Review of Salmon Escapement Goals in the Alaska Peninsula and Aleutian Islands Management Areas, 2020

by

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Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

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	$(F, t, \chi^2, etc.)$
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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ABSTRACT

In October 2020, an interdivisional team, including staff from the Division of Commercial Fisheries and the Division of Sport Fish, was formed to review Pacific salmon *Oncorhynchus* spp. escapement goals of Alaska Peninsula and Aleutian Islands Management areas (Area M). This 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). Of the 22 existing Area M salmon escapement goals evaluated, the team recommended revising 10 goals and leaving the remaining 12 goals unchanged.

After a comprehensive review of the available data, the team found that no changes in the current sustainable escapement goals (SEGs) were warranted for sockeye salmon *O. nerka* system runs to Bear (early and late run) and McLees Lakes, the Cinder, Meshik, and North Creek Rivers, nor for the sockeye salmon biological escapement goal (BEG) for Nelson River. In addition, the team determined no changes were warranted for Nelson River Chinook salmon (*O. tshawytscha*), South Peninsula pink salmon (*O. gorbuscha*), or the current aggregate district SEGs for chum salmon (*O. keta*) in the Southeastern, South Central, and Southwestern Districts.

The team determined revisions were warranted and revised goals for 6 sockeye salmon systems (Ilnik River SEG 40,000–75,000, Sandy River SEG 37,000–69,000, Christianson Lagoon SEG 23,000–50,000, Orzinski Lake SEG 14,000–28,000, Mortensen Lagoon SEG 1,400–5,700, and Thin Point Lake SEG 9,000–19,000), 2 chum salmon systems (Northern District SEG 49,000–132,000 and Northwestern District SEG 49,000–133,000), and 2 coho salmon systems (Nelson River SEG 19,000–29,000 and Ilnik River SEG 9,000–24,000). The chum salmon aggregate goal reviews incorporated a reduction to the number of index streams, which accounts for the apparent large changes in these goals.

Keywords: Pacific salmon, *Oncorhynchus*, escapement goal, Area M, Alaska Peninsula, stock status

INTRODUCTION

This report documents the 2020 review of salmon escapement goals in the Alaska Peninsula and Aleutian Islands Management areas (Area M) based on the Alaska Board of Fisheries (BOF) *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). Findings from this review are presented to the directors of the Divisions of Commercial Fisheries and Sport Fish of the Alaska Department of Fish and Game (ADF&G) and are intended to take effect for salmon stocks returning in 2023. Salmon escapement goals in Area M were last reviewed in 2018 (Schaberg et al. 2019).

Two important terms defined in the SSFP are as follows:

1. "*biological escapement goal* (BEG): the escapement that provides the greatest potential for maximum sustained yield (MSY); …" and
2. "*sustainable escapement goal* (SEG): 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…"

A report documenting the established escapement goals for stocks of 5 Pacific salmon species (Chinook *Oncorhynchus tshawytscha*, sockeye *O. nerka*, coho *O. kisutch*, pink *O. gorbuscha*, and chum *O. keta* salmon) spawning in the Kodiak, Chignik, Alaska Peninsula, and Aleutian Islands Management areas of Alaska was prepared in 2001 (Nelson and Lloyd 2001). Most of the escapement goals documented in the 2001 report were based on average escapement estimates and spawning habitat availability and had been implemented in the early 1970s and 1980s.

Since 2001, escapement goals for Area M have gone through review 6 times (Nelson et al. 2006; Honnold et al. 2007; Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

In October 2020, the Salmon Escapement Goal Interdivisional Review Team (hereafter referred to as the team) was formed to review the existing Area M salmon escapement goals and recent escapements for stocks with escapement goals. The team included staff from the Division of Commercial Fisheries (CF) and the Division of Sport Fish (SF): Kevin Schaberg (CF), Tim McKinley (SF), Nicholas Sagalkin (CF), Heather Finkle (CF), M. Birch Foster (CF), Michelle Wattum (CF), Jeff Wadle (CF), Michelle Stratton (CF), Reid Johnson (CF), Bob Murphy (CF), Lisa Fox (CF), Cassandra Whiteside (CF), Tyler Lawson (CF), Bill Templin (CF), Andrew Munro (CF), Rich Brenner (CF), Sarah Power (CF), Jim Hasbrouck (SF), Tom Vania (SF), Dan Bosch (SF), Mark Witteveen (SF), Adam St. Saviour (SF), Jason Dye (SF), and Tyler Polum (SF).

For this review, the team (1) reviewed recent escapements to all stocks with escapement goals; (2) determined the appropriate goal type (BEG or SEG) for each Area M salmon stock with an existing goal, based on the quality and quantity of available data; (3) determined the most appropriate methods to evaluate the escapement goal ranges; (4) estimated the escapement goal for each stock and compared these estimates with the current goal; (5) determined if a goal could be developed for any stocks or stock-aggregates that currently have no goal; and (6) developed recommendations for each goal evaluated to present to the directors of the divisions of Commercial Fisheries and Sport Fish for approval.

STUDY AREA

Area M is composed of 2 separate management areas: (1) the Alaska Peninsula Management Area and (2) the Aleutian Islands Management Area (Figure 1).

Alaska Peninsula Management Area includes all waters of Alaska from Cape Menshikof to Cape Sarichef and from a line extending from Scotch Cap through the easternmost tip of Ugamak Island to a line extending 135° southeast from Kupreanof Point (55°33.98′ N lat, 159°35.88′ W long; 5 AAC 09.100). The area is divided into 6 commercial fishing districts: the Southeastern (including the Southeastern District Mainland and the Shumagin Islands), South Central, Southwestern, Unimak, Northwestern, and Northern Districts (5 AAC 09.200). Commonly, aggregates of these districts are referred to as the South Peninsula and North Peninsula (Figure 2). These districts are further subdivided into sections and smaller statistical areas.

The Aleutian Islands Management Area includes the waters of Alaska surrounding the Aleutian Islands west of Cape Sarichef and west of a line extending from Scotch Cap through the easternmost tip of Ugamak Island, including waters surrounding the Pribilof Islands (5 AAC 12.100), except the Atka-Amlia Islands Area described in 5 AAC 11.101 (Figure 1). The Aleutian Islands area is separated into 4 commercial fishing districts: the Akutan, Unalaska, Umnak, and Adak Districts. There is little commercial salmon fishing in the area and very few of the 458 known salmon streams are consistently monitored for escapement (Holmes 1997).

BACKGROUND

Nelson River on the North Peninsula is the only Chinook salmon system in Area M with an escapement goal (Table 1, Figure 3). Chinook salmon escapement at this system is primarily monitored by weir counts. There are no spawning stocks of Chinook salmon documented along the South Peninsula or Aleutian Islands.

A total of 13 sockeye salmon stocks (12 systems) in Area M have escapement goals in place. Three of these stocks are located along the South Peninsula, 9 are located along the North Peninsula, and

1 is located on Unalaska Island (Table 1, Figures 3 and 4). All of these stocks directly affect the daily management of associated fisheries and 6 of these systems currently have weirs for direct enumeration of escapement. Escapements of the remaining stocks are monitored via aerial surveys.

Coho salmon are not monitored in some Area M streams due to the difficulty and expense of conducting surveys during late fall. However, there are escapement goals in place for 2 coho stocks on the North Peninsula (Table 1, Figure 3). There are no coho salmon escapement goals for the Aleutian Islands where conducting aerial surveys has proven to be unfeasible.

Pink salmon are generally a high-volume commercial species in Area M and are managed as aggregates of streams. The stock-aggregate pink salmon even- and odd-year escapement goal for the South Peninsula was converted to a single annual goal implemented in 2016 due to reduced variability in even- and odd- year run sizes. Harvest taken before July 15 was also excluded in the run reconstruction to avoid inclusion of nonlocal pink salmon (Table 1, Figure 3). The single stock-aggregate goal is composed of the respective sums of aerial survey escapement objectives for 165 individual index streams (Nelson and Lloyd 2001; Honnold et al. 2007).

A total of 5 stock-aggregate escapement goals are currently established for chum salmon in Area M (Table 1, Figures 2 and 3). Past reviews established stock-aggregate goals composed of the respective sums of aerial survey escapement objectives for 136 individual index streams (Nelson and Lloyd 2001; Honnold et al. 2007). The 2018 review, using consistently surveyed peak aerial survey data, reduced the number of index steams used for South Peninsula district aggregate escapement goals. There are no chum salmon escapement goals for the Aleutian Islands, where conducting aerial surveys to monitor escapement are problematic and costly.

METHODS

During the review process all escapement goals were reviewed and 6 sockeye salmon stocks, 2 coho salmon stocks, and 2 chum salmon aggregates were reevaluated (Table 1). Our review examined recent (2018 to 2020) data and updated previous analyses. We did not review or analyze data for most stocks for which goals were recently analyzed (2015 and 2018). A formal meeting, via teleconference, to discuss and develop recommendations was held in October 2020. The team also communicated on a regular basis by telephone and email and met again in February 2022.

Available escapement, harvest, and age data associated with each stock or combination of stocks were compiled from research reports, management reports, and unpublished historical databases. Limnological and spawning habitat data were compiled for each system when available. The team evaluated the type, quality, and amount of data for each stock (Table 2). This evaluation was used to assist in determining the appropriate type of escapement goal to apply to each stock, as defined in the SSFP and EGP.

BIOLOGICAL ESCAPEMENT GOAL DETERMINATION

In Alaska, most salmon BEGs are developed using Ricker (1954) spawner–recruit models (Munro and Brenner 2022). BEG ranges, as defined in the SSFP (5AAC 39.222), are estimates of the number of spawners that provide the greatest potential for maximum sustained yield, abbreviated as S_{MSY}. Only the Nelson River Chinook salmon BEG was reevaluated during this review.

SUSTAINABLE ESCAPEMENT GOAL DETERMINATION

Sustainable escapement goals (SEGs) for Area M salmon stocks were determined using the

Percentile Approach[1] described in Bue and Hasbrouck in 2001 for goals implemented prior to 2014. For goals reevaluated and implemented after 2014, the criteria of the Percentile Approach described in Clark et al. (2014) were used. The Percentile Approach is based on the principle that escapements of a stock within some range of percentiles observed over the time series of escapements and associated harvest from fishing represents a proxy for maintaining escapements within a range that encompasses S_{MSY} (Clark et al. 2014).

The Percentile Approach considers the measurement error of the data collection method (e.g., weirs and towers have lower measurement error than aerial or foot surveys), contrast of the escapement data (i.e., the ratio of highest observed escapement to the lowest observed escapement), and the average harvest rate of the stock. Based on these criteria, Clark et al. (2014) recommended the following tiers to set the SEG range.

Tier	Escapement contrast	Measurement error	Harvest rate	SEG range
1	>8	High (aerial and foot surveys)	Low to moderate (<0.40)	20th–60th percentile
2	>8	Low (weirs and towers)	Low to moderate (<0.40)	15th–65th percentile
3	4–8	–	Low to moderate (<0.40)	5th–65th percentile

CHINOOK SALMON

Nelson River

Escapement Goal Background and Previous Reviews

Nelson River is in the Nelson Lagoon Section of the Northern District of the Alaska Peninsula Management Area (Figure 3). Nelson River has the only Chinook salmon escapement goal currently established in Area M. Escapement has been counted almost every year since 1974 from either a tower (1974 to 1988) or a weir (1989 to present). Since 1985, salmon escapement was only assessed through the end of the sockeye salmon run. In nearly all years, an aerial survey was conducted to count Chinook salmon downstream of the tower or weir on the day that, or a few days after, the weir or tower was removed. Stock-specific catch data are available from the Nelson Lagoon Section gillnet fishery due to the terminal nature of that fishery. The first published escapement goal for Nelson River was developed in 1985, and a range was set at 4,500 to 9,000 Chinook salmon based on weir and counting tower data collected from 1978 to 1984 (Nelson and Lloyd 2001; Appendix A). The goal was changed in 1993 to a range of 3,200 to 6,400 Chinook salmon based on aerial survey data collected from 1985 to 1992 (Nelson and Lloyd 2001). The goal was corroborated in 2003 using a Ricker spawner–recruit curve, and was modified in 2006 (Nelson et al. 2006) to a BEG of 2,400 to 4,400 fish using a habitat model and corroborated with a Ricker spawner–recruit curve (Ricker 1954). The BEG was reevaluated in 2009, 2012, and 2015,

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

resulting in no change to the Nelson River Chinook salmon BEG (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015). The 2018 review, however, resulted in updating the goal using a Ricker spawner–recruit curve to a BEG with a range of 2,400 to 5,000 fish (Schaberg et al. 2019).

2020 Review

Nelson River Chinook salmon escapements since the last review were within or above the current BEG since 2018 (Appendix A2). The team determined that since the last formal review was done in 2018, new information from 2018 to 2020 would not effectively change the stock–recruit relationship and further analysis was not warranted in 2020.

SOCKEYE SALMON

Orzinski Lake

Escapement Goal Background and Previous Reviews

Orzinski Lake is located in the Northwest Stepovak Section of the Southeastern District (Figures 2 and 3). The first published escapement goal for Orzinski Lake was an aerial survey indexed goal of 10,000 to 20,000 fish developed in 1980 (Nelson and Lloyd 2001). A weir-based goal was established in 1992 with a range was set at 15,000 to 20,000 sockeye salmon (Nelson and Lloyd 2001; Appendix B). Aerial surveys were used to estimate escapement into Orzinski Lake from 1968 through 1989, and a weir was used from 1990 through the present. An escapement goal review of this system was conducted in 2003. All available stock assessment data were analyzed using the Percentile Approach, euphotic volume, smolt biomass as a function of zooplankton biomass, and lake surface area methods, and these analyses reasonably corroborated the existing SEG and no change was warranted (Nelson et al. 2006). During the 2006 escapement goal review (Honnold et al. 2007), staff examined escapement data using the Percentile Approach (Bue and Hasbrouck *unpublished*) and determined there was no significant change in the estimate and that the goal would remain the same. With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates for Orzinski Lake sockeye salmon are not available. Recent escapement estimates and age compositions were examined to determine if a change in the escapement goal was justified. Since the last review was in 2007 using the 4-tier Percentile Approach, the team agreed that analysis using the updated Percentile Approach (Clark et al. 2014) was warranted in 2020.

Thin Point Lake

Escapement Goal Background and Previous Reviews

Thin Point Lake is in the Thin Point Section of the Southwestern District (Figures 2 and 3). The first published escapement goal for Thin Point Lake was developed in the late 1980s and a range was set at 14,000 to 28,000 sockeye salmon (Nelson and Lloyd 2001; Appendix C). Aerial surveys have been used to estimate escapement into Thin Point Lake from 1968 to the present and a weir was used from 1994 to 1998.

An escapement goal review of this system was conducted in 2003. All available stock assessment data were analyzed using the Percentile Approach, euphotic volume analysis, smolt biomass as a function of zooplankton biomass, and lake surface area methods (Nelson et al. 2006). The authors concluded that these analyses reasonably corroborated the existing SEG and no change was warranted. With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses. (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates for Thin Point Lake sockeye salmon were not available. Recent escapement data (Appendix C2) were examined to determine if a change in the escapement goal was justified. The escapement has failed to meet the current escapement goal in 5 of the past 10 years. Since the last review was in 2006, the team agreed that analysis using the updated Percentile Approach was warranted in 2020.

Mortensens Lagoon

Escapement Goal Background and Previous Reviews

Mortensens Lagoon is in the Cold Bay Section of the Southwestern District (Figures 2 and 3). The first published escapement goal range for Mortensens Lagoon was developed in the late 1980s and set at 3,200 to 6,400 sockeye salmon (Nelson and Lloyd 2001; Appendix D). Aerial surveys have been used to estimate escapement into Mortensens Lagoon from 1968 to the present and a weir was operated from 2001 to 2006.

An escapement goal review conducted during 2003 using the Percentile Approach, euphotic volume analysis, smolt biomass as a function of zooplankton biomass, and lake surface area methods concluded that these analyses reasonably corroborated the existing SEG and no change was warranted (Nelson et al. 2006). During the subsequent 2006 escapement goal review, the team used the Percentile Approach, which corroborated the 3,200 to 6,400 sockeye salmon SEG (Honnold et al. 2007). With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates for Mortensens Lagoon sockeye salmon were not available. Recent escapement data (Appendix D2) were examined to determine if a change in the escapement goal was justified. The current escapement goal has been met or exceeded in 5 of the last 10 years. The team agreed that further analysis using the updated Percentile Approach was warranted in 2020.

Christianson Lagoon

Escapement Goal Background and Previous Reviews

Christianson Lagoon is in the Urilia Bay Section of the Northwestern District (Figures 2 and 3). The first published escapement goal range for Christianson Lagoon was developed in the 1980s and set at 25,000 to 50,000 sockeye salmon (Nelson and Lloyd 2001; Appendix E). Aerial surveys have been used to estimate escapement into Christianson Lagoon from 1960 to the present.

An escapement goal review of this system conducted during 2003 using the Percentile Approach concluded that the analysis reasonably corroborated the existing SEG and no change was warranted (Nelson et al. 2006). The 2006 escapement goal review corroborated the 25,000 to 50,000 sockeye salmon SEG (Honnold et al. 2007). With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates for Christianson Lagoon sockeye salmon were not available. Recent escapement data (Appendix E2) were examined to determine if a change in the escapement goal was justified. The current escapement goal has been met or exceeded in 8 of the past 10 years. The team agreed that further analysis using the updated Percentile Approach was warranted in 2020.

North Creek

Escapement Goal Background and Previous Reviews

North Creek is in the Black Hills Section of the Northern District (Figures 2 and 3). The first published escapement goal for North Creek was developed in the late 1980s, and a range was set at 4,400 to 8,800 sockeye salmon (Nelson and Lloyd 2001; Appendix F). Aerial surveys have been used to estimate escapement into North Creek from 1960 to the present. An escapement goal review of this system conducted during 2003 using the Percentile Approach concluded that the analysis reasonably corroborated the existing SEG, and no change was warranted (Nelson et al. 2006). During the 2006 escapement goal review, the team used the Percentile Approach and corroborated the 4,400 to 8,800 sockeye salmon SEG (Honnold et al. 2007). During the 2009 escapement goal review, the percentile ranges were recalculated using the Percentile Approach and updated escapement estimates from 1990 to 2008. Based on the results of this analysis, the team recommended maintaining the existing 4,400 to 8,800 sockeye salmon SEG (Witteveen et al. 2009). The 2012 and 2015 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses, and no review was conducted (Sagalkin and Erickson 2013; Schaberg et al. 2015). The Percentile Approach was used to analyze the North Creek SEG in 2018 resulting in adjusting the escapement goal to an SEG range of 7,500 to 10,000 sockeye salmon (Schaberg et al. 2019).

2020 Review

Stock-specific harvest estimates for North Creek sockeye salmon were not available. Since the SEG was revised during the last review in 2018, the team agreed that analysis was not warranted in 2020.

Nelson River

Escapement Goal Background and Previous Reviews

Nelson River is in the Nelson Lagoon Section of the Northern District (Figures 2 and 3). The first published escapement goal for Nelson River was developed in 1979, with a range of 100,000 to 150,000 sockeye salmon (Nelson and Lloyd 2001; Appendix G). Tower counts were used to estimate escapement into Nelson River from 1962 to 1988, and a weir has been used from 1989 to the present. An escapement goal review of this system conducted during 2003 using the Ricker

spawner–recruit model, Percentile Approach, euphotic volume analysis, smolt biomass as a function of zooplankton biomass, and lake surface area method recommended that the escapement goal should be reclassified as a BEG, with a range from 97,000 to 219,000 sockeye salmon (Nelson et al. 2006). The 2006 escapement goal review analysis using the Ricker spawner–recruit model corroborated the 97,000 to 219,000 sockeye salmon BEG (Honnold et al. 2007). With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Recent data for Nelson River sockeye salmon were available from 1970 to the present (Appendix G2) were examined to determine if a change in the escapement goal was justified. The data from 2018 to 2020 were similar to the recent past, thus the team agreed that no further analysis was necessary in 2020.

Bear Lake

Escapement Goal Background and Previous Reviews

Bear Lake is in the Bear River Section of the Northern District (Figures 2 and 3) and has an early and late run. The first published escapement goals for Bear Lake were developed in late 1960s, with ranges of 150,000 to 175,000 sockeye salmon for the early run; 50,000 to 75,000 sockeye salmon for the late run; and a total range of 200,000 to 250,000 sockeye salmon (Nelson and Lloyd 2001; Appendix H). Tower counts were used to estimate escapement into Bear River from 1964 to 1985, and a weir has been used from 1986 to the present.

An escapement goal review of this system conducted during 2003 using the Ricker spawner–recruit model, Percentile Approach, euphotic volume analysis, smolt biomass as a function of zooplankton biomass, and lake surface area method indicated that the escapement goal range should be increased to 293,000 to 488,000 sockeye salmon for the total Bear Lake run (176,000 to 293,000 for the early run; 117,000 to 195,000 for the late run; Nelson et al. 2006). The 2006 escapement goal review analysis also utilized the Ricker spawner–recruit model, Percentile Approach, euphotic volume analysis, smolt biomass as a function of zooplankton biomass, and lake surface area methods to analyze data; these methods corroborated the SEGs established in 2003, and no changes were made to the Bear Lake escapement goals (Honnold et al. 2007). With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates were not available for early-run Bear Lake sockeye salmon but were available for the late run. Recent escapement data (Appendices H2 and H4) were examined to determine if a change in the escapement goal was justified. Escapements for both runs have been within or above the current goals in 9 of the last 10 years, and the team agreed that no further analysis was necessary for the Bear Lake runs in 2020.

Sandy River

Escapement Goal Background and Previous Reviews

Sandy River is in the Bear River Section of the Northern District (Figures 2 and 3). Escapement has been monitored with aerial surveys since 1960, and a tower was used from 1962 to 1964. An aerial indexed total escapement goal range of 20,000 to 30,000 sockeye salmon was developed in the 1970s (Nelson and Lloyd 2001; Appendix I). In 1994, a weir was established for Sandy River and the goal range was doubled (40,000 to 60,000 fish) to account for more complete counts made at the weir (Nelson and Lloyd 2001). An escapement goal review of this system conducted during 2003 using the Percentile Approach, euphotic volume analysis, smolt biomass as a function of zooplankton biomass, and lake surface area method concluded that because of data uncertainty and that the established SEG produced sufficient returns of escapement and harvest, no change in the SEG was warranted (Nelson et al. 2006). The 2006 escapement goal review using the Percentile Approach with weir and aerial survey count data recommended changing the SEG range to 34,000 to 74,000 fish (Honnold et al. 2007). With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates for Sandy River sockeye salmon were not available. Recent escapement data (Appendix I2) were examined to determine if a change in the escapement goal was justified. Escapements have been within or above the current goal in 9 of the last 10 years. Since the SEG was last revised in 2007 Percentile Approach, the team agreed that analysis was warranted in 2020 using the updated Percentile Approach.

Ilnik River

Escapement Goal Background and Previous Reviews

The Ilnik River is in the Ilnik Section of the Northern District and includes 4 distinct spawning populations: Ilnik River, Willie Creek, Ocean River, and Wildman Lake (Figures 2 and 3). The current SEG for the Ilnik River system was developed in 1991 and set at 40,000 to 60,000 sockeye salmon (Nelson and Lloyd 2001; Appendix J). Aerial surveys were used to estimate escapement into the Ilnik River system from 1960 through 1990, and a weir was used from 1991 through the present. An escapement goal review of this system conducted during 2003 using the Percentile Approach, euphotic volume analysis, smolt biomass as a function of zooplankton biomass, and lake surface area method concluded that the existing escapement goal had produced sufficient returns and found that no change was warranted (Nelson et al. 2006). The 2006 escapement goal review with weir count data corroborated the existing SEG (Honnold et al. 2007). With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates for Ilnik River sockeye salmon were not available. Recent escapement estimates (Appendix J2) and were examined to determine if a change in the escapement goal was justified. The run data from 2018 to 2020 were similar to the recent past;

however, the team agreed that further analysis was necessary in 2020 as the Percentile Approach warranted updating from the review conducted in 2006.

Meshik River

Escapement Goal Background and Previous Reviews

Meshik River is in the Inner Port Heiden Section of the Northern District (Figures 2 and 3). The SEG range of 10,000 to 20,000 was initially established in the late 1980s and was based on average peak aerial survey escapements (Nelson and Lloyd 2001; Appendix K). Aerial surveys have been used to estimate escapement into Meshik River from 1960 through the present. An escapement goal review of this system conducted during 2003 using the Percentile Approach concluded that the analysis reasonably corroborated the existing SEG and no change was warranted (Nelson et al. 2006). Following the 2006 escapement goal review using the Percentile Approach, it was recommended to increase the Meshik River SEG to 20,000 to 60,000 fish; this change was implemented to reflect increased aerial survey effort and the subsequent increased sockeye salmon escapement estimates (Honnold et al. 2007).

In 2007, the BOF allowed fishing time in the Outer Port Heiden Section, which would affect escapement to the Meshik River. The Meshik River sockeye salmon escapement goal did not consider escapement to Red Bluff and Yellow Bluff Creeks, which contribute a substantial number of fish to the total escapement transiting the Port Heiden area (generally on the order of 25%) and cannot be managed separately from Meshik River sockeye salmon escapement. With inclusion of Red Bluff and Yellow Bluff Creeks escapement data, the upper range of the 75th percentile of escapement increased substantially, suggesting the need for increasing the upper and lower bounds of the escapement goal. Because of increased aerial surveying effort and the need to account for the contribution of Red Bluff Creek and Yellow Bluff Creek sockeye salmon escapements, the team recommended changing the Meshik River escapement goals from an SEG of 20,000 to 60,000 fish to an SEG of 25,000 to 100,000 fish (Witteveen et al. 2009). With 3 years of additional data, the 2012 escapement goal review team determined that the additional stock assessment would not substantially affect the results of previous escapement goal analyses. Thus, there was a consensus to not reevaluate the goal in 2012, and there was no change to the Meshik River sockeye salmon SEG (Sagalkin and Erickson 2013). In 2015, the SEG range was revised to 48,000 to 86,000 fish using the Percentile Approach (Schaberg et al. 2015; Clark et al. 2014). The 2018 review team determined that 3 years of additional data would not affect the escapement goal analysis (Schaberg et al. 2019).

2020 Review

Stock-specific harvest estimates for Meshik River sockeye salmon were not available. Recent escapement estimates (Appendix K2) were examined to determine if a change in the escapement goal was justified. The team determined that this stock did not warrant further review as additional escapement information since its update in 2015 would not substantially affect the results of previous escapement goal analyses.

Cinder River

Escapement Goal Background and Previous Reviews

Cinder River is in the Cinder River Section of the Northern District (Figures 2 and 3). An escapement goal range of 6,000 to 12,000 sockeye salmon was initially established in the late

1980s and was based on average peak escapements (Nelson and Lloyd 2001; Appendix L). Aerial surveys have been used to estimate escapement into Cinder River from 1960 through the present. An escapement goal review of this system conducted during 2003 using the Percentile Approach concluded that the analysis reasonably corroborated the existing SEG and no change was warranted (Nelson et al. 2006). The 2006 escapement goal review, also using the Percentile Approach, recommended revising the Cinder River SEG to 12,000 to 48,000 fish; this change was implemented to reflect increased aerial survey effort and the subsequent increased sockeye salmon escapement estimates (Honnold et al. 2007). In 2009, the team reviewed escapement data from Mud Creek and Cinder River. Mud Creek and Cinder River share the same outlet; therefore, Mud Creek cannot be managed independently of the Cinder River if a fishery were opened in the Cinder River Section. However, the team found that escapement between the 2 streams was not correlated, and surveys of Mud Creek are incomplete. Based on these results, the team recommended keeping the SEG the same (Witteveen et al. 2009). In 2012, escapement data were examined to determine if a change in the escapement goal was justified, and the team agreed that no further analysis was necessary in 2012 (Sagalkin and Erickson 2013). In 2015, the escapement from Cinder River and Mud Creek were combined and evaluated with the Percentile Approach (Clark et al. 2014), resulting in revising the SEG to 36,000 to 94,000 fish (Schaberg et al. 2015). The team determined that further review was not warranted for the 2018 review with 3 additional years of data (Schaberg et al. 2019).

2020 Review

Stock-specific harvest estimates for Cinder River sockeye salmon were not available. Recent escapement estimates (Appendix L2) were examined to determine if a change in the escapement goal was justified. The team determined that this stock did not warrant further review as it has been meeting or exceeding its goal range.

McLees Lake

Escapement Goal Background and Previous Reviews

McLees Lake is in the Unalaska District within the Aleutian Islands Management Area (Figure 4). The first published escapement goal for McLees Lake was developed in 1993 and a range was set at 4,000 to 6,000 sockeye salmon based on spawning capacity (Nelson and Lloyd 2001; Appendix M). Aerial surveys have been used to estimate escapement into McLees on a limited basis from 1967 to 2003, and a weir has been operated by U.S. Fish and Wildlife Service (USFWS) since 2001. No sockeye salmon were observed during aerial surveys of McLees Lake until 1974. An escapement goal review of this system in 2003, using the Percentile Approach from aerial survey numbers, concluded that with limited aerial survey estimates, few years of weir counts, and no history of management action ever exercised, the goal would be eliminated, but reevaluated in 3 years (Nelson et al. 2006). In 2006, the McLees Lake system was reevaluated with the Percentile Approach, and it was determined that no goal was justified; however, the McLees Lake sockeye salmon system would be reassessed pending collection of additional stock assessment data (Honnold et al. 2007). In 2009, an SEG for McLees Lake sockeye salmon was estimated according to the Percentile Approach resulting in an SEG of 12,000 to 59,000 fish. From the time the weir was first installed at McLees Lake in 2001 until 2004, the average sockeye salmon annual escapement was 71,000 fish. The magnitude of production from a lake the size of McLees Lake was unexpected. The average annual escapement from 2005 to 2008 was 14,000 fish. Based on limited knowledge of McLees Lake sockeye salmon, a wide escapement goal range (10,000 to

60,000 fish) was recommended during years when a weir is operated, and no SEG in the absence of a weir (Witteveen et al. 2009). In 2012 and 2015, escapement data were examined to determine if a change in the escapement goal was justified, and the teams agreed that no further analysis was necessary (Sagalkin and Erickson 2013; Schaberg et al. 2015). The 2018 team included 9 additional years of data in their analyses using the Percentile Approach, euphotic volume and zooplankton biomass models, and that resulted in a lower bound (LB) SEG of 10,000 sockeye salmon to address the lack of fishing power to constrain the upper end of an escapement goal (Schaberg et al. 2019).

2020 Review

Stock-specific subsistence harvest estimates for McLees Lake sockeye salmon are available, and commercial salmon harvest in the Aleutian Islands is infrequent. Recent escapement data (Appendix M2) were examined and the team determined that with 3 more years of weir counts since the current SEG was instituted, this stock did not require further review.

COHO SALMON

Nelson River

Escapement Goal Background and Previous Reviews

Nelson River is in the Nelson Lagoon Section of the Northern District (Figures 2 and 3). The first published escapement goal for Nelson River coho salmon was developed in the early 1980s, and a range was set at 18,000 to 25,000 fish (Nelson and Lloyd 2001; Appendix N). Aerial surveys were used to estimate coho salmon escapement into Nelson River from 1968 through 2014. An escapement goal review of this system conducted during 2003, using a risk analysis, concluded that the lower end (18,000) of the existing goal was appropriate as a LB SEG (Nelson et al. 2006). The 2006 review of the Nelson River coho salmon escapement goal was limited by insufficient data that was too poor and to estimate an SEG; therefore, no change was warranted for the LB SEG (Honnold et al. 2007). With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates were not available for the Nelson River coho salmon fisheries. Recent escapement estimates (Appendix N2) were examined to determine if a change in the escapement goal was justified. The LB SEG has been met in all of the last 10 years. The team, however, agreed that further analysis was necessary in 2020 because the last review occurred in 2004.

Ilnik River

Escapement Goal Background and Previous Reviews

An Ilnik River coho salmon escapement goal of 10,000 to 19,000 was adopted in 1993 (Table 1, Appendix O). This goal was eliminated following the 2004 escapement goal review. Historical aerial survey escapement estimates were often sporadic, due to airplane availability, poor weather, or the frequent turbid conditions in the Ilnik River. Escapement estimates during that time were generally below the SEG, probably due to the poor aerial survey coverage. During the 2009 review,

it was noted that sport fishing effort increased and there was some directed commercial fishing effort. In response to the increased effort, aerial survey effort also increased. Ilnik River coho salmon escapement data from 1985 to 2008 were assessed with the Percentile Approach and risk analysis methods. With the increase of sport fishery harvest and the use of coho salmon catch-per-unit-effort (CPUE) data to make management decisions, the team recommended a LB SEG of 9,000 fish based on the risk analysis method for Ilnik River (Witteveen et al. 2009). With additional years of data, the 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates were not available for the Ilnik River coho salmon fisheries. Recent escapement estimates (Appendix O2) were examined to determine if a change in the escapement goal was justified. The LB SEG has been met in 9 of the last 10 years; however, the team agreed that further analysis was necessary in 2020 as the last review occurred in 2009.

PINK SALMON

Pink salmon escapement estimates in Area M are based on aerial surveys of fish returning to spawn. Each year since 1968, pink salmon abundance has been estimated during one or more flights along the Alaska Peninsula area (Figure 1). Total indexed escapement estimates were calculated by Area M management biologists, with estimation techniques outlined in Poetter and Nichols (2014).

South Peninsula

Escapement Goal Background and Previous Reviews

Even- and odd-year pink salmon escapement goals, by district, were first established in 1992 (Nelson and Lloyd 2001; Appendix P). The sum of the district escapement goal ranges for the South Alaska Peninsula was 1,864,600 to 3,729,300 fish in even years and 1,637,800 to 3,275,700 fish in odd years. The difference between even- and odd-year escapement goals was due to higher even-year escapement goals in the Southwestern and Unimak Districts.

Stock-specific catch data are not available in this area; however, during a 2003 review of escapement goals (Nelson et al. 2006), the district escapement estimates were aggregated into a single South Peninsula areawide escapement that was used along with the total pink salmon catch of the South Peninsula to develop a single Ricker spawner–recruit model (Ricker 1954). Spawner–recruit models were developed from even-year, odd-year, and combined even- and odd-year escapement and catch data from 1975 to 2001. The contrast (3.2) in the even-year model was below the recommended minimum contrast of 4. The odd-year model had appropriate contrast and resulted in an S_{MSY} estimate of 2.77 (90% S_{MSY} range of 1.75 to 4.0) million fish. The model developed using the combined even- and odd-year escapement and catch data was considered the best model (Nelson et al. 2006) and resulted in an S_{MSY} estimate of 2.33 (90% S_{MSY} range of 1.52 to 3.29) million fish. The results from this model corroborated the aggregate even-and odd-year goals (sum of the district escapement goal ranges), which were then designated BEGs (Nelson et al. 2006).

The 2006 escapement goal review of South Peninsula pink salmon followed the same methods as the 2003 review with the addition of 2004 and 2005 data. No change was recommended to the

escapement goal range; however, the goal was reclassified as an SEG because it was based on aerial survey data (Honnold et al. 2007). In both 2009 and 2012 reviews, the team determined that the additional stock assessment data would not substantially affect the results of the previous escapement goal analyses. Thus, there was consensus to not reevaluate the goals in 2009 and 2012, and there was no change to the even- and odd-year South Peninsula pink salmon SEGs (Witteveen et al. 2009; Sagalkin and Erickson 2013).

With low pink salmon escapement in the South Peninsula for even years since 2010, the team decided it was prudent to reassess the current goal with the new information available in 2015. However, the inherent relationship between the even- and odd-year goals justified a reevaluation of both goals. Both even-, odd-, and combined-year datasets were analyzed with the Ricker spawner–recruit framework. However, one important adaptation was employed to model the population more accurately. This was to define the total harvest estimate for South Peninsula pink salmon as that occurring from July 15 to the end of the season for more precise accounting for local stocks (Matt Keyse, ADF&G Area Management Biologist-Area M, Sand Point, Alaska, personal communication). Given the similarity in the estimates of S_{MSY} from even- and odd-year models, and the uncertainty associated with the models, the SEG was updated in 2015 into an annual SEG of 1,750,000 to 4,000,000 fish based on the examination of the combined-year spawner–recruit models and the existing goals (Schaberg et al. 2015). The 2018 team agreed further analysis was not warranted with limited new information (Schaberg et al. 2019).

2020 Review

Aggregate stock harvest estimates for South Alaska Peninsula pink salmon were available. Recent run data (Appendix P2) were examined to determine if a change in the escapement goal was justified. The run data from 2018 to 2020 indicated the cycling among even- and odd- year runs may be more prevalent again. However, because of the recent revision to this goal, the review team agreed that no further analysis was necessary in 2020.

CHUM SALMON

Chum salmon escapement estimates in Area M are based on aerial surveys of fish returning to spawn. Total indexed escapement estimates were calculated by Area M management biologists, with estimation techniques outlined in Poetter and Nichols (2014).

South Peninsula

Escapement Goal Background and Previous Reviews

Chum salmon escapement goals, aggregated by district, were established in 1992 (Nelson and Lloyd 2001; Appendices Q through S) and remained unchanged after the escapement goal review in 2003 (Nelson et al. 2006). The 2006 escapement goal review of South Peninsula chum salmon corroborated the original goals, with the exception of Unimak District, which was changed from an SEG to LB SEG after review of risk analysis results (Honnold et al. 2007). With 3 years of additional data, the 2009 escapement goal review team determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses. Thus, there was consensus to not reevaluate the goal in 2009, and there was no change to the chum salmon aggregate SEGs (Witteveen et al. 2009). In 2012, the team reviewed the escapement information from the Unimak District and recommended removing the LB SEG for this district due to poor quality data. All other district goals were not reviewed, because escapement was adequate and did not indicate review was necessary (Sagalkin and Erickson 2013). The escapement

goal review team in 2015 determined it was unnecessary to review the district aggregate goals (Schaberg et al. 2015).

The 2018 review team agreed that review of the chum salmon aggregate escapement goals was warranted using new escapement information and the updated 3-tier Percentile Approach, which, for consistency and reproducibility, also led to creating an index of peak aerial survey counts from consistently sampled streams (Schaberg et al. 2019). The Southeastern District was represented by 26 index streams in the Southeastern District, 10 index streams in the South Central District, and 19 streams in the Southwestern District

2020 Review

Stock-specific harvest estimates for South Peninsula chum salmon were not available. Recent escapement estimates (Appendices Q2, R2, and S2) were examined to determine if a change in the escapement goal was justified. The team agreed no further analysis was warranted in 2020.

North Alaska Peninsula

Escapement Goal Background and Previous Reviews

Chum salmon escapement goals, aggregated by district, were set in 1992 at ranges of 223,600 to 447,200 for the Northwestern District and 119,600 to 239,200 for the Northern District (Nelson and Lloyd 2001; Appendices T and U). Based on separate Ricker spawner–recruit analyses during the 2003 escapement goal review, the Northwestern District escapement goal was changed to a BEG of 100,000 to 215,000 fish, and no change was recommended for the Northern District BEG (Nelson et al. 2006). The 2006 escapement goal review of North Alaska Peninsula chum salmon also used Ricker spawner–recruit models to analyze the available data. No changes were made to the goal ranges; however, the escapement goals were reclassified from BEGs to SEGs as aerial survey data were used to provide indices of escapement rather than total escapement estimates. With additional years of data, the 2009, 2012, 2015, and 2018 escapement goal review teams determined that the additional stock assessment data would not substantially affect the results of previous escapement goal analyses (Witteveen et al. 2009; Sagalkin and Erickson 2013; Schaberg et al. 2015, 2019).

2020 Review

Stock-specific harvest estimates for North Alaska Peninsula chum salmon were not available. Recent escapement estimates (Appendices T2 and U2) were examined to determine if a change in the escapement goal was justified. The team agreed further review of the chum salmon aggregate escapement goals was warranted using new escapement information and the updated Percentile Approach (Clark et al. 2014).

RESULTS

SUSTAINABLE ESCAPEMENT GOAL ESTIMATES

Sockeye Salmon

Orzinski Lake

Stock Status

Since 1990, the escapement estimates have exceeded the upper range of the goal 18 times, with the largest estimated escapements occurring between 2002 and 2005 (Appendix B).

Evaluation of Recent Data

An SEG for Orzinski Lake sockeye salmon was estimated according to the Percentile Approach using aerial survey escapement estimates from 1990 to 2020 with a contrast of 26.8. Exploitation of this stock is low and data are from weir counts (i.e., low measurement error) meeting the criteria to use the 15th to 65th percentiles, which estimated the SEG to range from 14,300 to 28,267 sockeye salmon.

Escapement Goal Recommendation

After applying the Percentile Approach to the last 31 years of weir count escapement data, the team determined an SEG range of 14,000 to 28,000 sockeye salmon was appropriate.

Thin Point Lake

Stock Status

Escapements to Thin Point Lake have been above the upper bound of the escapement goal 5 times since 1988; however, escapement has been below the lower bound of the range 12 times over the same period (Appendices C2 and C3).

Evaluation of Recent Data

An SEG for Thin Point Lake sockeye salmon was estimated according to the Percentile Approach using aerial survey escapement estimates from 1970 to 2020 with a contrast of 40.1. The harvest rate of this stock is believed to exceed 0.40 and data are from peak aerial survey counts, indicating high measurement error; under these conditions, the 25th to 75th percentiles were used to avoid potential overfishing of the run. This approach resulted in an SEG range of 8,850 to 19,000 sockeye salmon.

Escapement Goal Recommendation

The team recommended revising the Thin Point Lake SEG to a range of 9,000 to 19,000 fish based on the Percentile Approach.

Mortensens Lagoon

Stock Status

Escapements to Mortensens Lagoon have been above the upper bound of the escapement goal 8 times since 1990; however, escapement has been below the lower bound of the range 14 times over the same period (Appendices D2 and D3).

Evaluation of Recent Data

An SEG for Mortensens Lagoon sockeye salmon was determined according to the Percentile Approach using aerial survey data from 1970 to 2020. High contrast in the peak aerial survey escapement estimates (35.0) and possibly high harvest rate (>0.40) of this stock resulted in a SEG range of 1,425 to 5,700 (25th to 75th percentiles).

Escapement Goal Recommendation

The team recommended revising the current Mortensens Lagoon SEG range to 1,400 to 5,700 fish based on the updated 3-tier Percentile Approach.

Christianson Lagoon

Stock Status

Escapements to Christianson Lagoon have been above the upper bound of the escapement goal 10 times since 1990, with the largest peak aerial survey counts occurring in 2008, 2016, and 2017. Peak aerial survey escapement has been below the lower bound of the range 4 times over the same period (Appendices E2 and E3).

Evaluation of Recent Data

An SEG for Christianson Lagoon sockeye salmon was determined according to the Percentile Approach using peak aerial survey counts from 1971 to 2020. High contrast in the escapement index (101.6) and a harvest rate believed to exceed 0.40 of this stock resulted in a SEG range of 23,275 to 50,475 (25th to 75th percentiles).

Escapement Goal Recommendation

Based on the Percentile Approach, the team recommended revising the lower bound of the current Christianson Lagoon SEG range to an SEG range of 23,000 to 50,000 fish.

Sandy River

Stock Status

Since the goal was last updated in 2007, Sandy River sockeye salmon weir counts have exceeded the upper bound of the SEG 3 times between 2015 and 2017, and have been below the lower bound of the SEG only 2 times in 2008 and 2012 (Appendices I2 and I3).

Evaluation of Recent Data

Given the low measurement error, low contrast (6.3), and assumed (>0.40) relative harvest rate of a mixed-stock fishery, using the Percentile Approach, the team set the goal at the 25th to 75th percentiles of Sandy River sockeye salmon weir counts from 1994 to 2020. This resulted in a SEG range of 37,500 to 68,500 fish.

Escapement Goal Recommendation

The team recommended revising the current Sandy River SEG range by increasing the lower bound and decreasing the upper bound to a range of 37,000 to 69,000 fish based on the Percentile Approach.

Ilnik River

Stock Status

Relative to the current escapement goal established in 1991, the escapement of sockeye salmon through the Ilnik River weir has exceed the upper bound of the goal 18 times and failed to meet the lower bound 2 times over the past 30 years (Appendices J2 and J3).

Evaluation of Recent Data

An SEG for Ilnik River sockeye salmon was determined according to the Percentile Approach using weir count data from 1991 to 2020. High contrast in the escapement estimates (9.2) and low measurement error from weir counts of this stock resulted in applying the Tier 2 criteria for a resultant SEG range of 43,455 to 75,000 (15th to 65th percentiles).

Escapement Goal Recommendation

The team recommended revising the current Ilnik River SEG range based on results from the Percentile Approach to a goal range of 40,000 to 75,000 fish.

Coho Salmon

Nelson River

Stock Status

Since the Nelson River LB SEG was established in 2004, Nelson River coho salmon weir counts have been below the lower bound once in 2010 (15,000 fish; Appendices N2 and N3).

Evaluation of Recent Data

Applying the Percentile Approach to Nelson River coho salmon peak aerial survey counts from 1987 to 2020 (contrast 3.6) resulted in using the 25th to 75th percentiles to avoid potential overfishing because harvest rates are unknown, but assumed high, and contrast is low.

Escapement Goal Recommendation

The team recommended revising the current Nelson River LB SEG by increasing the lower bound and adding an upper bound for a range of 19,000 to 29,000 fish based on the Percentile Approach.

Ilnik River

Stock Status

Since the Ilnik River LB SEG was established in 2009, Ilnik River coho salmon peak aerial survey counts have been below the lower bound once in 2017 (6,000 fish; Appendices O2 and O3).

Evaluation of Recent Data

Applying the Percentile Approach to Ilnik River coho salmon peak aerial survey counts from 1987 to 2020 (contrast 122.0) resulted in using the 20th to 60th percentiles because contrast was high, harvest is considered moderate, and data are from peak aerial surveys.

Escapement Goal Recommendation

The team recommended revising the current Ilnik River LB SEG by maintaining the lower bound but adding an upper bound for a range of 9,000 to 24,000 fish based on the Percentile Approach.

Chum Salmon

North Peninsula

Stock Status

The current Northwestern District chum salmon SEG is 100,000–215,000 (Table 1). Since the implementation of the goal in 2003, escapement has been within the goal 9 years, above the goal 2 years, and below the goal 7 years (Appendices T2 and T3). The current Northern District chum salmon SEG is 119,600–239,200 (Table 1). Since 2003, escapement has been within the goal 14 years, above the goal 2 years, and below the goal 2 years (Appendices U2 and U3).

Evaluation of Recent Data

Current North Alaska Peninsula chum salmon goals were calculated using an indexed total escapement method (incorporates 21-day stream life, carcasses, mouth counts) that is described in

detail in annual management report appendices (e.g., Fox et al. 2018). The goals were based on a select number of individual streams (index streams) that were combined to form the district goals. A lack of consistency in the number and scope of individual aerial survey estimates annually decreased the ability to assess these escapement goals.

It was determined that peak aerial survey (PAS) counts of chum salmon would be a better metric for escapement goal evaluation. Peak aerial surveys were compiled from a database maintained by the Kodiak ADF&G office for the review process. To standardize past and future evaluation, and reduce any inconsistencies in the data points, the escapement number used to develop the goal were PAS that adhere to these criteria:

•   Include a single flight with the highest count for the year (PAS)

•   Include counts from within the stream itself (no bays, mouths, or other areas)

•   Include only live fish (no carcasses)

The team ensured that the number of systems included in the evaluation of escapement goals was consistent. To warrant inclusion, a system must first have met the above criteria in at least 32 of the last 34 years. Systems that represented the majority of the escapement in these areas met this initial validation, as they were known chum systems, and surveyed annually. This resulted in 9 index streams in the Northwestern District, and 18 index streams in the Northern District. Appendices T1 and U1 have the list of individual streams.

Escapement Goal Recommendation

Peak counts of fish observed in each index system were aggregated to create a PAS index for each district. Contrast, measurement error, and harvest rates were examined to determine the proper percentile ranges that should be used to establish SEGs with the Percentile Approach (Clark et. al 2014). This resulted in the selection of the 5th–65th percentile range for both the Northwestern and Northern Districts. The team recommends changing the chum salmon escapement goals to an SEG of 49,000–133,000 fish for the Northwestern District (Appendix T1) and an SEG of 49,000–132,000 fish for the Northern District (Appendix U1).

These escapement goal revisions appear to be significantly lower than the current goals; however, this is because of the switch to peak aerial surveys in place of the previous escapement indices, more stringent criteria for inclusion of surveys, and a reduced number of index streams in some districts.

DISCUSSION

Establishing prudent escapement goals is an evolving process, not only because each year provides more data, but also because methods to determine such goals are becoming more standardized and well documented. The SSFP and EGP are important steps in this evolution. Ideally, escapement goals should be based, in part, on ecological theory, principles of sustained yield, and empirical observations (Ricker 1954).

The methodologies used in this escapement goal evaluation were limited by the available data. Stock-specific catch data were not available for any stocks in Area M, with the exception of Nelson River Chinook and sockeye salmon and Bear Lake late-run and McLees Lake sockeye salmon. Although 5 systems in Area M (plus 1 additional system in the Aleutian Islands Management Area) currently have weirs for direct enumeration of escapement and are easily accessible for collection

of representative age data, escapement estimates for the remaining systems are determined via aerial survey observations. Aerial survey escapement estimates can be inaccurate and imprecise due to weather conditions, differences between observers, and logistical limitations.

The comprehensive review of the 22 existing Area M salmon escapement goals resulted in recommendations to leave 12 goals unchanged and revise 10 goals. Systems that did not warrant a change to their goals because either their escapement levels have consistently met their goals or have been comparable over the last 3 years include Nelson River Chinook salmon, 7 sockeye salmon systems (North Creek, Nelson, Bear [2 goals, early and late], Meshik, and Cinder Rivers, and McLees Lake); 1 pink salmon aggregate; and 3 chum salmon aggregates.

After a review of the available data, the team recommended that changes to the current escapement goals were warranted for 10 goals (6 sockeye salmon: Ilnik River SEG 40,000–75,000, Sandy River SEG 37,000–69,000, Christianson Lagoon SEG 23,000–50,000, Orzinski Lake SEG 14,000–28,000, Mortensen Lagoon SEG 1,400–5,700, and Thin Point Lake SEG 9,000–19,000; 2 chum salmon: Northern District SEG 49,000–132,000 and Northwestern District SEG 49,000–133,000; and 2 coho salmon: Nelson River SEG 19,000–29,000 and Ilnik River SEG 9,000–24,000).

Although these changes represent more biologically sound and streamlined escapement goals, they should have a limited effect on the traditional management under the auspices of current management plans, with the possible exception of Orzinski Lake sockeye salmon. There is only one allocative or management plan implication with the recommended changes, and that is for Orzinski Lake sockeye salmon. Currently in regulation, there is an escapement threshold of 25,000 sockeye salmon; achievement of that allows for further liberalization of the gillnet fleet in the Northwest Stepovak Section. When that threshold was developed, it was 5,000 fish (25%) above the upper bound of the contemporary SEG. With the recommendations for the Orzinski Lake sockeye salmon escapement goal, this threshold now would fall within the SEG range (14,000–28,000).

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TABLES AND FIGURES

Table 1.–Current escapement goals, escapements observed from 2011 through 2020, and results of the 2020 review for Chinook, sockeye, coho, pink, and chum salmon stocks of the Alaska Peninsula and Aleutian Islands Management areas.

System	2020 Goal range Lower	Upper	Type	Initial year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2020 Review
CHINOOK SALMON															
Nelson River	2,400	5,000	BEG	2019	1,704	1,092	1,221	3,801	2,890	4,618	1,852	5,022	12,163	2,498	No change
CHUM SALMON															
Northern District	119,600	239,200	SEG	2007	96,952	140,418	137,251	191,586	189,194	277,674	234,440	236,109	208,397	118,815	SEG 49,000–132,000
Northwestern District	100,000	215,000	SEG	2007	151,400	140,000	92,800	54,525	89,800	113,250	195,700	90,705	173,600	62,100	SEG 49,000–133,000
Southeastern District[a]	62,500	151,900	SEG	2019	137,500	30,152	(136,050)	74,300	(156,870)	(118,690)	416,845	9,460	106,100	(108,800)	No change
South Central District[a]	68,900	99,200	SEG	2019	68,800	(56,190)	101,400	91,600	182,000	166,000	566,213	(35,000)	226,800	93,500	No change
Southwestern District[a]	86,900	159,500	SEG	2019	(169,600)	(62,600)	(148,000)	(97,300)	(118,650)	146,200	(313,800)	(31,400)	(88,300)	84,550	No change
COHO SALMON															
Nelson River	18,000		LB SEG	2004	21,000	19,160	22,000	25,000	45,000	45,000	19,000	24,000	23,000	23,000	SEG 19,000–29,000
Ilnik River	9,000		LB SEG	2010	18,000	11,800	17,000	33,000	14,000	28,000	6,000	122,000	24,000	45,000	SEG 9,000–24,000
PINK SALMON															
South Peninsula Total	1,750,000	4,000,000	SEG	2016	2,494,950	478,910	2,320,790	1,340,380	7,820,800	1,038,160	5,663,637	732,422	4,236,700	3,209,750	No change
SOCKEYE SALMON															
Cinder River[b]	36,000	94,000	SEG	2016	105,500	73,000	90,000	96,000	118,000	200,500	222,600	189,000	95,025	115,800	No change
Ilnik River[c]	40,000	60,000	SEG	1991	43,000	61,000	51,000	59,000	26,000	124,000	238,000	81,000	75,000	41,000	SEG 40,000–75,000
Meshik River[d]	48,000	86,000	SEG	2016	101,900	50,900	123,600	114,700	171,700	131,800	250,525	228,700	167,700	116,550	No change
Sandy River	34,000	74,000	SEG	2007	37,500	27,100	42,000	59,000	116,000	170,000	145,000	35,000	71,000	60,000	SEG 37,000–69,000
Bear River Early Run	176,000	293,000	SEG	2004	207,451	173,158	219,074	259,046	304,356	293,280	585,840	324,093	294,727	299,198	No change
Bear River Late Run	117,000	195,000	SEG	2004	132,549	116,442	196,926	206,954	210,644	139,720	229,160	232,907	205,273	200,802	No change
Nelson River	97,000	219,000	BEG	2004	89,000	103,300	248,000	250,000	257,000	300,000	381,000	221,000	115,000	185,000	No change
Christianson Lagoon	25,000	50,000	SEG	1980s	35,200	40,000	16,500	59,000	34,900	111,700	223,600	26,100	39,300	22,800	SEG 23,000–50,000
North Creek	7,500	10,000	SEG	2019	10,200	18,000	8,500	7,500	18,000	21,000	5,800	8,300	11,000	8,200	No change
Orzinski Lake	15,000	20,000	SEG	1992	16,764	17,243	17,386	13,600	26,534	21,019	20,989	2,817	4,367	6,819	SEG 14,000–28,000

-continued-

Table 1.–Page 2 of 2.

| System | 2020 Goal range | | Type | Initial year | Escapement | | | | | | | | | | 2020 Review |
	Lower	Upper			2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
SOCKEYE SALMON (Continued)															
Mortensen Lagoon	3,200	6,400	SEG	late 1980s	500	5,000	4,000	500	NA	13,000	15,500	1,200	800	800	SEG 1,400–5,700
Thin Point Lake	14,000	28,000	SEG	late 1980s	14,800	19,000	5,700	8,600	20,800	36,400	39,300	1,000	9,600	9,900	SEG 9,000–19,000
McLees Lake[e]	10,000		LB SEG	2019	36,602	15,111	15,687	12,424	20,284	39,892	13,195	No weir	No weir	5,037	No change

[a] Southern AK peninsula chum salmon escapement goals are determined from an escapement index of consistently surveyed streams that contribute more than 5% to the overall district escapement as described in Schaberg et al. (2019). Values presented in Table 1 are indexed escapement and are not the sum of peak counts from all streams surveyed in a given district. Values in parentheses indicate incomplete surveys of index streams and do not meet the criteria for inclusion in escapement goal analyses.

[b] Cinder River sockeye salmon escapement includes Mud Creek. Counts are from streams that were consistently sampled ≥ 10 years and that contributed ≥ 5% to the total historical aggregate peak aerial survey escapement.

[c] Ilnik River sockeye salmon counts in 2009, 2010, 2012, 2013, and 2016 include Ocean River aerial surveys added as a separate component. In all other years Ocean River flows into Ilnik Lagoon and is counted at the Ilnik River weir.

[d] Meshik escapement includes Meshik River, Red Bluff Creek, and Yellow Bluff Creek. It does not include Highland or Charles Creeks.

[e] McLees Lake sockeye salmon SEG will be in effect if a weir is in place; there will be no goal if a weir is not operated.

Table 2.–General criteria used to assess quality of data in estimating Area M salmon escapement goals.

Data quality	Criteria
Excellent	Escapement, harvest, and age all estimated with relatively good accuracy and precision (i.e., escapement estimated by a weir or hydroacoustics; harvest estimated by Statewide Harvest Survey or fish tickets); escapement and return estimates can be derived for a sufficient time series to construct a brood table and estimate S_{MSY}.
Good	Escapement, harvest, and age estimated with reasonably good accuracy and/or precision (i.e., escapement estimated by capture-recapture experiment or multiple foot/aerial surveys); no age data or data of questionable accuracy and/or precision; data may allow construction of brood table; data time series relatively short to accurately estimate S_{MSY}.
Fair	Escapement estimated or indexed, and harvest estimated with reasonably good accuracy, but precision lacking for one, if not both; no age data; data insufficient to estimate total return and construct brood table.
Poor	Escapement indexed (i.e., single foot/aerial survey) such that the index provides a fairly reliable measure of escapement; no harvest and age data.
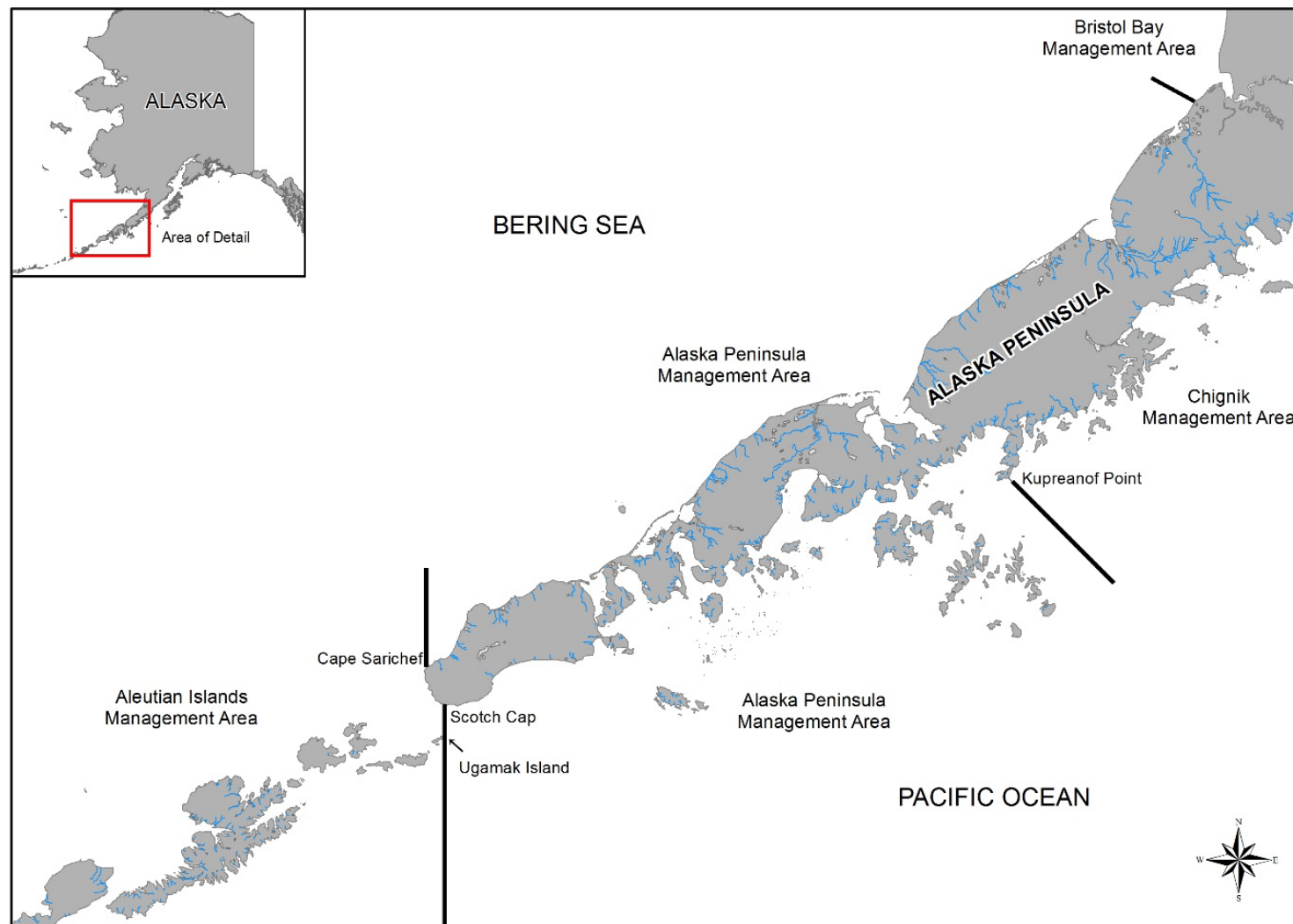
Figure 1.–Map of the Alaska Peninsula and Aleutian Islands Management areas.
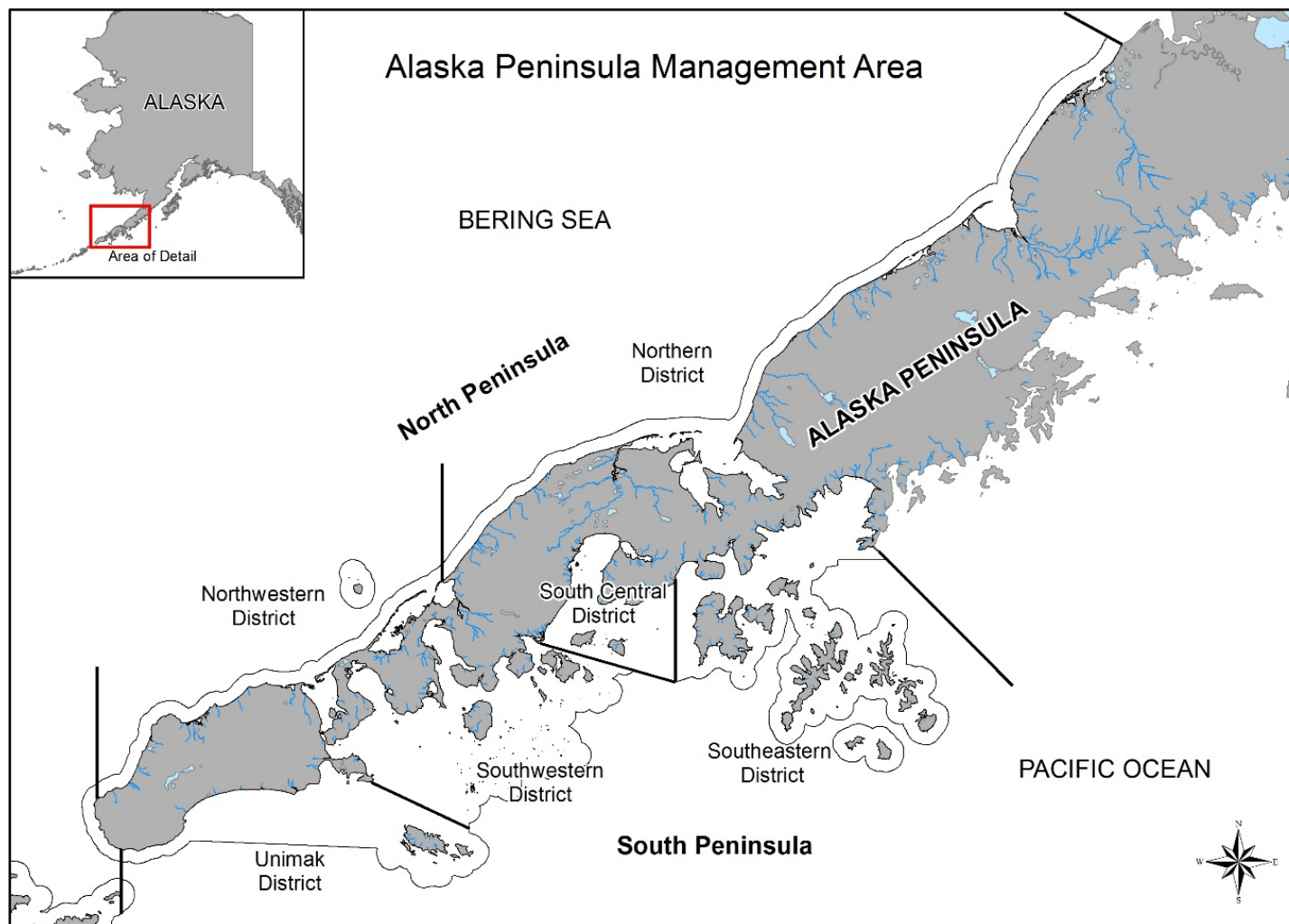
Figure 2.–Map of the Alaska Peninsula Management Area with commercial salmon fishing districts depicted.
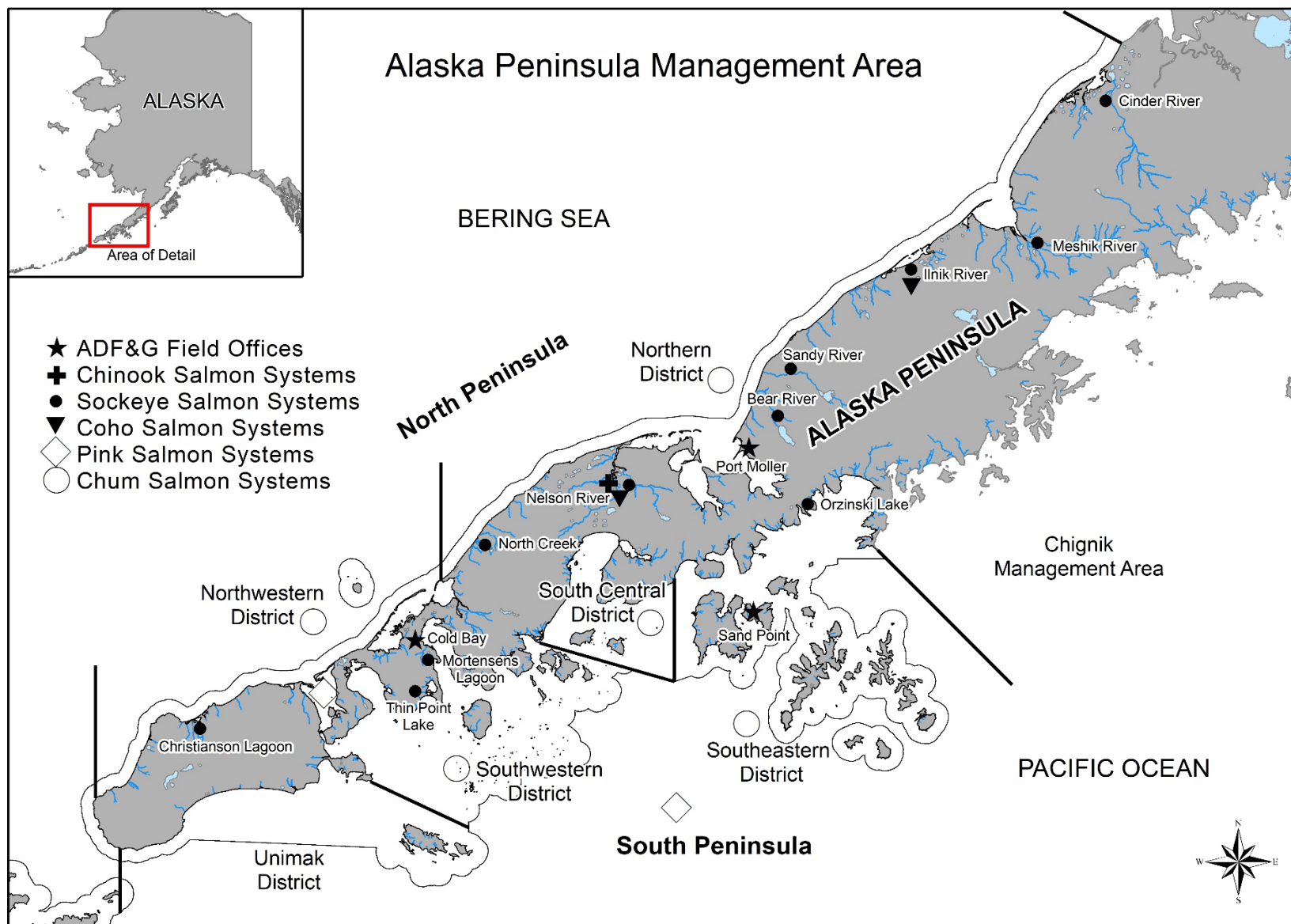
Figure 3.–Map of the Alaska Peninsula Management Area with salmon systems that currently have escapement goals depicted.
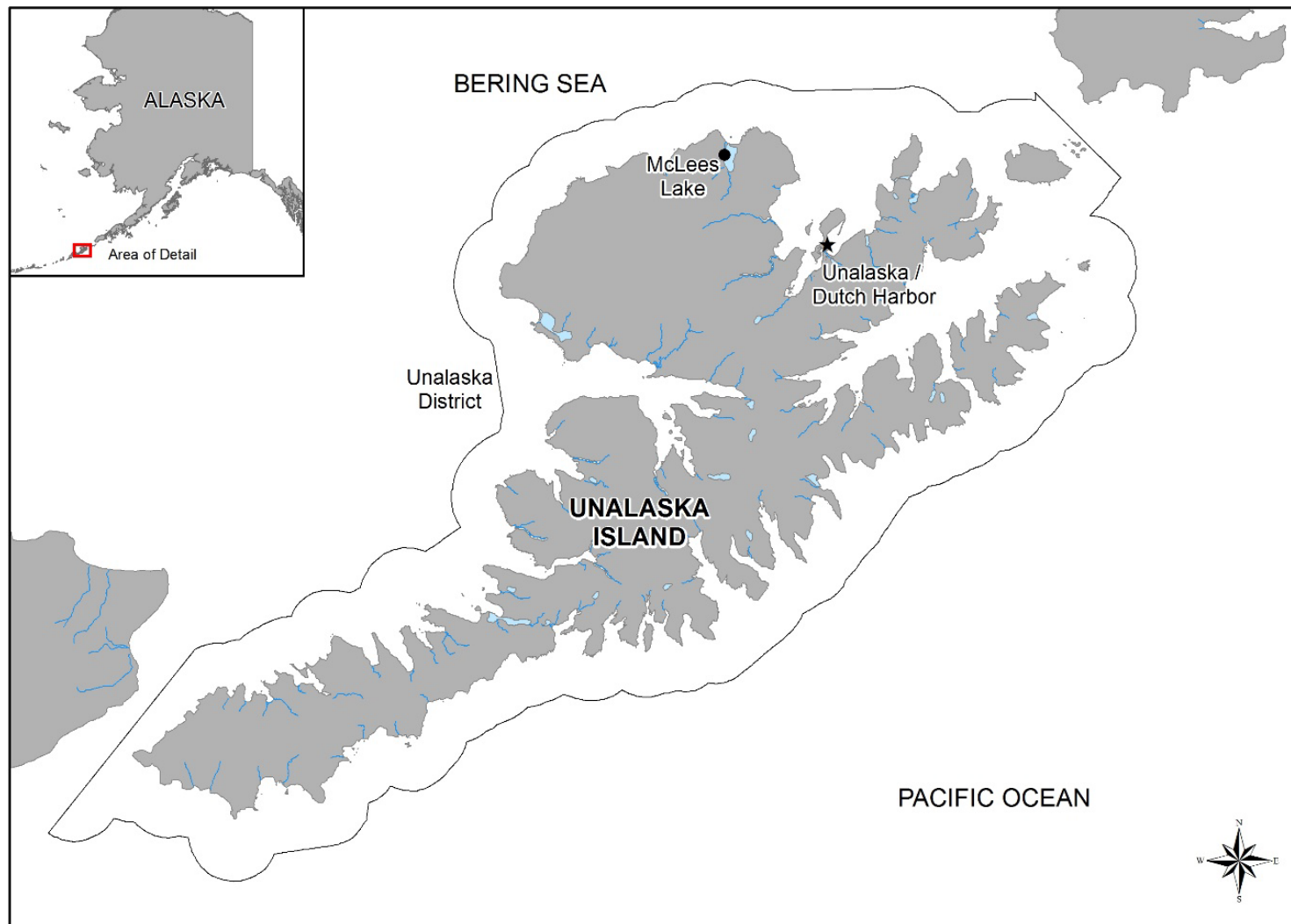
Figure 4.–Map of Unalaska Island within the Aleutian Islands Management Area with McLees Lake depicted.

APPENDIX A. SUPPORTING INFORMATION FOR THE NELSON RIVER CHINOOK SALMON ESCAPEMENT GOAL

Appendix A1.–Description of stock and escapement goal for Nelson River Chinook salmon.

System: **Nelson River.**

Species: **Chinook salmon.**

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region.
Management division:	Commercial Fisheries.
Primary fishery:	Commercial set and drift gillnet.
Current escapement goal:	BEG: 2,400 to 5,000 (2018).
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Tower 1974–1988; Weir 1989–present.
Data summary:	
Data quality:	Good
Data type:	Tower or weir and aerial counts, commercial harvest from fish tickets, age from commercial harvest (1985–2003 and 2014).
Comments:	BEG based on a Bayesian age-structured state space model to estimate spawner–recruit parameters.

Appendix A2.–Nelson River Chinook salmon escapement, harvest, and total run estimates, 1974–2020.

System: **Nelson River.**

Species: **Chinook salmon.**

Data available for analysis of escapement goal.

Year	Escapement index[a]	Commercial harvest[b]	Inriver sport harvest	Total run	Harvest rate
1974	1,092	1,987	–	3,079	0.65
1975	1,917	1,074	–	2,991	0.36
1976	3,232	1,982	–	5,214	0.38
1977	4,844	1,548	–	6,392	0.24
1978	3,901	2,991	–	6,892	0.43
1979	10,463	4,820	–	15,283	0.32
1980	4,506	7,996	–	12,502	0.64
1981	5,046	9,804	–	14,850	0.66
1982	6,503	12,042	–	18,545	0.65
1983	12,561	11,594	–	24,155	0.48
1984	5,412	6,965	–	12,377	0.56
1985	4,500	10,388	–	14,888	0.7
1986	4,757	4,329	–	9,086	0.48
1987	3,854	5,536	–	9,390	0.59
1988	1,873	5,335	–	7,208	0.74
1989	2,500	3,413	–	5,913	0.58
1990	1,800	2,923	–	4,723	0.62
1991	4,981	2,738	–	7,719	0.35
1992	2,320	2,141	–	4,461	0.48
1993	5,160	4,256	–	9,416	0.45
1994	4,552	3,193	–	7,745	0.41
1995	2,127	3,377	–	5,504	0.61
1996	3,967	2,224	–	6,191	0.36
1997	6,902	3,075	–	9,977	0.31
1998	4,809	2,349	–	7,158	0.33
1999	3,907	1,746	–	5,653	0.31
2000	3,891	1,229	–	5,120	0.24
2001	7,088	1,908	–	8,996	0.21
2002	6,750	1,181	–	7,931	0.15
2003	5,154	906	–	6,060	0.15
2004	7,664	2,710	–	10,374	0.26
2005	4,993	2,887	–	7,880	0.37
2006	2,516	3,020	–	5,536	0.55
2007	2,492	1,372	175	4,039	0.38
2008	5,012	881	153	6,046	0.17
2009	2,048	575	41	2,664	0.23
2010	2,769	360	14	3,143	0.12
2011	1,704	499	19	2,222	0.23
2012	1,092	254	0	1,346	0.19
2013	1,221	346	0	1,567	0.22
2014	3,801	415	0	4,216	0.10
2015	2,890	1,035	0	3,925	0.26
2016	4,618	1,188	0	5,806	0.20
2017	1,852	652	0	2,504	0.26
2018	5,022	902	0	5,924	0.15
2019	12,163	1,799	0	13,962	0.13
2020	2,498	699	0	3,197	0.22

Note: En dashes (–) denote the project was not in operation, or the data were not used in the analysis.

[a] The cumulative tower or weir count and aerial survey count downstream of the tower/weir site; includes enumeration of carcasses, as well as ancillary and qualitative data.

[b] Commercial harvest in the Nelson Lagoon (313-30) statistical area with an estimated proportion of the David's River Stock removed annually.

Appendix A3.–Nelson River Chinook salmon escapement and escapement goals.

System: **Nelson River.**

Species: **Chinook salmon.**

Solid circles represent tower counts, X-symbols represent weir counts, and dashed lines are the historical goals, SEGs and current BEG.
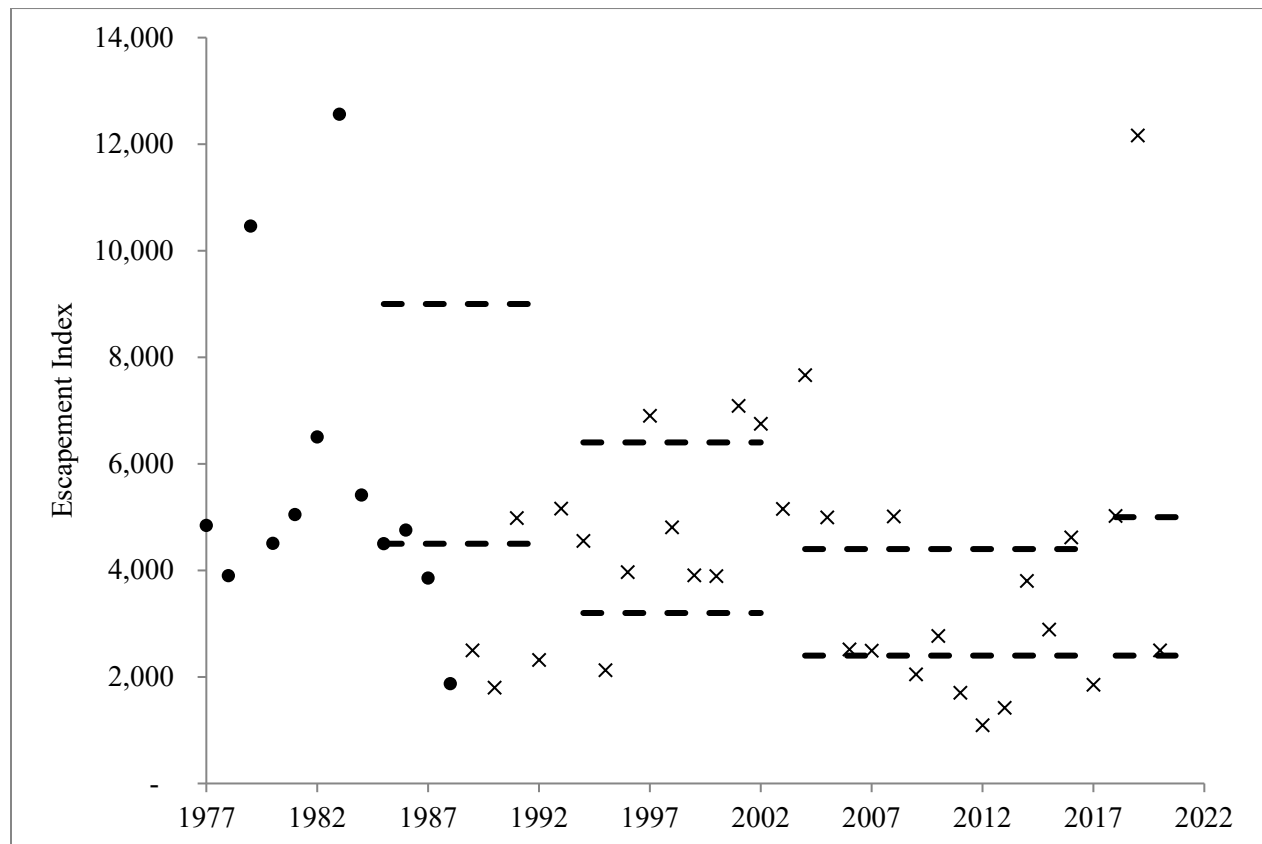
APPENDIX B. SUPPORTING INFORMATION FOR THE ORZINSKI LAKE SOCKEYE SALMON ESCAPEMENT GOAL

Appendix B1.–Description of stock and escapement goal for Orzinski Lake sockeye salmon.

System: **Orzinski Lake.**

Species: **Sockeye salmon.**

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial set gillnet and purse seine
Current escapement goal:	SEG: 15,000 to 20,000 (1992)
Recommended escapement goal:	SEG: 14,000 to 28,000
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1970–1989; weir 1990–present.
Data summary:	
Data quality:	Fair for aerial surveys; good for weir enumeration.
Datatype:	Escapement age date 1990–present. No stock-specific harvest information is available.
Data contrast:	1990 to 2020: 26.8
Methodology:	Percentile Approach
Criteria for SEG:	High contrast, low exploitation. S_{MSY} cannot be estimated from available run data.
Percentiles:	15th and 65th
Comments:	Weir count data used for this review.

Appendix B2.–Orzinski sockeye salmon escapements.

System: **Orzinski Lake.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Escapement index[a]	Weir counts	Year	Escapement index[a]	Weir counts
1970	4,450	–	1996	–	30,000
1971	11,100	–	1997	–	35,000
1972	6,500	–	1998	–	25,000
1973	1,200	–	1999	–	15,000
1974	61,500	–	2000	–	21,500
1975	22,500	–	2001	–	31,200
1976	24,600	–	2002	–	42,849
1977	17,000	–	2003	–	70,690
1978	22,000	–	2004	–	75,450
1979	20,000	–	2005	–	44,797
1980	12,100	–	2006	–	18,000
1981	14,000	–	2007	–	10,643
1982	9,000	–	2008	–	36,839
1983	21,300	–	2009	–	21,457
1984	19,300	–	2010	–	18,039
1985	14,000	–	2011	–	16,764
1986	10,300	–	2012	–	17,243
1987	11,400	–	2013	–	17,386
1988	19,500	–	2014	–	13,600
1989	16,700	–	2015	–	26,534
1990	–	15,000	2016	–	21,019
1991	–	40,000	2017	–	20,989
1992	–	25,000	2018	–	2,817
1993	–	24,700	2019	–	4,367
1994	–	38,000	2020	–	6,819
1995	–	30,000			

Note: En dashes (–) denote the project was not in operation, or the data were not used in the analysis.

[a] The escapement index represents the peak aerial survey, enumeration of carcasses, as well as ancillary and qualitative data.

System: **Orzinski Lake.**

Species: **Sockeye salmon.**

Solid circles represent aerial survey data, X-symbols represent weir counts, and dashed lines are the current SEG.
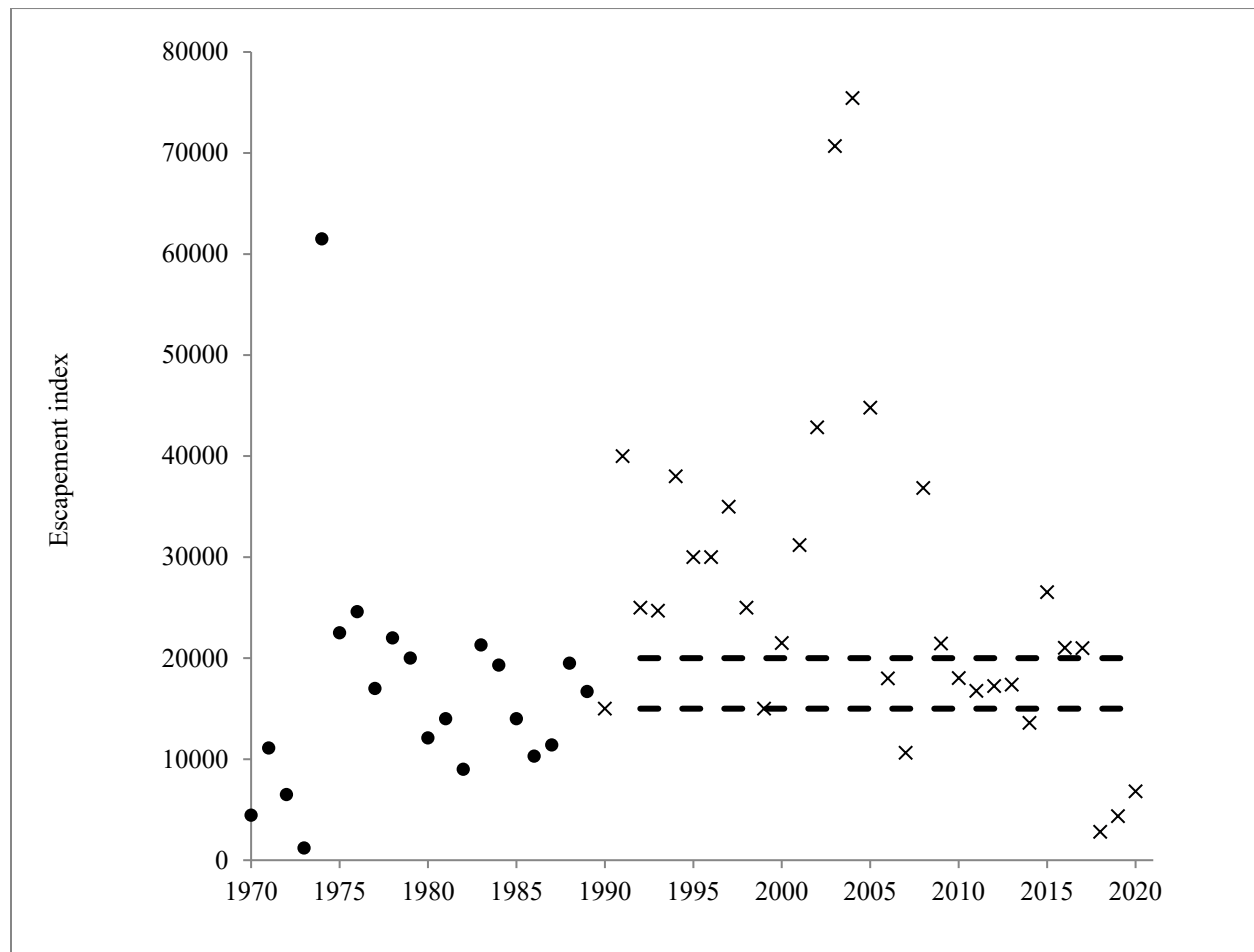
APPENDIX C. SUPPORTING INFORMATION FOR THE THIN POINT LAKE SOCKEYE SALMON ESCAPEMENT GOAL

Appendix C1.–Description of stock and escapement goal for Thin Point Lake sockeye salmon.

System: **Thin Point Lake.**

Species: **Sockeye salmon.**

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set and drift gillnet.
Current escapement goal:	SEG: 14,000 to 28,000 (late 1980s)
Recommended escapement goal:	SEG: 9,000 to 19,000
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1968–present. Weir counts, 1994–1998.
Data summary:	
Data quality:	Fair for aerial surveys; poor for weir counts.
Data type:	Due to prolonged milling behavior in Thin Point Lagoon below the weir site, most of the yearly escapement was not counted past the weir; therefore, aerial survey counts are considered more accurate. No stock-specific harvest information is available.
Data contrast:	1970 to 2020: 40.1
Methodology:	Percentile Approach
Criteria for SEG:	High contrast. S_{MSY} cannot be estimated from available run data.
Percentiles:	25th and 75th
Comments:	Harvest rates believed to exceed 0.40. Peak aerial survey counts were used in this review. Streams included were 284-2006 through 284-2010.

System: **Thin Point Lake.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Peak aerial survey count	Year	Peak aerial survey count
1970	1,730	1996	8,000
1971	1,320	1997	11,500
1972	980	1998	18,000
1973	1,000	1999	13,200
1974	16,000	2000	8,700
1975	5,340	2001	30,400
1976	27,500	2002	28,000
1977	17,000	2003	31,200
1978	11,400	2004	16,900
1979	5,605	2005	17,600
1980	10,450	2006	5,685
1981	7,920	2007	18,100
1982	13,800	2008	32,000
1983	10,200	2009	23,500
1984	10,400	2010	12,400
1985	15,100	2011	14,800
1986	11,600	2012	19,000
1987	9,000	2013	5,700
1988	21,000	2014	8,600
1989	18,700	2015	20,800
1990	17,600	2016	36,400
1991	27,200	2017	39,300
1992	24,800	2018	1,000
1993	14,000	2019	9,600
1994	9,600	2020	9,900
1995	19,000		

Appendix C3.–Thin Point Lake sockeye salmon escapement index and escapement goal.

System: **Thin Point Lake.**

Species: **Sockeye salmon.**

Observed escapement index from peak aerial survey counts by year (solid circles) and current SEG (dashed line).
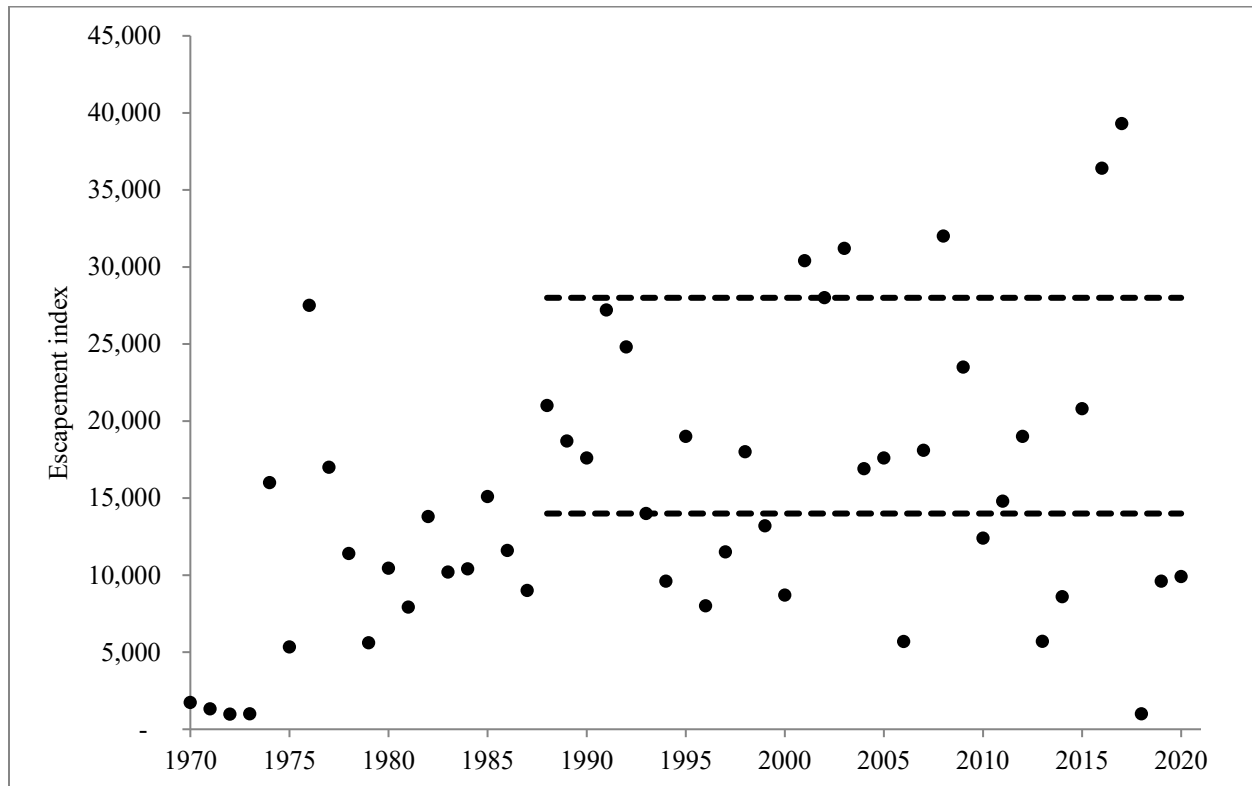
APPENDIX D. SUPPORTING INFORMATION FOR THE MORTENSENS LAGOON SOCKEYE SALMON ESCAPEMENT GOAL

Appendix D1.–Description of stock and escapement goal for Mortensens Lagoon sockeye salmon.

System: **Mortensens Lagoon.**

Species: **Sockeye salmon.**

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set gillnet.
Current escapement goal:	SEG: 3,200 to 6,400 (late 1980s)
Recommended escapement goal:	SEG: 1,400 to 5,700
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1970–present; Weir counts, 2001–2006.
Data summary:	
Data quality:	Poor for aerial surveys; good for weir counts.
Data type:	Fixed aerial surveys from 1970 to present, and weir counts from 2001 to 2006, with escapement age data during weir counts. No stock-specific harvest information is available.
Data contrast:	1970 to 2020: 35.0
Methodology:	Percentile Approach
Criteria for SEG:	High contrast, high exploitation. S_{MSY} cannot be estimated from available run data.
Percentiles:	25th and 75th
Comments:	Harvest rates believed to exceed 0.40. Peak aerial survey counts were used in this review.

Appendix D2.–Mortensens Lagoon sockeye salmon escapement indices.

System: **Mortensens Lagoon.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Peak aerial survey count	Weir count	Year	Peak aerial survey count	Weir count
1970	800	–	1996	1,060	–
1971	800	–	1997	1,300	–
1972	1,000	–	1998	2,100	–
1973	1,250	–	1999	1,500	–
1974	3,070	–	2000	1,500	–
1975	4,000	–	2001	5,500	–
1976	3,400	–	2002	4,000	5,200
1977	5,700	–	2003	6,500	16,804
1978	13,000	–	2004	6,400	7,215
1979	5,900	–	2005	17,500	21,703
1980	2,100	–	2006	3,000	14,688
1981	2,800	–	2007	6,200	–
1982	1,800	–	2008	5,600	–
1983	3,400	–	2009	9,000	–
1984	4,700	–	2010	6,600	–
1985	2,800	–	2011	500	–
1986	1,400	–	2012	5,000	–
1987	3,200	–	2013	4,000	–
1988	2,300	–	2014	500	–
1989	2,400	–	2015	NA	–
1990	800	–	2016	13,000	–
1991	7,050	–	2017	15,500	–
1992	5,700	–	2018	1,200	–
1993	3,000	–	2019	800	–
1994	2,800	–	2020	800	–
1995	7,900	–			

Note: En dashes (–) denote the project was not in operation, or the data were not used in the analysis. NA = not available because the counts were either incomplete, or the project did not operate.

System: **Mortensens Lagoon.**

Species: **Sockeye salmon.**

Solid circles represent peak aerial survey data, X-symbols represent weir counts, and lines are the current SEG.
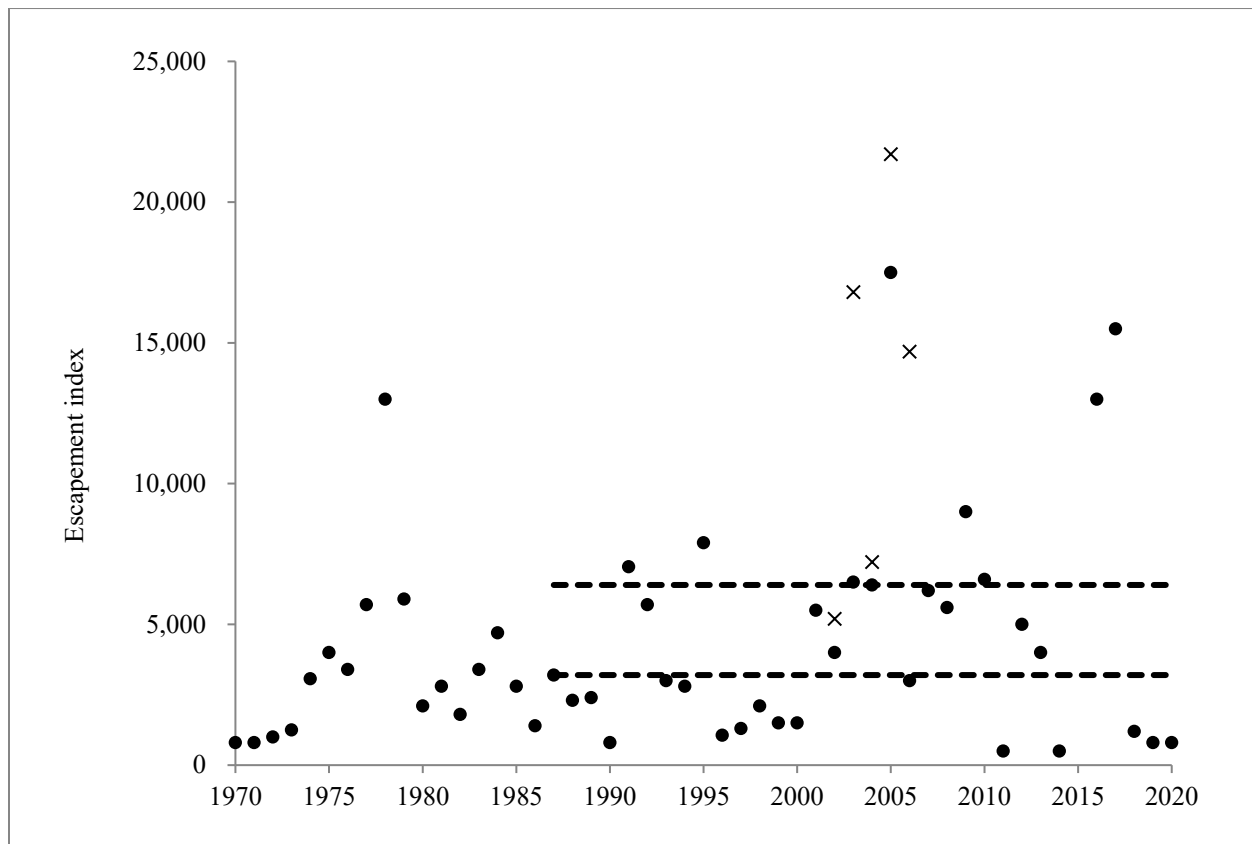
APPENDIX E. SUPPORTING INFORMATION FOR THE CHRISTIANSON LAGOON SOCKEYE SALMON ESCAPEMENT GOAL

Appendix E1.–Description of stock and escapement goal for Christianson Lagoon sockeye salmon.

System: **Christianson Lagoon.**

Species: **Sockeye salmon.**

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set gillnet.
Current escapement goal:	SEG: 25,000 to 50,000 (late 1980s)
Recommended escapement goal:	SEG: 23,000 to 50,000
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1971–present.
Data summary:	
Data quality:	Poor
Data type:	Fixed aerial surveys from 1971 to present; intermittent in 1960s. No stock-specific harvest information is available.
Data contrast:	1971 to 2020: 101.6
Methodology:	Percentile Approach
Criteria for SEG:	High contrast. S_{MSY} cannot be estimated from available run data.
Percentiles:	25th and 75th
Comments:	Harvest rates believed to exceed 0.40. Peak aerial survey counts were used in this review.

Appendix E2.–Christianson Lagoon sockeye salmon escapement index data.

System: **Christianson Lagoon.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Peak aerial survey counts	Year	Peak aerial survey counts
1971	29,540	1996	18,260
1972	4,330	1997	33,300
1973	4,070	1998	34,800
1974	3,050	1999	48,000
1975	10,400	2000	45,000
1976	21,035	2001	36,400
1977	2,200	2002	54,700
1978	10,150	2003	52,200
1979	24,700	2004	75,400
1980	60,700	2005	51,300
1981	58,100	2006	35,705
1982	25,500	2007	56,700
1983	13,300	2008	110,800
1984	63,000	2009	46,700
1985	25,700	2010	11,300
1986	36,800	2011	35,200
1987	22,300	2012	40,000
1988	29,700	2013	16,500
1989	44,700	2014	59,000
1990	43,600	2015	34,900
1991	61,900	2016	111,700
1992	27,500	2017	223,600
1993	44,700	2018	26,100
1994	37,800	2019	39,300
1995	41,800	2020	22,800

Appendix E3.–Christianson Lagoon sockeye salmon escapement index data and escapement goal.

System: **Christianson Lagoon.**

Species: **Sockeye salmon.**

Solid circles represent peak aerial survey data and dashed lines are the historical SEGs.
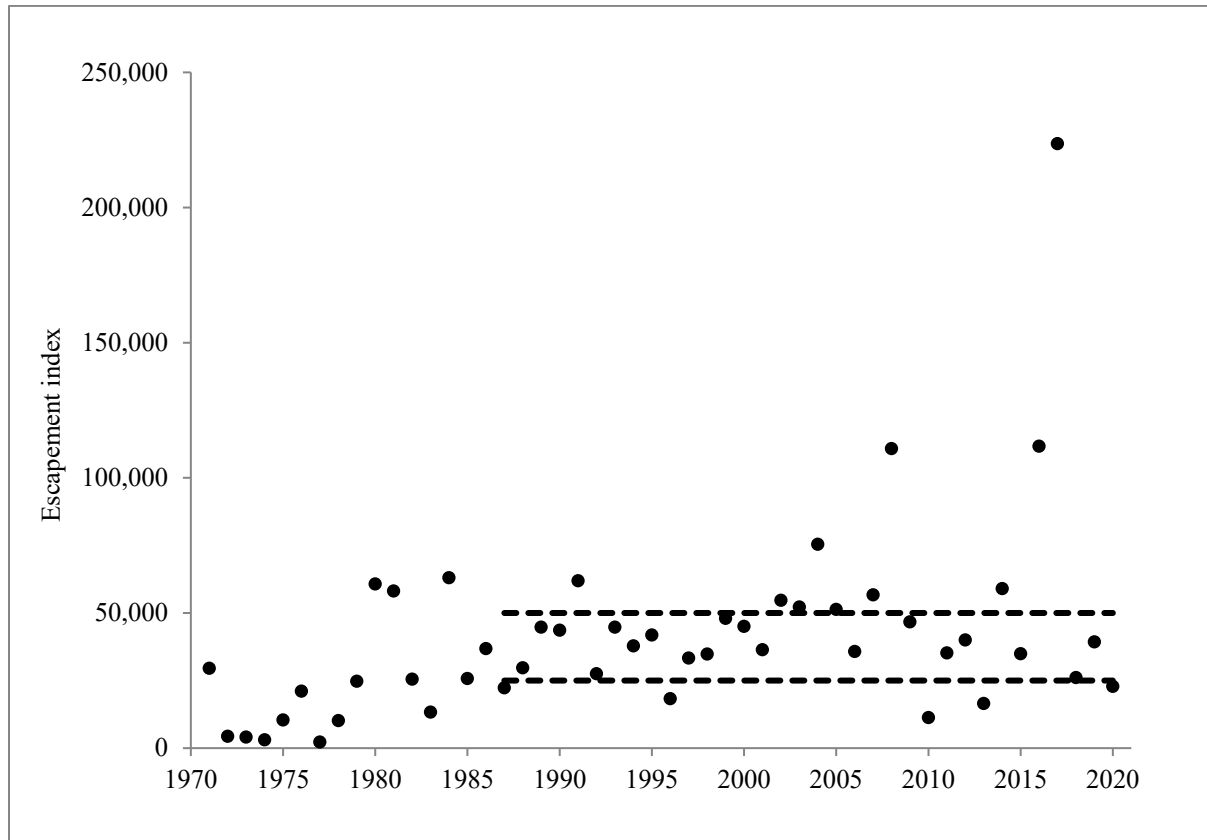
APPENDIX F. SUPPORTING INFORMATION FOR THE NORTH CREEK SOCKEYE SALMON ESCAPEMENT GOAL

Appendix F1.–Description of stock and escapement goal for North Creek sockeye salmon.

System: North Creek.

Species: Sockeye salmon.

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial set and drift gillnet.
Current escapement goal:	SEG: 7,500 to 10,000 (2019)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1960–present.
Data summary:	
Data quality:	Poor
Data type:	Fixed aerial surveys from 1960 to present. No stock-specific harvest information is available.
Comments:	Review supports current SEG, which is based on the Percentile Approach. North Creek is stream 313-1002. Peak aerial survey counts were used in this review.

Appendix F2.–North Creek sockeye salmon escapement index data.

System: **North Creek.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Peak aerial survey counts	Year	Peak aerial survey counts
1970	600	1996	8,000
1971	NA	1997	5,700
1972	NA	1998	6,700
1973	NA	1999	10,900
1974	1,800	2000	8,100
1975	1,650	2001	8,000
1976	7,000	2002	10,100
1977	3,300	2003	NA
1978	500	2004	15,000
1979	2,100	2005	45,000
1980	3,350	2006	7,530
1981	100	2007	16,800
1982	5,800	2008	38,000
1983	2,000	2009	8,000
1984	500	2010	18,500
1985	3,600	2011	10,200
1986	2,100	2012	18,000
1987	8,300	2013	8,500
1988	6,300	2014	7,500
1989	7,000	2015	18,000
1990	5,100	2016	21,000
1991	9,900	2017	5,800
1992	15,700	2018	8,300
1993	6,600	2019	11,000
1994	4,600	2020	8,200
1995	3,400		
1996	8,000		

Note: NA = not available because the counts were either incomplete, or the project did not operate.

System: **North Creek.**

Species: **Sockeye salmon.**

Solid circles represent peak aerial survey data and dashed lines are the historical and recommended SEGs.
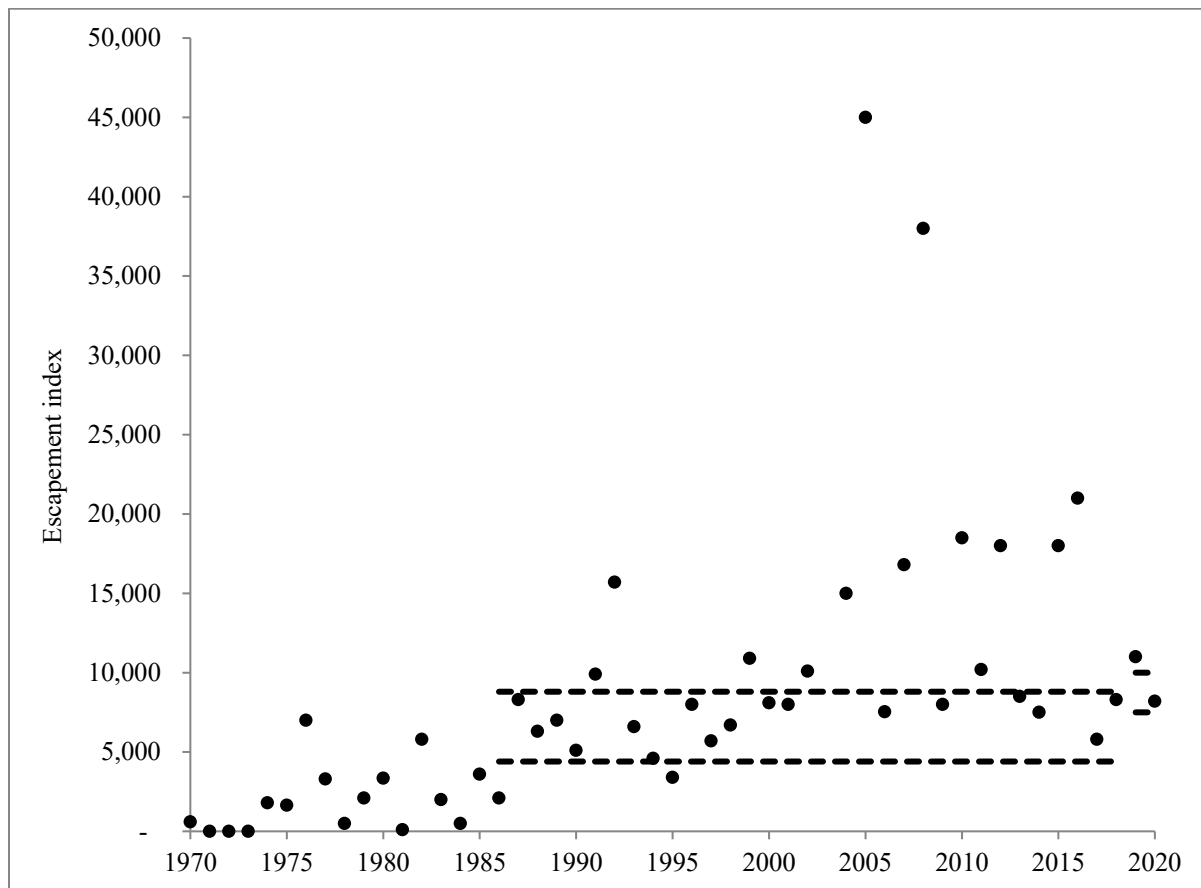
APPENDIX G. SUPPORTING INFORMATION FOR THE NELSON RIVER SOCKEYE SALMON ESCAPEMENT GOAL

Appendix G1.–Description of stock and escapement goal for Nelson River sockeye salmon.

System: Nelson River.

Species: Sockeye salmon.

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial set and drift gillnet.
Current escapement goal:	BEG: 97,000 to 219,000 (2004)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Tower counts, 1962–1988; Weir counts, 1989–present.
Data summary:	
Data quality:	Good for tower counts; excellent for weir counts.
Data type:	Tower counts from 1962 to 1988 and weir counts from 1989 to present. Escapement age data are available from 1985 to present. Stock-specific harvest information is available from 1970 to present.
Comments:	Current BEG was based on Ricker spawner–recruit model.

Appendix G2.–Nelson River sockeye salmon escapements.

System: **Nelson River.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Tower escapement	Weir escapement	Year	Tower escapement	Weir escapement
1970	81,900	–	1996	–	250,500
1971	58,900	–	1997	–	183,100
1972	27,600	–	1998	–	159,800
1973	18,200	–	1999	–	202,067
1974	37,400	–	2000	–	182,700
1975	133,100	–	2001	–	201,962
1976	101,000	–	2002	–	315,693
1977	146,000	–	2003	–	343,511
1978	280,000	–	2004	–	480,097
1979	352,100	–	2005	–	303,000
1980	335,400	–	2006	–	215,000
1981	244,200	–	2007	–	180,000
1982	171,600	–	2008	–	141,600
1983	124,000	–	2009	–	157,000
1984	244,100	–	2010	–	108,000
1985	314,300	–	2011	–	89,000
1986	117,000	–	2012	–	103,300
1987	144,000	–	2013	–	248,000
1988	128,300	–	2014	–	250,000
1989	–	193,300	2015	–	257,000
1990	–	240,700	2016	–	300,000
1991	–	268,400	2017	–	381,000
1992	–	162,300	2018	–	221,000
1993	–	207,200	2019	–	115,000
1994	–	325,300	2020	–	185,000
1995	–	329,400			

Note: En dashes (–) denote the project was not in operation, or the data were not used in the analysis.

System: **Nelson River.**

Species: **Sockeye salmon.**

Solid circles represent tower count data, X-symbols represent weir counts, and dashed lines are the historical escapement goals.
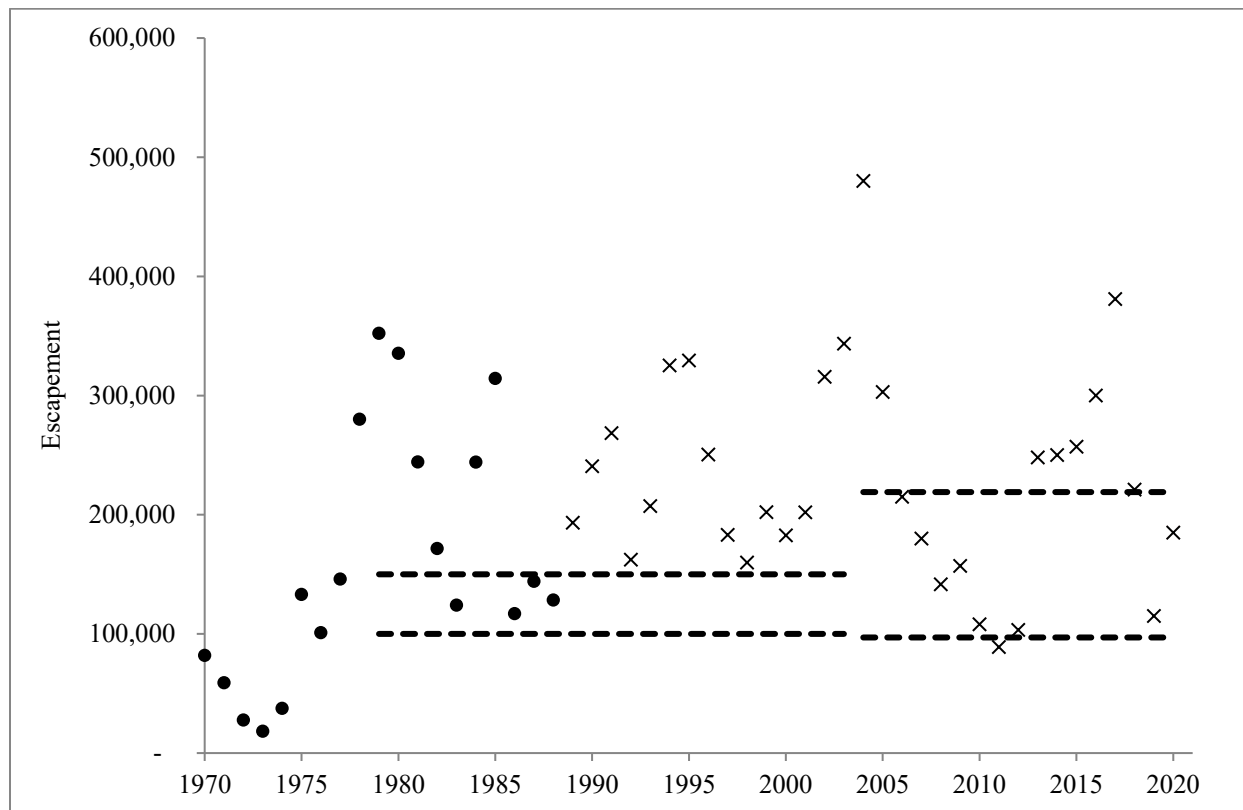
APPENDIX H. SUPPORTING INFORMATION FOR THE BEAR LAKE SOCKEYE SALMON ESCAPEMENT GOALS

Appendix H1.–Description of stock and escapement goals for Bear Lake sockeye salmon.

System: **Bear Lake.**

Species: **Sockeye salmon.**

Description of stock and escapement goals.

Regulatory area	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and drift gillnet.
Previous escapement goal:	SEG: Early Run: 176,000 to 293,000 (2003). SEG: Late Run: 117,000 to 195,000 (2003). SEG: Total Run: 293,000 to 488,000 (2003).
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Tower counts, 1964–1985; Weir counts, 1986–present.
Data summary:	
Data quality:	Good for tower counts; excellent for weir counts.
Data type:	Tower counts from 1964 to 1985; weir counts from 1986 to present. Escapement age data are available from 1985 to present and harvest age data are available from 1985 to present for the late run (after July 31). Stock-specific harvest information is available for the late run from 1970 to present. No-stock specific harvest information is available for the early run (prior to August 1).
Comments:	The Bear Lake system is considered spawner-limited and therefore, the spawning habitat model was used to estimate the SEG.

Appendix H2.–Bear Lake early-run sockeye salmon escapements.

System: **Bear Lake early run.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Tower counts	Weir counts	Year	Tower counts	Weir counts
1970	147,367	–	1996	–	247,371
1971	65,950	–	1997	–	214,689
1972	106,571	–	1998	–	221,580
1973	90,998	–	1999	–	222,110
1974	143,505	–	2000	–	184,053
1975	138,793	–	2001	–	177,495
1976	163,135	–	2002	–	179,480
1977	153,383	–	2003	–	226,201
1978	311,528	–	2004	–	354,565
1979	384,613	–	2005	–	332,248
1980	436,962	–	2006	–	262,995
1981	475,272	–	2007	–	206,233
1982	195,497	–	2008	–	125,526
1983	157,857	–	2009	–	216,237
1984	286,849	–	2010	–	226,534
1985	269,261	–	2011	–	207,451
1986	–	174,453	2012	–	173,158
1987	–	168,683	2013	–	219,074
1988	–	172,363	2014	–	259,046
1989	–	246,196	2015	–	304,356
1990	–	283,854	2016	–	293,280
1991	–	432,087	2017	–	585,840
1992	–	254,170	2018	–	324,093
1993	–	254,012	2019	–	294,727
1994	–	260,559	2020	–	299,198
1995	–	197,039			

Note: En dashes (–) denote the project was not in operation, or the data were not used in the analysis.

Appendix H3.–Bear Lake early-run sockeye salmon escapement and escapement goals.

System: **Bear Lake early run.**

Species: **Sockeye salmon.**

Solid circles represent tower count data, X-symbols represent weir counts, and dashed lines are the historical and current SEG.

Appendix H4.–Bear Lake late-run sockeye salmon table.

System: **Bear Lake late run.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Tower counts	Weir counts	Year	Tower counts	Weir counts
1970	121,633	–	1996	–	119,629
1971	185,050	–	1997	–	145,311
1972	20,429	–	1998	–	193,420
1973	34,002	–	1999	–	127,890
1974	106,495	–	2000	–	90,947
1975	131,207	–	2001	–	122,505
1976	121,865	–	2002	–	95,520
1977	61,617	–	2003	–	139,799
1978	418,472	–	2004	–	80,435
1979	567,387	–	2005	–	221,752
1980	238,038	–	2006	–	182,005
1981	214,728	–	2007	–	224,767
1982	104,503	–	2008	–	195,474
1983	172,143	–	2009	–	133,263
1984	108,151	–	2010	–	142,966
1985	170,739	–	2011	–	132,549
1986	–	98,047	2012	–	116,442
1987	–	89,317	2013	–	196,926
1988	–	140,637	2014	–	206,954
1989	–	204,804	2015	–	210,644
1990	–	262,946	2016	–	139,720
1991	–	173,913	2017	–	229,160
1992	–	195,830	2018	–	232,907
1993	–	197,988	2019	–	205,273
1994	–	204,441	2020	–	200,802
1995	–	107,961			

Note: En dashes (–) denote the project was not in operation, or the data were not used in the analysis.

System: **Bear Lake late run.**

Species: **Sockeye salmon.**

Solid circles represent tower count data, X-symbols represent weir counts, and dashed lines are the historical and current SEG.
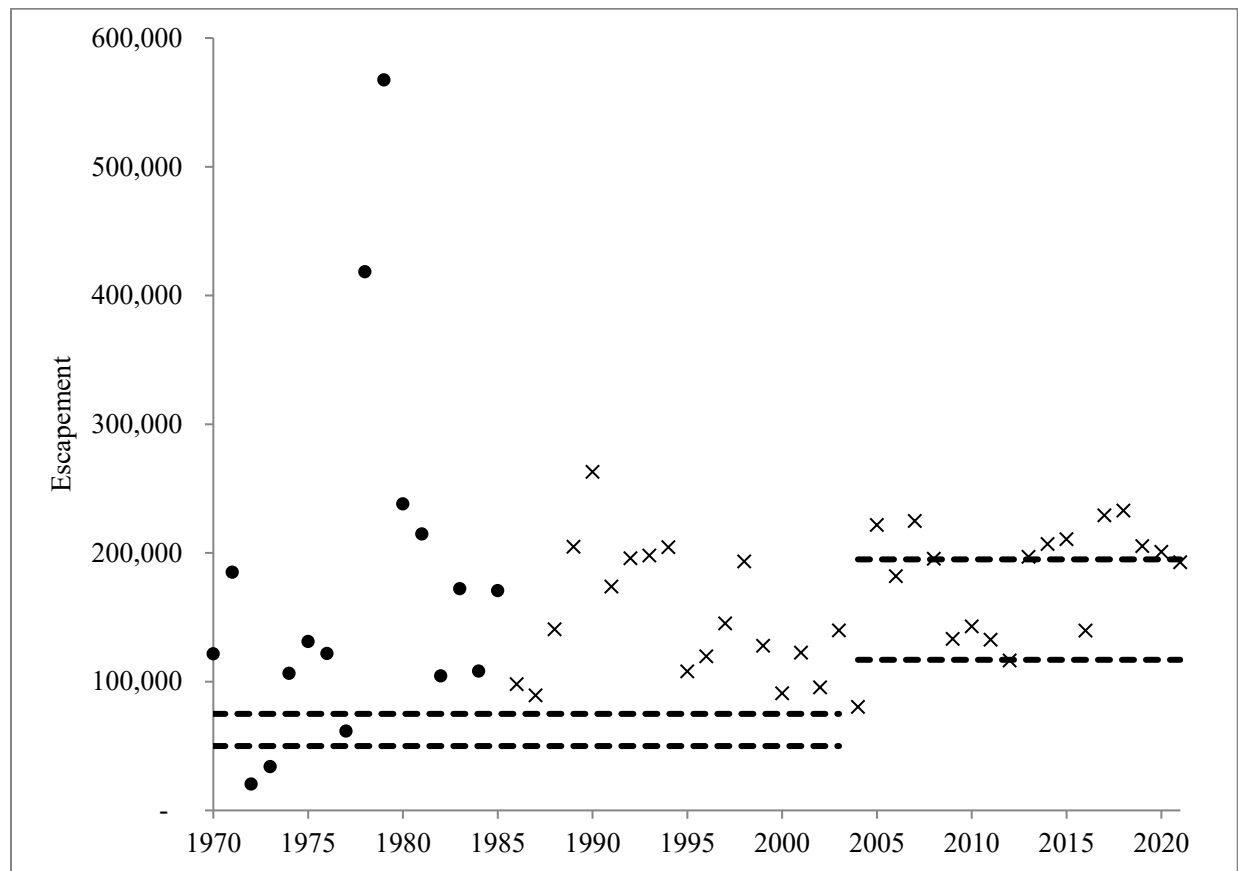
APPENDIX I. SUPPORTING INFORMATION FOR THE SANDY RIVER SOCKEYE SALMON ESCAPEMENT GOAL

Appendix I1.–Description of stock and escapement goal for Sandy River sockeye salmon.

System: Sandy River.

Species: Sockeye salmon.

Description of stock and escapement goals.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and drift gillnet.
Previous escapement goal:	SEG: 34,000 to 74,000 (2007)
Recommended escapement goal:	SEG: 37,000 to 69,000
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1960–1993; Tower counts, 1962–1964; Weir counts, 1994–present.
Data summary:	
Data quality:	Fair for aerial survey/tower count; good for weir counts.
Data type:	Weir counts from 1994 to 2011 are available and escapement age information is available during weir counts. No stock-specific harvest information is available.
Data contrast:	1994 to 2020: 6.3
Methodology:	Percentile Approach
Criteria for SEG:	Low contrast. S_{MSY} cannot be estimated from available run data.
Percentiles:	25th and 75th
Comments:	Harvest rate assumed >0.40.

Appendix I2.–Sandy River sockeye salmon escapements.

System: **Sandy River.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Escapement index[a]	Weir counts	Year	Escapement index[a]	Weir counts
1970	25,000	–	1996	–	64,000
1971	30,000	–	1997	–	38,000
1972	8,400	–	1998	–	52,000
1973	5,100	–	1999	–	58,000
1974	16,500	–	2000	–	40,000
1975	40,000	–	2001	–	51,000
1976	43,000	–	2002	–	49,000
1977	50,200	–	2003	–	66,000
1978	64,000	–	2004	–	32,000
1979	61,000	–	2005	–	101,000
1980	76,000	–	2006	–	48,000
1981	51,500	–	2007	–	44,700
1982	61,300	–	2008	–	32,200
1983	28,000	–	2009	–	36,000
1984	19,000	–	2010	–	37,000
1985	11,500	–	2011	–	37,500
1986	6,900	–	2012	–	27,100
1987	8,700	–	2013	–	42,000
1988	34,500	–	2014	–	59,000
1989	36,000	–	2015	–	116,000
1990	17,500	–	2016	–	170,000
1991	75,200	–	2017	–	145,000
1992	21,200	–	2018	–	35,000
1993	49,300	–	2019	–	71,000
1994	–	115,000	2020	–	60,000
1995	–	125,000			

Note: En dashes (–) denote the project was not in operation, or the data were not used in the analysis.

[a]   The escapement index represents the peak aerial survey, enumeration of carcasses, as well as ancillary and qualitative data.

System: **Sandy River.**

Species: **Sockeye salmon.**

Solid circles represent aerial survey data, X-symbols represent weir counts, and dashed lines are the historical SEGs.
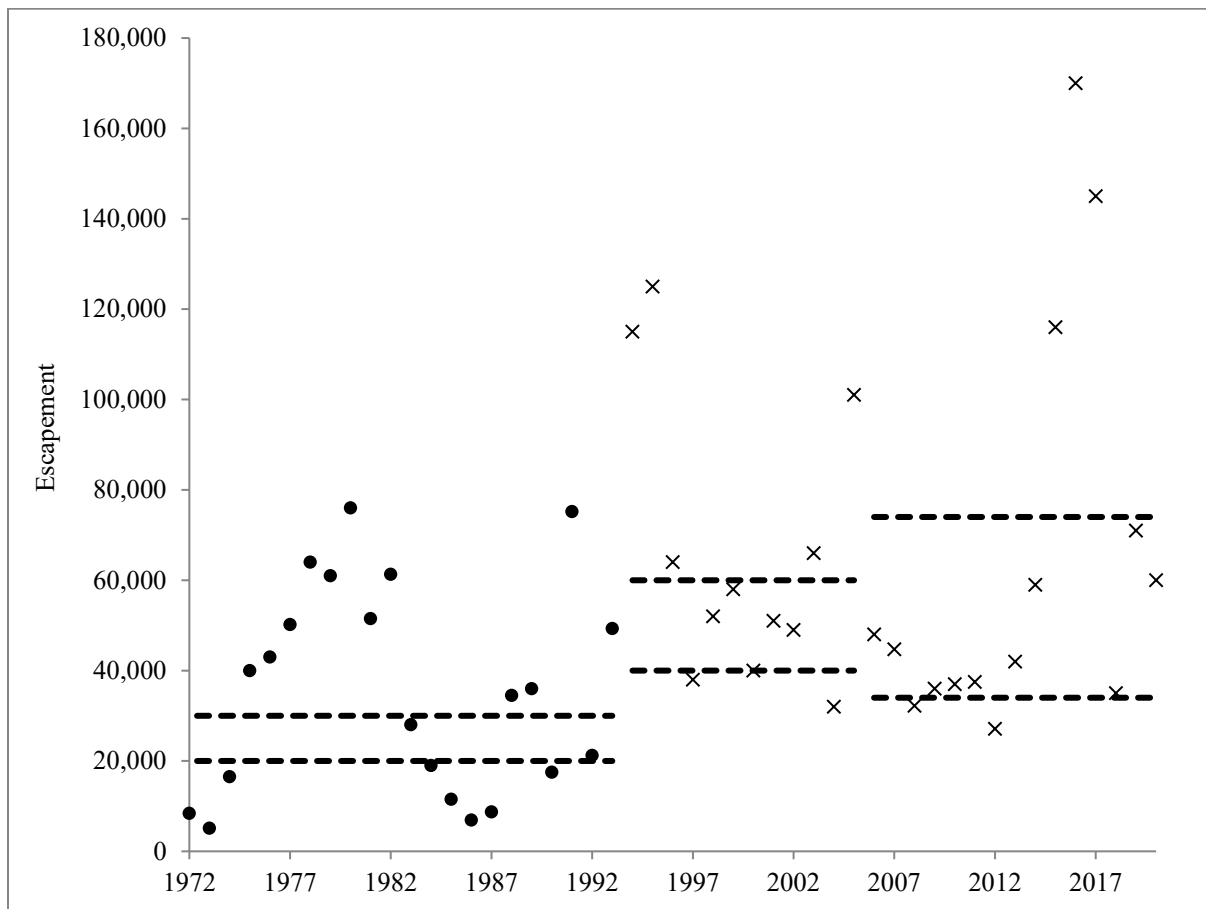
APPENDIX J. SUPPORTING INFORMATION FOR THE ILNIK RIVER SOCKEYE SALMON ESCAPEMENT GOAL

Appendix J1.–Description of stock and escapement goal for Ilnik River sockeye salmon.

System: **Ilnik River.**

Species: **Sockeye salmon.**

Description of stock and escapement goals.

Regulatory area	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial drift and set gillnet.
Previous escapement goal:	SEG: 40,000 to 60,000 (1991)
Recommended escapement goal:	SEG: 40,000 to 75,000
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1960–1990; Weir count, 1991–present.
Data summary:	
Data quality:	Fair for aerial surveys; good for weir counts.
Data type:	Fixed-wing aerial surveys from 1970 to 1990; intermittent during 1960s. Weir counts from 1991 to present, with escapement age data available during weir counts. No stock-specific harvest information is available.
Data contrast:	1991 to 2020: 9.2
Methodology:	Percentile Approach
Criteria for SEG:	Contrast >8. S_{MSY} cannot be estimated from available run data, however measurement error is low from using weir count data.
Percentiles:	15th and 65th
Comments:	Current escapement goal based on Percentile Approach, euphotic volume analysis, smolt biomass as a function of zooplankton biomass, and lake surface area methods. Ilnik River system escapement includes Ocean River escapement.

Appendix J2.–Ilnik River sockeye salmon escapements.

System: **Ilnik River.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Escapement index[a]	Weir counts	Year	Escapement index[a]	Weir counts
1970	15,300	–	1996	–	62,000
1971	26,100	–	1997	–	82,000
1972	13,100	–	1998	–	50,000
1973	16,000	–	1999	–	75,000
1974	14,500	–	2000	–	95,000
1975	40,500	–	2001	–	58,000
1976	37,500	–	2002	–	43,000
1977	30,000	–	2003	–	69,000
1978	23,100	–	2004	–	82,000
1979	97,200	–	2005	–	154,000
1980	97,600	–	2006	–	88,000
1981	97,500	–	2007	–	93,000
1982	42,500	–	2008	–	44,300
1983	28,600	–	2009	–	66,000
1984	29,500	–	2010	–	59,000
1985	27,000	–	2011	–	43,000
1986	66,800	–	2012	–	61,000
1987	30,700	–	2013	–	51,000
1988	26,900	–	2014	–	59,000
1989	16,500	–	2015	–	26,000
1990	35,700	–	2016	–	124,000
1991	–	135,000	2017	–	238,000
1992	–	45,000	2018	–	81,000
1993	–	70,000	2019	–	75,000
1994	–	75,000	2020	–	41,000
1995	–	39,000			

Note: En dashes (–) denote the project was not in operation, or the data were not used in the analysis.

[a] The escapement index represents the peak survey, enumeration of carcasses, as well as ancillary and qualitative data.

Appendix J3.–Ilnik River sockeye salmon escapement and escapement goal.

System: **Ilnik River.**

Species: **Sockeye salmon.**

Solid circles represent aerial survey data, X-symbols represent weir counts, and dashed lines are the current SEG.
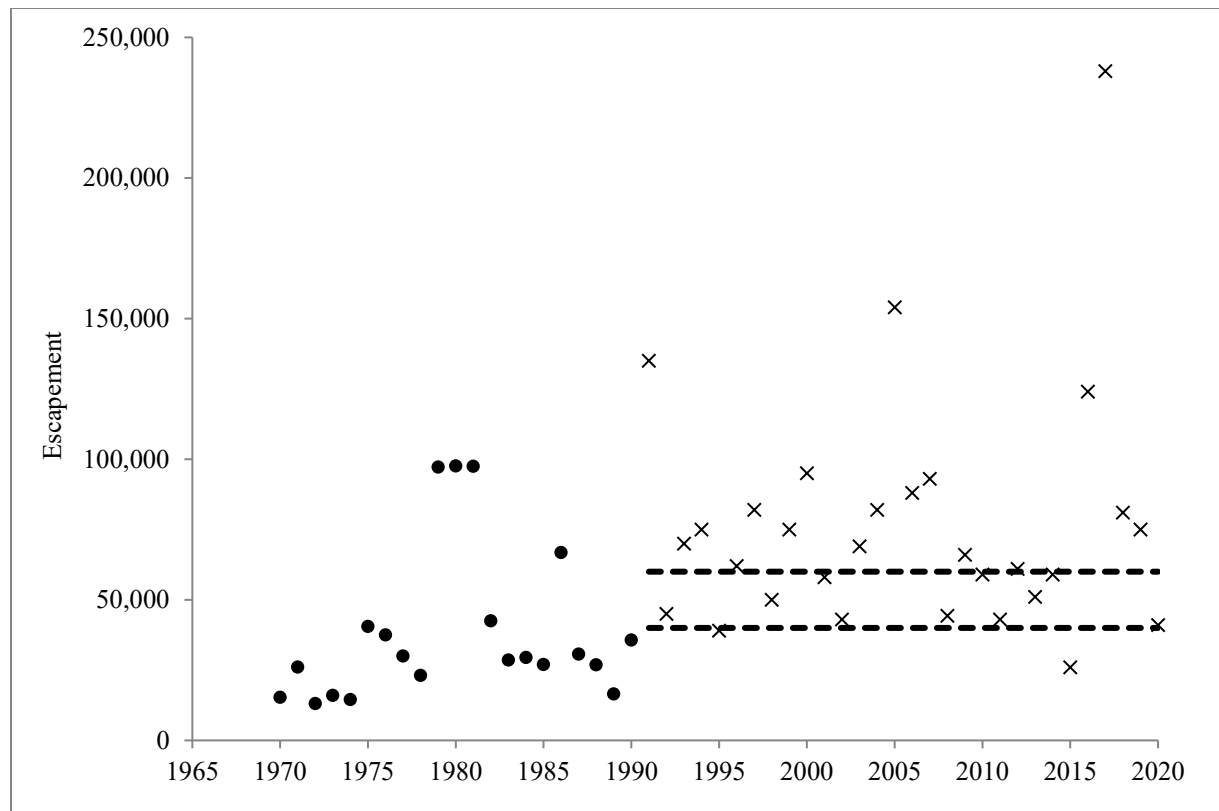
APPENDIX K. SUPPORTING INFORMATION FOR THE MESHIK RIVER SOCKEYE SALMON ESCAPEMENT GOAL

Appendix K1.–Description of stock and escapement goal for Meshik River sockeye salmon.

System: **Meshik River.**

Species: **Sockeye salmon.**

Description of stock and escapement goals.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial drift and set gillnet.
Current escapement goal:	SEG: 48,000 to 86,000 (2015)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1970–present.
Data summary:	
Data quality:	Poor
Data type:	Fixed-wing aerial surveys from 1960 to present; missing data points throughout period. 1990 to present includes increased aerial survey effort. No stock-specific harvest information is available.
Comments:	This index includes Red Bluff (317-204A) and Yellow Bluff (317-204B) Creeks in addition to Meshik River (317-207). Counts exclude carcasses and are limited to streams. Highest counts for each stream were used for the review. If both Red Bluff and Yellow Bluff Creeks were not surveyed, that year was excluded from the analysis. Current escapement goal based on Percentile Approach.

Appendix K2.–Meshik River sockeye salmon escapements.

System: **Meshik River.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Peak aerial survey escapement
1990	36,790
1991	24,880
1992	37,400
1993	NA
1994	45,700
1995	70,020
1996	59,950
1997	15,100
1998	56,025
1999	68,800
2000	279,100
2001	237,700
2002	NA
2003	153,600
2004	121,100
2005	144,600
2006	152,700
2007	92,600
2008	95,750
2009	125,000
2010	110,700
2011	101,900
2012	50,900
2013	123,600
2014	114,700
2015	171,700
2016	131,800
2017	250,525
2018	228,700
2019	167,700
2020	116,550

Note: NA = not available because the counts were either incomplete, or the project did not operate.

System: **Meshik River.**

Species: **Sockeye salmon.**

Observed Meshik River sockeye salmon escapement by year, and current SEG range (dotted lines).
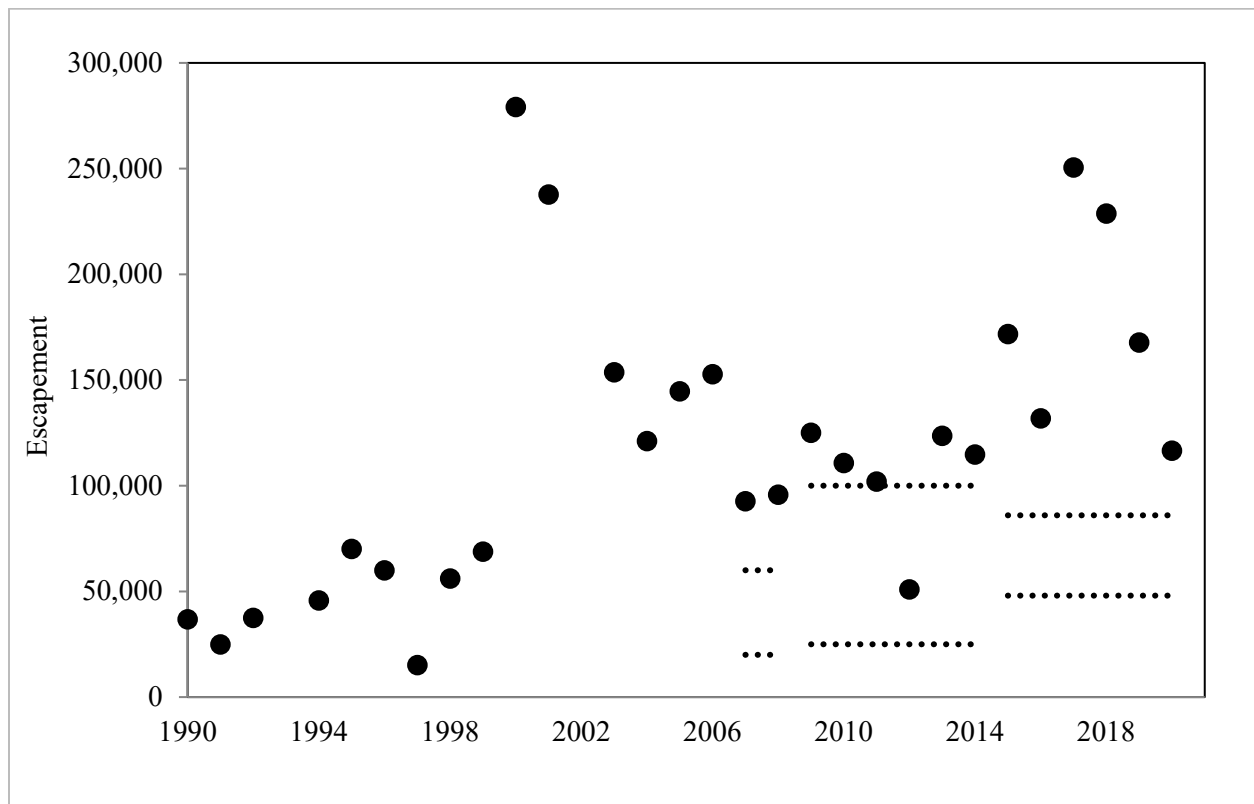
APPENDIX L. SUPPORTING INFORMATION FOR THE CINDER RIVER SOCKEYE SALMON ESCAPEMENT GOAL

Appendix L1.–Description of stock and escapement goal for Cinder River sockeye salmon.

System: **Cinder River.**

Species: **Sockeye salmon.**

Description of stock and escapement goals.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial drift and set gillnet.
Current escapement goal:	SEG: 36,000 to 94,000 (2016)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1970–present.
Data summary:	
Data quality:	Poor
Data type:	Fixed-wing aerial surveys from 1960 to present; missing data points throughout time period. 1990 to present includes increased aerial survey effort. No stock-specific harvest information is available.
Comments:	The Percentile Approach used data from 1991 to the present as those data represent better quality aerial surveys. Only streams that were consistently sampled for 10 or more years and that contributed ≥5% to the total historical aggregate peak aerial survey escapement were used in the analysis. For this review cycle, the following streams met the criteria: Mud Creek (318-2004) Cinder River mainstem (318-2006A) Lava Creek (318-2006D) Meloy Creek (318-2006H) Wiggly Creek (318-2006J)

Appendix L2.–Cinder River sockeye salmon escapements.

System: **Cinder River.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Peak aerial survey escapement[a]
1991	45,500
1992	11,100
1993	NA
1994	77,400
1995	36,000
1996	NA
1997	65,000
1998	22,703
1999	18,000
2000	82,500
2001	51,000
2002	10,200
2003	111,000
2004	65,000
2005	120,000
2006	106,000
2007	130,000
2008	121,800
2009	131,000
2010	106,000
2011	105,500
2012	73,000
2013	90,000
2014	96,000
2015	118,000
2016	200,500
2017	222,600
2018	189,000
2019	95,025
2020	115,800

Note: NA = not available because the counts were either incomplete, or the project did not operate.

[a] The peak aerial survey represents the streams consistently sampled ≥10 years and contributing ≥5% to the total historical aggregate peak aerial survey escapement.

System: **Cinder River.**

Species: **Sockeye salmon.**

Observed escapement by year and current SEG range (dotted lines).
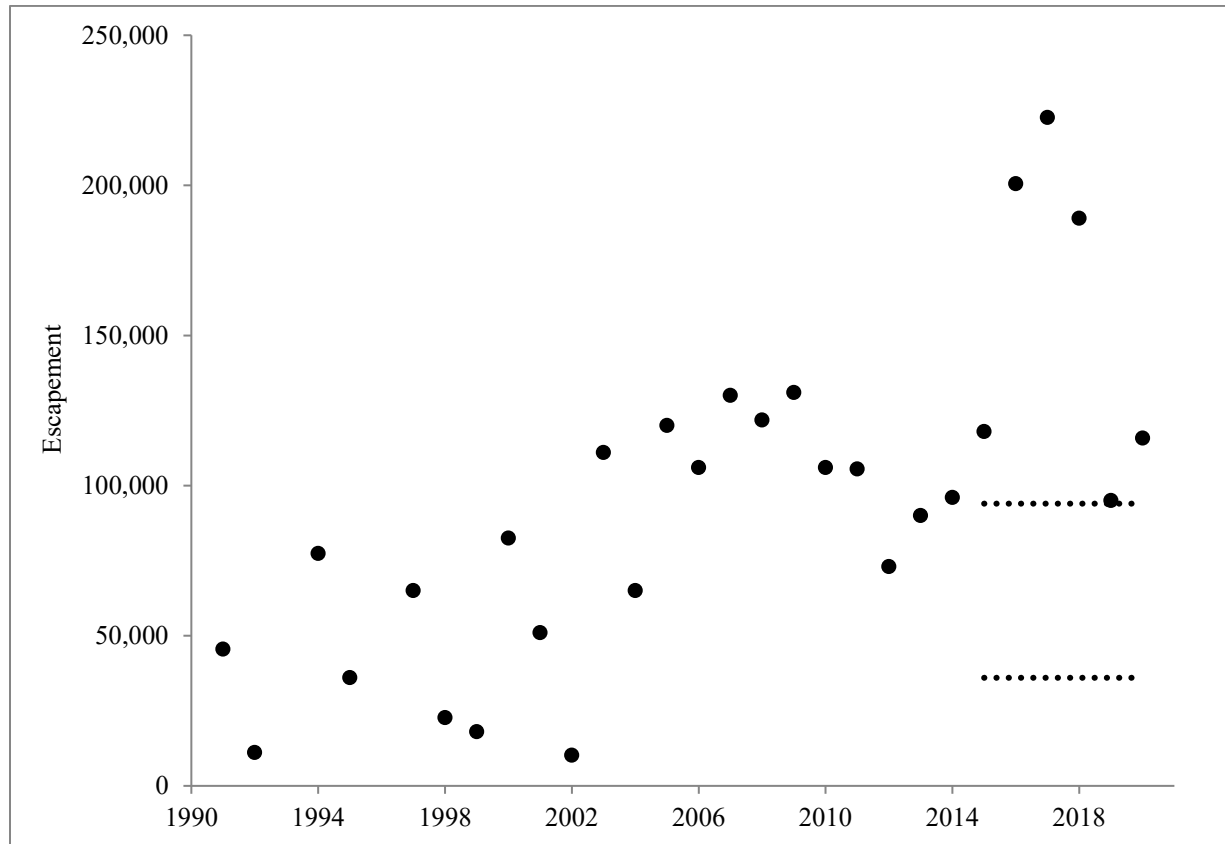
APPENDIX M. SUPPORTING INFORMATION FOR THE MCLEES LAKE SOCKEYE SALMON ESCAPEMENT GOAL

Appendix M1.–Description of stock and escapement goal for McLees Lake sockeye salmon.

System: **McLees Lake.**

Species: **Sockeye salmon.**

Description of stock and escapement goal.

Regulatory area	Aleutian Islands – Westward Region.
Management division:	Commercial Fisheries.
Primary fishery:	Commercial purse seine.
Current escapement goal:	LB SEG: >10,000 (2018)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1974–2003, 2018, 2019 Weir counts, 2001–2017, 2020
Data summary:	
Data quality:	Fair for aerial survey counts; good for weir counts.
Data type:	No stock-specific harvest information is available.
Comments:	Only weir escapement was examined in the review.

Appendix M2.–McLees Lake sockeye salmon escapements.

System: **McLees Lake.**

Species: **Sockeye salmon.**

Data available for analysis of escapement goal.

Year	Weir counts
2001	45,866
2002	97,780
2003	101,793
2004	40,328
2005	12,097
2006	12,936
2007	21,428
2008	8,661
2009	10,120
2010	32,842
2011	36,602
2012	15,111
2013	15,687
2014	12,424
2015	20,284
2016	39,892
2017	13,195
2018	NA
2019	NA
2020	5,037

Note: NA = not available because the counts were either incomplete, or the project did not operate.

System: **McLees Lake.**

Species: **Sockeye salmon.**

Solid circles represent weir counts, the dashed lines represent the historical SEGs.
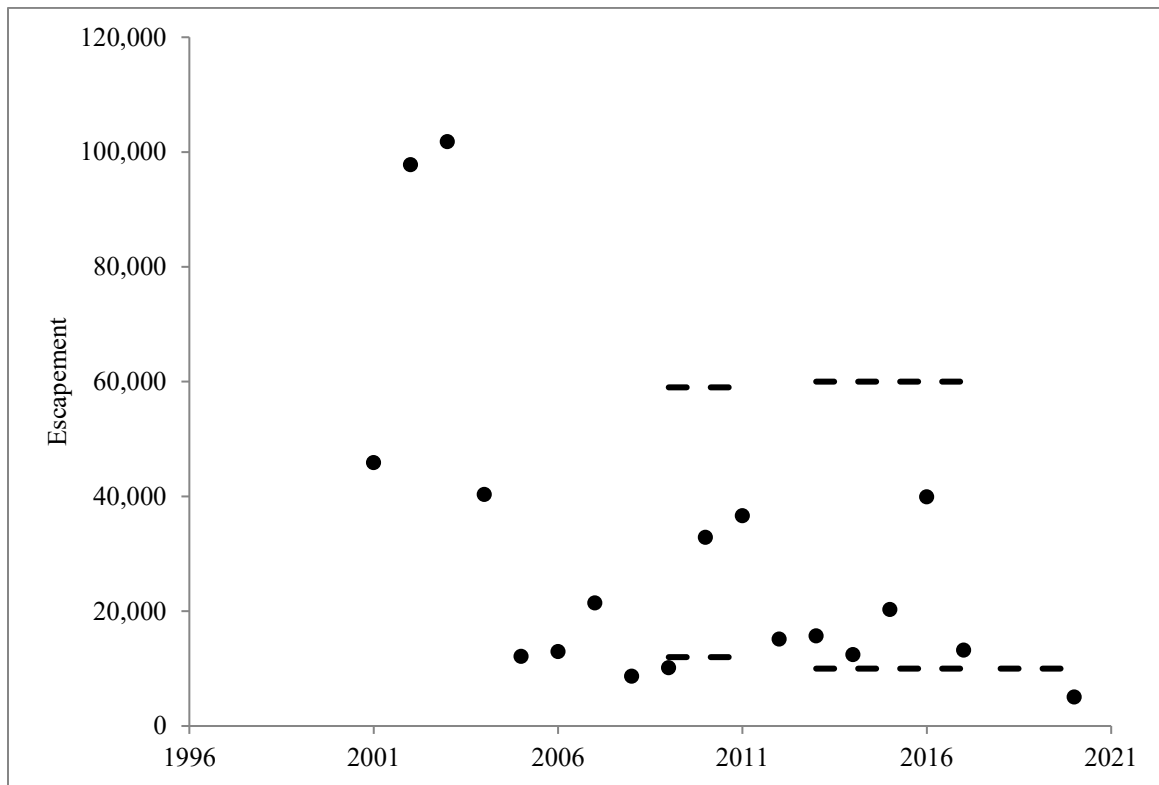
APPENDIX N. SUPPORTING INFORMATION FOR THE NELSON RIVER COHO SALMON ESCAPEMENT GOAL

Appendix N1.–Description of stock and escapement goal for Nelson River coho salmon.

System: Nelson River.

Species: Coho salmon.

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial set and drift gillnet.
Current escapement goal:	SEG: 18,000 (2004)
Recommended escapement goal:	SEG: 19,000 to 29,000
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1968–present.
Data summary:	
Data quality:	Fair for aerial survey counts.
Data type:	Fixed-wing aerial surveys from 1968 to present. No stock-specific harvest information is available.
Data contrast:	1987 to 2020: 3.6
Methodology:	Percentile Approach
Criteria for SEG:	Low contrast. S_{MSY} cannot be estimated from available run data.
Percentiles:	25th and 75th
Comments:	Data are peak aerial survey counts. Harvest rate assumed >0.40.

Appendix N2.–Nelson River coho salmon escapements.

System: **Nelson River.**

Species: **Coho salmon.**

Data available for analysis of escapement goal.

Year	Peak aerial survey escapement	Year	Peak aerial survey escapement
1970	3,900	1996	20,500
1971	3,400	1997	18,000
1972	1,210	1998	20,000
1973	1,500	1999	16,000
1974	1,200	2000	18,000
1975	1,200	2001	36,000
1976	5,700	2002	35,500
1977	13,000	2003	26,700
1978	1,425	2004	52,500
1979	17,000	2005	24,000
1980	26,700	2006	19,000
1981	30,000	2007	19,000
1982	NA	2008	24,000
1983	13,000	2009	22,000
1984	28,630	2010	15,000
1985	17,500	2011	21,000
1986	23,000	2012	19,160
1987	27,500	2013	22,000
1988	17,000	2014	25,000
1989	32,000	2015	45,000
1990	30,000	2016	45,000
1991	33,000	2017	19,000
1992	20,000	2018	44,000
1993	14,600	2019	23,000
1994	18,000	2020	23,000
1995	22,500		

Note: NA = not available because the counts were either incomplete, or the project did not operate.

System: **Nelson River.**

Species: **Coho salmon.**

Observed escapement by year (solid circles) with historical SEG range and current Lower Bound SEG (dashed lines).
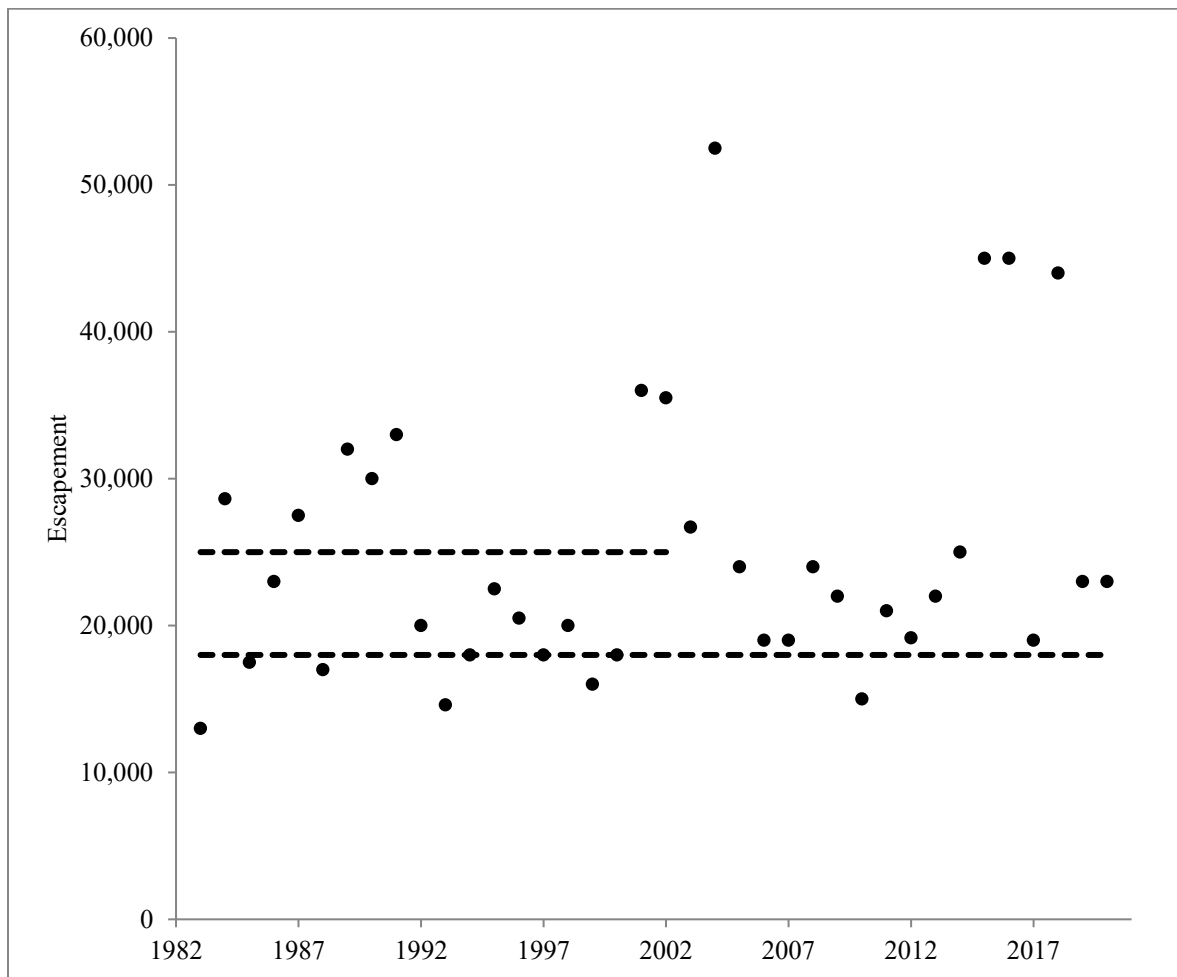
APPENDIX O. SUPPORTING INFORMATION FOR THE ILNIK RIVER COHO SALMON ESCAPEMENT GOAL

Appendix O1.–Description of stock and escapement goals for Ilnik River coho salmon.

System: Ilnik River.

Species: Coho salmon.

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial set and drift gillnet.
Current escapement goal:	Lower Bound SEG: 9,000 (2009)
Recommended escapement goal:	SEG: 9,000 to 24,000
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1968–present.
Data summary:	
Data quality:	Poor
Data type:	Fixed-wing aerial surveys sporadically 1968 to 1985; consistently surveyed 1985 to present. No stock-specific harvest information is available.
Data contrast:	1987 to 2020: 122.0
Methodology:	Percentile Approach
Criteria for SEG:	High contrast. S_{MSY} cannot be estimated from available run data.
Percentiles:	20th and 60th
Comments:	Data are peak aerial survey counts from the Ilnik River (stream number 316-2001). Harvest rate is assumed to be <0.40.

Appendix O2.–Ilnik River coho salmon escapements.

System: **Ilnik River.**

Species: **Coho salmon.**

Data available for analysis of escapement goal.

Year	Peak aerial survey escapement
1985	35,000
1986	25,000
1987	8,000
1988	8,500
1989	25,300
1990	24,000
1991	27,000
1992	20,900
1993	28,000
1994	6,000
1995	12,000
1996	2,100
1997	19,000
1998	9,000
1999	1,000
2000	3,000
2001	37,000
2002	45,000
2003	37,000
2004	40,000
2005	NA
2006	27,000
2007	19,000
2008	27,000
2009	24,000
2010	19,600
2011	18,000
2012	11,800
2013	17,000
2014	33,000
2015	14,000
2016	28,000
2017	6,000
2018	122,200
2019	24,000
2020	45,000

Note: NA = not available because the counts were either incomplete, or the project did not operate.

System: **Ilnik River.**

Species: **Coho salmon.**

Observed escapement by year (solid circles), and historical and current SEGs (dashed line).
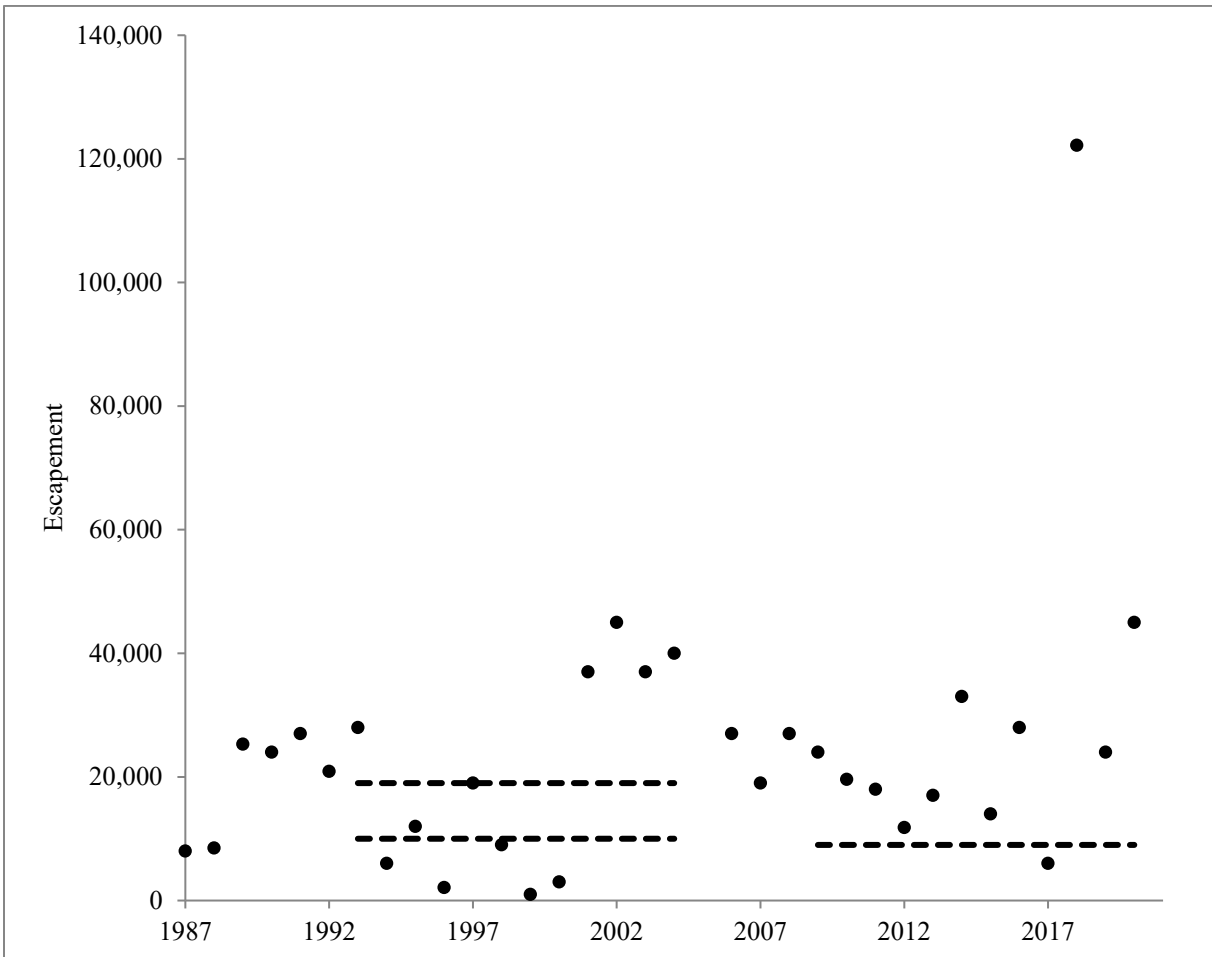
APPENDIX P. SUPPORTING INFORMATION FOR THE SOUTH PENINSULA PINK SALMON ESCAPEMENT GOALS

Appendix P1.–Description of stock and escapement goals for South Peninsula pink salmon.

System: South Peninsula.

Species: Pink salmon.

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set and drift gillnet.
Current escapement goal:	SEG: Even/Odd year. 1,750,000 to 4,000,000 (2016)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1968–present.
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys for most years 1960 to present. No stock-specific harvest information is available.
Comments:	Escapement goal based on a spawner–recruit analysis.

Appendix P2.–South Peninsula aggregate pink salmon escapement, total harvest, and brood year recruitment, 1975 to 2020.

System: **South Peninsula.**

Species: **Pink salmon.**

Data available for analysis of escapement goal.

Year	Escapement	Total harvest[a]	Recruitment	R/S
1975	552,100	55,395	4,113,817	7.5
1976	1,456,400	2,300,748	8,284,540	5.7
1977	2,677,800	1,436,017	8,980,149	3.4
1978	2,858,700	5,425,840	8,801,269	3.1
1979	2,629,500	6,350,649	6,829,503	2.6
1980	2,641,600	6,159,669	6,993,466	2.6
1981	2,306,800	4,522,703	3,576,093	1.6
1982	2,293,000	4,700,466	14,713,689	6.4
1983	851,200	2,724,893	5,913,566	6.9
1984	4,351,600	10,362,089	5,378,871	1.2
1985	1,613,800	4,299,766	2,698,805	1.7
1986	1,716,700	3,662,171	9,667,154	5.6
1987	1,540,500	1,158,305	8,783,157	5.7
1988	2,839,600	6,827,554	3,884,568	1.4
1989	1,870,900	6,912,257	12,903,424	6.9
1990	1,598,400	2,286,168	11,908,705	7.5
1991	2,946,800	9,956,624	12,820,896	4.4
1992	2,834,400	9,074,305	9,722,866	3.4
1993	2,990,100	9,830,796	22,523,513	7.5
1994	3,071,725	6,651,141	5,444,530	1.8
1995	6,406,300	16,117,213	6,948,735	1.1
1996	3,647,550	1,796,980	12,128,294	3.3
1997	5,243,275	1,705,460	13,201,054	2.5
1998	4,668,065	7,460,229	5,883,882	1.3
1999	5,015,310	8,185,744	6,887,202	1.4
2000	2,792,985	3,090,897	5,787,715	2.1
2001	2,965,136	3,922,066	9,483,367	3.2
2002	3,762,800	2,024,915	14,481,357	3.8
2003	5,511,220	3,972,147	13,600,587	2.5
2004	8,311,410	6,169,947	5,707,867	0.7
2005	6,165,634	7,434,953	9,522,831	1.5
2006	2,862,250	2,845,617	13,938,442	4.9
2007	2,680,213	6,842,618	8,175,290	3.1
2008	3,338,370	10,600,072	1,185,176	0.4
2009	3,067,000	5,108,290	6,616,906	2.2
2010	742,912	442,264	664,044	0.9
2011	2,494,950	4,121,956	9,623,217	3.9
2012	478,910	185,134	1,844,492	3.9
2013	2,320,790	7,302,427	23,065,223	9.9
2014	1,340,380	504,112	1,341,580	1.0
2015	7,820,800	15,244,423	25,556,581	3.3
2016	1,038,160	303,420	1,077,164	1.0
2017	5,663,637	19,892,944	14,499,933	2.6
2018	732,422	344,742	6,443,564	8.8
2019	4,236,700	10,263,233		
2020	3,209,750	3,233,814		

[a] Total harvest was estimated using reported harvest from July 15 through the end of the season to more accurately estimate harvest of local stocks and exclude fish bound for other areas.

System: **South Peninsula (all years).**

Species: **Pink salmon.**

Observed escapement by year (solid circles), and current SEG (dotted line).
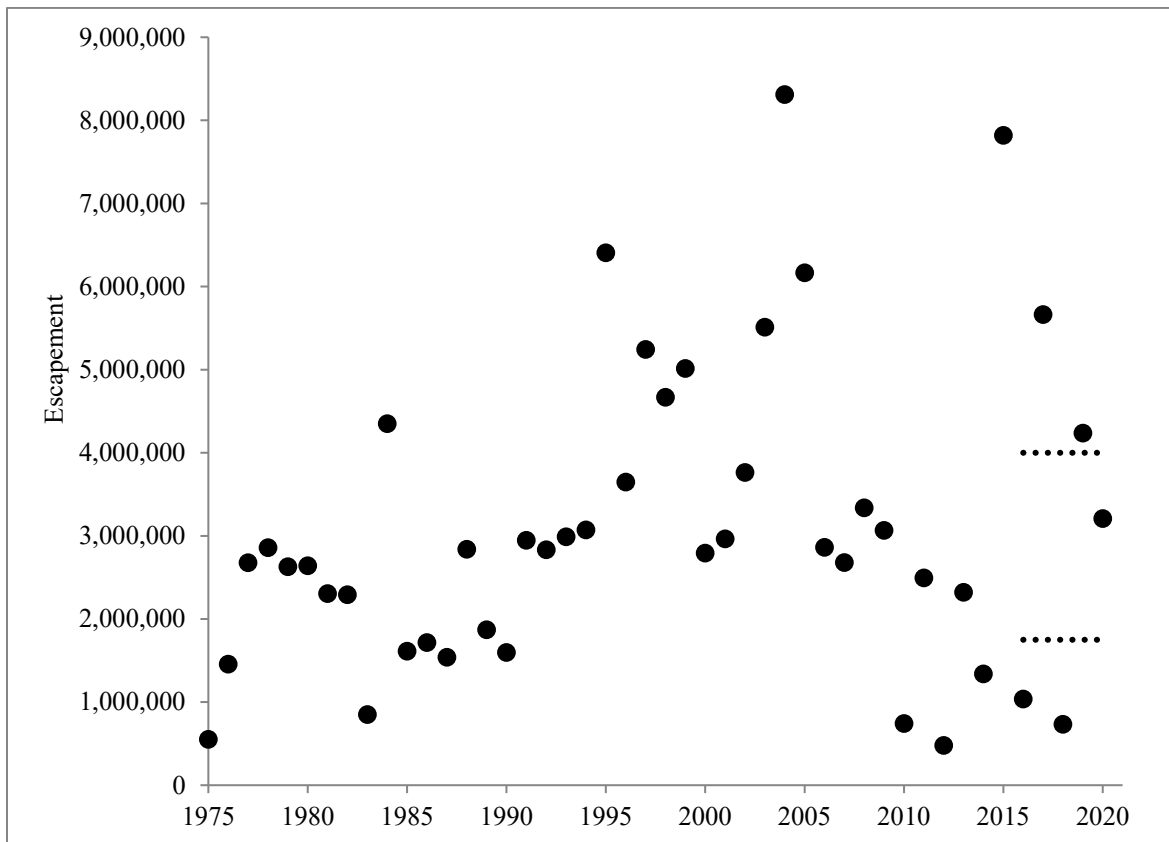
APPENDIX Q. SUPPORTING INFORMATION FOR THE SOUTHEASTERN DISTRICT CHUM SALMON ESCAPEMENT GOAL

System: Southeastern District.

Species: Chum salmon.

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set gillnet.
Current escapement goal:	SEG: 62,500 to 151,900 (2019)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1960–present.
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys available from 1960 to present. Data used in analysis represents indicator streams and years with a complete survey dataset from 1987 to present. No stock-specific harvest information is available.
Comments:	Peak aerial survey data from 26 area-wide systems were used in the Percentile Approach to represent an indexed escapement goal:
	281-1001 Dorenoi Bay, Major (SW)
	281-1002 Dorenoi Bay, Minor (NE River)
	281-2002 Chichagof Lagoon
	281-3204 Little Norway
	281-3205 Clark Bay (SW)
	281-3207 Grub Gulch
	281-3301 Ramsey Bay (1st Stm N Rock Wall)
	281-3302 Ramsey Bay (2nd Stm N Rock Wall)
	281-3303 Louie's Corner
	281-3304 Big River
	281-3305 Stepovak River
	281-3401 Granville Bay
	281-3506 Boulder Bay
	281-7005 Beaver River
	281-8008 Lefthand Bay Kagayan (Lefthand River)
	281-8009 Foster Creek
	281-8014 Johnson Creek
	281-8015 Coleman Creek
	281-9003 San Diego (West Side)
	281-9004 San Diego (Lagoon and Stream)
	282-1011 Apollo Gold Mine Creek (Delarof Harbor)
	282-1203 Zachary Bay 1203
	282-1204 Zachary Bay 1204
	282-1205 Zachary Bay 1205
	282-1302 Dry Lagoon
	282-1303 Bay Point

Appendix Q2.–Southeastern District chum salmon escapements.

System: **Southeastern District.**

Species: **Chum salmon.**

Data available for analysis of escapement goal.

Year	All district PAS	District index
1987	167,300	118,375
1988	85,700	76,775
1989	99,650	59,575
1990	114,595	64,470
1991	181,365	150,650
1992	83,450	(63,950)
1993	45,550	22,905
1994	59,800	27,130
1995	137,650	75,750
1996	133,600	102,600
1997	267,650	169,700
1998	246,025	168,700
1999	82,550	58,200
2000	179,950	134,150
2001	318,300	217,800
2002	204,150	152,150
2003	218,810	201,000
2004	367,200	251,100
2005	412,500	442,000
2006	405,300	169,100
2007	201,451	165,301
2008	277,450	(178,700)
2009	106,500	(96,950)
2010	62,612	(68,660)
2011	145,300	137,500
2012	31,072	30,152
2013	184,350	(136,050)
2014	82,300	74,300
2015	250,370	(156,870)
2016	150,456	(118,690)
2017	592,460	416,845
2018	16,960	9,460
2019	159,600	106,100
2020	144,350	(108,800)

Note: All district PAS = sum of peak aerial survey counts observed in the entire district. Values in parentheses indicate incomplete survey of district index streams, which excludes those years from analysis as outlined in Schaberg et al. (2019).

System: **Southeastern District.**

Species: **Chum salmon.**

Observed escapement by year using the all-district PAS index (solid circles) and district index (open circles), and historical (dashed line) and current SEG (dotted line).
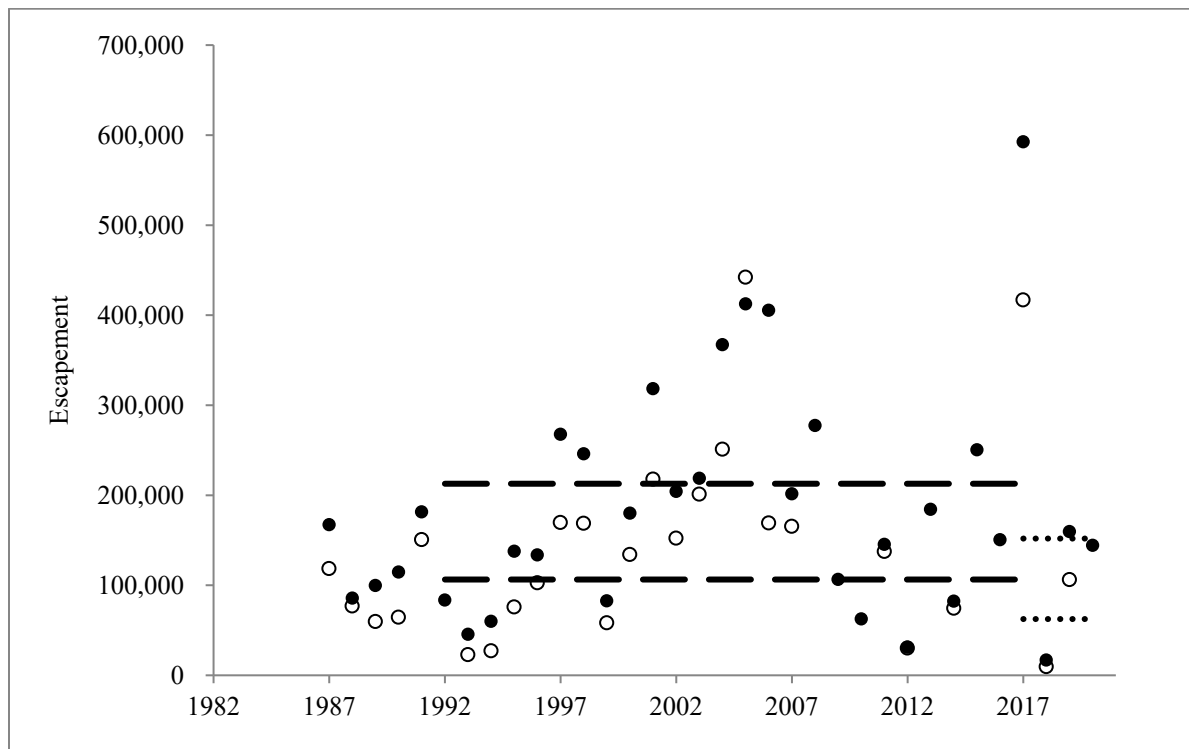
APPENDIX R. SUPPORTING INFORMATION FOR THE SOUTH CENTRAL DISTRICT CHUM SALMON ESCAPEMENT GOAL

Appendix R1.–Description of stock and escapement goal for South Central District chum salmon.

System: South Central District.

Species: Chum salmon.

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set gillnet.
Current escapement goal:	SEG: 68,900 to 99,200 (2019)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1960–present.
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys available from 1960 to 2017. Data used in analysis represents indicator streams and years with a complete survey dataset from 1987 to present. No stock-specific harvest information is available.
Comments:	Peak aerial survey data from 10 areawide systems were used in the Percentile Approach to estimate an indexed escapement goal:
	283-6102 SW Stream, Long John Lagoon
	283-6104 Long John Lagoon Springs
	283-6304 Stream S of Chinaman Lagoon
	283-6310 Chinaman Lagoon Main
	283-6313 Ruby's (Jackson's) Lagoon
	283-6316 Settlement Point (Creek)
	283-6405 Bluff Point
	283-6406 Canoe Bay River
	283-6408 Entrance (Arnies) Creek
	283-7001 Mino's Creek

Appendix R2.–South Central District chum salmon escapements.

System: **South Central District.**

Species: **Chum salmon.**

Data available for analysis of escapement goal.

Year	All district PAS	District index
1987	161,900	80,300
1988	183,400	118,300
1989	89,530	47,500
1990	96,280	63,680
1991	163,990	96,700
1992	110,640	77,700
1993	126,800	69,540
1994	151,900	76,900
1995	187,100	104,150
1996	173,800	104,290
1997	274,400	221,000
1998	144,300	100,900
1999	253,500	89,200
2000	84,100	53,300
2001	155,500	81,900
2002	129,400	83,100
2003	79,000	42,900
2004	184,800	85,300
2005	235,700	198,900
2006	119,600	(95,920)
2007	126,000	(112,900)
2008	140,450	106,000
2009	18,600	(6,100)
2010	85,600	63,600
2011	169,000	68,800
2012	86,190	(56,190)
2013	155,050	101,400
2014	95,000	91,600
2015	298,900	182,000
2016	248,360	166,000
2017	810,053	566,213
2018	41,900	(35,000)
2019	237,100	226,800
2020	154,000	93,500

Note: All district PAS = sum of peak aerial survey counts observed in the district. Values in parentheses indicate incomplete surveys of district index streams, which excludes those years from the analysis as outlined in Schaberg et al. (2019).

Appendix R3.–South Central District chum salmon escapement graph.

System: South Central District.

Species: Chum salmon.

Observed escapement by year using the all-district PAS index (solid circles) and district index (open circles), and historical (dashed line) and current SEGs (dotted line).
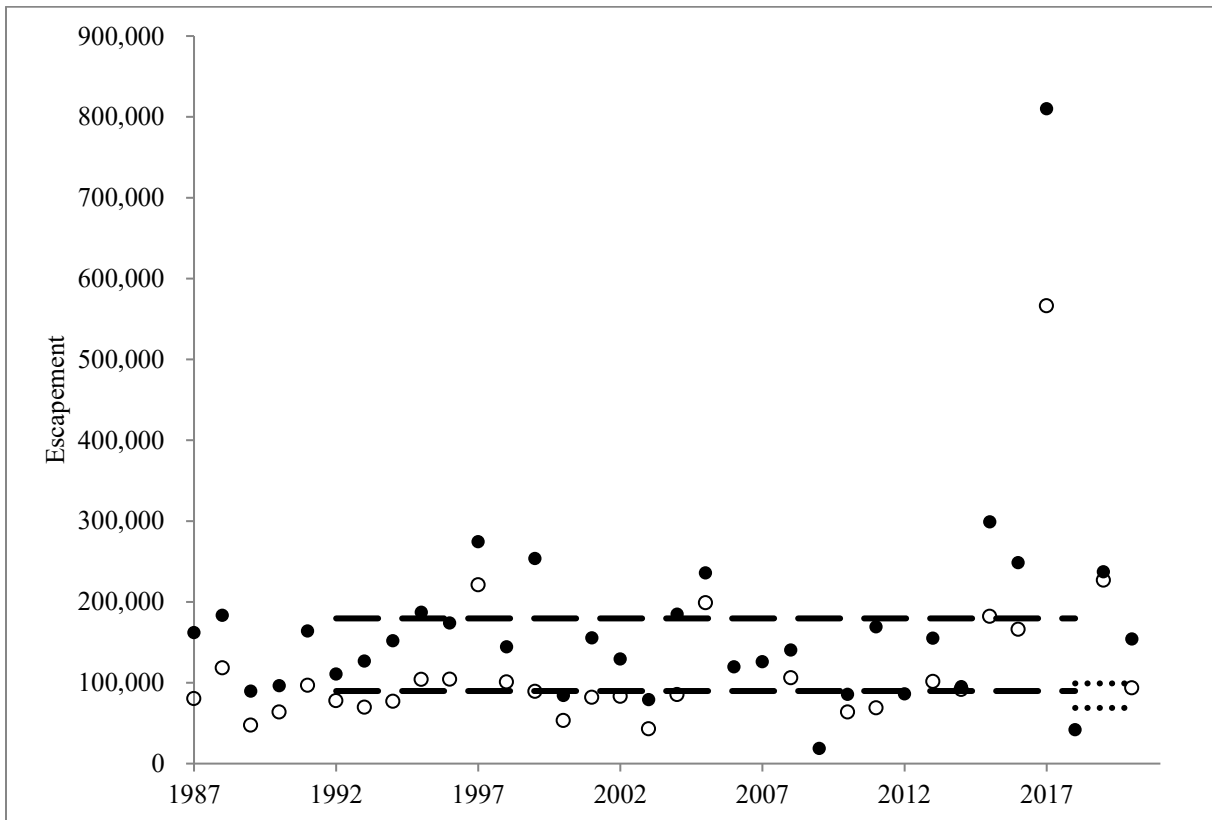
APPENDIX S. SUPPORTING INFORMATION FOR THE SOUTHWESTERN DISTRICT CHUM SALMON ESCAPEMENT GOAL

System: Southwestern District.

Species: Chum salmon.

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set and drift gillnet.
Current escapement goal:	SEG: 86,900 to 159,500 (2019)
Recommended escapement goal:	No change
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1960–present.
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys available from 1960 to 2017. Data used in analysis represents indicator streams and years with a complete survey dataset from 1987 to present. No stock-specific harvest information is available.
Comments:	Peak aerial survey data from 19 areawide systems were used in the Percentile Approach to estimate an indexed escapement goal:

                                                   284-1211 Cannery Creek

    284-1212 Little John Lagoon S Spit

    284-1213 Little John Lagoon Stream

    284-2001 Sandy Cove Stream

    284-3201 Old Man's Lagoon Stream

    284-3305 Ram's Creek

    284-3402 Russel Creek

    284-3409 Barney's Creek

    284-3410 Delta Creek, Lenard Harbor

    284-4101 Belkofski Village Creek

    284-4207 Belkofski Bay River

    284-4209 Captain's Harbor

    284-5203 Little Bear Bay

    284-5205 Stream Guard Creek

    284-5206 West Spring Holes

    284-5207 Volcano Sloughs-Center

    284-5208 Volcano River

    284-6004 Ikatan River

    284-6006 Sankin Bay Creek

Appendix S2.–Southwestern District chum salmon escapements.

System: **Southwestern District.**

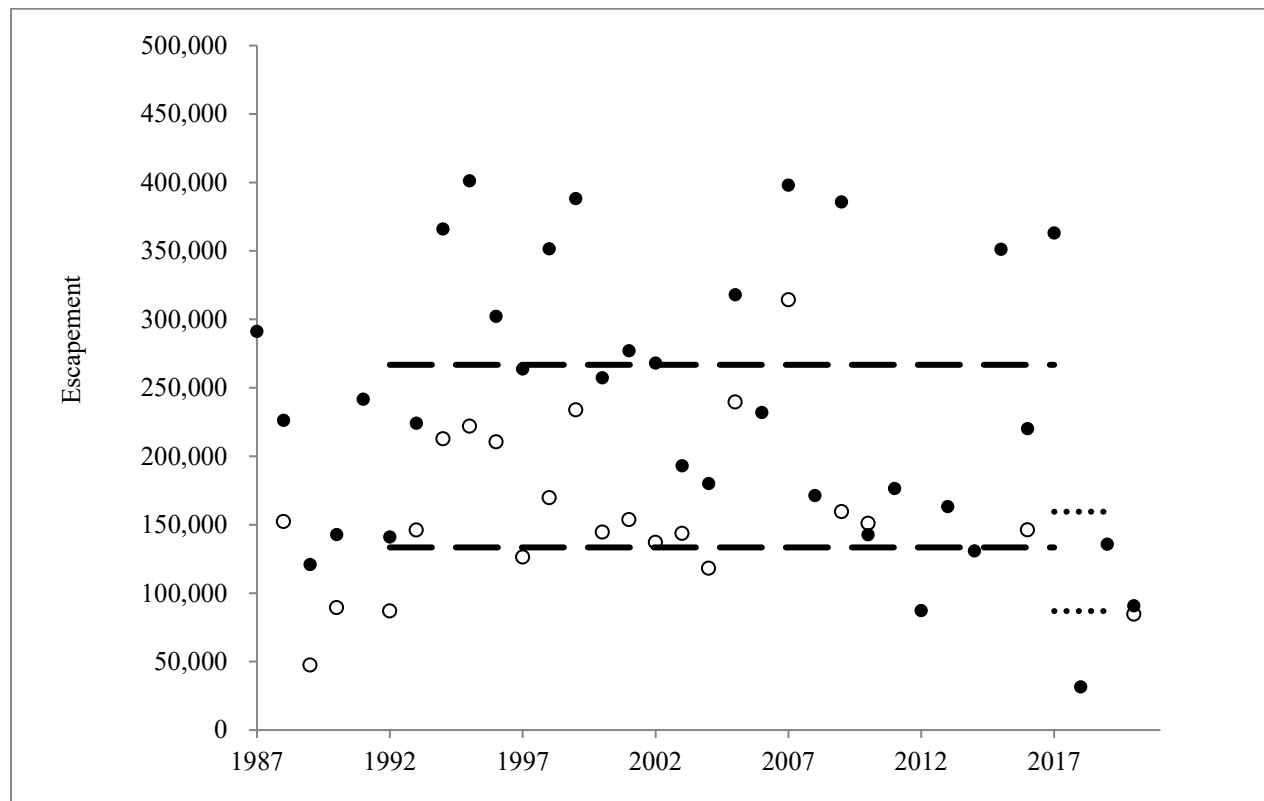**Species:** **Chum salmon.**

Data available for analysis of escapement goal.

Year	All district PAS	District index
1987	291,100	(229,760)
1988	226,200	152,250
1989	120,830	47,380
1990	142,770	89,320
1991	241,600	(119,200)
1992	141,000	86,900
1993	224,080	146,070
1994	365,900	212,700
1995	401,150	221,900
1996	302,100	210,500
1997	263,700	126,300
1998	351,410	169,710
1999	388,130	233,800
2000	257,225	144,525
2001	277,021	153,600
2002	268,000	137,000
2003	193,030	143,650
2004	180,000	118,100
2005	317,910	239,500
2006	231,935	(160,200)
2007	398,010	314,210
2008	171,250	(123,100)
2009	385,730	159,500
2010	142,650	151,000
2011	176,425	(169,600)
2012	87,230	(62,600)
2013	163,200	(148,000)
2014	130,745	(97,300)
2015	351,150	(118,650)
2016	220,060	146,200
2017	363,000	(313,800)
2018	31,400	(31,400)
2019	135,650	(88,300)
2020	90,750	84,550

Note: All district PAS = sum of peak aerial survey counts observed in the district. Values in parentheses indicate incomplete surveys of district index streams, which excludes those years from the analysis as outlined in Schaberg et al. (2019).

System: **Southwestern District.**

Species: **Chum salmon.**

Observed escapement by year using the all-district PAS index (solid circles) and district index (open circles), and historical (dashed line) and current SEGs (dotted line).

APPENDIX T. SUPPORTING INFORMATION FOR THE NORTHWESTERN DISTRICT CHUM SALMON ESCAPEMENT GOAL

System: **Northwestern District.**

Species: **Chum salmon.**

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region.
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set and drift gillnet.
Current escapement goal:	SEG: 100,000 to 215,000 (2007)
Recommended escapement goal:	SEG: 49,000 to 133,000
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1980–present.
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys from 1980 to present. Indexed total escapement 1987 to present. No stock-specific harvest information is available.
Data contrast:	Aerial surveys, 1987–2020: 6.8
Methodology:	Percentile Approach
Criteria for SEG:	Moderate contrast, moderate exploitation
Percentiles:	5th and 65th
Comments:	Current SEG was based on Ricker analysis.
	Peak aerial survey date used in the review are from the following index streams:
	311-5002 Swanson Lagoon
	311-6001 Mike's Valley
	311-6008 Trader's Cove
	311-6012 Warmsprings Bay
	312-2002 Mike's Duck Camp
	312-2003 Alligator Hole, Ctr.
	312-2004 Alligator Hole, East
	312-2005 Frosty Creek
	312-4001 Joshua Green River

Appendix T2.–Northwestern District chum salmon escapements.

System: **Northwestern District.**

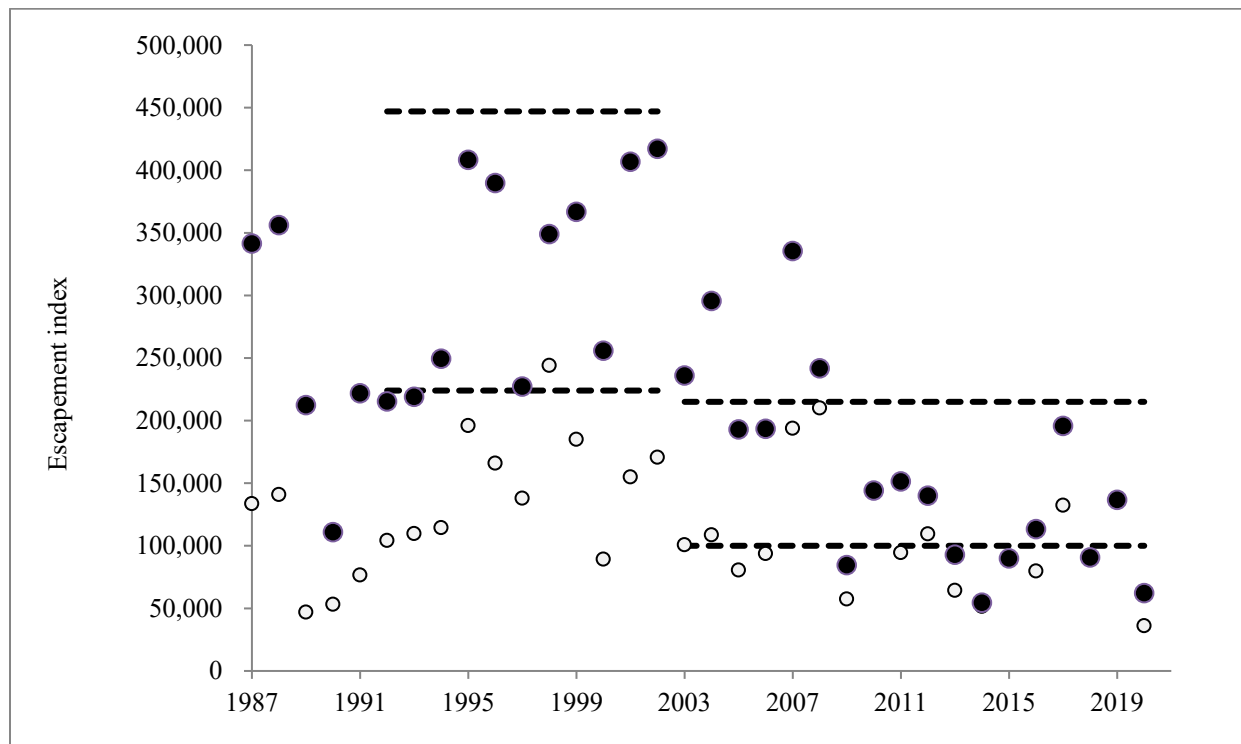**Species:** **Chum salmon.**

Data available for analysis of escapement goal.

Year	Indexed total escapement	Revised district PAS index
1987	341,500	133,600
1988	356,200	140,900
1989	212,300	46,900
1990	110,905	53,200
1991	221,800	76,600
1992	215,300	104,200
1993	219,030	109,700
1994	249,420	114,400
1995	408,300	196,000
1996	389,730	165,900
1997	227,200	138,000
1998	349,000	244,100
1999	366,800	185,000
2000	255,800	89,200
2001	406,812	155,000
2002	417,100	170,700
2003	236,000	100,700
2004	295,600	108,700
2005	192,965	80,600
2006	193,460	93,775
2007	335,450	193,800
2008	241,750	210,000
2009	84,460	57,460
2010	144,100	(137,400)
2011	151,400	94,500
2012	140,000	109,500
2013	92,800	64,300
2014	54,525	51,550
2015	89,900	(35,600)
2016	113,250	79,850
2017	195,700	132,300
2018	90,705	(40,405)
2019	136,700	(97,600)
2020	62,100	36,100

Note: Values in parentheses indicate incomplete surveys of district index streams, which excludes those years from the analysis as outlined in Schaberg et al. (2019).

System: **Northwestern District.**

Species: **Chum salmon.**

Observed escapement by year using the indexed total escapement (solid circles) and the revised district index (open circles), and historical SEGs (dashed line).

APPENDIX U. SUPPORTING INFORMATION FOR THE NORTHERN DISTRICT CHUM SALMON ESCAPEMENT GOAL

System: **Northern District.**

Species: **Chum salmon.**

Description of stock and escapement goal.

Regulatory area:	Alaska Peninsula Management Area – Westward Region
Management division:	Commercial Fisheries
Primary fishery:	Commercial purse seine and set and drift gillnet.
Current escapement goal:	SEG: 119,600 to 239,200 (2007)
Recommended escapement goal:	SEG: 49,000 to 132,000
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial survey, 1982–present.
Data summary:	
Data quality:	Fair
Data type:	Fixed-wing aerial surveys from 1982 to present. Indexed total escapement 1987 to present. No stock-specific harvest information is available.
Data contrast:	Aerial surveys, 1987–2020: 6.5
Methodology:	Percentile Approach
Criteria for SEG:	Moderate contrast, moderate exploitation
Percentiles:	5th to 65th
Comments:	Current SEG was based on Ricker analysis.
	Peak aerial survey date used in the review are from the following index streams: 313-1002 North Creek 313-3003 Sapsuk River, Branches and Lake 314-2003 Doe Valley 314-2004 Deer Valley 314-2005 Portage Creek 314-2006 Grass Valley 314-2007 Lawrence Valley 314-2009 Coal Creek 314-3004 Mud Bay, West Creek 314-3005 Mud Bay, East Creek 314-3007 Right Head Bay, South Creek 314-3009 Right Head Bay, North Creek 314-3010 Left Head Creek 315-1001 Frank's Lagoon 316-1004 SW Three Hills 317-207A Meshik River, Mainstem 317-207E Blue Violet, Sleepy and Black Creeks 318-206A Cinder River, Mainstem

System: **Northern District.**

Species: **Chum salmon.**

Data available for analysis of escapement goal.

Year	Indexed total escapement	Revised district PAS index
1987	161,400	78,405
1988	144,100	109,095
1989	102,300	39,370
1990	115,530	76,650
1991	81,450	51,450
1992	136,400	-68,100
1993	183,350	-99,000
1994	230,800	-124,300
1995	347,700	-219,700
1996	436,400	-311,300
1997	160,985	-73,525
1998	380,350	143,925
1999	299,475	216,250
2000	338,900	182,850
2001	285,900	256,000
2002	262,710	149,240
2003	214,660	117,350
2004	139,350	72,800
2005	103,675	47,300
2006	382,583	174,000
2007	243,334	80,550
2008	228,537	134,400
2009	154,131	121,800
2010	145,310	116,900
2011	96,952	64,500
2012	140,418	126,900
2013	137,251	71,300
2014	191,586	135,100
2015	189,944	123,050
2016	277,674	160,400
2017	234,440	118,700
2018	236,109	129,930
2019	208,397	147,050
2020	118,815	92,850

Note: Values in parentheses indicate incomplete surveys of district index streams, which excludes those years from the analysis as outlined in Schaberg et al. (2019).

System: **Northern District.**

Species: **Chum salmon.**

Observed escapement by year using the indexed total escapement (solid circles) and the revised district index (open circles), and historical SEG (dashed line).