, and escapement estimates.

Year	Goose Creek	Montana Creek	Little Willow Creek	Sheep Creek	Willow Creek	Total run	Escapement
1979	NS	NS	327	778	NS	14,074	13,019
1980	NS	NS	NS	NS	NS	14,559	13,139
1981	262	814	459	1,013	991	14,393	12,580
1982	140	NS	316	527	592	11,734	10,052
1983	477	NS	1,042	975	NS	19,143	17,236
1984	258	NS	NS	1,028	2,789	25,961	22,618
1985	401	NS	1,305	1,634	1,856	33,685	29,841
1986	630	NS	2,133	1,285	2,059	41,143	31,451
1987	416	1,320	1,320	895	2,768	36,326	27,818
1988	1,076	2,016	1,515	1,215	2,496	42,661	33,724
1989	835	NS	1,325	610	5,060	42,212	33,006
1990	552	1,269	1,115	634	2,365	35,472	27,102
1991	968	1,215	498	154	2,006	28,764	20,745
1992	369	1,560	673	NS	1,660	37,580	19,444
1993	347	1,281	705	NS	2,227	41,598	22,548
1994	375	1,143	712	542	1,479	30,945	17,508
1995	374	2,110	1,210	1,049	3,792	39,901	32,985
1996	305	1,841	1,077	1,028	1,776	33,874	26,079
1997	308	3,073	2,390	NS	4,841	48,502	41,112
1998	415	2,936	1,782	1,160	3,500	45,707	38,722
1999	268	2,088	1,837	NS	2,081	42,301	28,673
2000	348	1,271	1,121	1,162	2,601	35,575	26,350
2001	NS	1,930	2,084	NS	3,188	43,978	33,301
2002	565	2,357	1,680	854	2,758	43,452	34,950
2003	175	2,576	879	NS	3,964	36,524	28,038
2004	417	2,117	2,227	285	2,985	40,951	34,733
2005	468	2,600	1,784	760	2,463	36,988	30,043
2006	306	1,850	816	580	2,217	32,262	25,772
2007	105	1,936	1,103	400	1,373	26,068	19,693
2008	117	1,357	NS	NS	1,255	20,443	15,334
2009	65	1,460	776	500	1,133	16,191	14,362
2010	76	755	468	NS	1,173	14,121	12,561
2011	80	494	713	350	1,061	11,899	10,474
2012	57	416	494	363	756	10,297	10,046
2013	62	1,304	858	NC	1,752	17,455	17,201
2014	232	953	684	262	1,335	16,308	16,083
2015	NS	1,416	788	NS	2,046	25,032	24,699
2016	NS	692	675	NS	1,814	23,374	22,972
2017	148	603	840	NS	840	14,140	13,615
2018	90	473	280	334	411	ND	9,916
2019	NS	789	631	NS	897	ND	11,578
2020	126	760	579	NS	675	ND	13,815
2021	NS	849	558	NS	887	ND	15,208
2022	NS	220	359	NS	444	ND	7,654

Note: Escapement not surveyed or monitored during years with NS. ND indicates no available data.

Appendix A4.–Talkeetna River Chinook salmon single aerial survey (SAS) index counts, total run, and escapement estimates.

Year	Clear Creek	Prairie Creek	Total run	Escapement
1979	864	NS	10,171	9,767
1980	NS	NS	9,779	9,448
1981	NS	1,875	9,971	9,436
1982	982	3,844	11,092	10,388
1983	938	3,200	14,603	13,421
1984	1,520	9,000	21,514	19,944
1985	2,430	6,500	26,130	24,908
1986	NS	8,500	31,754	29,322
1987	NS	9,138	33,780	30,636
1988	4,850	9,280	44,300	40,872
1989	NS	9,463	38,444	34,392
1990	2,380	9,113	30,721	27,128
1991	1,974	6,770	25,052	22,068
1992	1,530	4,453	20,359	16,447
1993	886	3,023	15,693	10,455
1994	1,204	2,254	13,028	10,449
1995	1,928	3,884	19,437	16,713
1996	2,091	5,037	23,161	19,126
1997	5,100	7,710	41,950	37,843
1998	3,894	4,465	32,186	27,819
1999	2,216	5,871	24,961	20,867
2000	2,142	3,790	21,438	18,335
2001	2,096	5,191	24,385	21,189
2002	3,496	7,914	31,260	28,225
2003	NS	4,095	26,124	24,453
2004	3,417	5,570	28,746	25,855
2005	1,924	3,862	18,801	16,535
2006	1,520	3,570	19,535	17,520
2007	3,310	5,036	26,868	23,741
2008	1,795	3,039	17,396	15,212
2009	1,205	3,500	13,662	11,378
2010	903	3,022	13,770	12,438
2011	512	2,038	7,328	5,982
2012	1,177	1,185	9,506	9,158
2013	1,471	3,304	18,801	18,500
2014	1,390	2,812	13,997	13,808
2015	1,205	3,290	13,366	13,195
2016	NS	1,853	9,785	9,615
2017	780	1,930	7,269	6,998
2018	940	1,194	ND	7,376
2019	1511	2371	ND	11,352
2020	741	1553	ND	7,279
2021	1040	1764	ND	9,107
2022	539	704	ND	4,288

Note: Escapement not surveyed or monitored during years with NS. ND indicates no available data.

Appendix A5.–Yentna River Chinook salmon single aerial survey (SAS) index counts, total run, and escapement estimates.

Year	Cache Creek	Lake Creek	Talachulitna River	Peters Creek	Total run	Escapement
1979	NS	4,196	1,648	NS	25,437	23,095
1980	NS	NS	NS	NS	22,158	20,874
1981	NS	NS	2,025	NS	23,912	22,673
1982	NS	3,577	3,101	NS	29,280	26,883
1983	497	7,075	10,014	2,272	47,603	44,183
1984	NS	NS	6,138	324	49,979	46,052
1985	206	5,803	5,145	2,901	42,443	38,944
1986	424	NS	3,686	1,915	43,442	38,159
1987	556	4,898	NS	1,302	41,246	34,993
1988	818	6,633	4,112	3,927	45,859	39,183
1989	362	NS	NS	959	32,981	25,649
1990	484	2,075	2,694	2,027	27,573	20,965
1991	499	3,011	2,457	2,458	27,525	21,586
1992	487	2,322	3,648	996	31,099	23,711
1993	1,690	2,869	3,269	1,668	32,871	23,016
1994	628	1,898	1,575	573	23,164	16,180
1995	1,601	3,017	2,521	1,041	29,845	24,393
1996	581	3,514	2,748	749	27,433	22,707
1997	1,774	3,841	4,494	2,637	42,508	36,497
1998	1,771	5,056	2,759	4,367	39,195	34,151
1999	1,720	2,877	4,890	3,298	37,859	30,914
2000	709	4,035	2,414	1,648	35,632	28,131
2001	624	4,661	3,309	4,226	39,931	33,332
2002	671	4,852	7,824	2,959	49,025	43,761
2003	558	8,153	9,573	3,998	63,733	57,417
2004	212	7,598	8,352	3,757	71,049	65,457
2005	1,460	6,345	4,406	1,508	51,817	44,430
2006	1,230	5,300	6,152	1,114	47,402	39,386
2007	551	4,081	3,871	1,225	39,832	33,653
2008	NS	2,004	2,964	NS	22,671	17,159
2009	NS	1,394	2,608	1,283	17,610	13,407
2010	NS	1,617	1,499	NS	19,479	16,119
2011	27	2,563	1,368	1,103	17,921	14,794
2012	87	2,366	847	459	17,668	16,465
2013	582	3,655	2,285	1,643	30,445	28,639
2014	475	3,506	2,256	1,443	28,654	27,550
2015	363	4,686	2,582	1,514	42,760	40,375
2016	120	3,588	4,295	1,122	29,448	27,409
2017	9	1,601	1,087	307	14,487	12,693
2018	154	1,767	1,483	1,674	ND	14,430
2019	252	2692	3225	1209	ND	21,435
2020	128	1677	2019	449	ND	14,850
2021	NS	2258	2386	438	ND	18,890
2022	NS	1920	NS	462	ND	16,583

Note: Escapement not surveyed or monitored during years with NS. ND indicates no available data.

Appendix A6.–Data available for analysis of Alexander Creek Chinook salmon escapement goal.

Year	Escapement [a]	Year	Escapement [a]
1974	2,193	1999	3,974
1975	1,878	2000	2,331
1976	5,412	2001	2,282
1977	9,246	2002	1,936
1978	5,854	2003	2,012
1979	6,215	2004	2,215
1980	NS	2005	2,140
1981	NS	2006	885
1982	2,546	2007	480
1983	3,755	2008	150
1984	4,620	2009	275
1985	6,241	2010	177
1986	5,225	2011	343
1987	2,152	2012	181
1988	6,273	2013	588
1989	3,497	2014	911
1990	2,596	2015	1,117
1991	2,727	2016	754
1992	3,710	2017	170
1993	2,763	2018	296
1994	1,514	2019	1,297
1995	2,090	2020	596
1996	2,319	2021	288
1997	5,598	2022	NS
1998	2,807		

[a] Escapement not surveyed or monitored during years with NS.

Appendix A7.–Data available for analysis of Chulitna River Chinook salmon escapement goal.

Year	Escapement [a]	Year	Escapement [a]
1982	863	2003	NS
1983	4,058	2004	2,162
1984	4,191	2005	2,838
1985	783	2006	2,862
1986	NS	2007	5,166
1987	5,252	2008	2,514
1988	NS	2009	2,093
1989	NS	2010	1,052
1990	2,681	2011	1,875
1991	4,410	2012	667
1992	2,527	2013	1,262
1993	2,070	2014	1,011
1994	1,806	2015	3,137
1995	3,460	2016	1,151
1996	4,172	2017	NS
1997	5,618	2018	1,125
1998	2,586	2019	2,765
1999	5,455	2020	845
2000	4,218	2021	1,535
2001	2,353	2022	NS
2002	9,002		

[a] Escapement not surveyed or monitored during years with NS.

Appendix A8.–Data available for analysis of Chuitna River Chinook salmon escapement goal.

Year	Escapement [a]	Year	Escapement [a]
1977	NS	2000	1,456
1978	NS	2001	1,501
1979	1,246	2002	1,394
1980	NS	2003	2,339
1981	1,362	2004	2,938
1982	3,438	2005	1,307
1983	4,043	2006	1,911
1984	2,845	2007	1,180
1985	1,600	2008	586
1986	3,946	2009	1,040
1987	NS	2010	735
1988	3,024	2011	719
1989	990	2012	502
1990	480	2013	1,690
1991	537	2014	1,398
1992	1,337	2015	1,965
1993	2,085	2016	1,372
1994	1,012	2017	235
1995	1,162	2018	939
1996	1,343	2019	2,115
1997	2,232	2020	869
1998	1,869	2021	806
1999	3,721	2022	NS

[a] Escapement not surveyed or monitored during years with NS.

Appendix A9.–Data available for analysis of Theodore River Chinook salmon escapement goal.

Year	Escapement [a]	Year	Escapement [a]
1977	NS	2000	1,271
1978	NS	2001	1,237
1979	512	2002	934
1980	NS	2003	1,059
1981	535	2004	491
1982	1,368	2005	478
1983	1,519	2006	958
1984	1,251	2007	486
1985	1,458	2008	345
1986	1,281	2009	352
1987	1,548	2010	202
1988	1,906	2011	327
1989	1,026	2012	179
1990	642	2013	476
1991	508	2014	312
1992	1,053	2015	426
1993	1,110	2016	68[b]
1994	577	2017	21[b]
1995	694	2018	18[b]
1996	368	2019	201
1997	1,607	2020	111
1998	1,807	2021	38
1999	2,221	2022	NS

[a] Escapement not surveyed or monitored during years with NS.

[b] Not used in escapement goal calculation.

Appendix A10.–Data available for analysis of Little Susitna River aerial survey-based Chinook salmon escapement goal and weir-based escapement goal.

Year	Aerial survey	Weir
1977	NS	–
1978	NS	–
1979	NS	–
1980	NS	–
1981	NS	–
1982	NS	–
1983	929	–
1984	558	–
1985	1,005	–
1986	NS	–
1987	1,386	–
1988	3,197	7,712
1989	2,184	4,367
1990	922	–
1991	892	–
1992	1,441	–
1993	NS	–
1994	1,221	2,981
1995	1,714	2,893
1996	1,079	–
1997	NS	–
1998	1,091	–
1999	NS	–
2000	1,094	–
2001	1,238	–
2002	1,660	–
2003	1,114	–
2004	1,694	–
2005	2,095	–
2006	1,855	–
2007	1,731	–
2008	1,297	–
2009	1,028	–
2010	589	–
2011	887	–
2012	1,154	–
2013	1,651	2,383[b]
2014	1,759	3,135
2015	1,507	5,026
2016	1,622	4,969
2017	1,192	2,531
2018	530[a]	549[b]
2019	NS	3,666
2020	558	2,445
2021	889	3,121
2022	NS	2,288

Note: Escapement not surveyed during years with NS; weir not monitored in years with en dash.

[a] Not used in escapement goal calculation.

[b] Incomplete count due to flooding of weir.

Appendix A11.–Data (by return year) available for analysis of Crooked Creek Chinook salmon escapement goal.

Return year	Count at the weir[a] Non-AFC	AFC	Total	Actual escapement[b] Total	Wild	Sport harvest Early run [c] (through 6/30)	Creel survey[d] (through 6/30)	Total
1976	1,682 [e]	ND	1,682	1,537	1,537	ND	ND	ND
1977	3,069 [e]	ND	3,069	2,390	2,390	ND	ND	ND
1978	4,535	180	4,715	4,388	4,220	ND	ND	251
1979	2,774	770	3,544	3,177	2,487	ND	ND	283
1980	1,764	518	2,282	2,115	1,635	ND	ND	310
1981	1,871	1,033	2,904	2,919	1,881	ND	ND	1,242
1982	1,449	2,054	3,503	4,107	1,699	ND	ND	2,316
1983	1,543	2,762	4,305	3,842	1,377	ND	ND	2,853
1984	1,372	2,278	3,650	3,409	1,281	ND	ND	3,964
1985	1,175	1,637	2,812	2,491	1,041	ND	ND	2,986
1986	1,539	2,335	3,874	4,055	1,611	ND	ND	7,071
1987	1,444	2,280	3,724	3,344	1,297	ND	ND	4,461
1988	1,174	2,622	3,796	700	216	ND	ND	4,953
1989	1,081	1,930	3,011	750	269	ND	ND	3,767
1990	1,066	1,581	2,647	1,663	670	ND	ND	2,852
1991	ND	ND	2,281	893	ND	ND	ND	5,055
1992	ND	ND	3,533	843	ND	ND	ND	6,049
1993	ND	ND	2,291	657	ND	ND	ND	8,695
1994	ND	ND	1,790	640	ND	ND	ND	7,217
1995	ND	ND	2,206	750	ND	ND	ND	6,681
1996	ND	ND	2,224	764	ND	5,295	ND	6,128
1997	ND	ND	ND	ND	ND	5,627	ND	6,728
1998	ND	ND	ND	ND	ND	4,202	ND	4,839
1999	1,559	232	1,791	1,397	1,206	7,597	ND	8,255
2000	1,224	192	1,416	1,077	940	8,815	ND	9,901
2001	2,122	464	2,586	2,315	1,897	7,488	ND	8,866
2002	2,526	800	3,326	2,708	1,933	4,791	ND	5,242
2003	2,923	1,204	4,127	3,597	2,500	3,090	ND	4,234
2004	2,641	2,232	4,873	4,356	2,196	3,295	2,407	4,333
2005	2,018	1,060	3,168	2,936	1,909	3,468	2,665	4,520
2006	1,589	1,057	2,646	2,569	1,516	2,421	2,489	3,304
2007	1,038	489	1,527	1,452	965	2,601	2,654	3,663
2008	1,018	396	1,414	1,181	879	2,996	1,984	3,789
2009	674	255	929	734	617	1,637	1,532	3,801
2010	1,090	262	1,352	1,348	1,088	2,239	1,333	3,907
2011	677	256	933	782	654	2,054	ND	3,680
2012	633	163	796	731	631	872	ND	927
2013	1,211	198	1,409	1,213	1,102	1,073	ND	1,073
2014	1,522	911	2,433	2,148	1,411	323	ND	323
2015	1,639	601	2,240	1,903	1,456	589	ND	589
2016	1,833	2,184	4,017	3,847	1,747	683	ND	683
2017	994	682	1,676	1,135	911	27	ND	27
2018	777	964	1,741	1,022	714	30	ND	30

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Appendix A11.–Page 2 of 2.

Return	Count at the weir[a]			Actual escapement[b]		Sport harvest		
						Early run[c]	Creel survey[d]	
year	Non-AFC	AFC	Total	Total	Wild	(through 6/30)	(through 6/30)	Total
2019	1,641	1,995	3,636	1,876	1,444	815	ND	815
2020	918	1,782	2,700	1,088	830	2,178	ND	2,178
2021	635	1,041	1,676	809	594	2,159	ND	2,159
2022	780	2,214	2,994	1,188	735	336	ND	336

Note: AFC means adipose fin clip. ND indicates no available data.

[a] Excludes age 0.1 fish. No weir count in 1997 and 1998.

[b] Number of fish estimated to have actually spawned. During all years, fish were removed at the weir for broodstock and from 1988–1996 fish were also sacrificed for disease concerns.

[c] From Statewide Harvest Survey (Alaska Sport Fishing Survey database [Internet]. 1996–present. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited December 2019]. Available from: https://www.adfg.alaska.gov/sf/sportfishingsurvey/) for the Kasilof River sport fishery (large fish >20 inches only). Includes both wild and hatchery fish and an unknown number of late-run fish prior to 1996.

[d] Harvest estimates from early-run Chinook salmon creel survey, Kasilof River (Cope 2011, 2012). Total harvest is naturally and hatchery-produced combined.

[e] Assumed wild.

Appendix A12.–Estimates of escapement and total return of Kenai River early-run Chinook salmon 75 cm METF and longer.

Brood year	Escapement	Total return	Brood year	Escapement	Total return
1986	8,320	15,199	2005	12,545	6,330
1987	7,109	16,577	2006	5,780	4,650
1988	5,773	15,530	2007	4,493	2,105
1989	4,184	12,254	2008	3,539	1,450
1990	11,344	8,567	2009	3,835	3,512
1991	13,475	9,100	2010	3,082	4,794
1992	11,881	7,186	2011	5,212	6,781
1993	8,442	8,229	2012	2,948	5,857
1994	4,792	13,759	2013	1,541	3,616
1995	3,228	15,572	2014	2,541	4,071
1996	1,853	9,329	2015	4,172	2,855
1997	3,433	15,785	2016	6,328	4,927
1998	5,269	17,425	2017	6,678	ND
1999	4,617	18,970	2018	2,934	ND
2000	9,917	11,284	2019	4,055	ND
2001	12,306	6,380	2020	2,443	ND
2002	7,776	7,125	2021	4,024	ND
2003	12,168	6,730	2022	2,047	ND
2004	18,323	3,198			

Note: ND indicates no available data.

Appendix A13.–Estimates of escapement and total return of Kenai River late-run Chinook salmon 75 cm METF and longer.

Brood year	Escapement	Total return	Brood year	Escapement	Total return
1986	49,197	57,247	2005	55,764	28,696
1987	48,096	63,506	2006	40,911	20,829
1988	42,003	61,111	2007	31,276	20,423
1989	26,852	42,109	2008	30,001	12,525
1990	24,496	40,934	2009	20,807	21,987
1991	29,076	51,875	2010	13,425	19,674
1992	37,788	45,478	2011	16,541	26,343
1993	38,346	42,003	2012	23,427	25,801
1994	31,400	40,549	2013	12,719	15,203
1995	31,022	49,364	2014	11,584	15,037
1996	30,453	54,970	2015	16,857	11,975
1997	24,734	67,788	2016	15,652	14,249
1998	33,381	93,230	2017	20,583	ND
1999	28,769	97,600	2018	17,405	ND
2000	26,331	63,383	2019	11,709	ND
2001	27,895	41,911	2020	11,854	ND
2002	42,940	47,723	2021	12,238	ND
2003	51,862	34,998	2022	13,911	ND
2004	70,617	17,661			

Note: ND indicates no available data.

APPENDIX B: SUPPORTING INFORMATION FOR UPPER COOK INLET CHUM SALMON ESCAPEMENT GOALS

Appendix B1.–Data available for analysis of Clearwater Creek chum salmon escapement goal.

Year	Escapement [a]	Year	Escapement [a]
1971	5,000	2000	31,800
1972	NS	2001	14,570
1973	8,450	2002	8,864
1974	1,800	2003	800
1975	4,400	2004	3,900
1976	12,700	2005	530
1977	12,700	2006	500
1978	6,500	2007	5,590
1979	1,350	2008	12,960
1980	5,000	2009	8,300
1981	6,150	2010	13,700
1982	15,400	2011	11,630
1983	10,900	2012	5,270
1984	8,350	2013	9.010
1985	3,500	2014	3,500
1986	9,100	2015	10,790
1987	6,350	2016	5,060
1988	NS	2017	7,040
1989	2,000	2018	1,800
1990	5,500	2019	9,600
1991	7,430	2020	3,970
1992	8,000	2021	9,440
1993	1,130	2022	4,681
1994	3,500		
1995	3,950		
1996	5,665		
1997	8,230		
1998	2,710		
1999	6,400		

Note: Escapements are peak aerial survey counts.

[a] Escapement not surveyed or monitored during years with NS.

APPENDIX C: SUPPORTING INFORMATION FOR UPPER COOK INLET COHO SALMON ESCAPEMENT GOALS

Appendix C1.–Data available for analysis of Deshka River coho salmon escapement goal.

Year	Escapement	Year	Escapement
1995	12,824	2009	27,348
1996	1,394	2010	10,393
1997	8,063	2011[a]	7,326
1998[a]	6,773	2012	6,825
1999[a]	4,566	2013	22,141
2000	26,387	2014	11,578
2001	29,927	2015	10,775
2002[a]	24,612	2016[a]	6,820
2003	17,305	2017	36,869
2004	62,940	2018	13,072
2005	47,887	2019	10,445
2006	59,419	2020	NS
2007	10,575	2021	NS
2008	12,724	2022	NS

Note: NS means escapement not surveyed or monitored.

[a] Weir inoperable for 6 or more days.

Appendix C2.–Data available for analysis of Fish Creek coho salmon escapement goal.

Year	Escapement[a]	Year	Escapement[a]
1969	5,671[b]	1996	682
1970	NS	1997	3,437[b]
1971	NS	1998	5,463[b]
1972	955[b]	1999	1,766[b]
1973	280[b]	2000	5,218[b]
1974	1,539[b]	2001	9,247[b]
1975	2,135[b]	2002	14,651[b]
1976	1,020[b]	2003	1,231[b]
1977	970	2004	1,415
1978	3,184	2005	3,011
1979	2,511	2006	4,967
1980	8,924	2007	6,868
1981	2,330	2008	4,868
1982	5,201	2009	8,214[b]
1983	2,342	2010	6,977[b]
1984	4,510	2011	1,428
1985	5,089	2012	1,237[b]
1986	2,166	2013	7,593[b]
1987	3,871	2014	10,283[b]
1988	2,162	2015	7,912[b]
1989	3,479	2016	2,484
1990	2,673	2017	8,966[b]
1991	1,297	2018	5,022[b]
1992	1,705	2019	3,025
1993	2,078	2020	4,555
1994	350	2021	NS
1995	390	2022	3,137[c]

[a] Escapement not surveyed or monitored during years with NS.

[b] Calculation of percentiles based on escapements in 1969, 1972–1976, 1978, 1997–2003, 2009–2010, 2012–2015, 2017–2018; these were years with no stocking and for which the weir was operated past September 1. Escapements for 1969, 1972–1976 and 1997, were expanded by 25% to account for removal of weir from September 1 to 17. In 1977, the weir was removed in August, and 1979–1996 were excluded because stocked fish returned.

[c] Incomplete count.

Appendix C3.–Data available for analysis of Jim Creek coho salmon escapement goal.

Year	Escapement[a]	Year	Escapement[a]
1981	NS	2002	2,473
1982	NS	2003	1,421
1983	NS	2004	4,652
1984	NS	2005	1,464
1985	662	2006	2,389
1986	439	2007	725
1987	667	2008	1,890
1988	1,911	2009	1,331
1989	597	2010	242
1990	599	2011	261
1991	484	2012	213
1992	11	2013	663
1993	503	2014	122
1994	506	2015	571
1995	702	2016	106
1996	72	2017	607
1997	701	2018	758
1998	922	2019	162
1999	12	2020	735
2000	657	2021	1,499
2001	1,019	2022	1,899

[a] Escapement for McRoberts Creek only; this is a tributary to Jim Creek. Escapement is not surveyed or monitored during years with NS.

Appendix C4.–Data available for analysis of Little Susitna River coho salmon escapement goal.

Year	Sport harvest[a]	Total escapement[b]	Percent hatchery contribution to escapement[c]	Escapement Hatchery	Escapement Wild	Harvest above weir (lower weir site)	Used to calculate EG[d]
1977	3,415	NS	NS	NS	NS	NA	NS
1978	4,865	NS	NS	NS	NS	NA	NS
1979	3,382	NS	NS	NS	NS	NA	NS
1980	6,302	NS	NS	NS	NS	NA	NS
1981	5,940	NS	NS	NS	NS	NA	NS
1982	7,116	NS	NS	NS	NS	NA	NS
1983	2,835	NS	NS	NS	NS	NA	NS
1984	14,253	NS	NS	NS	NS	NA	NS
1985	7,764	NS	NS	NS	NS	NA	NS
1986	6,039	6,999[e]	ND	ND	6,999	ND	ND
1987	13,003	NS	NS	NS	NS	NS	NS
1988	19,009	20,491	22	4,428	16,063	ND	ND
1989	14,129	15,232[e]	45	6,862	8,370	400	ND
1990	7,497	14,310	24	3,370	10,940	683	10,257
1991	16,450	37,601	22	8,322	29,279	427	28,852
1992	20,033	20,393	11	2,324	18,069	ND	ND
1993	27,610	33,378	29	9,615	23,763	ND	ND
1994	17,665	27,820	18	5,124	22,696	ND	ND
1995	14,451	11,817	9	1,069	10,748	ND	ND
1996	16,753	16,699	3	444	16,255	NA	16,255
1997	7,756	9,894[e]	NA	NA	9,894	NA	ND
1998	14,469	15,159	NA	NA	15,159	NA	15,159
1999	8,864	3,017	NA	NA	3,017	NA	3,017
2000	20,357	15,436	NA	NA	15,436	NA	15,436
2001	17,071	30,587	NA	NA	30,587	NA	30,587
2002	19,278	47,938	NA	NA	47,938	NA	47,938
2003	13,672	10,877	NA	NA	10,877	NA	10,877
2004	15,307	40,199	NA	NA	40,199	NA	40,199
2005	10,203	16,839[e]	NA	NA	16,839	NA	ND
2006	12,399	8,786[e]	NA	NA	8,786	NA	ND
2007	11,089	17,573	NA	NA	17,573	NA	17,573
2008	13,498	18,485	NA	NA	18,485	NA	18,485
2009	8,346	9,523	NA	NA	9,523	NA	9,523
2010	10,622	9,214	NA	NA	9,214	NA	9,214
2011	2,452	4,826	NA	NA	4,826	NA	4,826
2012	1,681	6,779	NA	NA	6,779	ND	ND
2013	5,229	13,583[e]	NA	NA	13,583	1,559	ND
2014	6,922	24,211	NA	NA	24,211	1,454	22,757
2015	8,880	12,756[e]	NA	NA	12,756	1,202	ND
2016	4,361	10,049	NA	NA	10,049	953	9,096
2017	3,068	17,781	NA	NA	17,781	181	17,600
2018	6,663	7,583[e]	NA	NA	7,583	1,160	6,423

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Appendix C4.–Page 2 of 2.

Year	Sport harvest[a]	Total escapement[b]	Percent hatchery contribution to escapement[c]	Escapement Hatchery	Escapement Wild	Harvest above weir (lower weir site)	Used to calculate EG[d]
2019	3,167	4,229	NA	NA	4,229	677	3,552
2020	2,557	10,765	NA	NA	10,765	986	9,779
2021	3,650	10,923	NA	NA	10,923	694	10,229
2022	2,114	3,162	NA	NA	3,162	346	2,816

Note: NS means no escapement data to calculate value; NA means not applicable; ND means no data.

[a] Source: Statewide Harvest Survey (Alaska Sport Fishing Survey database [Internet]. 1996–present. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited November 2019]. Available from: https://www.adfg.alaska.gov/sf/sportfishingsurvey/).

[b] Escapement not surveyed or monitored during years with no escapement value.

[c] Based on sampling and coded wire tag data collected at the weir in 1988–1996. Hatchery stocking program ended in 1995; thus, no hatchery-produced fish in the coho salmon run since 1997.

[d] For the years 1996–2011, the weir was above the Parks Highway where fishing is prohibited, so the weir count is the escapement.

[e] Incomplete or partial count due to weir submersion.

APPENDIX D: SUPPORTING INFORMATION FOR UPPER COOK INLET SOCKEYE SALMON ESCAPEMENT GOALS

Appendix D1.–Data available for analysis of Chelatna Lake sockeye salmon escapement goal.

Year	Escapement	Year	Escapement
1992	35,300[a]	2008	74,469
1993	20,235	2009	17,721
1994	28,303	2010	37,734
1995	20,124	2011	70,353[d]
1996	35,747[b]	2012	37,736
1997	84,899	2013	70,555
1998	51,798[b]	2014	26,374
1999	NS	2015	69,897
2000	NS	2016	60,792
2001	NS	2017	26,986
2002	NS	2018	20,434
2003	NS	2019	26,303
2004	NS	2020	NS
2005	NS	2021	NS
2006	18,433[c]	2022	NS
2007	41,290[c]		

Note: NS means no survey.

[a] Mark–recapture estimate.

[b] Weir inoperable during high water events; missing counts estimated using linear expansion between counts before and after high water (Fair et al. 2009).

[c] Weir inoperable during high water events; missing counts estimated using proportion of radio–tagged fish passing during high water (Fair et al. 2009).

[d] Includes 5,238 estimated passage over the weir during a highwater event.

Appendix D2.–Data available for analysis of Fish Creek sockeye salmon escapement goal.

Year	Escapement[a,b]	Year	Escapement[a,b]	Year	Escapement[a,b]
1946	57,000[c]	1979	68,739	2012	18,813
1947	150,000[c]	1980	62,828	2013	18,912
1948	150,000[c]	1981	50,479	2014	43,915
1949	68,240	1982	28,164	2015	102,309
1950	29,659	1983	118,797	2016	46,202
1951	34,704	1984	192,352	2017	63,882
1952	92,724	1985	68,577	2018	72,157
1953	54,343	1986	29,800	2019	75,411
1954	20,904	1987	91,215	2020	64,408
1955	32,724	1988	71,603	2021	99,324[e]
1956	32,663[b]	1989	67,224	2022	58,330[e]
1957	15,630	1990	50,000		
1958	17,573	1991	50,500		
1959	77,416[d,e]	1992	71,385		
1960	80,000[d,e]	1993	117,619		
1961	40,000[d,e]	1994	95,107		
1962	60,000[d,e]	1995	115,000		
1963	119,024[d,e]	1996	63,160		
1964	65,000[d,e]	1997	54,656		
1965	16,544[d,e]	1998	22,853		
1966	41,312[d,e]	1999	26,746		
1967	22,624[d,e]	2000	19,533		
1968	19,616[d,e]	2001	43,469		
1969	12,456	2002	90,483		
1970	25,000[f]	2003	92,298		
1971	31,900[g]	2004	22,157		
1972	6,981	2005	14,215		
1973	2,705	2006	32,562		
1974	16,225	2007	27,948		
1975	29,882	2008	19,339		
1976	14,032	2009	83,480		
1977	5,183	2010	126,836		
1978	3,555	2011	66,678		

Note: Shaded values indicate years of hatchery production and were not used to evaluate the SEG recommendation. NS means no survey.

[a] Counting occurred downstream of Knik Road prior to 1983, at South Big Lake Road from 1983 to 1991, and at Lewis Road from 1992 to present.

[b] Data for 1979–2000 were excluded from analyses because hatchery stocks were present.

[c] Escapement enumerated by ground surveys.

[d] Escapement enumerated using a counting screen.

[e] Minimum counts due to termination of counting before the end of the run.

[f] Includes 3,500 sockeye salmon behind weir when it washed out on August 8, 1970.

[g] Includes 500 sockeye salmon behind weir when it was removed on August 7, 1971.

Appendix D3.–Data available for analysis of Judd Lake sockeye salmon escapement goal.

Year	Escapement	Year	Escapement
1973	26,428[a]	1998	34,416
1974	NS	1999	NS
1975	NS	2000	NS
1976	NS	2001	NS
1977	NS	2002	NS
1978	NS	2003	NS
1979	NS	2004	NS
1980	43,350[a]	2005	NS
1981	NS	2006	40,633
1982	NS	2007	57,392
1983	NS	2008	53,681
1984	NS	2009	44,616
1985	NS	2010	18,466
1986	NS	2011	39,909
1987	NS	2012	18,715
1988	NS	2013	14,088
1989	12,792	2014	22,229
1990	NS	2015	47,934
1991	NS	2016	NS
1992	NS	2017	35,731
1993	NS	2018	30,844
1994	NS	2019	44,145
1995	NS	2020	31,219
1996	NS	2021	49,440
1997	NS	2022	38,369

Note: NS means no survey.

[a] Aerial survey.

Appendix D4.–Data available for analysis of Kasilof River sockeye salmon escapement goal.

Brood year	Escapement	Returns	Yield	Return per spawner
1968	90,958	145,853	54,895	1.6
1969	46,964	110,919	63,955	2.36
1970	38,797	168,239	129,442	4.34
1971	91,887	295,083	203,196	3.21
1972	115,486	372,639	257,153	3.23
1973	40,880	341,734	300,854	8.36
1974	71,540	342,896	271,356	4.79
1975	48,884	321,500	272,616	6.58
1976	142,058	691,693	549,635	4.87
1977	158,410	610,171	451,761	3.85
1978	119,165	695,679	576,514	5.84
1979	155,527	783,821	628,294	5.04
1980	188,314	1,082,721	894,407	5.75
1981	262,271	1,853,442	1,591,171	7.07
1982	184,204	1,287,592	1,103,388	6.99
1983	215,730	1,008,308	792,578	4.67
1984	238,413	766,694	528,281	3.22
1985	512,827	369,740	-143,087	0.72
1986	283,054	674,252	391,198	2.38
1987	256,707	887,782	631,075	3.46
1988	204,336	665,176	460,840	3.26
1989	164,952	512,385	347,433	3.11
1990	147,663	501,812	354,149	3.4
1991	233,646	946,237	712,591	4.05
1992	188,819	815,919	627,100	4.32
1993	151,801	521,361	369,560	3.43
1994	218,826	765,529	546,703	3.5
1995	202,428	530,599	328,171	2.62
1996	264,511	751,566	487,055	2.84
1997	263,780	682,580	418,800	2.59
1998	259,045	792,308	533,263	3.06
1999	312,481	1,158,888	846,407	3.71
2000	263,631	1,388,432	1,124,801	5.27
2001	318,735	1,627,669	1,308,934	5.11
2002	235,732	1,250,022	1,014,290	5.3
2003	353,526	1,560,304	1,206,778	4.41
2004	523,653	1,491,097	967,444	2.85
2005	360,065	878,678	518,613	2.44
2006	389,645	744,647	355,002	1.91
2007	365,184	484,387	119,203	1.33
2008	327,018	873,640	546,622	2.67
2009	326,283	1,035,630	709,347	3.17
2010	295,265	1,377,594	1,082,329	4.67
2011	245,721	686,373	440,652	2.79
2012	374,523	509,565	135,042	1.36

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Appendix D4.–Page 2 of 2.

Brood year	Escapement	Returns	Yield	Return per spawner
2013	489,654	649,852	160,198	1.33
2014	440,192	700,251	260,059	1.59
2015	470,677	820,766	350,089	1.74
2016	239,981	ND	ND	ND
2017	358,724	ND	ND	ND
2018	388,009	ND	ND	ND
2019	374,109	ND	ND	ND
2020	540,872	ND	ND	ND
2021	521,859	ND	ND	ND
2022	968,149	ND	ND	ND

Note: ND indicates no available data. Parentheses indicate negative values.

Appendix D5.–Data available for analysis of Kenai River sockeye salmon escapement goal.

Brood year	Escapement	Returns	Yield	Return per spawner
1968	115,545	960,169	844,624	8.31
1969	72,901	430,947	358,046	5.91
1970	101,794	550,923	449,129	5.41
1971	406,714	986,397	579,683	2.43
1972	431,058	2,547,851	2,116,793	5.91
1973	507,072	2,125,986	1,618,914	4.19
1974	209,836	788,067	578,231	3.76
1975	184,262	1,055,373	871,111	5.73
1976	507,440	1,506,012	998,572	2.97
1977	951,038	3,112,620	2,161,582	3.27
1978	511,781	3,785,040	3,273,259	7.4
1979	373,810	1,321,039	947,229	3.53
1980	615,382	2,673,295	2,057,913	4.34
1981	535,524	2,464,323	1,928,799	4.6
1982	755,672	9,587,700	8,832,028	12.69
1983	792,765	9,486,794	8,694,029	11.97
1984	446,297	3,859,109	3,412,812	8.65
1985	573,761	2,587,921	2,014,160	4.51
1986	555,207	2,165,138	1,609,931	3.9
1987	2,011,657	10,356,627	8,344,970	5.15
1988	1,212,865	2,546,639	1,333,774	2.1
1989	2,026,619	4,458,679	2,432,060	2.2
1990	794,616	1,507,693	713,077	1.9
1991	727,146	4,436,074	3,708,928	6.1
1992	1,207,382	4,271,576	3,064,194	3.54
1993	997,693	1,689,779	692,086	1.69
1994	1,309,669	3,052,634	1,742,965	2.33
1995	776,847	1,899,870	1,123,023	2.45
1996	963,108	2,261,757	1,298,649	2.35
1997	1,365,676	3,626,402	2,260,726	2.66
1998	929,090	4,465,328	3,536,238	4.81
1999	949,276	5,755,063	4,805,786	6.06
2000	696,899	7,058,333	6,361,435	10.13
2001	738,229	1,697,957	959,728	2.3
2002	1,126,616	3,628,712	2,502,096	3.22
2003	1,402,292	1,919,813	517,521	1.37
2004	1,690,547	3,236,600	1,546,053	1.91
2005	1,654,003	4,804,018	3,150,015	2.9
2006	1,892,090	5,006,280	3,114,190	2.65
2007	964,243	4,378,678	3,414,435	4.54
2008	708,805	3,380,397	2,671,592	4.77

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Appendix D5.–Page 2 of 2.

Brood year	Escapement	Returns	Yield	Return per spawner
2009	848,117	3,809,455	2,961,339	4.49
2010	1,038,302	3,625,388	2,587,086	3.49
2011	1,280,733	4,512,033	3,231,301	3.52
2012	1,212,921	1,468,110	255,189	1.21
2013	980,208	1,108,445	128,238	1.13
2014	1,218,342	3,809,669	2,591,328	3.13
2015	1,400,047	2,272,980	872,932	1.62
2016	1,118,155	ND	ND	ND
2017	1,056,773	ND	ND	ND
2018	831,096	ND	ND	ND
2019	1,457,031	ND	ND	ND
2020	1,605,627	ND	ND	ND
2021	2,006,290	ND	ND	ND
2022	1,206,003[a]	ND	ND	ND

Note: ND indicates no available data.

[a] Escapement is preliminary because sport harvest estimate is not final.

Appendix D6.–Data available for analysis of Larson Lake sockeye salmon escapement goal.

Year	Escapement	Year	Escapement
1984	35,252	2004	NS
1985	37,874	2005	9,955
1986	32,322	2006	57,411
1987	16,748	2007	47,924
1988	NS	2008	34,595
1989	NS	2009	40,930
1990	NS	2010	20,324
1991	NS	2011	12,225
1992	NS	2012	16,557
1993	NS	2013	21,821
1994	NS	2014	12,430
1995	NS	2015	23,185
1996	NS	2016	14,333
1997	40,163	2017	31,866
1998	63,514	2018	23,632
1999	18,943	2019	9,699
2000	11,987	2020	12,074
2001	NS	2021	21,993
2002	NS	2022	17,436
2003	NS		

Note: NS means no survey.

Appendix D7.–Data available for analysis of Packers Creek sockeye salmon escapement goal.

Year	Escapement	Year	Escapement
1974	2,123	2001	NS
1975	4,522	2002	NS
1976	13,292	2003	NS
1977	16,934	2004	NS
1978	23,651	2005	22,000
1979	37,755	2006	NS
1980	28,520	2007	46,637
1981	12,934	2008	25,247
1982	15,687	2009	16,473
1983	18,403	2010	NS
1984	30,403	2011	NS
1985	36,864	2012	NS
1986	29,604	2013	NS
1987	35,401	2014	19,242
1988	18,607	2015	28,072
1989	22,304	2016	NS
1990	31,868	2017	17,164
1991	41,275	2018	16,247
1992	30,143	2019	7,719[a]
1993	40,869	2020	15,903[a]
1994	30,776	2021	19,975
1995	29,473	2022	15,451
1996	16,971		
1997	31,439		
1998	17,728		
1999	25,648		
2000	20,151		

Note: NS means no survey.

[a] Incomplete survey

Appendix D8.–Data available for analysis of early-run Russian River sockeye salmon escapement goal.

Brood year	Escapement[a]	Total return	Yield	Return/spawner	Harvest[b]
1965	21,510	5,970	(15,540)	0.28	10,030
1966	16,660	7,822	(8,838)	0.47	14,950
1967	13,710	18,662	4,952	1.36	7,240
1968	9,120	19,800	10,680	2.17	6,920
1969	5,000	13,169	8,169	2.63	5,870
1970	5,450	12,642	7,192	2.32	5,750
1971	2,650	8,728	6,078	3.29	2,810
1972	9,270	98,980	89,710	10.68	5,040
1973	13,120	26,788	13,668	2.04	6,740
1974	13,160	52,849	39,689	4.02	6,440
1975	5,650	14,130	8,480	2.50	1,400
1976	14,735	115,408	100,673	7.83	3,380
1977	16,060	17,515	1,455	1.09	20,400
1978	34,240	17,001	(17,239)	0.50	37,720
1979	19,750	94,836	75,086	4.80	8,400
1980	28,620	42,401	13,781	1.48	27,220
1981	21,140	76,040	54,900	3.60	10,720
1982	56,110	278,179	222,069	4.96	34,500
1983	21,270	23,549	2,279	1.11	8,360
1984	28,900	42,857	13,957	1.48	35,880
1985	30,610	43,776	13,166	1.43	12,300
1986	36,340	90,637	54,297	2.49	35,100
1987	61,510	109,215	47,705	1.78	154,200
1988	50,410	87,848	37,438	1.74	54,780
1989	15,340	57,055	41,715	3.72	11,290
1990	26,720	94,893	68,173	3.55	30,215
1991	32,389	126,044	93,655	3.89	65,390
1992	37,117	64,978	27,861	1.75	30,512
1993	39,857	41,584	1,727	1.04	37,261
1994	44,872	114,649	69,777	2.56	48,923
1995	28,603	26,462	(2,141)	0.93	23,572
1996	52,905	192,657	139,752	3.64	39,075
1997	36,280	63,876	27,596	1.76	36,788
1998	34,143	57,692	23,549	1.69	42,711
1999	36,607	106,219	69,612	2.90	34,283
2000	32,736	94,932	62,196	2.90	40,732
2001	78,255	77,071	(1,184)	0.98	35,400
2002	85,943	74,180	(11,763)	0.86	52,139
2003	23,650	68,346	44,696	2.89	22,986
2004	56,582	105,293	48,711	1.86	32,727
2005	52,903	31,718	(21,185)	0.60	37,139
2006	80,524	59,545	(20,979)	0.74	51,167
2007	27,298	36,587	9,289	1.34	37,185
2008	30,989	72,061	41,072	2.33	43,420
2009	52,178	109,924	48,772	1.93	59,702
2010	27,074	63,213	36,139	2.34	23,412

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Appendix D8.–Page 2 of 2.

Brood year	Escapement[a]	Total return	Yield	Return/spawner	Harvest[b]
2011	29,129	76,795	44,936	2.54	22,697
2012	24,115	13,215	(10,900)	0.55	15,231
2013	35,776	115,625	79,849	3.23	27,162
2014	44,920	133,878	88,958	2.98	35,870
2015	50,226	92,528	42,302	1.84	29,997
2016	38,739	43,116	4,377	1.11	13,086
2017[c]	37,123	ND	ND	ND	27,109
2018[c]	44,110	ND	ND	ND	26,999
2019[c]	125,942	ND	ND	ND	60,339
2020[c]	27,103	ND	ND	ND	25,731
2021[c]	46,976	ND	ND	ND	35,776
2022[c]	61,098	ND	ND	ND	20,366

Note: ND indicates no available data. Parentheses indicate negative values.

[a] Escapements of brood years 1965–1968 from tower counts and of 1969–2022 from weir counts.

[b] Harvest during 1965–1996 from an onsite creel survey and during 1997–2022 from Statewide Harvest Survey. Estimates are only of fish harvested near the Russian River itself.

[c] Complete return data not yet available.

Appendix D9.–Data available for analysis of late-run Russian River sockeye salmon escapement goal.

Year	Harvest[a]	Escapement[b] above weir	Year	Harvest[a]	Escapement[b] above weir
1963	1,390	51,120	1993	26,772	99,259
1964	2,450	46,930	1994	26,375	122,277
1965	2,160	21,820	1995	11,805	61,982
1966	7,290	34,430	1996	19,136	34,691
1967	5,720	49,480	1997	12,910	65,905
1968	5,820	48,880	1998	25,110	113,477
1969	1,150	28,870	1999	32,335	139,863
1970	600	26,200	2000	30,229	56,580
1971	10,730	54,420	2001	18,550	74,964
1972	16,050	79,115	2002	31,999	62,115
1973	8,930	25,070	2003	28,085	157,469
1974	8,500	24,900	2004	22,417	110,244
1975	8,390	31,960	2005	18,503	54,808
1976	13,700	31,940	2006	29,694	84,432
1977	27,440	21,360	2007	17,161	53,068
1978	24,530	34,340	2008	24,158	46,638
1979	26,840	87,850	2009	34,366	80,088
1980	33,500	83,980	2010	9,579	38,848
1981	23,720	44,520	2011	14,723	41,529
1982	10,320	30,800	2012	15,535	54,911
1983	16,000	33,730	2013	20,713	31,573
1984	21,970	92,660	2014	18,360	52,277
1985	58,410	136,970	2015	14,448	46,223
1986	30,810	40,280	2016	12,123	37,837
1987	40,580	53,930	2017	10,855	44,110
1988	19,540	42,480	2018	15,344	71,052
1989	55,210	138,380	2019	17,717	64,585
1990	56,180	83,430	2020	11,363	78,832
1991	31,450	78,180	2021	15,282	123,950
1992	26,101	63,478	2022	19,994	124,561

[a] Harvest during 1963–1996 from an onsite creel survey and during 1997–2021 from Statewide Harvest Survey (Alaska Sport Fishing Survey database [Internet]. 1996–present. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited November 2022]. Available from: https://www.adfg.alaska.gov/sf/sportfishingsurvey/). Estimates are only of fish harvested near the Russian River itself.

[b] Escapements of brood years 1963–1968 from tower counts and 1969–2022 from weir counts.

APPENDIX E: ESCAPEMENT GOAL MEMO PRESENTED TO THE ALASKA BOARD OF FISHERIES

Appendix E1.–2023 Memo to the Board of Fisheries on 2022 Upper Cook Inlet escapement goals.

THE STATE of ALASKA
GOVERNOR MICHAEL J. DUNLEAVY

Department of Fish and Game

DIVISIONS OF SPORT FISH AND COMMERCIAL FISHERIES
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MEMORANDUM

TO: Tom Taube, Acting Director, Division of Sport Fish

Sam Rabung, Director, Division of Commercial Fisheries

DATE: March 31, 2023

SUBJECT: Upper Cook Inlet Escapement Goal Memorandum

THRU: Jason Dye, Regional Supervisor, JED
Division of Sport Fish, Region II

Bert Lewis, Regional Supervisor, BL
Division of Commercial Fisheries, Region II

FROM: Tim McKinley, Regional Research TRM
Coordinator, Division of Sport Fish, Region II

Jack W. Erickson, Regional Research Coordinator, Division of Commercial Fisheries, Region II

This memorandum summarizes the Alaska Department of Fish and Game (department) review of Upper Cook Inlet (UCI) escapement goals and associated findings for escapement goals. Escapement goals in this management area have been set and evaluated at regular intervals since statehood. All UCI escapement goals were last reviewed by the department (McKinley et al. 2020) during the 2019–2020 Alaska Board of Fisheries (board) cycle. Due to changing productivity of a stock or system, escapement goals evolve over time. As a result, during the escapement goal review process, the department evaluates new methodologies and concepts and utilizes the best available data to establish or update escapement goals.

Between March 2022 and March 2023, an interdivisional salmon escapement goal review committee, including staff from the divisions of Commercial Fisheries and Sport Fish, met twice and reviewed existing salmon escapement goals in the UCI management area.

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The department recognizes the importance of releasing escapement goal findings earlier in the year so the public may submit proposals relative to goals before the deadline of Monday, April 10, 2023. Thus, department staff completed their review on an accelerated timeline, and developed findings for UCI salmon escapement goals (Table 1). It is important to note that any goal changes will not take effect until the 2024 fishing season, as they are not officially adopted until after the 2023–2024 board regulatory cycle.

The review was based on the *Policy for the management of sustainable salmon fisheries* (5 AAC 39.222) and the *Policy for statewide salmon escapement goals* (5 AAC 39.223). Two important terms are used:

> 5 AAC 39.222(f)(3) "biological escapement goal" or "(BEG)" means the escapement that provides the greatest potential for maximum sustained yield . . .;"
>
> and
>
> 5 AAC 39.222(f)(36) "sustainable escapement goal" or "(SEG)" means a level of escapement, indicated by an index or an escapement estimate, that is known to provide for sustained yield over a 5 to 10 year period, used in situations where a BEG cannot be estimated or managed for . . .;"

Accordingly, the committee also determined the appropriate goal type (BEG or SEG) for each salmon stock with an existing goal. Based on the quality and quantity of available data, the committee determined the most appropriate methods to evaluate the escapement goals.

Escapement goals were evaluated for UCI stocks using a variety of methods: 1) spawner-recruit analyses, and (or) 2) the percentile approach (Clark et al. 2014). The committee developed escapement goals for each stock, compared them with the current goal if one exists, and agreed on whether to keep the current goal or change it. The methods used to evaluate the escapement goals and the rationale for subsequent findings will be described in a published report (McKinley et al. *In prep*) available prior to the February 2024 Upper Cook Inlet regulatory meeting.

Susitna River king salmon

The committee findings are for no change in the SEGs for any of the four king salmon stock goals in the Susitna River drainage. The stock-recruit model used to set the initial Susitna River king salmon escapement goals for four stocks in 2020 (Deshka, Eastside, Talkeetna, and Yentna Rivers) was updated using data available through 2022. Although modeled estimates of Smsy increased for some stocks, the review team determined no changes to the current escapement goals are warranted as these goals were just developed and set in 2020, and an increase in model error (specifically process error) is responsible for most of the increase in estimates of Smsy (Table 1). If estimates of Smsy are again higher in future in-cycle reviews, the committee would be more likely to consider a change in the related escapement goals.

The estimate of Smsy for the Deshka River stock increased by approximately 1,000 fish (8%). The updated Optimum Yield Profile (OYP) suggests approximately 80% probability of achieving at least 80% of MSY with the current BEG (9,000–18,000), a change from approximately 92% and 78% probabilities at the lower and upper bounds in the 2020 analysis. However, the process error associated with this analysis is very large and has increased since the initial 2020 escapement goal analysis. Because the increase in Smsy is driven by increased process error and the OYP

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probabilities associated with the existing goal continue to provide a high probability of maximum sustained yield, no change to the goal is warranted.

The estimate of Smsy for the Eastside Susitna River stock increased by approximately 1,600 fish (12%). The OYP probabilities associated with the existing SEG (13,000–25,000) in 2020 (96% and 19%) probability of achieving at least 80% of MSY at the lower and upper bound, respectively) were extremely conservative compared to other king salmon goals in Alaska, and remain so (91% and 36% probability of achieving at least 80% of MSY at the lower and upper bound, respectively) with the updated analysis. As with the results for the Deshka River stock, the process error associated with the results for this stock increased since the last board meeting and contribute to the increase in the estimate of Smsy. Because of increased process error and the OYP probabilities associated with the existing goal range continuing to be conservative, no change to the goal is warranted.

The estimates of Smsy for the Talkeetna River stock and Yentna River stock are unchanged from the estimates used in the 2020 escapement goal review to set the current SEGs (9,000–17,500 and 13,000–22,000, respectively); no change to the goal is warranted.

Campbell Creek king salmon

The committee findings are for a change in the current lower bound SEG for Campbell Creek king salmon, from 380 fish to 340. Campbell Creek king salmon are assessed by a foot survey and experience a very small (unestimated) harvest via a youth fishery. Previous escapement goals for this stock were 250 fish (beginning in 1993), and a range of 50–700 fish beginning in 2001. The current lower bound SEG of 380, established in 2011, is based on the risk-based analysis (Bernard et al. 2009). The 2023 review used the 1982–2022 foot surveys (the same starting year used for the current SEG) and the percentile approach. As this stock fits the Tier 1 percentile criteria (high contrast, high measurement error, low harvest rates), the 20th percentile was used and resulted in a lower bound SEG of 340 king salmon.

Kenai River early- and late-run king salmon

The committee findings are for no change in the SEGs for either of these king salmon stocks. Large fish (fish ≥75 cm mid-eye-to-fork of tail length) sustainable escapement goals (assessed by estimates of large fish produced from sonar) were adopted for the first time for both of these stocks in 2017. For the 2023 early-run reconstruction, the late-run king salmon abundance was not included as an index of early-run abundance (as done in the the 2017 model); the resultant early run estimate of Smsy is approximately 800 fish larger (24%) than the estimate in 2017. The difference in Smsy is driven by the removal of late-run king salmon abundance as an early-run index. The updated OYP suggests approximately 84% and 75% probabilities of achieving at least 80% of MSY at the lower and upper bounds of the current SEG (2,800–5,600), a change from approximate 97% and 47% probabilities at the lower and upper bounds in the 2017 analysis. Because the change in Smsy is driven by a change to the model and the updated analysis suggests the current goal continues to provide high probabilities of maximizing sustained yield, no change to the SEG is warranted. For comparison, the optimum escapement goal (OEG) for this stock is 3,900–6,600.

The late run estimate of Smsy from the 2023 analysis is similar to the 2017 estimate (17,879 vs 18,477, respectively). Also, the existing late-run SEG anticipates similar OYP probabilities as were selected in 2017. For comparison, the OEG for this stock is 15,000–30,000. The committee found that no change in the SEGs for either of the Kenai River king salmon stocks is warranted.

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Fish Creek sockeye salmon

The current weir-based SEG (15,000–45,000) for Fish Creek was established in 2017 using the percentile approach. For this review, the committee updated the time series through 2020 and concluded there was insufficient new information to suggest the goal should be changed.

Kasilof River sockeye salmon

The current sonar-based BEG (140,000–320,000) for Kasilof River sockeye salmon was established in 2020. For this review, the committee updated the escapement time series and incorporated production data through 2021. The committee then examined the fit of 3 stock-recruit models (traditional Ricker, Ricker autoregressive, and Beverton-Holt) to data from brood years 1968 to 2015 (i.e., all available spawner-return data). As with the previous analysis (McKinley et al. 2020), the best fitting model was a Ricker model autoregressive with 1-year lag. There was insufficient new information to suggest the goal should be changed.

Kenai River sockeye salmon

The current sonar-based SEG (750,000–1,300,000) for Kenai River sockeye salmon was established in 2020 based on the traditional Ricker model (Hasbrouck et al. 2022). This review updated the escapement time series and incorporated production data through 2021. The committee then examined the fit of 3 stock-recruit models (traditional Ricker, Ricker autoregressive, and Beverton-Holt) to the data from brood years 1968 to 2015. Markov-type yield tables were also updated to include production data through 2021. The results from the stock-recruit analysis and the Markov-type yield tables were consistent with those reported previously by Hasbrouck et al. (2022). Therefore, no change to the escapement goal is warranted.

In summary, the escapement goal committee reviewed 28 salmon escapement goals for the UCI management area. The only escapement goal change is to update the Campbell Creek king salmon lower bound SEG.

A report containing details of the escapement goal analyses will be published prior to the February 2024 Upper Cook Inlet regulatory meeting. A brief oral report will be given to the board at the October 2023 Work Session. A more detailed oral report concerning escapement goals will be presented to the board in February 2024. These reports will list all current and new escapement goals for UCI, as well as a detailed description of the methods used to reach the committee's findings.

Salmon stock of concern recommendations will be finalized after the 2023 salmon season to include the most recent year's escapements. These recommendations will be formalized in a memo and presented at the board Work Session in October 2023.

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Table 1.–Summary of current escapement goals and committee findings for salmon stocks in Upper Cook Inlet, 2023.

System	Current Escapement Goal			Escapement Goal findings beginning with 2024 season			
	Goal	Type	Year adopted	Range or lower bound	Type	Data	Action
King Salmon							
Susitna River							
Deshka River	9,000–18,000	BEG	2020			weir	No Change
Eastside Susitna River	13,000–25,000	SEG	2020			multiple aerial surveys[a]	No Change
Talkeetna River	9,000–17,500	SEG	2020			multiple aerial surveys[a]	No Change
Yentna River	13,000–22,000	SEG	2020			multiple aerial surveys[a]	No Change
	16,000-22000	OEG	2020				
Alexander Creek	1,900–3,700	SEG	2020			single aerial survey	No Change
Chulitna River	1,200–2,900	SEG	2020			single aerial survey	No Change
West Cook Inlet and Knik Arm							
Chuitna River	1,000–1,500	SEG	2020			single aerial survey	No Change
Theodore River	500–1,000	SEG	2020			single aerial survey	No Change
Little Susitna River weir	2,300–3,900	SEG	2017			weir	No Change

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Table 1.–Page 2 of 3.

System	Current Escapement Goal: Goal	Current Escapement Goal: Type	Current Escapement Goal: Year adopted	Escapement Goal findings beginning with 2024 season: Range or lower bound	Escapement Goal findings beginning with 2024 season: Type	Data	Action
West Cook Inlet and Knik Arm							
Little Susitna River aerial	700–1,500	SEG	2020			single aerial survey	No Change
Anchorage							
Campbell	380	LB SEG	2011	**340**	LB SEG	single foot survey	Update
Northern Kenai Peninsula							
Crooked Creek	700–1,400	SEG	2020			weir	No Change
Kenai River - Early Run (large fish)	2,800–5,600[b]	SEG	2017			sonar	No Change
	3,900–6,600[b]	OEG	2017				
Kenai River - Late Run (large fish)	13,500–27,000[b]	SEG	2017			sonar	No Change
	15,000–30,000	OEG	2020				
Chum Salmon							
Clearwater Creek	3,500–8,000	SEG	2017			peak aerial survey	No Change
Coho Salmon							
Susitna River							
Deshka River	10,200–24,100	SEG	2017			weir	No Change
Knik Arm							
Fish Creek (Knik)	1,200–6,000	SEG	2020			weir	No Change
Jim Creek	250–700	SEG	2020			single foot survey	No Change
Little Susitna River	9,200–17,700[c]	SEG	2020			weir	No Change

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Table 1.–Page 3 of 3.

	Current Escapement Goal			Escapement Goal findings beginnings with 2024 season			
System	Goal	Type	Year adopted	Range or lower bound	Type	Data	Action
Sockeye Salmon							
Susitna River							
Chelatna Lake	20,000–45,000	SEG	2017			weir	No Change
Judd Lake	15,000–40,000	SEG	2017			weir	No Change
Larson Lake	15,000–35,000	SEG	2017			weir	No Change
Cook Inlet and Knik Arm							
Fish Creek	15,000–45,000	SEG	2017			weir	No Change
Packers Creek	15,000–30,000	SEG	2008			weir	No Change
Northern Kenai Peninsula							
Kasilof River	140,000–320,000	BEG	2020			sonar	No Change
	140,000–370,000	OEG	2011				
Kenai River	750,000–1,300,000	SEG	2020			sonar	No Change
Russian River-Early Run	22,000–42,000	BEG	2011				No Change
Russian River-Late Run	44,000–85,000	SEG	2020			weir	No Change

[a] Single aerial surveys of individual tributaries are combined with other historical data to estimate annual run size for three stocks of the Susitna River drainage.

[b] Fish 75 cm mid-eye-to-fork of tail length or longer

[c] Based on escapement (weir count - harvest above weir).