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Review of Salmon Escapement Goals in Southeast Alaska, 2024

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

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The Alaska Department of Fish and Game interdivisional escapement goal review committee reviewed Pacific salmon *Oncorhynchus* spp. escapement goals for Southeast Alaska in August 2023 and again early in 2024. Escapement goals were reviewed based on the *Policy for the Management of Sustainable Salmon Fisheries* (5 AAC 39.222) and the *Policy for Statewide Escapement Goals* (5 AAC 39.223) adopted by the Alaska Board of Fisheries into regulation in 2001. There are 47 escapement goals in Southeast Alaska for 11 Chinook, 12 sockeye, 13 coho, 3 pink, and 8 chum salmon stocks. The Southeast escapement goal review committee's findings included revisions to these goals as follows: (1) revise the mainstem Stikine River sockeye salmon sustainable escapement goal range of 20,000–40,000 fish to a biological escapement goal range of 13,000–33,000 fish based on a revised dataset; (2) revise the Tahltan Lake (tributary to the Stikine River) sockeye salmon biological escapement goal range of 18,000–30,000 fish to a biological escapement goal range of 11,000–25,000 fish based on a updated/revised dataset; (3) eliminate the existing goal for Klawock River coho salmon; (4) eliminate the existing goal for Chilkat River fall-run chum salmon; (5) revise the Northern Southeast Inside chum salmon aggregate lower bound sustainable escapement goal of 107,000 fish to a lower bound sustainable escapement goal of 95,000 based on a recalculation of the revised escapement index; and (6) revise the Northern Southeast Outside chum salmon aggregate lower bound sustainable escapement goal of 25,000 fish to a lower bound sustainable escapement goal of 19,500 based on a recalculation of the revised escapement index. Detailed analyses are presented for Chilkat River Chinook salmon, Chilkat River sockeye salmon, and Taku River sockeye salmon, although the committee did not find basis for revisions to those goals.

Keywords: Southeast Alaska, Yakutat, escapement goal, transboundary river, biological escapement goal, sustainable escapement goal, sockeye salmon, *Oncorhynchus nerka*, Chinook salmon, *O. tshawytscha*, coho salmon, *O. kisutch*, chum salmon, *O. keta*, pink salmon, *O. gorbuscha*, Alaska Board of Fisheries

INTRODUCTION

In 2000 and 2001, the Alaska Board of Fisheries (BOF, also referred to as the "board") adopted 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) into state regulation to ensure that the state's salmon stocks would be conserved, managed, and developed using the sustained yield principle. These policies require the Alaska Department of Fish and Game (ADF&G, the department) to report on salmon stock status and escapement goals to the board on a regular basis, document and review existing salmon escapement goals, establish goals for stocks for which escapement can be reliably measured, and prepare scientific analyses with supporting data when goals are created, modified, or recommended for elimination.

Southeast Alaska salmon stock status and escapement goals have been reviewed and summarized in comprehensive reports on a 3-year cycle, beginning with the 2002/2003 board cycle. Geiger and McPherson (2004) produced ADF&G's first report for the Southeast Region, which included chapters on all 5 species of Pacific salmon found in Alaska. That report was updated by Der Hovanisian and Geiger (2005) for the 2005/2006 board cycle. Stock status was reported in individual reports for each species for the 2008/2009 and 2011/2012 board cycles: Chinook salmon *Oncorhynchus tshawytscha* (McPherson et al. 2008; Der Hovanisian et al. 2011), sockeye salmon *O. nerka* (Eggers et al. 2008; Heinl et al. 2011), coho salmon *O. kisutch* (Shaul et al. 2008, 2011), pink salmon *O. gorbuscha* (Heinl et al. 2008; Piston and Heinl 2011a), and chum salmon *O. keta* (Eggers and Heinl 2008; Piston and Heinl 2011b). Southeast Alaska escapement goal reviews for the 2014/2015, 2017/2018, and 2021/2022 board cycles were summarized by Heinl et al. (2014a), (2017), and (2021), respectively.

In August 2023, ADF&G convened a committee to review Southeast Alaska escapement goals in preparation for the 2024/2025 board meetings; the committee met again in January 2024. The Southeast escapement goal review committee consisted of regional and statewide management, research and biometric staff from the Divisions of Sport Fish and Commercial Fisheries, as well

as statewide fisheries scientists from both divisions. Here we report the results of our review and provide a summary of associated findings. We also provide brief overviews of stock assessment for each species and updates on escapement goal performance from 2018 to 2023 for all stocks with formal escapement goals.

METHODS

During this review, the Southeast escapement goal review committee evaluated 47 existing escapement goals for 11 Chinook, 12 sockeye, 13 coho, 3 pink, and 8 chum salmon stocks (Tables 1–5). The committee primarily considered those goals with recent information that could potentially result in a substantially different escapement goal, those goals with changes in stock assessment that required recalculation of existing goals, and goals that should be eliminated or established. The committee also considered management needs—how the goal was integrated into fisheries management and how well the goal performed. The committee determined the appropriate goal type (biological or sustainable) for each escapement goal that was reviewed and evaluated the type, quality, and quantity of available data for each stock to determine the appropriate type of escapement goal as defined in regulation.

Generally, an escapement goal for a stock should provide escapement that produces sustainable yields. Escapement goals for salmon are typically based on stock–recruit relationships (e.g., Ricker 1954; Beverton and Holt 1957), representing the productivity of the stock and estimated carrying capacity. In this review, the information sources for stock–recruit models were spawner–return data. However, specific methods to determine escapement goals vary in their technical complexity and are largely determined by the quality and quantity of the available data. Thus, escapement goals are evaluated and revised over time as improved methods of assessment and goal setting are developed, and when new and better information becomes available.

Table 1.–Southeast Alaska Chinook salmon escapement goals, 2018–2023 escapements, and escapement goal findings.

System	Assessment method	Goal type	Escapement goal[a]	Year established	Escapement						Escapement goal findings
					2018	2019	2020	2021	2022	2023	
Keta River	HS expansion	BEG	550–1,300	2018	1,662	1,041	668	707	689	759[b]	No change
Blossom River	HS expansion	BEG	500–1,400	2018	1,087	557	515	170	395	670[b]	No change
Chickamin River	HS expansion	BEG	2,150–4,300	2018	2,052	1,610	2,280	2,404	2,522	3,719[b]	No change
Unuk River	HS/FS expansion	BEG	1,800–3,800	2009	1,971	3,115	1,135	2,666	1,304	2,072[b]	No change
Stikine River	MR	BEG	14,000–28,000	2000	8,603	13,817	9,753	8,376	9,090	12,795[b]	No change
Andrew Creek	AS/HS/FS expansion	BEG	650–1,500	1998	482	698	470	530	821	386[b]	No change
King Salmon River	HS expansion	BEG	120–240	1997	30	27	100	134	123	68[b]	No change
Taku River[c]	MR, HS expansion	BEG	19,000–36,000	2009	7,271	11,558	15,593	11,341	12,722	14,755[b]	No change
Chilkat River	MR	Inriver[d]	1,850–3,600	2003	873[b]	2,028[b]	3,180[b]	2,038[b]	1,582[b]	2,234[b]	No change
	MR	BEG	1,750–3,500	2003	873[b]	2,028[b]	3,180[b]	2,038[b]	1,582[b]	2,234[b]	No change
Alsek River	Weir expansion	BEG	3,500–5,300	2013	4,348[b]	6,319[b]	5,330[b]	5,562[b]	3,351	4,185[b]	No change
Situk River	Weir	BEG	450–1,050	2003	420[b]	623[b]	1,197[b]	1,064[b]	890	144[b]	No change

Note: AS = aerial survey, FS = foot survey, HS = helicopter survey, MR = mark–recapture, BEG = biological escapement goal; gray cells indicate lower bound of the escapement goal not met.

[a] Goals and escapement numbers for Chinook salmon are for large fish (≥660 mm mid eye to fork length, or age-1.3 fish and older), except the Alsek River goal which is germane to age-1.2 fish and older and can include fish <660 mm mid eye to fork length.

[b] Preliminary estimate pending publication of final report.

[c] Estimates are based on mark–recapture studies.

[d] The Chilkat River Chinook salmon escapement is the mark–recapture estimate of inriver run minus reported subsistence harvest. The inriver goal of 1,850–3,600 (5 AAC 33.384) is directly measured through mark–recapture and is not discounted for inriver subsistence harvests that average <100 fish.

Table 2.–Southeast Alaska sockeye salmon escapement goals, 2018–2023 escapements, and escapement goal findings.

System	Assessment method	Goal type	Escapement goal	Year established	Escapement						Escapement goal findings
					2018	2019	2020	2021	2022	2023	
Hugh Smith Lake	Weir	OEG[a]	8,000–18,000	2003	2,039	2,240	3,860	3,235	1,657	1,689	No change
McDonald Lake	FS expansion	SEG	55,000–120,000	2009	11,000	24,200	8,200	44,500	34,100	74,900	No change
Mainstem Stikine River	Run reconstruction	SEG	20,000–40,000	1987	12,159	23,174	7,126	31,896[b]	45,250[b]	18,060[b]	**Revise to BEG 13,000–33,000**
Tahltan Lake	Weir	BEG	18,000–30,000	1993	16,350	36,787	11,158	42,846[b]	52,772[b]	37,359[b]	**Revise to BEG 11,000–25,000**
Speel Lake	Weir	SEG	4,000–9,000	2015	4,244	6,447	NC	8,643	5,686	3,556	No change
Taku River[c]	MR	BEG	40,000–75,000	2022	83,490	78,011	109,322	153,243[b]	90,396[b]	101,518[b]	No change
Redoubt Lake	Weir	OEG[d]	7,000–25,000	2003	72,409	59,106	41,289	60,004	85,785	153,406	No change
		BEG	10,000–25,000	2003	72,409	59,106	41,289	60,004	85,785	153,406	No change
Chilkat Lake	Sonar	BEG	70,000–150,000	2009	108,047	136,091	50,746	65,199	100,634	128,002	No change
Chilkoot Lake	Weir	SEG	38,000–86,000	2009	85,463	140,378	60,218	98,672	57,176	69,688	No change
East Alsek River	AS, IE	SEG	9,000–24,000	2018	10,500	27,300	13,670	29,700	23,800	19,300	No change
Klukshu (Alsek) River	Weir	BEG	7,500–11,000	2013	7,143	18,749	4,287	25,691[b]	29,629[b]	13,690[b]	No change
Situk River	Weir	BEG	30,000–70,000	2003	26,704	72,530	63,343	119,072	90,369	127,873	No change

Note: AS = aerial survey, FS = foot survey, IE = index escapement, MR = mark–recapture, NC = no count, BEG = biological escapement goal, SEG = sustainable escapement goal, OEG = optimal escapement goal; gray cells indicate lower bound of the escapement goal not met.

[a] Hugh Smith Lake sockeye salmon OEG was set by the Alaska Board of Fisheries (5 AAC 33.390); the OEG is the same as the BEG (8,000–18,000 fish) but includes wild and hatchery-produced fish. No lake stocking has occurred since 2003.

[b] Preliminary estimate pending publication of final report.

[c] A revised BEG of 40,000–75,000 naturally spawned sockeye salmon was adopted by the Pacific Salmon Commission Transboundary River Panel in 2020 and the Alaska Board of Fisheries in 2021, which replaced the original SEG of 71,000–80,000 fish set in 1986.

[d] Redoubt Lake sockeye salmon OEG was set by the Alaska Board of Fisheries (5 AAC 01.760).

Table 3.–Southeast Alaska coho salmon escapement goals, 2018–2023 escapements, and escapement goal findings.

System		Assessment method	Goal type	Escapement goal	Year established	Escapement						Escapement goal findings
						2018	2019	2020	2021	2022	2023	
Hugh Smith Lake		Weir	BEG	500–1,600	2009	580	1,235	628	899	886	2,207	No change
Klawock River[a]		Weir	SEG	4,000–9,000	2013	13,578	5,287	5,783	5,289	6,968	9,919	**Eliminate Goal**
Taku River		MR	BEG	50,000–90,000	2015	51,173[b]	82,759[b]	52,063[b]	75,526[b]	66,034[b]	89,013[b]	No change
Auke Creek		Weir	BEG	200–500	1994	146	345	173	322	449	759	No change
Juneau Roadside Index	Montana Creek	FS, IE	SEG	400–1,200	2006	1,161	203	495	391	NC[c]	NC[c]	No change
	Peterson Creek	FS, IE	SEG	100–250	2006	172	NC[c]	65	15	65	192	No change
Ketchikan Survey Index		HS, IE	BEG	4,250–8,500	2006	13,866	7,913	8,610	21,006	11,945	22,695	No change
Sitka Survey Index		FS, IE	BEG	400–800	2006	1,502	1,480	630	1,486	1,363	1,392	No change
Berners River		FS, HS, IE	BEG	3,600–8,100	2018	3,550	9,405	3,296	5,933	4,472	8,039	No change
Chilkat River		AS/FS, MR, IE	BEG	30,000–70,000	2006	65,749	34,779	28,802	53,597	42,452	70,881	No change
Tawah Creek (Lost River)		BS, IE	SEG	1,400–4,200	2015	2,211	1,866	NS	NS	NS	NS	No change
Situk River		BS, IE	BEG	3,800–9,600	2022	6,198	10,381	NS	NS	NS	9,841	No change
Tsiu-Tsivat Rivers		AS, IE	SEG	10,000–29,000	2018	48,600	NS[d]	56,000	NS	NS	NS	No change

Note: AS = aerial survey, FS = foot survey, BS = boat survey, HS = helicopter survey, IE = index escapement, MR = mark–recapture, BEG = biological escapement goal, SEG = sustainable escapement goal, NC = no count; NS = no survey; gray cells indicate lower bound of the escapement goal not met.

[a] Klawock coho salmon escapement goal was officially adopted by the Alaska Board of Fisheries in 2013, but escapement was managed for this goal beginning in 2007.

[b] Preliminary estimate pending publication of final report.

[c] A coho salmon survey was conducted, however, river conditions precluded a valid count (index of escapement) from being obtained.

[d] In 2019, a peak index survey was not conducted for Tsiu/Tsivat river coho salmon due to lack of available aircraft.

Table 4.–Southeast Alaska pink salmon escapement goals, 2018–2023 escapements, and escapement goal findings.

System	Assessment method	Goal type	Escapement goal	Year established	Escapement						Escapement goal findings
					2018	2019	2020	2021	2022	2023	
Southern Southeast	AS, IE	BEG	3.0–8.0 million	2009	4.9 million	5.6 million	5.7 million	9.8 million	5.8 million	12.1 million	No change
Northern Southeast Inside	AS, IE	BEG	2.5–6.0 million	2009	1.4 million	1.7 million	2.3 million	3.9 million	3.2 million	7.4 million	No change
Northern Southeast Outside	AS, IE	BEG	0.75–2.5 million	2009	1.9 million	1.5 million	1.8 million	1.9 million	1.1 million	2.3 million	No change

Note: AS = aerial survey, IE = index escapement, BEG = biological escapement goal; gray cells indicate lower bound of the escapement goal not met.

Table 5.–Southeast Alaska chum salmon escapement goals, 2018–2023 escapements, and escapement goal findings.

System	Assessment method	Goal type	Escapement goal	Year established	Escapement						Escapement goal findings
					2018	2019	2020	2021	2022	2023	
Chum salmon (summer run)											
Southern Southeast	AS/FS/HS, IE	LB SEG	62,000	2015	127,000	105,000	70,000	77,000	136,000	276,000	No change
Northern Southeast Inside	AS/FS, IE	LB SEG	107,000	2018	109,000	123,000	52,000	67,000	116,000	324,000	**Revise to LB SEG 95,000**
Northern Southeast Outside	AS/FS, IE	LB SEG	25,000	2015	19,400	25,500	16,100	11,600	18,000	14,600	**Revise to LB SEG 19,500**
Chum salmon (fall run)											
Cholmondeley Sound	AS, IE	SEG	30,000–48,000	2009	70,000	20,000	30,000	55,000	42,000	93,000	No change
Port Camden	AS, IE	SEG	2,000–7,000	2009	1,000	4,800	1,500	2,200	700	800	No change
Security Bay	AS, IE	SEG	5,000–15,000	2009	5,600	14,300	11,500	3,000	3,000	18,500	No change
Excursion River	AS, IE	SEG	4,000–18,000	2009	6,200	3,600	200	1,900	800	7,700	No change
Chilkat River	FW expansion	SEG	75,000–250,000	2015	NA[a]	224,000	23,000	169,000	343,000	751,000	**Eliminate Goal**

Note: AS = aerial survey, FS = foot survey, HS = helicopter survey, IE = index escapement, FW = fish wheel, SEG = sustainable escapement goal, LB SEG = lower-bound SEG; gray cells indicate lower bound of the escapement goal not met.

[a] In 2018, Chilkat River fish wheel counts were unreliable due to extremely low water and road construction near fish wheel site; fall-run chum salmon escapement estimate not available.

ESCAPEMENT GOAL DEVELOPMENT

Escapement goals were classified by the escapement goal review committee as either biological or sustainable escapement goals as defined in the *Policy for the Management of Sustainable Salmon Fisheries* (5 AAC 39.222) under section (f) as follows:

> "(3) 'biological escapement goal' or '(BEG)' means the escapement that provides the greatest potential for maximum sustained yield…" and
>
> "(36) 'sustainable escapement goal' or '(SEG)' means a level of escapement, indicated by an index or an escapement estimate, that is known to provide for sustained yield over a 5 to 10 year period, used in situations where a BEG cannot be estimated or managed for; …the SEG will be determined by the department and will take into account data uncertainty and be stated as either a 'SEG range' or 'lower bound SEG'…" and
>
> "(25) 'optimal escapement goal' or '(OEG)' means a specific management objective for salmon escapement that considers biological and allocative factors and may differ from the SEG or BEG…"

A wide variety of analytical methods have been used to establish escapement goals for Southeast Alaska salmon stocks. The following methods were used during the current escapement goal review:

Stock–recruit Analysis—Analysis of the relationship between escapement (number of spawners) and subsequent production of recruits (i.e., adults) in the next generation determines levels of spawning abundance that maximize sustained yield over time. The Ricker production model (Ricker 1954) is the most widely used method to estimate these levels of spawning abundance. Stock–recruit models that better fit coho salmon production include Beverton-Holt (Beverton and Holt 1957) and hockey-stick (Barrowman and Myers 2000; Shaul et al. 2013) models. Bayesian age-structured state-space models (Fleischman et al. 2013) have also been used recently to better account for observation and measurement error, process variation or natural fluctuations in the actual quantities, and missing data, which are common to salmon data sets. State-space models provide less biased estimates of population parameters and reference points than traditional stock–recruit methods (Su and Peterman 2012).

Percentile Method—The percentile approach for establishing sustainable escapement goals follows guidance by Clark et al. (2014) and has since been used extensively throughout Alaska (Munro 2019) to develop sustainable escapement goals in situations where stock assessment data are insufficient to estimate the escapement that produces maximum sustained yield, S_{MSY}. The percentile approach is based on the principle that a range of observed escapements, or indices of escapements, that have been sustained over a period of time represents a sustainable escapement goal for a stock that has been fished and has likely sustained an unknown level of harvest over that same period. Maintaining escapements within a specified range of percentiles of those observed escapements provides a proxy for the range of escapements that encompasses S_{MSY} (Clark et al. 2014).

Clark et al. (2014) recommended 3 tiers of percentile ranges (Table 6) that performed well with respect to S_{MSY} across a wide range of productivities, serial correlation in escapements, and measurement error in escapements for stocks that experience low to moderate (<0.40) average harvest rates. Clark et al. (2014) further cautioned that the percentile approach is not recommended for stocks that have both very low escapement contrast (≤4) and high measurement error, or those

stocks that experience average harvest rates ≥0.40; however, it was recommended that if the percentile approach must be used for stocks that experience higher harvest rates, the lower bound of the escapement goal range should be set no lower than the 25th percentile of observed escapements as a precautionary approach to prevent overfishing, and the upper bound should be set at the 75th percentile or greater, regardless of the level of measurement error.

Table 6.–Three tiers recommended by Clark et al. (2014) to set sustainable escapement goals based on percentiles of observed escapement counts for stocks that experience low to moderate (<0.40) harvest rates.

Tier	Escapement contrast[a] and measurement error	Sustainable escapement goal range
Tier 1	High contrast (>8); high error (aerial and foot surveys)	20th to 60th percentiles
Tier 2	High contrast (>8); low error (weirs, towers)	15th to 65th percentiles
Tier 3	Low contrast (≤8)	5th to 65th percentiles

[a] Contrast is the relative range of the entire time series of escapement data calculated by dividing the maximum observed escapement by the minimum observed escapement.

Yield Analysis—Yield analysis is defined as a graphical or tabular examination of yields produced from observed escapements or escapement indices from which the escapement range with the greatest yields is identified (Hilborn and Walters 1992). In Southeast Alaska, this method has only been used to establish escapement goals for pink salmon. Yield analysis is useful for setting escapement goals when the form of the stock–recruit relationship is not known. In the case of Southeast Alaska pink salmon, total spawning escapement cannot be accurately estimated from available escapement indices, because they represent an unknown fraction of the total escapement. Thus, a Ricker analysis of Southeast Alaska pink salmon data is not possible without making potentially ill-advised assumptions (Zadina et al. 2004). Hilborn and Walters (1992) cautioned that the tabular approach should only be used with very large sample sizes (i.e., a minimum of 30–50 data points), which we have for Southeast Alaska pink salmon.

STOCK ASSESSMENT OVERVIEW

The Southeast Alaska region encompasses all coastal waters and inland drainages entering the Gulf of Alaska from Dixon Entrance north and west to Cape Suckling. Stock assessment and escapement goal development for non-transboundary stocks of salmon is conducted and reviewed by ADF&G then adopted by the BOF. For some Chinook stocks, additional review by the Chinook Technical Committee (CTC) of the Pacific Salmon Commission (PSC) is necessary. For the transboundary Alsek, Taku, and Stikine Rivers, stock assessment is a cooperative effort among ADF&G, Fisheries and Oceans Canada, and several Canadian First Nations groups. Escapement goal development for transboundary stocks is coordinated and reviewed by the Transboundary Technical Committee (TTC) of the PSC. In some cases, additional reviews are necessary by the Canadian Science Advisory Secretariat. Final transboundary river escapement goals are adopted by the Transboundary Panel of the PSC and ultimately the BOF. Stock assessment projects include estimation of stock-specific harvests and escapement estimates, often involving postseason run-reconstruction analyses of fishery data. Detailed overviews of transboundary river stock assessment projects are outlined in annual management plans (e.g., TTC 2020).

Chinook Salmon

In Southeast Alaska, Chinook salmon are known to occur in 34 rivers (Kissner 1978). Assessment programs are currently in place to estimate spawning escapements in 11 of these rivers (Situk, Alsek, Chilkat, Taku, King Salmon, Stikine, Unuk, Chickamin, Blossom, and Keta Rivers, and Andrew Creek) that serve as indicator stocks for Southeast Alaska Chinook salmon production. Stock-specific information for these indicator stocks, including current and historical escapements, escapement goals, and stock status can be found in Appendix A.

In the mid-1970s, it became apparent that many Chinook salmon stocks in Southeast Alaska were depressed relative to historical levels of production (Kissner 1978), and a management plan was implemented that closed commercial and recreational fisheries in terminal and near-terminal areas in U.S. waters. A 15-year Chinook salmon rebuilding program was formally established by ADF&G in 1981 (ADF&G 1981). The program used regionwide, all-gear catch ceilings for Chinook salmon designed to rebuild spawning escapements by 1995. This rebuilding program was incorporated into a comprehensive coastwide rebuilding program for all wild Chinook salmon stocks under the auspices of the U.S./Canada Pacific Salmon Treaty (treaty). During the rebuilding program, ADF&G established interim point escapement goals for the 11 indicator stocks in Southeast Alaska based on the highest observed escapement count prior to 1981. Biological escapement goal ranges based on more rigorous analyses have subsequently been established for all indicator stocks (Table 1).

Escapements to the 11 indicator systems are monitored and estimated using river-specific approaches, which are described here. Escapements are enumerated annually using weirs operated on the Klukshu River (in the Alsek River drainage) and the Situk River. Escapements are estimated using mark–recapture studies on the Chilkat, Taku, and Stikine Rivers, and using calibrated observer surveys on the King Salmon, Chickamin, Unuk, Blossom, and Keta Rivers, and Andrew Creek. Escapement estimates in the Alsek River include age-1.2 fish and older, and in the Chilkat River include fish age-1.3 and older. Escapement estimates for the other 9 indicator stocks are germane to "large" fish, defined as Chinook salmon ≥660 mm mid eye to fork of tail length, which is roughly analogous to fish that are age-1.3 and older. In Southeast Alaska, nearly all adult female Chinook salmon are age-1.3 and older. Younger adult Chinook salmon (age-1.1 and age-1.2 fish) are predominately precocial males or "jacks."

Among the 11 Southeast Alaska Chinook salmon stocks that are monitored for escapement, there are 4 stocks (Chilkat, Taku, Stikine, and Unuk Rivers) for which a full stock assessment is performed. This includes marking and coded-wire-tagging juveniles and smolt, which provide estimates of smolt abundance, and estimates of harvest by gear, area, and time in mixed stock commercial and sport fisheries. These data, when paired with spawning abundance estimates, allow for calendar year estimates of total run and harvest rate along with brood year estimates of marine (smolt-to-adult) survival, total return, and exploitation rate.

Southeast Chinook salmon stocks can be classified into 2 broad categories, inside-rearing (mostly within Southeast Alaska waters) and outside-rearing (Gulf of Alaska and Bering Sea), based on ocean migrations. Outside-rearing stocks spend limited time rearing in marine waters in Southeast Alaska and are harvested primarily in Southeast Alaska during their spawning migrations in the spring and early summer (mid-March through June). These stocks include Chinook salmon returning to the Situk, Alsek, Taku, and Stikine Rivers. Inside-rearing stocks are vulnerable to harvest in Southeast Alaska and northern British Columbia fisheries as immature fish, as well as

during their spawning migrations, and include the other 7 Southeast Chinook salmon indicator stocks at the Chilkat, King Salmon, Unuk, Chickamin, Blossom, and Keta Rivers, and Andrew Creek. Note that there is some overlap in ocean migrations within these 2 broad classifications. Southeast Alaska and transboundary river indicator stocks produce primarily yearling smolt, which are fish that spend 2 winters in the freshwater environment. Exceptions occur in the Situk River, which produces mostly sub-yearling smolt that spend only 1 winter in freshwater (McPherson et al. 2005), and in the Keta and Blossom Rivers, that produce around 10% sub-yearling smolt (Fleischman et al. 2011).

Sockeye Salmon

Sockeye salmon harvested in Southeast Alaska originate from 3 sources: coastal lakes and rivers, transboundary rivers that flow through Canada and into Alaska (e.g., the Alsek, Taku, and Stikine Rivers), and Canadian river systems whose returning adult salmon migrate through U.S. waters (e.g., the Nass and Skeena Rivers). Although sockeye salmon spawn in more than 200 systems within Southeast Alaska, most systems produce relatively few fish. Consequently, comprehensive stock assessment projects that provide detailed information on escapement and harvest are limited to the largest producers, including the Chilkat and Chilkoot systems in Upper Lynn Canal, and the transboundary Alsek, Taku, and Stikine Rivers. Lack of long-term monitoring information, particularly regarding harvests, which often occur in mixed stock commercial net fisheries, greatly limits potential for development of escapement goals for the many smaller systems (Geiger et al. 2004). Long-term escapement monitoring projects have been maintained at Chilkat, Chilkoot, Redoubt, Speel, McDonald, and Hugh Smith Lakes. In the Yakutat area, sockeye salmon escapements have been measured with a weir at the Situk River since 1976, but most other Yakutat area sockeye salmon systems have been assessed through survey counts. Escapement goals are currently established for 2 Yakutat area stocks (Situk and East Alsek), 4 transboundary river stocks (Klukshu, Taku, Stikine, and Tahltan Rivers), and 6 other Southeast stocks (Chilkat, Chilkoot, Speel, Redoubt, McDonald, and Hugh Smith; Table 2, Appendix B).

Coho Salmon

Excellent coho salmon habitat occurs in thousands of streams distributed throughout Southeast Alaska, many of which are small producers about which little is known (Priest et al. 2021). Due to the abundant and widely distributed nature of the resource, stock assessment projects occur only on a small fraction of producing streams. Assessment is further challenged by the wet coastal climate of the region, including frequent freshets during the fall months when spawners return to freshwater. The majority of the harvest is taken in mixed stock fisheries in areas distant from natal streams. In addition to wild stocks within Southeast Alaska, important contributions to the total regional harvest are made by local hatchery stocks (13 total), several transboundary rivers, and by natural systems and hatcheries on the northern British Columbia coast. Currently, 13 systems or groups of systems have escapement goals, including 8 with biological escapement goals and 5 with sustainable escapement goals (Table 3, Appendix C). Direct stock assessment occurs at 2 levels: full indicator stocks and escapement indicator stocks.

Full indicator stocks are monitored for spawning escapement and are coded-wire-tagged as smolts, which provides estimates of total adult abundance and spawning escapement (including age, size, and sex), smolt production (abundance, age, and size), marine survival, fishery contributions (by area, gear type, and time), and harvest rates. Over time, these parameters are used to evaluate the relationship between spawning escapement and production and to establish biological escapement

goals that produce maximum sustained yield. Annual estimates for these parameters extend from the early 1980s for 3 systems (Auke Creek, Berners River, and Hugh Smith Lake) and were later expanded to include the Taku River in 1992 and the Chilkat River in 2000.

In addition to the full indicator stocks, a systematic escapement survey program was developed to assess coho salmon spawning abundance in individual streams and aggregates of index streams. Escapement indicators have been established in the Haines, Juneau, Sitka, Ketchikan, and Yakutat areas where foot, helicopter, or boat surveys are systematically conducted. Escapement goals for surveyed streams near Sitka and Ketchikan apply to the sum of peak survey counts on aggregates of streams in each area (5 near Sitka and 14 near Ketchikan). Only peak survey counts that meet standards for timing, survey conditions, and completeness are included in the indices, and statistical interpolations are made for missing counts on individual streams to maintain comparability of the index across years. In the Juneau and Yakutat areas, survey-based escapement goals apply to individual streams (2 near Juneau and 3 near Yakutat). In the Haines area, peak survey counts at 4 tributaries are expanded to estimate total escapement to the Chilkat River.

Pink Salmon

Wild pink salmon spawn in more than 2,500 coastal streams in Southeast Alaska (Zadina et al. 2004). The vast majority of the pink salmon harvest takes place in mixed stock commercial fisheries in Southeast Alaska waters from Dixon Entrance, north to Cross Sound. Yakutat area pink salmon stocks are spatially segregated from the rest of Southeast Alaska and are harvested primarily in terminal, inriver commercial set gillnet fisheries (Clark 1995a). The majority (96%) of the pink salmon harvest in Southeast Alaska occurs in commercial purse seine fisheries, which are managed through extensive inseason monitoring of harvests, fishing effort, and movement of pink salmon into spawning streams (Van Alen 2000; Zadina et al. 2004).

Because pink salmon production in Southeast Alaska is broadly dispersed, assessment of escapements has been based on aerial surveys. Peak aerial survey counts of 702 streams in the region are used to generate an annual escapement measure, or index of abundance, upon which pink salmon escapement goals are based (Piston and Heinl 2020a). Southeast Alaska pink salmon are largely harvested in mixed stock fisheries, so it is not possible to allocate harvests of pink salmon to stock group of origin at any finer scale than subregion. Therefore, escapement goals for Southeast Alaska pink salmon have been established for aggregates of pink salmon runs in 3 broad subregions (Table 4, Appendix D; Zadina et al. 2004). The Southern Southeast Subregion includes 366 index streams from Sumner Strait south to Dixon Entrance (Districts 1–8), the Northern Southeast Inside Subregion includes 295 index streams located on inside waters north of Sumner Strait (Districts 9–12, 14–15, and District 13 subdistricts 51–59), and the Northern Southeast Outside Subregion includes 41 index streams located on the outside waters of Chichagof and Baranof Islands in northern Southeast Alaska (District 13, excluding Peril Straits and Hoonah Sound subdistricts 51–59; Table 4; Piston and Fish 2024b).

Chum Salmon

There are more than 1,200 streams and rivers in Southeast Alaska for which ADF&G has a record of adult chum salmon spawning since 1960. Counts of 1,000 or more chum salmon were obtained at approximately 450 of those streams prior to 1985 (Piston and Heinl 2020b). Chum salmon populations in Southeast Alaska are generally divided into 2 runs based on migration timing: summer-run fish spawn during the period mid-July to mid-August, and fall-run fish spawn in September or later. Of the chum salmon populations that have been consistently monitored, most

have been monitored through aerial surveys, although small numbers have been monitored annually by foot surveys. Inriver fish wheel counts have been used to monitor salmon escapements to the Taku and Chilkat Rivers, which are large glacial, mainland river systems. Stock-specific harvest information is not available for the vast majority of wild chum salmon stocks in Southeast Alaska, which are predominantly harvested in mixed stock fisheries. Some fall-run chum salmon stocks are harvested directly in terminal or near-terminal fisheries, which allows for some accounting of stock-specific harvest; however, in many cases, these fall-run fish also migrate through mixed stock fisheries where stock composition of the harvest may not be known.

Southeast Alaska chum salmon index streams are grouped into appropriate stock groups by area and run-timing based on marine-tagging and genetic studies (Eggers and Heinl 2008). Southeast Alaska summer-run chum salmon index streams were grouped into 3 stock groups that are composed of aggregates of index streams across broad subregions, upon which lower bound sustainable escapement goals are based (Table 5, Appendix E; Piston and Fish 2024a): the Southern Southeast Subregion includes 15 index streams (Districts 1–7); the Northern Southeast Inside Subregion includes 63 index streams (Districts 8–12, 14–15, and District 13 subdistricts 51–59); and the Northern Southeast Outside Subregion includes 9 index streams (District 13, excluding Peril Straits and Hoonah Sound subdistricts 51–59). Southeast Alaska fall-run chum salmon index streams were grouped into stocks that support terminal commercial fisheries or have supported fisheries in the past. Fall-run stocks with sustainable escapement goals include Cholmondeley Sound, Security Bay, Port Camden, Excursion Inlet, and the Chilkat River (Table 5, Appendix E).

ESCAPEMENT GOAL FINDINGS

The Southeast Alaska escapement goal review committee found that of the 47 existing escapement goals, 4 should be revised (mainstem Stikine River sockeye salmon, Tahltan Lake sockeye salmon, Northern Southeast Inside chum salmon, and Northern Southeast Outside chum salmon), and 2 eliminated (Klawock River coho salmon and Chilkat River chum salmon; Tables 1–5). Summaries of these specific reviews and findings are provided in the sections that follow. Escapement goal reviews conducted for several additional stocks (Chilkat River and Taku River sockeye salmon, and Chilkat River Chinook salmon) are also documented below, though no basis was found for changes to those escapement goals. Escapement goals not presented in the following sections remained status quo.

Chilkat River Chinook Salmon

The Chilkat River, a moderate-sized glacial system near Haines, Alaska, is one of the principal producers of Chinook salmon in Southeast Alaska (McPherson et al. 2003). In 2003, ADF&G established a BEG range of 1,750–3,500 large Chinook salmon for the Chilkat River drainage above the adult marking area with an S_{MSY} point estimate of 2,200 (5 AAC 33.384; Ericksen and McPherson 2004). The lower bound of the escapement goal range has been met in 25 of the past 33 years during which abundance has been estimated using mark–recapture methods.

Chilkat River Chinook salmon are considered an inside-rearing stock, as supported by coded wire tag recovery data showing spatial and temporal patterns in Southeast Alaska's mixed stock commercial and sport fisheries. Since the 1999 brood year, smolt have been tagged with coded wire tags at relatively high rates (mean tagging rate = 8.5%). Analysis of these data indicates that Chilkat River Chinook salmon are primarily caught in Southeast Alaska commercial drift gillnet (31% of harvest) and spring troll fisheries (17%), followed by Haines area spring sport fishery

(13%), and the northern Southeast Alaska sport fishery (12%). The remainder of harvest occurs in commercial winter and summer troll, purse seine, and inriver subsistence fisheries.

The current BEG for Chilkat River Chinook salmon stock is based on a spawner–recruit time series through brood year 1998 (Ericksen and McPherson 2004). More recently, Elliott and Peterson (*In prep*) updated the analysis using data through brood year 2012, finding that the revised S_{MSY} estimate remains consistent with the past estimate (Figure 1). This time series is updated annually and now extends through brood year 2017. Recent years have included below-goal escapements in 2012–2014 and 2016–2017, with a wide range of productivity. The 2012 and 2013 brood years produced abundances below replacement, while the 2014, 2016, and 2017 brood years produced abundances above replacement. Given this variability, inclusion of 5 additional brood years is not likely to alter the spawner–recruit relationship or change S_{MSY}. The escapement goal committee recommends no change to the current escapement goal for Chilkat River Chinook salmon.

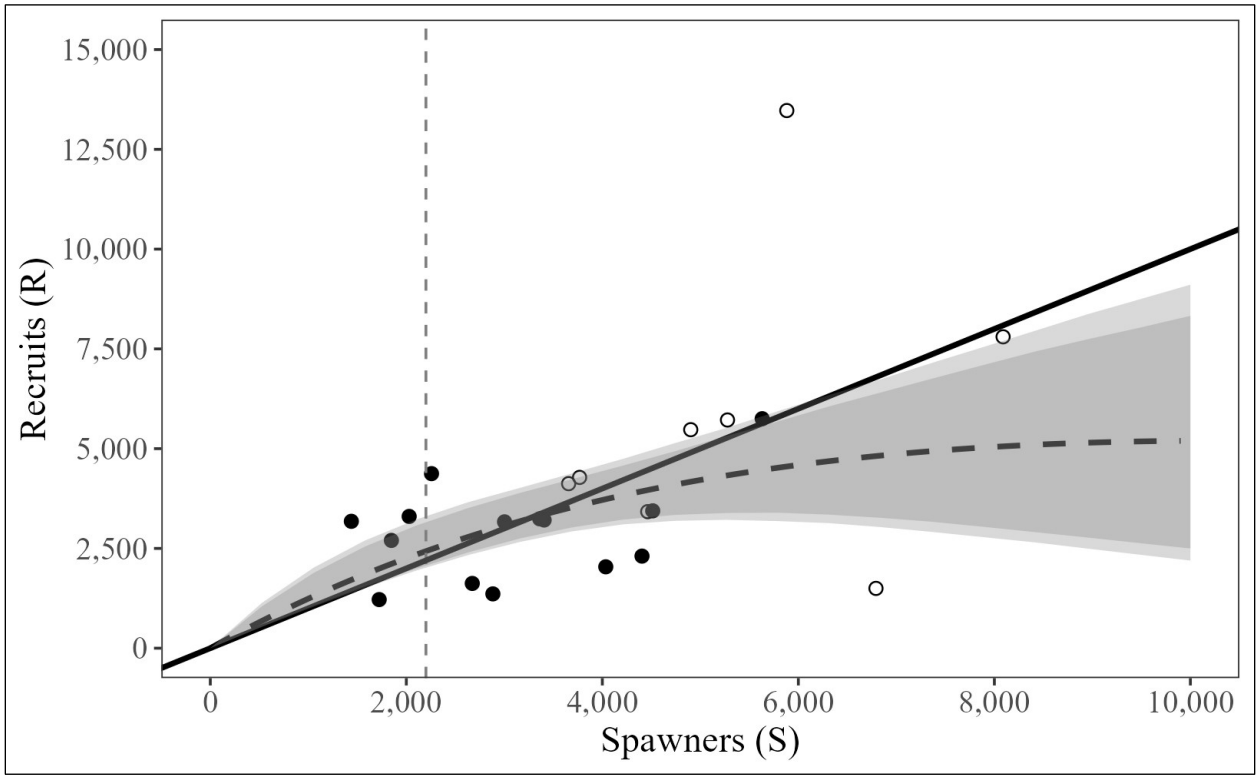

Figure 1.–Spawner–recruit relationship (dashed line) with 90% and 95% confidence intervals (shaded regions) for Chilkat River Chinook salmon as derived from a Ricker model, brood years 1991–2012. The 14 years of added data are depicted by closed circles (brood years 1999–2012). The bias-corrected estimate of S_{MSY} is shown as a vertical dashed gray line.

Chilkat Lake Sockeye Salmon

Chilkat Lake, approximately 44 river km upstream from the city of Haines, supports one of the largest runs of sockeye salmon in Southeast Alaska. Chilkat Lake sockeye salmon are primarily harvested in the District 115 commercial drift gillnet fishery in northern Lynn Canal. Smaller but unknown portions of the Chilkat Lake sockeye salmon run are also harvested in the commercial purse seine fisheries that target pink salmon in Icy and northern Chatham Straits (Ingledue 1989; Gilk-Baumer et al. 2015), and in subsistence fisheries in Chilkat Inlet and in the Chilkat River.

The current BEG range of 70,000–150,000 sockeye salmon was established in 2009, based on a spawner–recruit analysis by Eggers et al. (2008, 2010). Following a comprehensive review of historical stock assessment data (Bednarski et al. 2017), Miller and Heinl (2018) updated the escapement goal analysis using age-structured, state-space stock–recruit models to better account for multiple overlapping methods of escapement enumeration and missing data (brood years 1976−2012; calendar years 1976–2016). Model results (Table 7) were similar to those of Eggers et al. (2008, 2010), and the escapement goal review committee findings were to maintain the BEG range of 70,000–150,000 sockeye salmon (Heinl et al. 2017).

Table 7.–Parameter estimates (posterior medians, posterior means, 95% credible intervals, and CVs) from the first-order autoregressive Ricker model for the Chilkat Lake sockeye salmon data for brood years 1976–2018. The posterior CVs are the posterior standard deviations divided by the posterior means. Refer to Miller and Heinl (2018) for parameter definitions.

Parameter	5%	Median	95%	Mean	CV
α	1.76	2.86	4.86	2.98	0.27
β	1.60×10^{-6}	5.42×10^{-6}	9.33×10^{-6}	5.41×10^{-6}	0.36
$\ln(\alpha)$	0.56	1.05	1.58	1.06	0.25
$\ln(\alpha')$	0.78	1.26	1.90	1.28	0.22
ϕ	0.09	0.41	0.73	0.41	0.39
σ_R	0.46	0.57	0.73	0.58	0.12
S_{MSY}	56,285	83,428	204,214	95,642	0.87
$S_{MSY.c}$	65,566	96,257	260,869	114,361	0.52[a]
S_{MAX}	107,233	184,519	623,391	235,121	0.71[a]
S_{EQ}	130,474	196,163	455,801	222,079	0.82
U_{MSY}	0.26	0.45	0.62	0.45	0.21
$q_{m\text{-}r}$	1.48	1.60	1.73	1.60	0.04
q_{weir}	0.65	0.74	0.84	0.74	0.06
D	16.64	24.52	36.03	24.96	0.20
p_4	0.04	0.05	0.07	0.05	0.14
p_5	0.53	0.56	0.59	0.56	0.03
p_6	0.35	0.38	0.42	0.38	0.04
MSY	28,908	71,922	162,665	78,427	0.65

[a] The coefficients of variation for the reference points S_{MAX} and $S_{MSY.c}$ were calculated as (97.5th percentile minus 5th percentile)/3.92/posterior median point estimate. If the posterior median is approximately normal, then the lower and upper bounds of the 95% credible intervals are ±1.96 × SE from the median point estimate.

For this review, methods used by Miller and Heinl (2018) were updated to include brood years 2013−2018 (Figure 2). An age-structured state-space spawner–recruit model was fit to data on abundance, harvest, age composition, and coefficients of variation to examine the effect of autocorrelation on recruits, and to account for multiple overlapping methods of escapement enumeration and missing data (age composition was considered unknown in the model for years 1996–1998 when the weir was not operated). DIDSON escapement counts were treated as the "true" counts, and the weir counts and mark–recapture estimates of escapement were treated as indices of escapement in the state-space model. Despite the addition of 6 years of data, the resulting parameter estimates (Table 7) were very similar to those estimated by Miller and Heinl (2018). The probability of achieving 90% of maximum sustained yield (MSY) at the lower and upper bounds of the current escapement goal is estimated to be 65% and 31%, respectively, and an average 64% over the entire escapement goal range (Figure 3). Yield would be maximized at

escapements near S_{MSY} (near 84% probability of achieving 90% of MSY). These probabilities improve substantially with respect to achieving 80% of MSY. The escapement goal review committee's findings are to maintain the current BEG of 70,000–150,000 sockeye salmon counted with the DIDSON system at the Chilkat Lake weir site. The escapement goal has been met or exceeded in 8 of the last 10 years (2014−2023); the escapement goal was not met in 2020 and 2021. The escapement goal review committee's findings are for no changes to the escapement goal for Chilkat Lake sockeye salmon.

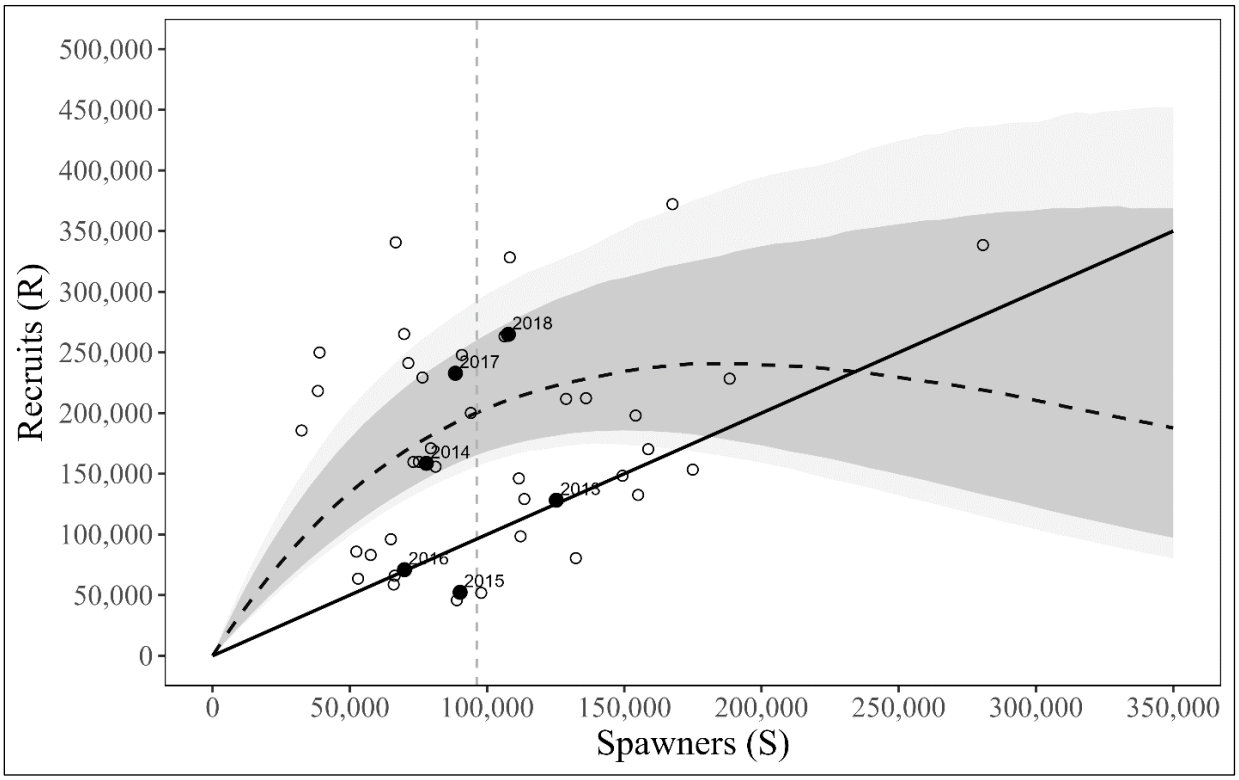

Figure 2.–Spawner–recruit relationship (dashed line) with 90% and 95% credible intervals (shaded regions) for Chilkat Lake sockeye salmon as derived from a first-order autoregressive Ricker model for brood years 1976–2018. Recruits replace spawners on the solid, black diagonal line. The 6 years of added data are labeled with brood year (2013–2018). The point estimate of the expected median (bias-corrected) of $S_{MSY,c}$ is shown as a vertical dashed gray line.

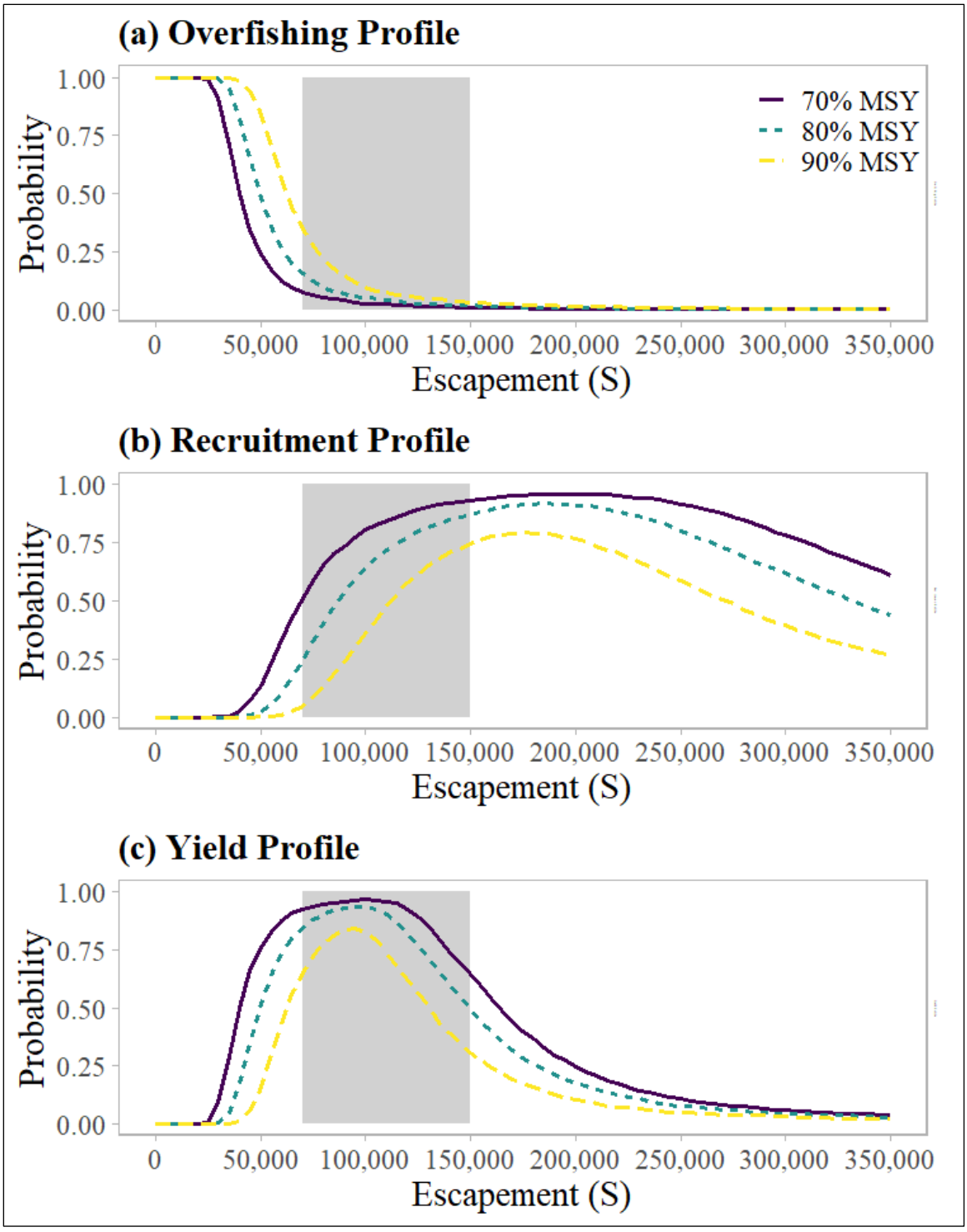

Figure 3.–Overfishing profiles (OFPs; a), maximum recruitment probability profiles (MRPs; b), and optimal yield profiles (OYPs; c) for Chilkat Lake sockeye salmon. The OYPs and MRPs show the probability that an escapement will result in specified fractions (0.70, 0.80, and 0.90 line) of maximum sustained yield or maximum recruitment. The OFPs show the probability that reducing escapement to a specified level will result in less than specified fractions of maximum sustained yield. The shaded region is the current biological escapement goal range of 70,000 to 150,000 spawners.

Stikine River Sockeye Salmon

The Stikine River is a transboundary river system that originates in the Stikine plateau of northwestern British Columbia and terminates in the Pacific Ocean near Wrangell, Alaska. Canadian-origin Stikine River salmon runs are jointly managed by Fisheries and Oceans Canada, the Tahltan First Nation, and the department through Chapter 1, Annex IV of the treaty. Provisions of the treaty establish conservation and harvest sharing objectives for Canadian-origin Stikine River sockeye salmon, and escapement goals have been established for 2 stocks: Tahltan Lake and mainstem Stikine River (hereafter, references to Stikine River sockeye salmon and associated escapement goals refer specifically to fish of Canadian origin). Under the terms of the treaty, beginning in 2024, the total allowable catch of both natural and enhanced sockeye salmon will be allocated 57.5% U.S. and 42.5% Canada. The above-border Stikine River sockeye salmon run (Tahltan Lake and mainstem stocks, combined) has averaged 95,000 fish since 1979 (1979–2022), and the terminal run, which includes marine harvest (in U.S. Districts 106 and 108), has averaged 132,000 fish (1979–2022). The harvest rate has averaged 50% (1979–2022), resulting in average spawning escapements of 29,000 fish at Tahltan Lake and 32,000 fish for the mainstem Stikine River.

The escapement goal review committee reviewed the findings of the PSC TTC Working Group regarding the Tahltan Lake and mainstem Stikine River stocks. The most appropriate model for both stocks uses a linearized Ricker spawner–recruit function with an autoregressive lognormal process error with a lag of 1 year using brood years 1983 to 2014. Both revised escapement goals are consistent with *Canada's Policy for Conservation of Wild Pacific Salmon* and the Alaska *Policy for the Management of Sustainable Salmon Fisheries*, and meet the treaty directive for establishing a maximum sustained yield escapement goal.

Tahltan Lake Sockeye Salmon

The current BEG for the Tahltan stock is 18,000 to 30,000 sockeye salmon with a management objective of 24,000 fish (TTC 1993; Humphreys et al. 1994). This goal accounts for 20,000 naturally spawning fish and up to 4,000 fish needed for broodstock to meet the objectives of the Canada/U.S. Stikine River enhancement program (TTC 1993). For the Tahltan Lake stock, the finding is to replace the current BEG with a BEG range of 11,000 to 25,000 sockeye salmon, a range that has an 80% probability of achieving ≥80% of maximum sustained yield at the lower and upper bounds (Figures 4 and 5, Table 8). The mean spawner level that produces maximum sustained yield (S_{MSY}) is estimated to be 18,600 spawners. The revised escapement goal range incorporates uncertainty about the true abundance and productivity of the stock.

Mainstem Stikine River Sockeye Salmon

The current SEG for the mainstem Stikine River is 20,000 to 40,000 sockeye salmon with a management objective of 30,000 fish. For the mainstem Stikine River stock, the finding is to replace the current SEG with a BEG range of 13,000 to 33,000 sockeye salmon, a range that has an 80% probability of achieving ≥80% of maximum sustained yield at the lower and upper bounds. The mean spawner level that produces maximum sustained yield is estimated as 21,200 spawners (Figures 4 and 5, Table 9). This range accounts for the uncertainty about the true abundance and productivity of the stock.

Table 8.–Parameter estimates (posterior medians, posterior means, 95% credible intervals, and CVs) from the first-order autoregressive Ricker model for the Tahltan natural stock of Stikine River sockeye salmon for brood years 1983–2014. The posterior CVs are the posterior standard deviations divided by the posterior means.

Parameter	5%	Median	95%	Mean	CV
α	3.34	6.54	11.26	6.81	0.35
β	2.39×10^{-5}	3.72×10^{-5}	5.33×10^{-5}	3.78×10^{-5}	0.24
$\ln(\alpha)$	1.21	1.88	2.42	1.85	0.20
$\ln(\alpha')$	1.77	2.38	2.98	2.38	0.15
ϕ	0.12	0.43	0.69	0.42	0.41
σ	0.71	0.87	1.10	0.88	0.13
S_{MSY}	13,572	18,053	25,560	18,611	0.20
$S_{MSY.c}$	15,515	20,894	30,723	21,750	0.21
S_{MAX}	18,767	26,873	41,797	28,059	0.25
S_{EQ}	35,951	49,275	69,289	50,462	0.20
U_{MSY}	0.50	0.69	0.80	0.68	0.14
MSY	17,272	42,140	74,385	43,733	0.40

Table 9.–Parameter estimates (posterior medians, posterior means, 95% credible intervals, and CVs) from the first-order autoregressive Ricker model for the mainstem stock of Stikine River sockeye salmon in brood years 1983–2014. The posterior CVs are the posterior standard deviations divided by the posterior means.

Parameter	5%	Median	95%	Mean	CV
α	2.87	4.51	6.67	4.60	0.25
β	2.07×10^{-5}	2.79×10^{-5}	3.60×10^{-5}	2.81×10^{-5}	0.16
$\ln(\alpha)$	1.05	1.51	1.90	1.49	0.17
$\ln(\alpha')$	1.29	1.71	2.14	1.71	0.15
ϕ	0.21	0.53	0.80	0.52	0.34
σ	0.41	0.51	0.64	0.51	0.14
S_{MSY}	16,694	21,048	26,308	21,199	0.14
$S_{MSY.c}$	18,864	23,015	29,307	23,383	0.14
S_{MAX}	27,774	35,907	48,309	36,623	0.17
S_{EQ}	40,480	53,619	67,781	53,790	0.15
U_{MSY}	0.45	0.59	0.70	0.59	0.13
MSY	15,389	31,870	51,403	32,441	0.33

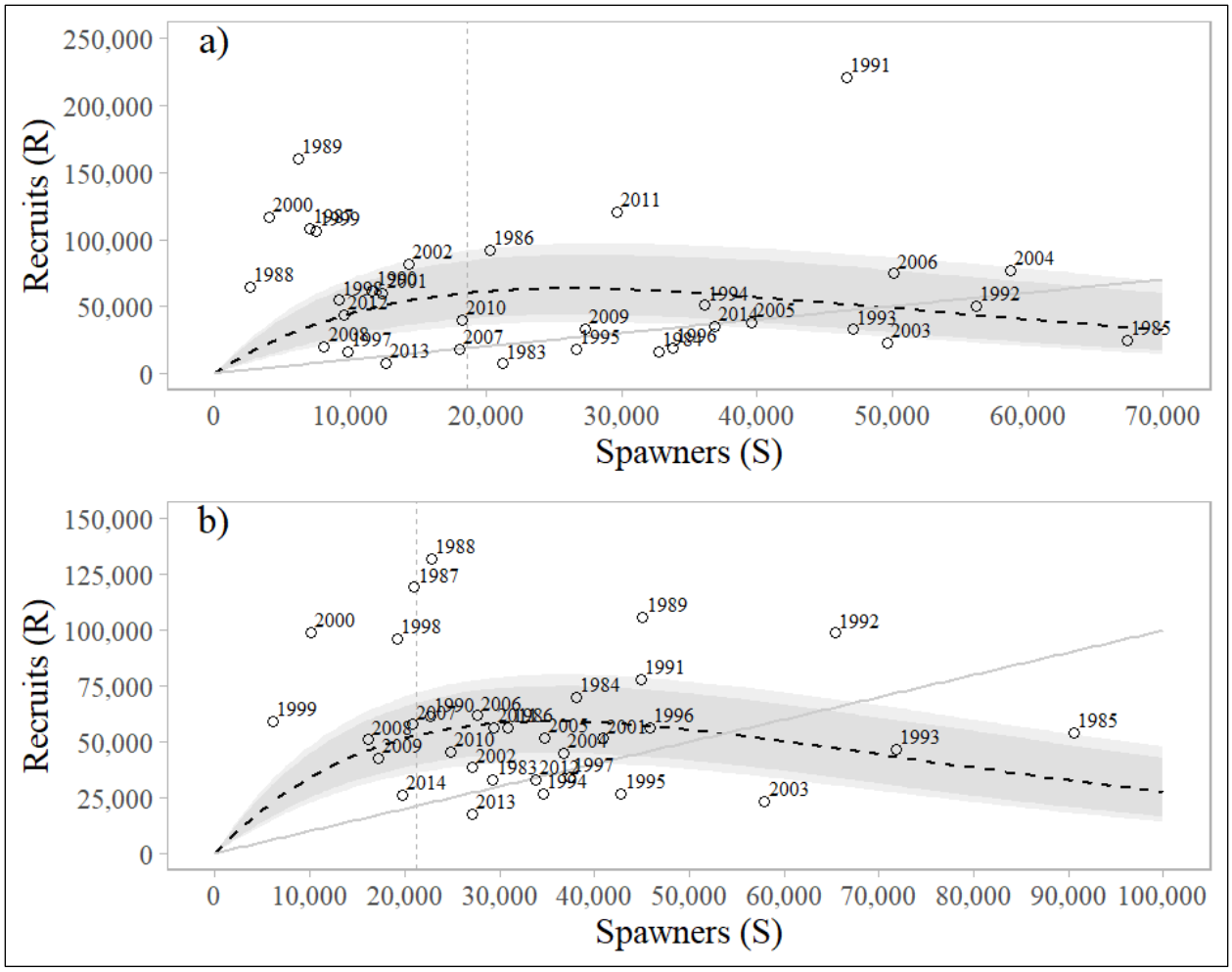

Figure 4.–Spawner–recruit relationship (dashed line) with 90% and 95% credible intervals (shaded regions) for the Tahltan natural stock of Stikine River sockeye salmon (a) and the mainstem stock of Stikine Ricker sockeye salmon (b) as derived from a first-order autoregressive Ricker model for brood years 1983–2014.

Note: Recruits replace spawners on the solid, gray diagonal line. The point estimates of the expected median (non-bias corrected) of S_{MSY} are shown as a vertical dashed gray line in each figure.

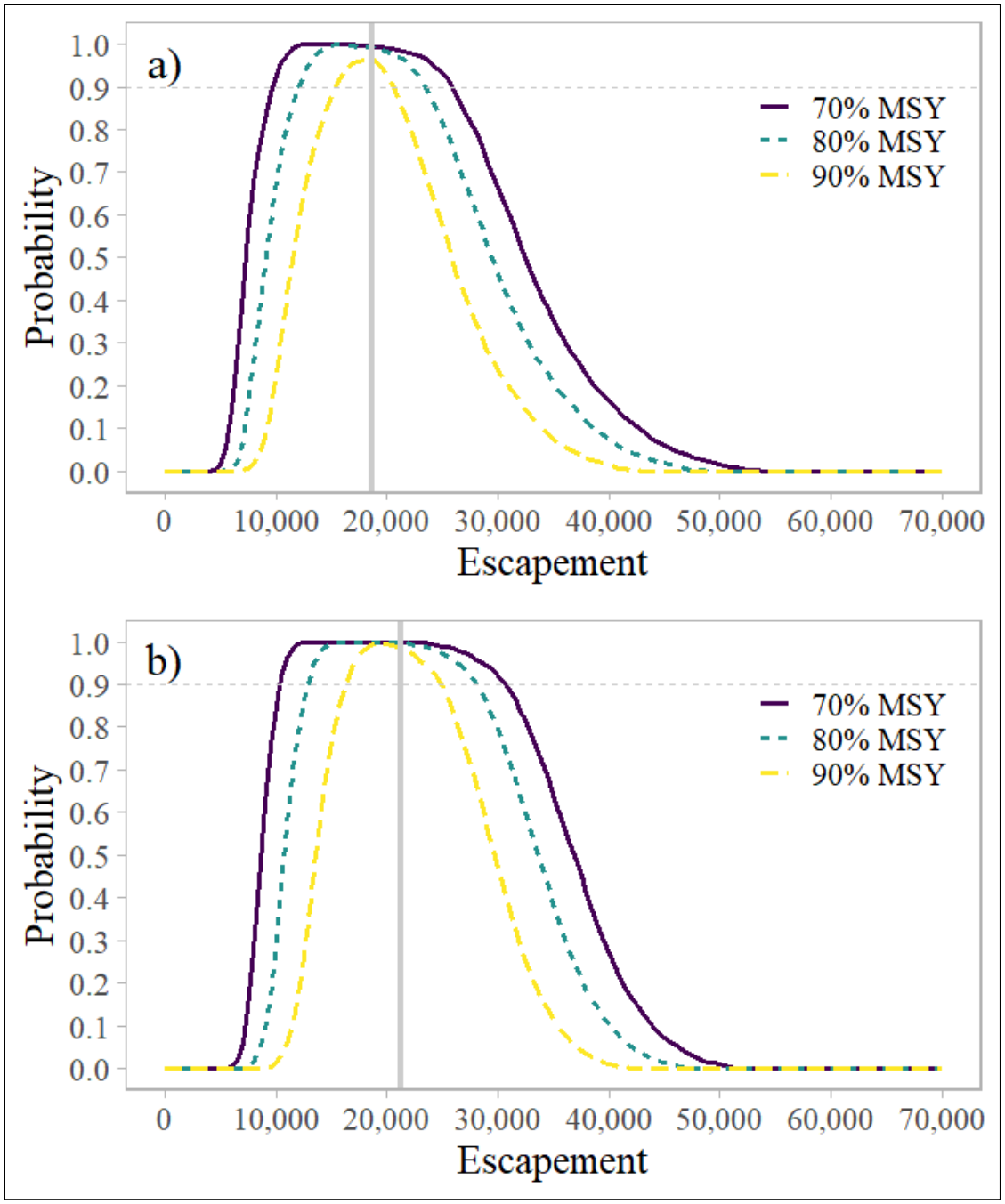

Figure 5.–Optimal yield profiles (OYPs) for the Tahltan natural stock of Stikine River sockeye salmon stock (a) and the mainstem stock of Stikine Ricker sockeye salmon (b) as derived from a first-order autoregressive Ricker model for brood years 1983–2014.

Note: The OYPs show the probability that an escapement will result in specified fractions (i.e., 70%, 80%, and 90%) of maximum sustained yield. The vertical lines are the point estimate of S_{MSY} based on median (non-bias corrected) recruitment; 18,100 for the Tahltan natural stock and 21,000 for the mainstem stock. The dashed horizontal line is at 0.90 probability for reference.

Taku River Sockeye Salmon

The Taku River is a transboundary river system originating in the Stikine Plateau of northwestern British Columbia and terminating in the marine waters of U.S. District 111. The merging of 2 principal tributaries, the Inklin and Nakina Rivers, approximately 50 km upstream from the U.S./Canada border, forms the mainstem of the Taku River. Sockeye salmon returning to the Taku River drainage are primarily harvested in the U.S. District 111 traditional commercial drift gillnet fishery in Taku Inlet (Subdistrict 111-32), and in the inriver Canadian commercial fishery. Other harvests occur in the inriver U.S. personal use fishery, a test/assessment fishery, and Canadian Aboriginal food, social, and ceremonial fishery. The current BEG of naturally spawned Taku River sockeye salmon is 40,000–75,000 fish, with a management objective of 58,000 fish (Miller and Pestal 2020). With the addition of 4 brood years (2015–2018; Figure 6), the 2020 analysis was updated by the PSC Transboundary Taku River sockeye salmon working group (working group), that consisted of representatives from Fisheries and Oceans Canada, the department, and the Taku River Tlingit First Nation Fisheries. The data in this updated analysis was through the 2022 season because full biological data from the 2023 season was not yet available at the time of the analysis; but analyses were through brood year 2018, because the returns of age-5 and older fish can be estimated through the state-space model. The working group used methods identical to those used in the previous analyses detailed in Pestal et al. (2020) and Miller and Pestal (2020).

The scientific reviewers of the 2020 escapement goal recommended revising the spawner–recruit analysis with the inclusion of recently completed brood years, updated historical data, and improved analytical techniques, which ultimately improved precision in the 2023 analysis. The escapement goal review committee's findings are to maintain the current Taku River sockeye salmon BEG of 40,000–75,000 naturally spawned Taku River sockeye salmon with a management objective of 58,000 fish (Figure 7, Table 10).

Table 10.–Parameter estimates (posterior medians, posterior means, 95% credible intervals, and CVs) from the first-order autoregressive Ricker model for Taku River sockeye salmon data in brood years 1980–2018. Further information about parameters is in Miller and Pestal (2020). The posterior CVs are the posterior standard deviations divided by the posterior means.

Parameter	5%	Median	95%	Mean	CV
α	3.35	6.35	11.28	6.62	0.32
β	4.38×10^{-6}	1.33×10^{-5}	2.11×10^{-5}	1.31×10^{-5}	0.33
$\ln(\alpha)$	1.21	1.85	2.42	1.84	0.17
$\ln(\alpha')$	1.27	1.91	2.48	1.91	0.16
ϕ	-0.14	0.28	0.70	0.28	0.76
σ_R	0.25	0.32	0.43	0.33	0.14
S_{MSY}	37,676	51,742	117,863	57,841	0.40
$S_{MSY.c}$	38,205	52,875	123,492	59,426	0.42
S_{MAX}	47,398	75,160	228,477	89,952	0.59
S_{EQ}	115,368	144,034	302,743	159,592	0.36
U_{MSY}	0.53	0.70	0.81	0.69	0.10
D	14.91	21.96	31.88	22.39	0.20
π_4	0.36	0.39	0.43	0.39	0.04
π_5	0.51	0.54	0.58	0.54	0.03
π_6	0.05	0.06	0.08	0.06	0.13
MSY	85,956	118,056	170,718	120,885	0.23

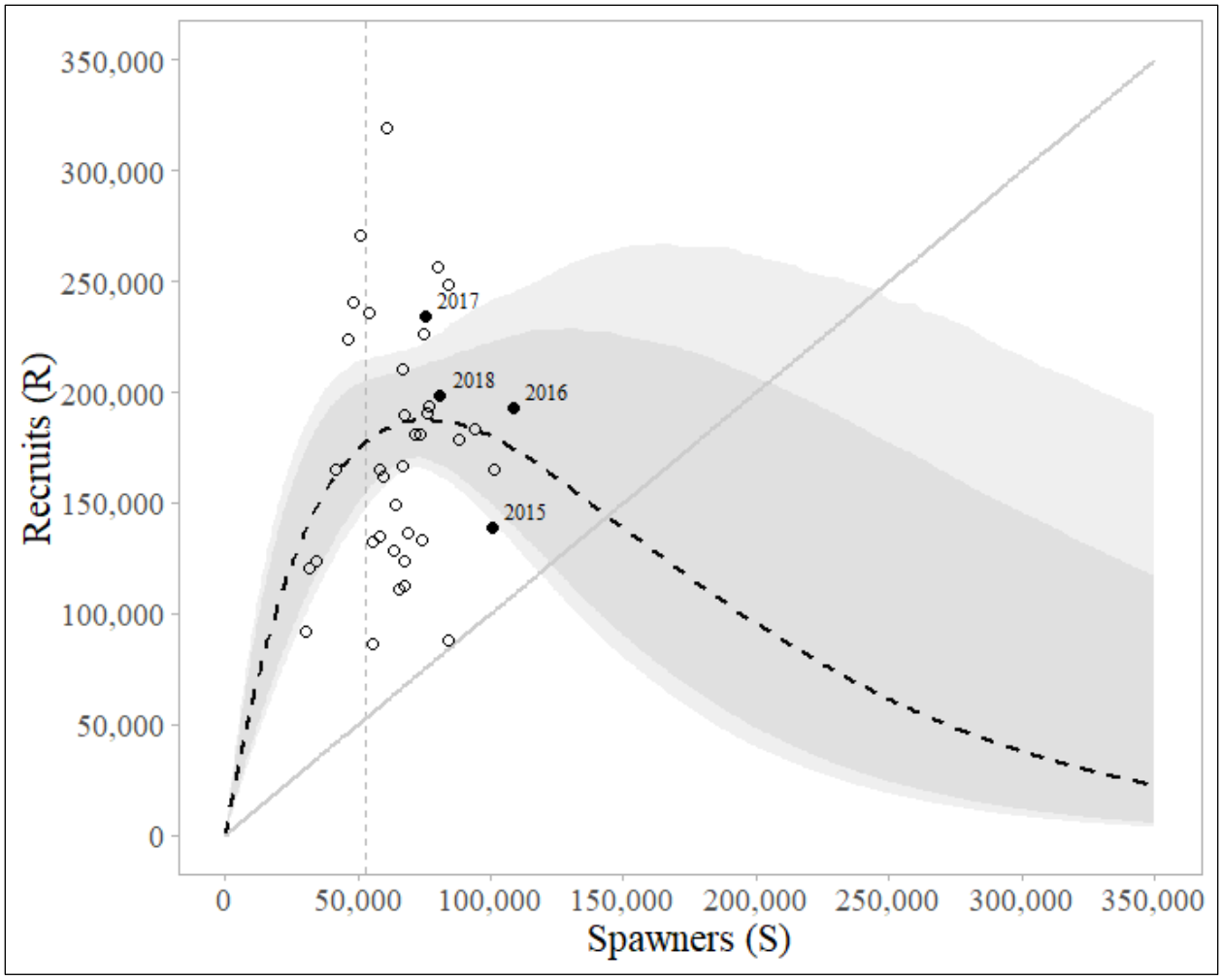

Figure 6.–Spawner–recruit relationship (dashed line) with 90% and 95% credible intervals (shaded regions) for Taku River sockeye salmon as derived from a first-order autoregressive Ricker model for brood years 1980–2018. Recruits replace spawners on the solid, gray diagonal line. The 4 years of added data are labeled with brood year (2015–2018). The point estimate of the expected median (bias-corrected) of $S_{MSY.c}$ is shown as a vertical dashed gray line.

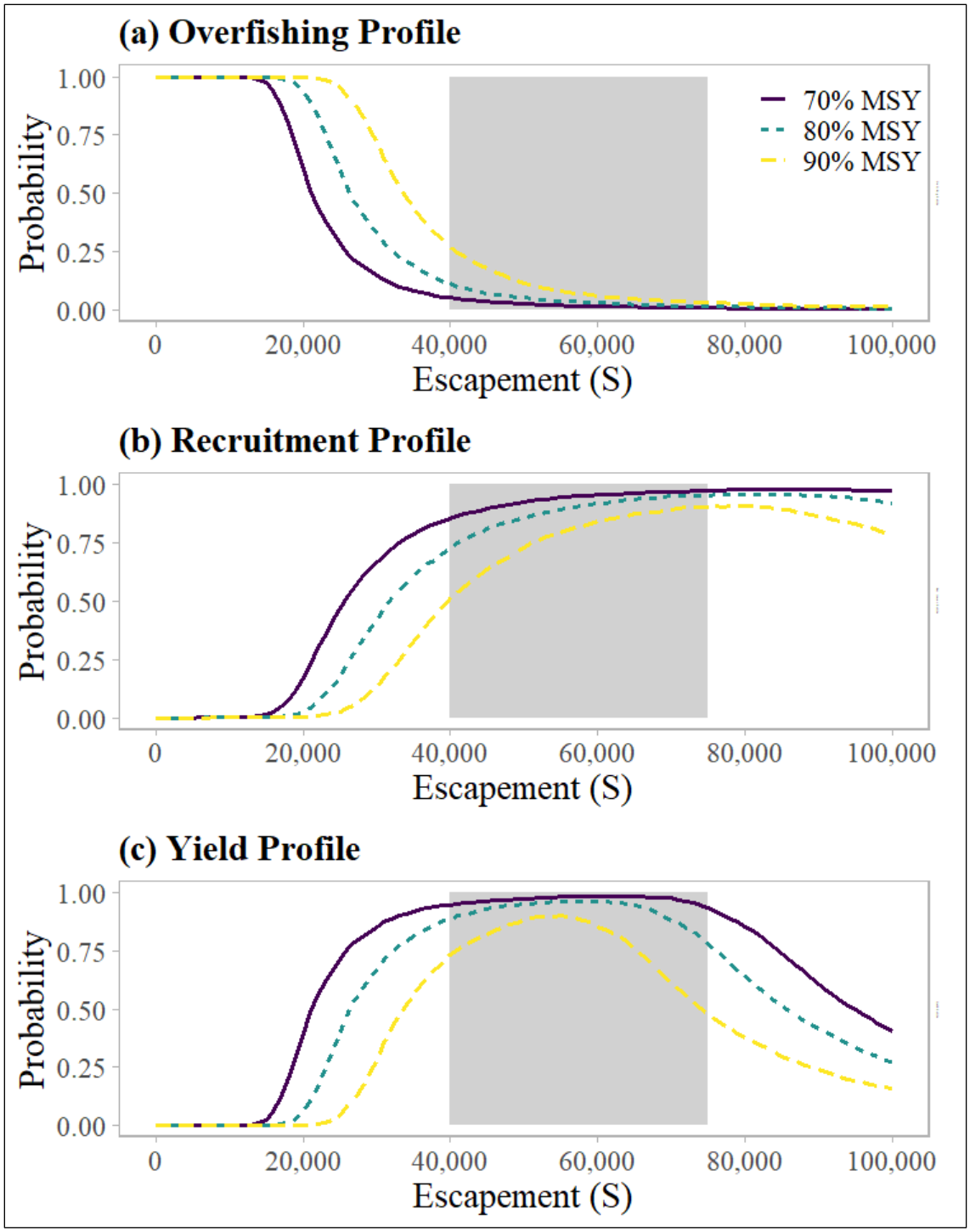

Figure 7.–Overfishing profiles (OFPs), maximum recruitment probability profiles (MRPs), and optimal yield profiles (OYPs) for Taku River sockeye salmon. The OYPs and MRPs show the probability that an escapement will result in specified percentages (70%, 80%, and 90% lines) of maximum sustained yield or maximum recruitment. The OFPs show the probability that reducing escapement to a specified level will result in less than specified fractions of maximum sustained yield. The shaded region is the current biological escapement goal range of 40,000 to 75,000 naturally spawned fish.

Klawock River Coho Salmon

The Klawock River is located on the west coast of Prince of Wales Island, near the town of Klawock, Alaska. In 1977 and 1978, the State of Alaska built a hatchery on the river, 300 m below Klawock Lake (Stopha 2016) and approximately 3.5 km above the estuary. The state operated the hatchery through the early 1990s; management of the hatchery was then transferred to the Prince of Wales Hatchery Association (1996–2015), followed by the Southern Southeast Regional Aquaculture Association since 2016. Hatchery-produced coho salmon (Klawock Lake broodstock) have been released annually in the lake, river, and estuary since 1980; over the past decade, the hatchery released an average of 4.1 million coho smolt per year. A portion of the annual coho salmon escapement is allowed to pass into the lake to spawn naturally, while the remainder is used for broodstock and cost recovery. Otolith sampling conducted from 2013 to 2015 indicated that nearly all coho salmon that passed as escapement in those years were first generation hatchery fish (Stopha 2016).

Prior to 2007, an informal, maximum escapement target of 6,000 coho salmon was established for the Klawock River (Der Hovanisian 2013). An SEG range of 4,000–9,000 coho salmon was established in 2007 and formally adopted in 2013 (Der Hovanisian 2013; and see Appendix E in Munro and Volk 2014). The annual hatchery management plan includes stipulations for the hatchery to operate the weir from early July through the end of November and includes a weekly escapement schedule with a target escapement of 6,500 coho salmon. Although "most of the run now comprises hatchery returns" (Stopha 2016), the purpose of the escapement schedule is to maintain the historical escapement timing of the run.

The Klawock River coho salmon escapement consists primarily of hatchery fish; therefore, the escapement goal review committee's findings are to eliminate the formal escapement goal for Klawock River coho salmon. The existing escapement schedule for Klawock River coho salmon is described in the Klawock River Hatchery Annual Management Plan. The escapement schedule will help maintain run timing and other stock characteristics for Klawock River coho salmon, avoid over escapement and overloading the spawning grounds, and support fishery stability in the future.

Northern Southeast Inside Subregion Summer-Run Chum Salmon

The Northern Southeast Inside Subregion includes summer-run chum salmon index streams located on the inside waters of Southeast Alaska north of Sumner Strait. The current lower-bound SEG is 107,000 chum salmon counted on peak surveys for the aggregate set of 63 index streams (Piston and Heinl 2017). Escapement indices were generally high in the 1960s, and then declined in the 1970s–1980s. The escapement index trended upward into the late 1990s, trended downward through 2010, and has fluctuated considerably since that time. Escapement indices were above the current escapement goal in 3 of the past 5 years, 2019–2023 (Piston and Fish 2024a).

Summer-run chum salmon escapement goals provide an indication of management performance over broad areas of Southeast Alaska, and management actions are generally not directed at meeting the broad aggregate goals unless specific actions are identified due to multiple years of escapements below goal. Wild summer-run chum salmon are primarily harvested incidentally in mixed stock commercial fisheries that are often distant from spawning grounds, and it is not possible to identify stream-specific harvests (Piston and Heinl 2020b). Therefore, summer-run chum salmon stocks are assessed over broad subregions, and goals are based on peak counts at aggregates of streams. Traditional purse seine fisheries are managed primarily for pink salmon. Hatchery produced summer-run chum salmon are a targeted species in traditional gillnet fisheries

in the Northern Southeast Inside Subregion, but management during the summer is based primarily around major sockeye salmon stocks in the vicinity of the fisheries (e.g., Chilkat, Chilkoot, and Taku Rivers; Thynes et al. 2021b). The harvest rate on wild summer-run chum salmon in traditional, mixed stock commercial net fisheries in the Northern Southeast Inside Subregion is assumed to be at least moderate (Eggers and Heinl 2008).

As in past escapement goal evaluations for Southeast Alaska chum salmon, the percentile approach was used (Clark et al. 2014), whereby the contrast of the escapement data, level of assessment error, and the exploitation rate of the stock were used to select percentiles of observed annual escapements to be used for estimating an SEG. For exploited stocks with high contrast (>8), the lower bound of the escapement goal range was set at the 25th percentile as a precautionary measure for stock protection.

The escapement index was recalculated after removal of 13 index streams that had various data limitations; index streams were primarily removed due to factors making consistent chum salmon counts difficult (Piston and Fish 2024a). Factors for removing an index stream include small chum salmon escapements in proportion to average pink salmon escapements in the same stream (masking the presence of chum salmon during aerial surveys), continual issues regarding visibility from the air (e.g., glacial water, tannic water, and extensive overhanging vegetation), and high proportions of stray hatchery chum salmon. Index streams removed due to the presence of high proportions of hatchery chum salmon in the escapement typically exceeded 50% hatchery salmon (Dry Bay Creek 56% in 2022 and 71% in 2023, Fish Creek range = 69–88%, Sawmill Creek range = 15–78%; Piston and Heinl 2012a; Piston and Heinl 2012b; Josephson et al. 2021; Piston and Fish 2024a). Straying of hatchery-produced chum salmon into these streams is not necessarily an indicator of diminished wild chum salmon production in these drainages, but the presence of hatchery-produced fish makes it impossible to estimate the abundance of wild chum salmon from aircraft or foot surveys alone. Overall, these 13 streams represent a relatively small proportion of total wild chum salmon production from the 63 total index streams in the subregion (Piston and Fish 2024a). The removal of the 13 index streams will not alter existing management strategies and is intended to ensure that the index more accurately tracks wild chum salmon escapement trends, which will help ensure fisheries are managed sustainably.

Twenty-nine streams were identified in the index with survey counts during over half of the years between 1960 and 1981. This set of 29 index streams also accounted for a large percentage of the annual subregion escapement index from 1982 to 2016 (median = 74%). Escapement indices were calculated for the years 1960–1981 by expanding this set of 29 index streams in 3 steps (Piston and Fish 2024a). First, these 29 streams were grouped together, and missing values were imputed for the years 1960–1981 (18% of the data points). Second, annual surveys were summed to this set of 29 index streams. Finally, the total Northern Southeast Inside Subregion escapement index was estimated for 1960–1981, by dividing the annual sum-of-surveys to this set of 29 index streams by the median of 74%. These calculations provided annual escapement indices for the years 1960–2016, which was recommended as baseline years for recalculating escapement goals if changes to the indices occurred (Piston and Heinl 2017). Given the high contrast (>8) in the entire 1960–2023 escapement series, and at least moderate exploitation rates, the 25th percentile of the escapement index was used from 1960 to 2016 (Piston and Heinl 2017) to calculate a lower bound SEG of 95,000 chum salmon counted on peak surveys to the 50 (63 original, 13 removed) index streams in this subregion (Piston and Fish 2024a).

Northern Southeast Outside Subregion Summer-Run Chum Salmon

The Northern Southeast Outside Subregion includes summer-run chum salmon index streams on the outside waters of Chichagof and Baranof Islands in northern Southeast Alaska. The current Northern Southeast Outside Subregion escapement goal is set at the 25th percentile of the annual sum of peak escapement survey data from 9 index streams over the years 1982–2016 (Piston and Heinl 2017). Escapement indices were above the current escapement goal in most years through 2008, but have since declined and were below goal in 4 of the past 5 years (2020–2023; Piston and Fish 2024a).

Summer-run chum salmon in the Northern Southeast Outside Subregion are harvested incidentally in traditional purse seine fisheries that are managed primarily for pink salmon; occasionally, specific bays or inlets may be open to target summer-run chum salmon when there is an observed high abundance returning to a specific system (Thynes et al. 2021a). Harvest of summer-run chum salmon in this subregion were typically very low prior to the onset of hatchery runs in the area (Piston and Heinl 2020b). Summer-run chum salmon escapement goals provide an indication of management performance over broad areas of Southeast Alaska. The harvest rate on wild summer-run chum salmon in traditional, mixed stock commercial net fisheries in the Northern Southeast Outside Subregion is assumed to be at least moderate (Eggers and Heinl 2008).

As in past escapement goal evaluations for Southeast Alaska chum salmon, the percentile approach was used, where the contrast of the escapement data, level of assessment error, and the exploitation rate of the stock were used to select percentiles of observed annual escapements to be used for estimating an SEG. For exploited stocks with high contrast (>8), the lower bound of the escapement goal range was set at the 25th percentile as a precautionary measure for stock protection. The escapement index was recalculated with the removal of the West Crawfish NE Arm Head index stream, which was removed due to recent high proportions of stray hatchery fish in the escapement (range = 59–80% since 2018) from the nearby Crawfish Inlet release site. In addition, in all recent years, numbers of presumed hatchery fish ranging from 1,500 to 20,000 were observed milling at the mouth of the creek in August, making standard index counts of wild chum salmon impossible to obtain (Piston and Heinl 2020b; Piston and Fish 2024a). Straying of hatchery-produced chum salmon into this stream is not necessarily an indicator of diminished wild chum salmon production in this drainage, but as previously noted, the presence of hatchery-produced fish makes it impossible to estimate the abundance of wild chum salmon from aircraft or foot surveys alone. The removal of the West Crawfish index stream does not alter existing management strategies and is intended to ensure that the index more accurately tracks wild chum salmon escapement trends, which will help ensure fisheries are managed sustainably. Interpolated counts for all streams in all prior years were recalculated with the West Crawfish NE Arm Head Stream removed.

Given the relatively high contrast (7) in the entire 1982–2023 escapement series, and at least moderate exploitation rate, the 25th percentile of the escapement index was used to calculate a lower-bound SEG of 19,500 chum salmon counted on peak surveys to the eight index streams in this subregion. For calculating the goal, only data from 1982 to 2016 was used, which was recommended as a baseline for summer-run chum salmon in this subregion (Piston and Heinl 2017), and to avoid simply lowering the goal during a period of poor escapements.

Chilkat River Fall-Run Chum Salmon

The Chilkat River drainage near Haines supports the largest fall chum salmon run in the region (Halupka et al. 2000). Most of the spawning takes place in the mainstem and side channels of the Chilkat River (ADF&G Anadromous Waters Catalog number 115-32-10250) and its major tributary, the Klehini River (ADF&G Anadromous Waters Catalog number 115-32-10250-2077). Chilkat River fall-run chum salmon are primarily harvested in the Lynn Canal (District 115) commercial drift gillnet fishery, although harvest also occurs in other mixed stock fisheries prior to reaching Lynn Canal. Chilkat River fall-run chum salmon total runs averaged 298,000 fish since 1990, and the harvest rate in the Lynn Canal commercial drift gillnet fishery averaged 22% during 1990–2023.The current Chilkat River fall-run chum salmon SEG of 75,000–250,000 fish or, equivalently, a fish wheel index catch of 1,160–3,875 chum salmon, was based on an updated spawner–recruit analysis of the 1994–2008 brood years (Piston and Heinl 2014a).

The very poor relationship between fish wheel counts and mark–recapture estimates ($R^2 = 0.15$), which were used to expand fish wheel counts to estimates of total escapement (expansion factor >50), is one of the reasons the Chilkat fish wheel project is being discontinued beginning in 2024. The escapement goal committee's findings are to eliminate the goal and continue to manage the fishery based on fishery performance.

SUMMARY

The Southeast escapement goal review committee found basis for revising 6 of the 47 existing salmon escapement goals. No new goals were established, but 2 goals were found to have a basis for elimination. Escapement goals for the current 47 stocks included 27 designated as a biological escapement goal, 18 designated as a sustainable escapement goal, and 2 managed for an optimal escapement goal. Committee findings were reviewed by ADF&G regional and headquarters staff prior to publication. Brief overviews of stock assessment, escapement goal history, and escapement goal performance through 2023 are provided in Appendices A–E for all stocks with formal escapement goals. Specific details regarding the escapement goals currently in place for each stock can be found in the reports cited within these appendices.

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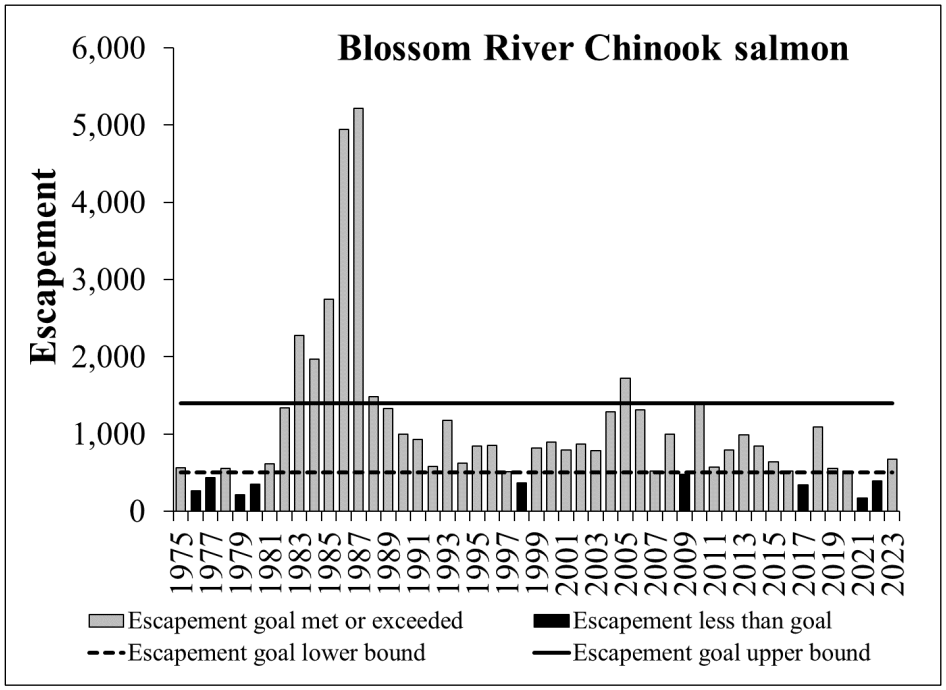
APPENDIX A.
CHINOOK SALMON ESCAPEMENT GOAL PERFORMANCE

Appendix A1.–Blossom River Chinook salmon.

The Blossom River is a clearwater system that empties into Behm Canal, 65 km east of Ketchikan, Alaska, and supports a mostly inside-rearing stock of Chinook salmon. The waters of east Behm Canal are closed to Chinook salmon fishing year-round and there are no directed fisheries that target this stock. Immature and mature fish are harvested in marine mixed stock fisheries in Southeast Alaska and northern British Columbia (based on coded wire tag information from the nearby Unuk and Chickamin wild stocks, and Whitman, Neets, and Deer Mountain hatchery stocks). Age data collected since 1998 indicate that about 10% of these fish are sub-yearling smolt. Total escapements were estimated from mark–recapture studies conducted in 1998 and from 2004 to 2006. Escapement estimates in all other years since 1975 were based on expanded helicopter index surveys. Four years (1998, 2004–2006) of concurrent mark–recapture estimates and index counts were used to estimate the peak index count expansion factor of 3.87.

Escapement Goals and Stock Status: In 1994, ADF&G established a peak index escapement goal of 300 large spawners (fish ≥660 mm mid eye to tail fork), based on a stock–recruit analysis. In 1997, the goal was revised to a range of 250 to 500 large spawners (McPherson and Carlile 1997). The current biological escapement goal range of 150 to 300 large index spawners was established in 2012 based on a stock–recruit analysis by Fleischman et al. (2011). After applying the expansion factor, the escapement goal based on the index of large spawners was then converted to a total drainagewide escapement goal range of 500 to 1,400 large spawners, which was officially adopted in 2018 (Heinl et al. 2017).

Between 1976 and 1980, estimated escapements were mostly below the current lower bound of the escapement goal; in the 6 years that followed, some of the largest escapements were observed. This was then followed by a >30-year period (1988–2019) of reduced but relatively stable escapements averaging about 870 large fish. From 2019 to 2023, escapements were within the escapement goal range in 3 of 5 years (Appendix Figure A1).



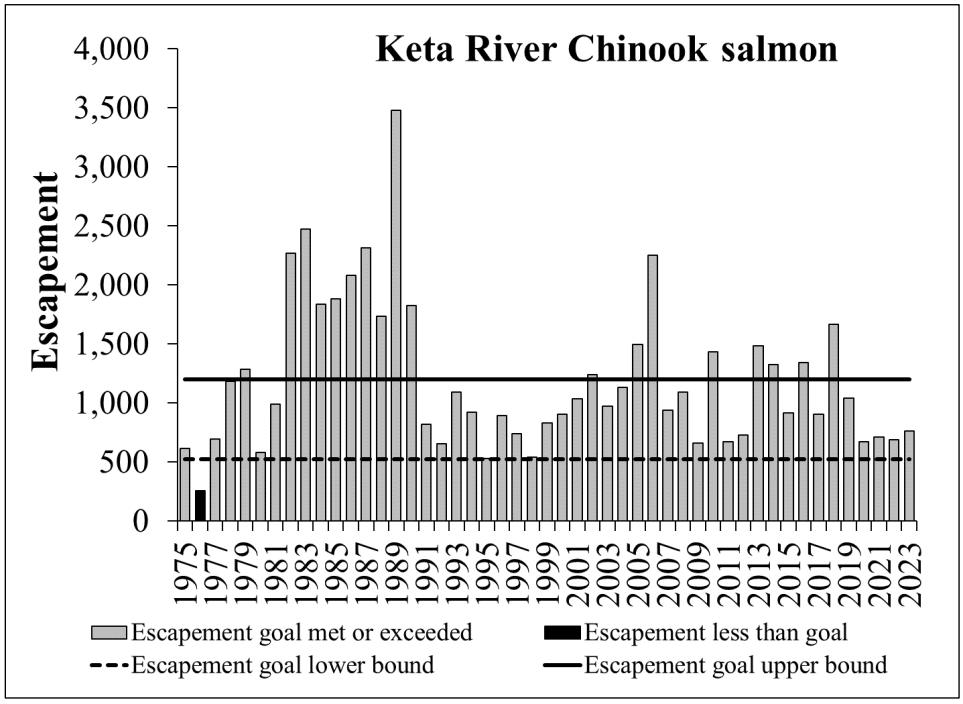
Appendix Figure A1.–Estimated Blossom River Chinook salmon escapements, 1975–2023, and biological escapement goal range of 500–1,400 large spawners as indicated by horizontal lines.

Appendix A2.–Keta River Chinook salmon.

The Keta River is a clearwater system that empties into Behm Canal, 74 km east of Ketchikan, Alaska, and supports a mostly inside-rearing stock of Chinook salmon. The waters of east Behm Canal are closed to Chinook salmon fishing year-round and there are no directed fisheries that target this stock. Immature and mature fish are harvested in marine mixed stock fisheries in Southeast Alaska and northern British Columbia (based on coded wire tag information from the nearby Unuk and Chickamin wild stocks, and Whitman, Neets, and Deer Mountain hatchery stocks). Age data collected since 1998 indicate that about 10% of these fish are sub-yearling smolt. Total escapements were estimated from mark–recapture studies conducted from 1998 to 2000. Escapement estimates in all other years since 1975 were based on expanded helicopter index surveys. Three years (1998–2000) of concurrent mark–recapture estimates and index counts were used to estimate the peak index count expansion factor of 3.01.

Escapement Goals and Stock Status: In 1994, ADF&G established a peak index escapement goal of 300 large spawners (fish ≥660 mm mid eye to tail fork) based on a stock–recruit analysis. In 1997, the goal was revised to a range of 250 to 500 large index spawners (McPherson and Carlile 1997). The current biological escapement goal range of 175 to 400 large index spawners was established in 2012 based on a stock–recruit analysis by Fleischman et al. (2011). After applying the expansion factor, the escapement goal based on the index of large spawners was then converted to a total drainagewide escapement goal range of 550 to 1,300 large spawners, which was officially adopted in 2018 (Heinl et al. 2017).

Like the nearby Blossom River, survey counts were low in the 1970s, increased in the mid- to late 1980s, and have been relatively stable since that time. From 2019 to 2023, escapements were within the escapement goal range in all 5 years (Appendix Figure A2).



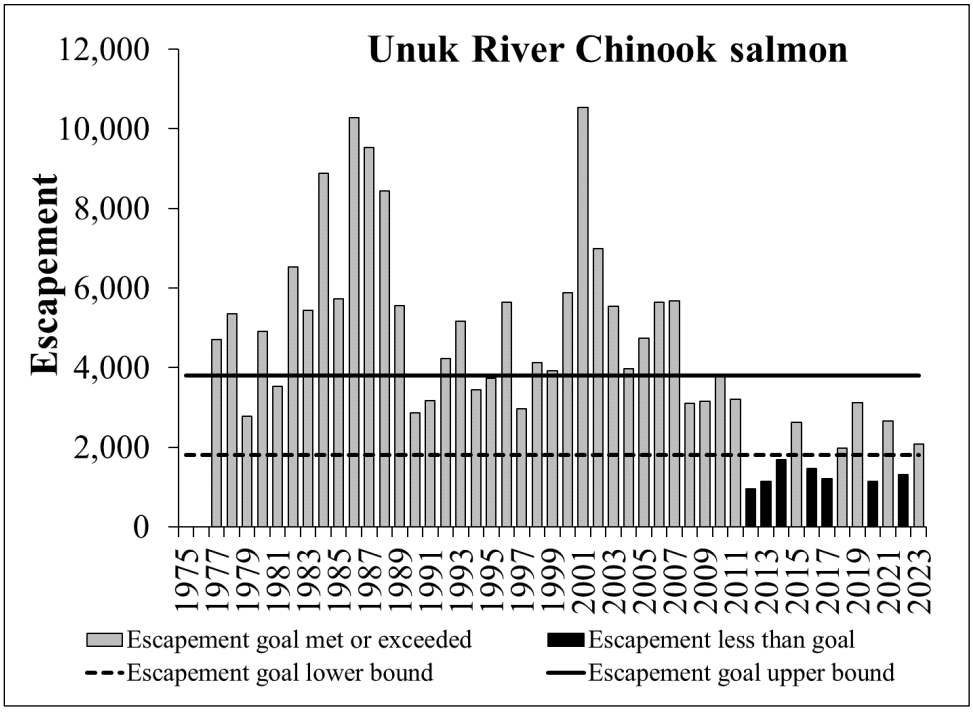
Appendix Figure A2.–Estimated Keta River Chinook salmon escapements, 1975–2023, and biological escapement goal range of 550–1,300 large spawners as indicated by horizontal lines.

Appendix A3.–Unuk River Chinook salmon.

The Unuk River is a glacial system that flows into Behm Canal, 87 km northeast of Ketchikan, Alaska, and supports a mostly inside-rearing stock of Chinook salmon. The waters of east Behm Canal are closed to Chinook salmon fishing and there are no directed fisheries that target this stock. Immature and mature fish are harvested in marine mixed stock fisheries in Southeast Alaska and northern British Columbia. Coded-wire-tagging of this stock was conducted from 1982 to 1986 and from 1992 to present. Escapements of large spawners were based on mark–recapture estimates of total escapement from 1997 to 2009 and in 2011, and expanded index counts using helicopter and foot surveys from 1977 to 1996 and 2010 to 2019. Radiotelemetry studies conducted in 1994 and 2009 indicated that aerial and foot surveys covered 80% of the spawning area. Seven years (1997–2004) of concurrent mark–recapture estimates and survey counts were used to estimate the peak index count expansion factor of 4.83.

Escapement Goals and Stock Status: In 1994, ADF&G established a peak index escapement goal of 875 large spawners (fish ≥660 mm mid eye to tail fork). In 1997, the goal was revised to an index goal range of 650 to 1,400 large spawners (McPherson and Carlile 1997). The current biological escapement goal range of 1,800 to 3,800 large spawners was established in 2009 based on a stock–recruit analysis of the 1982–2001 brood years (Hendrich et al. 2008). The troll fishery accounts for 70% of the total harvest, followed by the sport fishery (15%), the drift gillnet and terminal hatchery fisheries (6% each), and marginal amounts in the purse seine, high seas trawl, and Canadian mixed net fisheries. On average, 95% of the harvest occurs in Southeast Alaska.

The recent abrupt decline in productivity was unexpected given escapements had exceeded the lower bound of the current escapement goal established in 2009 for 34 straight years, and harvest rates averaged around 30% through 2011. However, in 2012, the escapement goal was missed for the first time on record, and the harvest rate was a record high of 72%. From 2019 to 2023, escapements were within the escapement goal range in 3 of 5 years (Appendix Figure A3); harvest rates during these 5 years averaged 28% (range 18–36%).



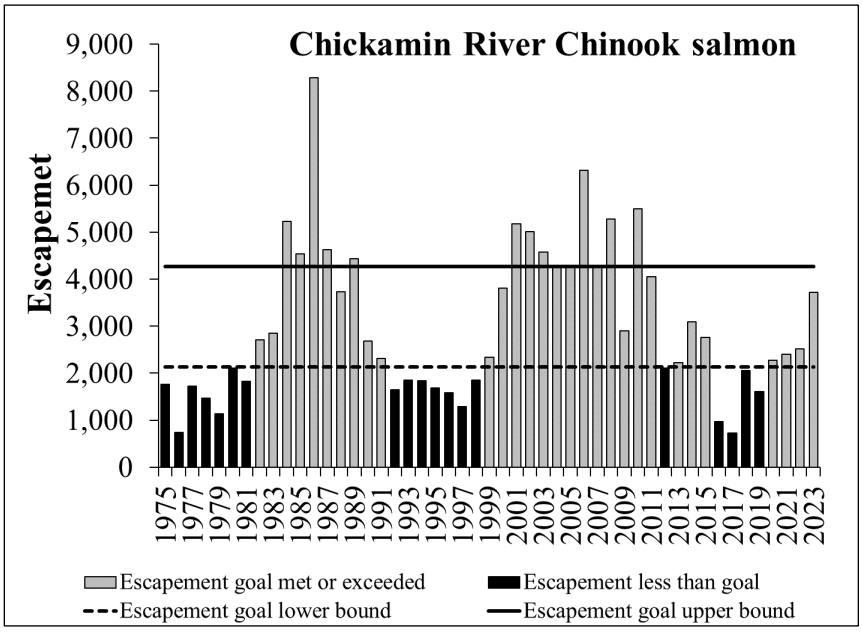
Appendix Figure A3.–Estimated Unuk River Chinook salmon escapements, 1977–2023, and biological escapement goal range of 1,800–3,800 large spawners.

Appendix A4.–Chickamin River Chinook salmon.

The Chickamin River is a glacial system that empties into Behm Canal, 67 km northeast of Ketchikan, Alaska, and supports a mostly inside-rearing stock of Chinook salmon. The waters of east Behm Canal are closed to Chinook salmon fishing year-round and there are no directed fisheries that target this stock. Immature and mature fish are harvested in marine mixed stock fisheries in Southeast Alaska and northern British Columbia. Coded-wire-tagging of this stock was conducted from 1983 to 1988 and from 2001 to 2007. Escapement is measured using index counts of large fish. Mark–recapture studies conducted in 1995, 1996, and from 2001 to 2005 showed that an average 21% of the total escapement is counted during index counts using helicopter and foot surveys (Weller et al. 2007). A radiotelemetry study in 1996 also showed that index counts are conducted in stream reaches where more than 80% of all spawning occurs. Six years (1996, 2001–2005) of concurrent mark–recapture estimates and index counts were used to estimate the peak index count expansion factor of 4.75.

Escapement Goals and Stock Status: In 1994, ADF&G established a peak index escapement goal of 525 large spawners (fish ≥660 mm mid eye to tail fork) based on a stock–recruit analysis by McPherson and Carlile (1997). The goal was revised in 1997 to the current biological escapement goal range of 450 to 900 large index spawners (McPherson and Carlile 1997). After applying the expansion factor, the escapement goal based on the index of large spawners was then converted to a total drainagewide escapement goal range of 2,150 to 4,300 large spawners, which was officially adopted in 2018 (Heinl et al. 2017).

Based on coded wire tagging studies conducted in the 2000s, it was observed that nearly all (99%) of the Chickamin River Chinook salmon harvest occurred in Southeast Alaska. During this time period, the troll fishery accounted for about half of the total harvest, followed by all net fisheries (combined 35%), and sport fisheries (15%). The Chickamin River stock shows a cyclic pattern of escapement; peak survey counts from 1975 to 1981 and 1992 to 1998 were below the current escapement goal range, and those from 1982 to 1991 and 1999 to 2011 were within or above the range. This stock, like other Chinook salmon stocks in Alaska, has recently experienced a decline in productivity. From 2019 to 2023, escapements were within the escapement goal range in 4 of 5 years (Appendix Figure A4).

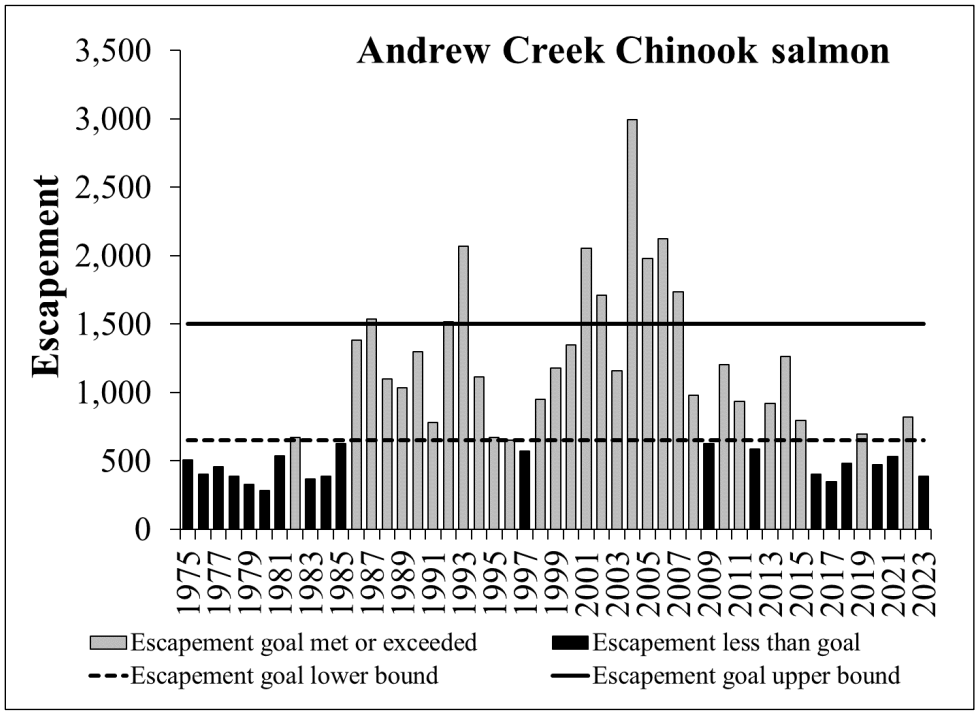


Appendix Figure A4.–Estimated Chickamin River Chinook salmon escapements, 1975–2023, and biological escapement goal range of 2,150–4,300 large spawners.

Appendix A5.–Andrew Creek Chinook salmon.

Andrew Creek is a clearwater tributary of the lower Stikine River, located on the mainland near Petersburg and Wrangell, Alaska, that supports a mostly inside-rearing stock of Chinook salmon. Harvests of immature and mature Andrew Creek fish occur primarily in Southeast Alaska and to a small extent in northern British Columbia fisheries, based on coded wire tag recoveries of Chinook salmon from Southeast Alaska hatcheries that use Andrew Creek brood stock. Escapements were counted through a weir operated across the creek from 1976 to 1984. Escapement estimates in 1975 and from 1985 to 2011 were based on expanded helicopter, fixed-wing aircraft, and foot surveys, and escapement estimates since 2012 have been based solely on expanded foot surveys. Concurrent weir and index count data in 1979, 1981, 1982, and 1984 were used to estimate the peak index count expansion factor of 1.95.

Escapement Goals and Stock Status: In 1985, ADF&G established an escapement goal of 750 large fish which was based on professional judgement at the time. The current biological escapement goal range of 650 to 1,500 large spawners (fish ≥660 mm mid eye to tail fork) was established in 1998 based on a stock–recruit analysis by Clark et al. (1998). The Andrew Creek stock, like other Chinook salmon stocks in Alaska, has recently experienced a decline in productivity. A large terminal marine drift gillnet fishery occurred in the spring, near the mouth of the Stikine River, that targeted Stikine River and other nearby Chinook salmon stocks but that fishery closed in 1976. Then, beginning in 2005, in years of surplus Chinook salmon production to the Stikine River, directed Chinook salmon fisheries were allowed in the marine waters in District 8 near Petersburg and Wrangell. Directed commercial and liberalized sport fisheries were implemented between 2005 and 2009. Limited directed fisheries occurred in 2011, 2012, and 2015, and these directed fisheries likely increased harvest rates on Andrew Creek Chinook salmon. From 2019 to 2023, escapements were within the escapement goal range in 2 of 5 years (Appendix Figure A5).



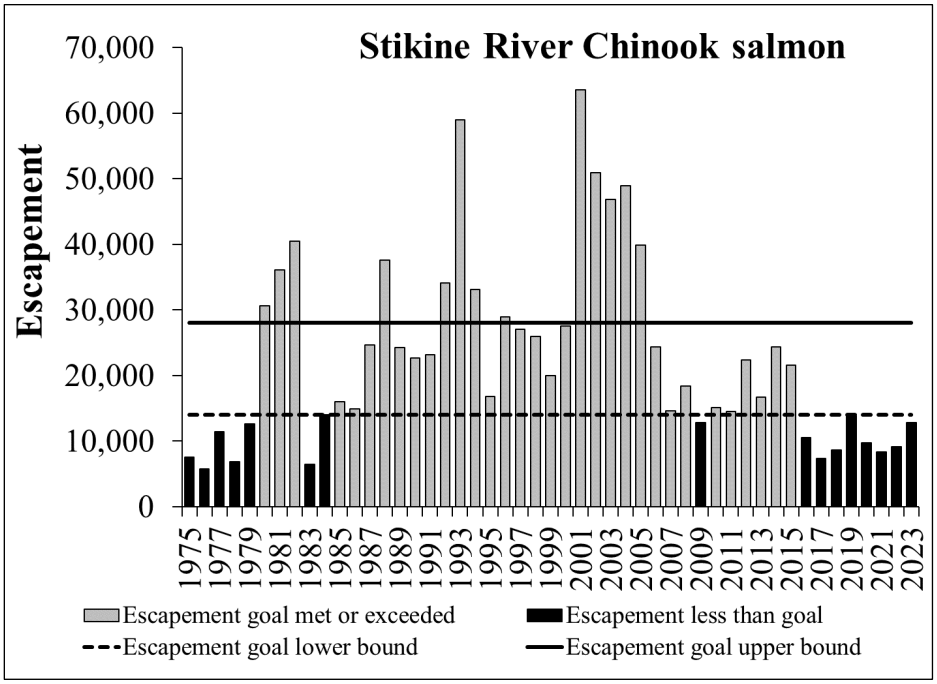
Appendix Figure A5.–Estimated Andrew Creek Chinook salmon escapements, 1975–2023, and biological escapement goal range of 650–1,500 large spawners.

Appendix A6.–Stikine River Chinook salmon.

The Stikine River is a transboundary glacial system that supports an outside-rearing stock of Chinook salmon. The Stikine River originates in British Columbia and flows into central Southeast Alaska near the towns of Petersburg and Wrangell. It is the largest river by volume flowing into Southeast Alaska. Wild smolt have been coded-wire-tagged since 2000 to estimate smolt and adult production and harvest rates. Escapements were evaluated through survey counts conducted on the Little Tahltan River, a tributary in the upper Stikine River drainage, from 1975 to 1984, and weir counts from 1985 to present. Since 1996, mark–recapture studies have been conducted to estimate total Stikine River escapement; these studies indicate the Little Tahltan River weir counts are quite variable in comparison to the total Stikine River escapement and represent 3% to 33% of the total annual escapement.

Escapement Goals and Stock Status: The current biological escapement goal range of 14,000 to 28,000 large spawners (fish ≥660 mm mid eye to tail fork) was established in 2000 based on a stock–recruit analysis by Bernard et al. (2000). Beginning in 2005, during years of surplus Chinook salmon production to the Stikine River, directed commercial and liberalized sport fisheries for Chinook salmon were implemented in the marine waters in District 8 near Petersburg and Wrangell and inriver in Canada. In years of directed Chinook salmon fishing, total harvest rates ranged between 50% and 70%. In other years, harvest rates average only 20%, and most harvest occurs in the late winter and spring commercial troll fisheries, commercial drift gillnet, and sport fisheries in District 8 near Petersburg and Wrangell, and in Canadian inriver gillnet and Aboriginal fisheries. Due to conservation concerns, fisheries known to intercept Stikine River Chinook salmon were restricted beginning in 2018, and since that time harvest rates have been 3–18%.

This stock has shown a decline in productivity in recent years due to reduced marine survivals, and it is unlikely that directed fisheries will be prosecuted until productivity improves. From 2019 to 2023, escapements were below the escapement goal range in all 5 years (Appendix Figure A6), and the harvest rate averaged 12%.

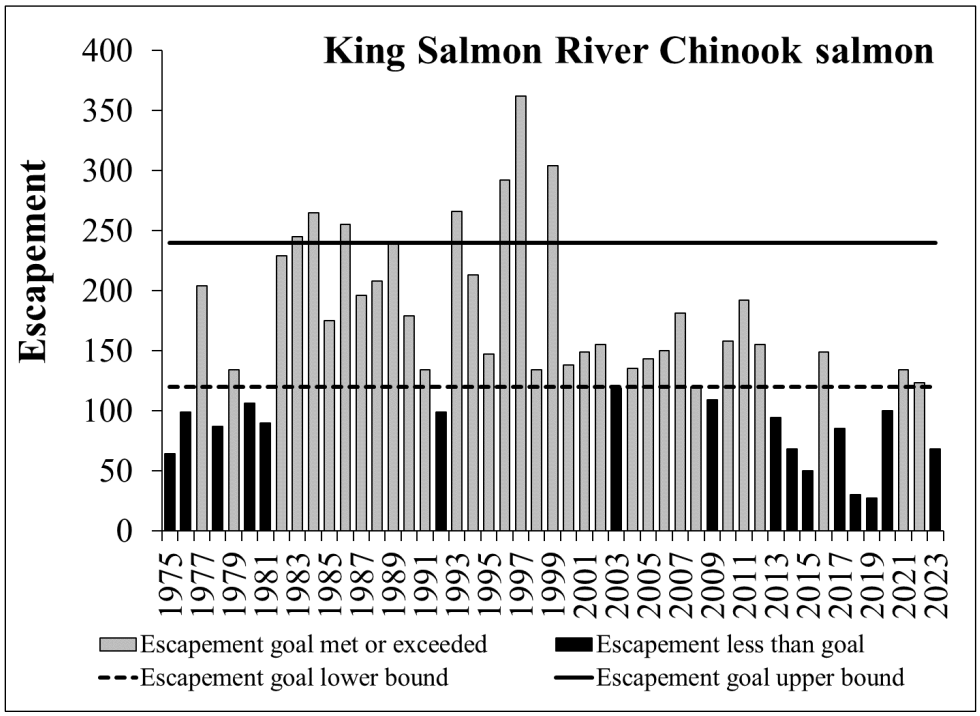


Appendix Figure A6.–Estimated Stikine River Chinook salmon escapements, 1975–2023, and biological escapement goal range of 14,000–28,000 large spawners.

Appendix A7.–King Salmon River Chinook salmon.

The King Salmon River is a clearwater system located on Admiralty Island (and thus the only monitored Chinook salmon island stock), about 30 km south of Juneau, Alaska, that supports a mostly inside-rearing stock of Chinook salmon. This stock does not support directed fisheries but is harvested incidentally in marine waters in sport and commercial fisheries. Escapements were counted through a weir operated across the river from 1983 to 1992. Escapement estimates from 1971 to 1982 and 1993 to 2011 were based on expanded helicopter or foot surveys, and escapement estimates since 2012 have been based solely on expanded foot surveys. Ten years (1983–1992) of concurrent weir and index count data were used to estimate the peak index count expansion factor of 1.52.

Escapement Goals and Stock Status: In 1981, ADF&G established a peak index escapement goal of 200 large spawners (fish ≥660 mm mid eye to tail fork), based on maximum counts of 200 spawners in 1957 and 211 spawners in 1973. In the mid-1980s, the goal was revised to 250 large spawners counted through the weir that was operated at the time. The current biological escapement goal range of 120 to 240 large spawners was established in 1997, based on a stock–recruit analysis of the 1971–1991 brood years (McPherson and Clark 2001). From 2019 to 2023, escapements were within the escapement goal range in 2 of 5 years (Appendix Figure A7).



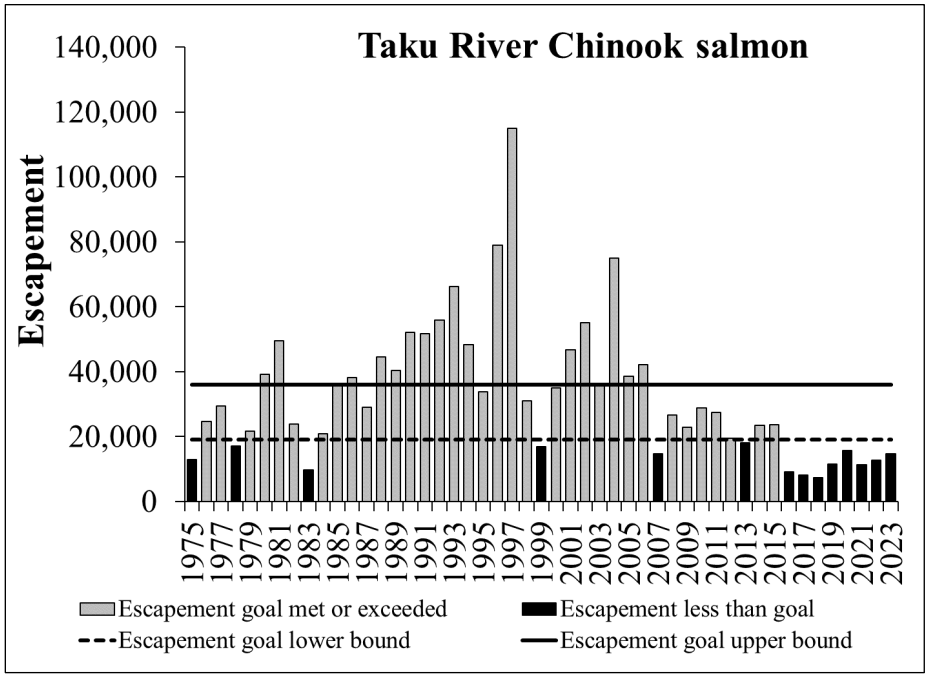
Appendix Figure A7.–Estimated King Salmon River Chinook salmon escapements, 1975–2023, and biological escapement goal range of 120–240 large spawners.

Appendix A8.–Taku River Chinook salmon.

The Taku River is a transboundary glacial system that supports an outside-rearing stock of Chinook salmon. The Taku River originates in British Columbia and drains over 17,000 square kilometers before its terminus at Taku Inlet, approximately 40 km northeast of Juneau. Wild smolt were coded-wire-tagged from 1976 to 1981 and from 1993 to present. Total escapement was estimated from mark–recapture studies conducted from 1989 to 1990, 1995 to 1998, 2000 to 2012, and 2014 to 2019. In all other years, expanded index counts using helicopter surveys were used to estimate escapement. Five years (1989, 1990, 1995–1997) of concurrent mark–recapture estimates and index survey counts were used to estimate the peak index count expansion factor of 5.2.

Escapement Goals and Stock Status: Prior to 1999, several systemwide or index goals were developed based on limited data. In 1999, an escapement goal range of 30,000 to 55,000 large spawners (fish ≥660 mm mid eye to tail fork) was established based on a stock–recruit analysis that maximized smolt production (McPherson et al. 2000). The current biological escapement goal range of 19,000 to 36,000 large spawners was established in 2009 based on a stock–recruit analysis by McPherson et al. (2010).

Starting in 2005, during years of surplus Chinook salmon production to the Taku River, directed commercial and liberalized sport fisheries for Chinook salmon were prosecuted in the marine waters in District 11 near Juneau and in river in Canada. In years of directed fishing, total harvest rates averaged about 40%. In other years, harvest rates average only about 20%, and most harvest occurs in the late winter and spring commercial troll fisheries (mid-March through June), commercial drift gillnet and sport fisheries in District 11 near Juneau, and in Canadian inriver gillnet and Aboriginal fisheries. Due to conservation concerns, fisheries known to intercept Taku River Chinook salmon were restricted beginning in 2018, and since that time, harvest rates have been 4–20%. This stock has shown a decline in productivity in recent years due to reduced marine survivals, and it is unlikely that directed fisheries will be prosecuted until conditions improve. From 2019 to 2023, escapements were below the escapement goal range in all 5 years (Appendix Figure A8), and harvest rate averaged 7%.

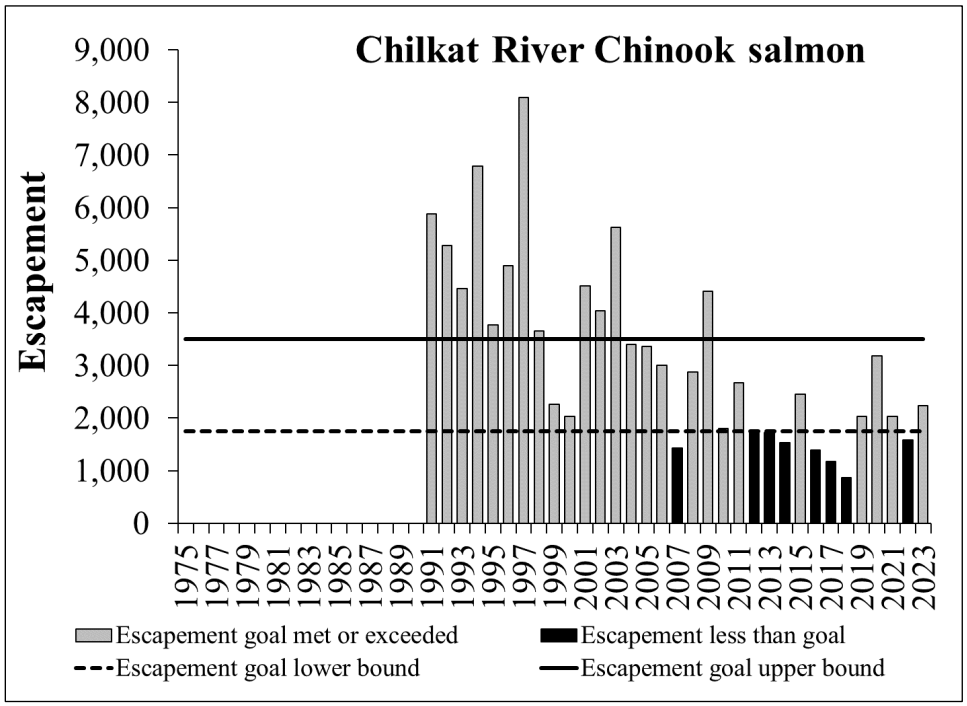


Appendix Figure A8.–Estimated Taku River Chinook salmon escapements, 1975–2023, and biological escapement goal range of 19,000–36,000 large spawners.

Appendix A9.–Chilkat River Chinook salmon.

The Chilkat River is a glacial system located near Haines, Alaska, which supports a mostly inside-rearing stock of Chinook salmon. This stock is targeted in a relatively small terminal marine sport fishery in Chilkat Inlet, and is also harvested incidentally in mixed stock sport, and commercial drift gillnet and troll fisheries, primarily in northern Southeast Alaska. The Chilkat stock is also harvested incidentally in Chilkat Inlet and Chilkat River subsistence fisheries. Lynn Canal fisheries that harvest this stock are managed according to the *Lynn Canal and Chilkat River King Salmon Fishery Management Plan* (5 AAC 33.384) to achieve escapements within the escapement goal range. Escapements are based on estimates of large spawner abundance from a mark–recapture program conducted annually since 1991. Escapement data are relatively precise, with CVs for annual escapements averaging 14% since 1991. From 1975 to 1992, aerial survey counts were conducted on 2 small, clearwater tributaries. Radiotelemetry studies conducted in 1991 and 1992, however, showed that survey counts were not representative of escapement in the entire drainage and the surveys were discontinued. Smolts have been coded-wire-tagged at relatively high rates (8–10%) since 1999; additional wild-stock tagging occurred in 3 prior years.

Escapement Goals and Stock Status: In 1981, ADF&G established an escapement goal of 2,000 large fish based on the assumed fraction of the escapement represented by survey counts (now discontinued). The current biological escapement goal range of 1,750 to 3,500 large spawners (fish age-1.3 and older) was established in 2003 based on a stock–recruit analysis by Ericksen and McPherson (2004). In 2003, the Board of Fisheries also adopted an inriver goal of 1,850 to 3,600 large fish (5 AAC 33.384) to account for incidental harvest in the Chilkat River subsistence sockeye salmon fishery. The Chilkat River stock, like other Chinook salmon stocks in Alaska, has recently experienced a decline in productivity. Coded wire tag information suggests harvest rates have been low, at about 24% for recent brood years. From 2019 to 2023, escapements were within the escapement goal range in 4 of 5 years (Appendix Figure A9), and harvest rates averaged 3%.

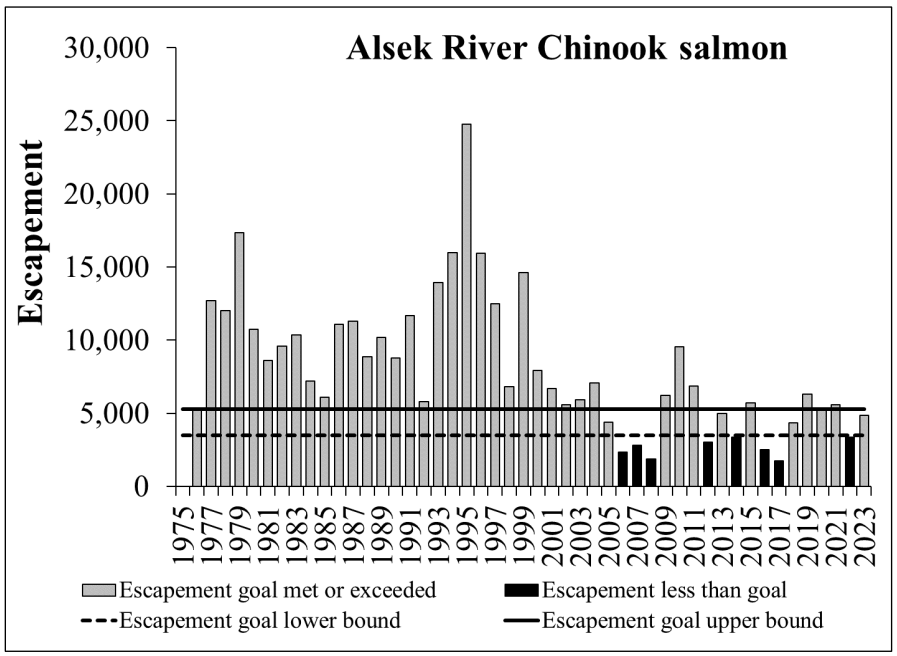


Appendix Figure A9.–Chilkat River Chinook salmon escapements (mark–recapture estimates), 1991–2023, and biological escapement goal range of 1,750–3,500 large spawners.

The Alsek River is a transboundary glacial system that originates in southwestern Yukon and northwestern British Columbia and flows into the Gulf of Alaska approximately 80 km southeast of Yakutat. This river supports an outside-rearing stock of Chinook salmon. Since 1976, the principle means of indexing escapement has been through a weir operated at the Klukshu River, 1 of 51 tributaries of the Tatshenshini River, the principal salmon-producing branch of the Alsek River. Mark–recapture studies of total escapement in the Alsek River were conducted from 1998 to 2004. Seven years (1998–2004) of concurrent mark–recapture estimates and measures of inriver run (weir counts plus any downstream harvest in the Klukshu River) were used to estimate the Klukshu inriver run expansion factor of 4.0.

Escapement Goals and Stock Status: In 1998, a biological escapement goal of 1,100 to 2,300 Chinook salmon was established for the Klukshu River (McPherson et al. 1998). In 2013, the goal was revised to a biological escapement goal of 800 to 1,200 fish for the Klukshu River, with a corresponding drainagewide Alsek River biological escapement goal of 3,500 to 5,300 fish based on run-reconstruction and stock–recruit analysis (Bernard and Jones 2010; TTC 2014). Unlike other Chinook salmon escapement goals in Southeast Alaska, which are germane to large fish, both the Alsek and Klukshu River goals includes ocean-age-2 fish (fish age-1.2 and older). Because the drainagewide escapement is a simple linear expansion of the Klukshu River escapement, and for consistency with other index systems in Southeast Alaska that report total drainagewide escapements, the drainagewide Alsek River escapement goal is the preferred escapement goal performance metric, and the Klukshu River goal was eliminated during the 2017/2018 Board of Fisheries cycle (Heinl et al. 2017).

Directed Canadian sport and Aboriginal fisheries occur in various upriver sections of the Alsek River. In the U.S., some fish are caught as bycatch in the commercial set gillnet sockeye salmon and subsistence fisheries that take place in the lower river and at Dry Bay. The Alsek River stock, like other Chinook salmon stocks in Alaska, has recently experienced a decline in productivity. Harvest rates for this stock are some of the lowest observed for a wild Chinook salmon stock and have averaged only about 12% since 1976. From 2019 to 2023, escapements in the Alsek River were within or above the escapement goal range in 4 of 5 years (Appendix Figures A10), and harvest rates averaged 4%.

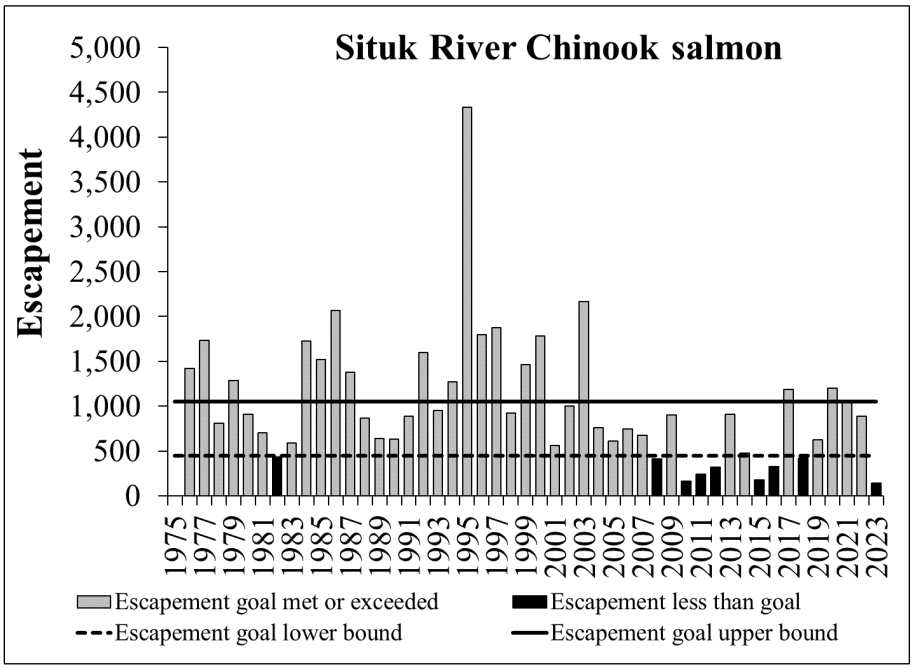


Appendix Figure A10.–Estimated Alsek River Chinook salmon escapements, 1976–2023, and biological escapement goal range of 3,500–5,300 fish.

Appendix A11.–Situk River Chinook salmon.

The Situk River is a clearwater system located near Yakutat, Alaska, that supports an outside-rearing stock of Chinook salmon. Situk-origin Chinook salmon are harvested primarily in directed sport, commercial, and subsistence fisheries located in river, in the Situk-Ahrnklin Inlet, and in nearby surf waters. Fisheries that target this stock are managed according to the *Situk-Ahrnklin Inlet and Lost River King Salmon Fisheries Management Plan* (5 AAC 30.365) to achieve escapements within the escapement goal range. Escapements are based on weir counts minus upstream sport fishery harvests, which are estimated from an on-site creel survey and a postseason mail-out survey. The weir has been operated annually since 1976 and was also operated from 1928 to 1955.

Escapement Goals and Stock Status: In 1991, ADF&G established an escapement goal of 600 large spawners based on stock–recruit analysis, and in 1997, the escapement goal was revised (McPherson et al. 2003) to a range of 500 to 1,000 large spawners (fish ≥660 mm mid eye to tail fork). A new biological escapement goal range of 450 to 1,050 large spawners was established in 2003 using a more robust dataset and an updated stock–recruit analysis (McPherson et al. 2005). The Situk River stock, like other Chinook salmon stocks in Alaska, has recently experienced a decline in productivity. Sport fishery regulations and harvests have been significantly restricted, with partial (above weir) or total closures since 2008. Terminal net fishery harvests for commercial and subsistence fisheries were also curtailed beginning in 2008, but retention of Chinook salmon incidentally harvested in net fisheries continued until 2011. Significant management actions have been taken since 2011, and all inlet net fisheries have been closed to the retention of Chinook salmon unless it was apparent the lower bound of the escapement goal would be met (Zeiser and Woods 2016). Total annual terminal harvest rates for all gear groups combined averaged about 60% from 1990 to 2003; however, harvest rates have been substantially lower since 2004. From 2019 to 2023, escapements were within or above the escapement goal range in 4 of 5 years (Appendix Figure A11), and harvest rates averaged 2%.



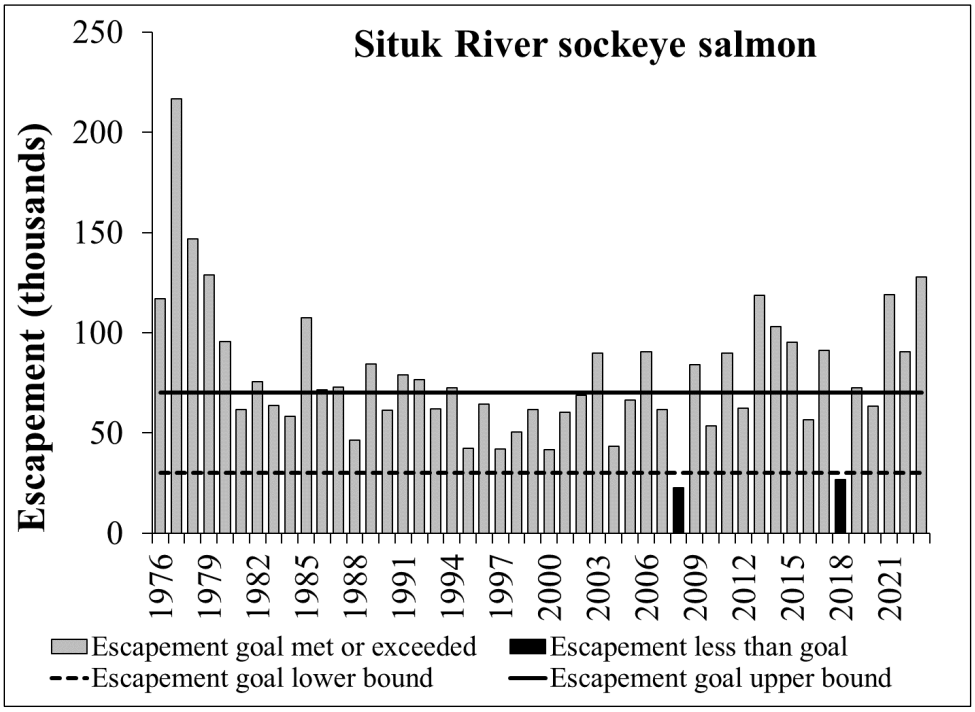
Appendix Figure A11.–Situk River Chinook salmon escapements (weir counts), 1976–2023, and biological escapement goal range of 450–1,050 large spawners.

APPENDIX B.
SOCKEYE SALMON ESCAPEMENT GOAL PERFORMANCE

Appendix B1.–Situk River sockeye salmon.

The Situk River is located on the Yakutat forelands, approximately 15 km southeast of Yakutat, Alaska. The river flows into the Situk-Ahrnklin Inlet, the site of the oldest and, historically, most productive set gillnet fishery in the Yakutat area (Woods and Zeiser 2010). Sockeye salmon escapements have been enumerated annually at an adult counting weir on the Situk River since 1976.

Escapement Goals and Stock Status: Prior to 1987, ADF&G managed the Situk-Ahrnklin Inlet fisheries to achieve a Situk River escapement of 80,000–100,000 sockeye salmon (ADF&G 1988). An escapement goal range of 40,000–55,000 sockeye salmon was established in 1987 based on preliminary stock–recruit analysis (McPherson et al. 1987). The escapement goal was revised in 1995 to a biological escapement goal range of 30,000–70,000 sockeye salmon based on a stock–recruit analysis by Clark et al. (1995a), and the goal remained unchanged following an updated analysis by Clark et al. (2002). From 2019 to 2023, escapements were within or above the escapement goal range in all 5 years (Appendix Figure B1).

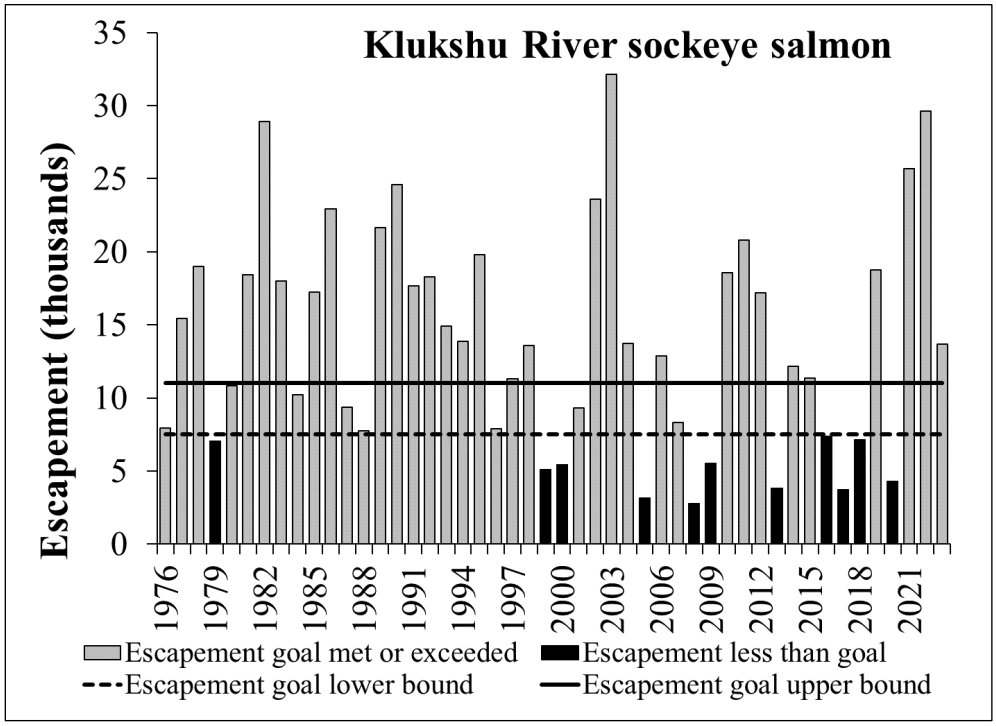


Appendix Figure B1.–Situk River sockeye salmon escapement (weir counts), 1976–2023, and biological escapement goal range of 30,000–70,000 fish.

Appendix B2.–Klukshu (Alsek) River sockeye salmon.

The Alsek River is a large transboundary river located on the mainland, approximately 80 km southeast of Yakutat, Alaska. Alsek River sockeye salmon are harvested primarily in U.S. commercial set gillnet fisheries in Dry Bay, at the mouth of the Alsek River, and in Canadian recreational and traditional aboriginal fisheries that take place primarily in the upper Tatshenshini drainage. Escapements to the Klukshu River, a major sockeye salmon-producing tributary of the Alsek River, have been enumerated annually since 1976 at an adult counting weir just upstream of the confluence of the Klukshu and Tatshenshini Rivers. The Klukshu weir is the principal tool for monitoring sockeye salmon stocks in the Alsek River (TTC 2014).

Escapement Goals and Stock Status: In 1984, the Transboundary Technical Committee of the Pacific Salmon Commission established an interim Alsek River drainage escapement goal range of 33,000–58,000 sockeye salmon, of which 12,000–35,000 were expected to enter the Klukshu River (TTC 1990). In 2000, a biological escapement goal of 7,500–15,000 sockeye salmon was established for the Klukshu River based on a stock–recruit analysis (Clark and Etherton 2000). In 2013, the Klukshu River goal was revised to biological escapement goal range of 7,500–11,000 fish, and a drainagewide biological escapement goal range of 24,000–33,500 fish was established for the Alsek River, based on a run-reconstruction and stock–recruit analysis (Eggers and Bernard 2011; TTC 2014). In 2018, however, the department recommended eliminating the Alsek River sockeye salmon goal (Heinl et al. 2017) due to lack of timely escapement information with which to measure performance and based on management considerations, which continue to be focused on meeting the escapement goal for the Klukshu River (TTC 2019). From 2019 to 2023, Klukshu River spawning escapements were above the escapement goal range in 4 of 5 years (Appendix Figure B2).

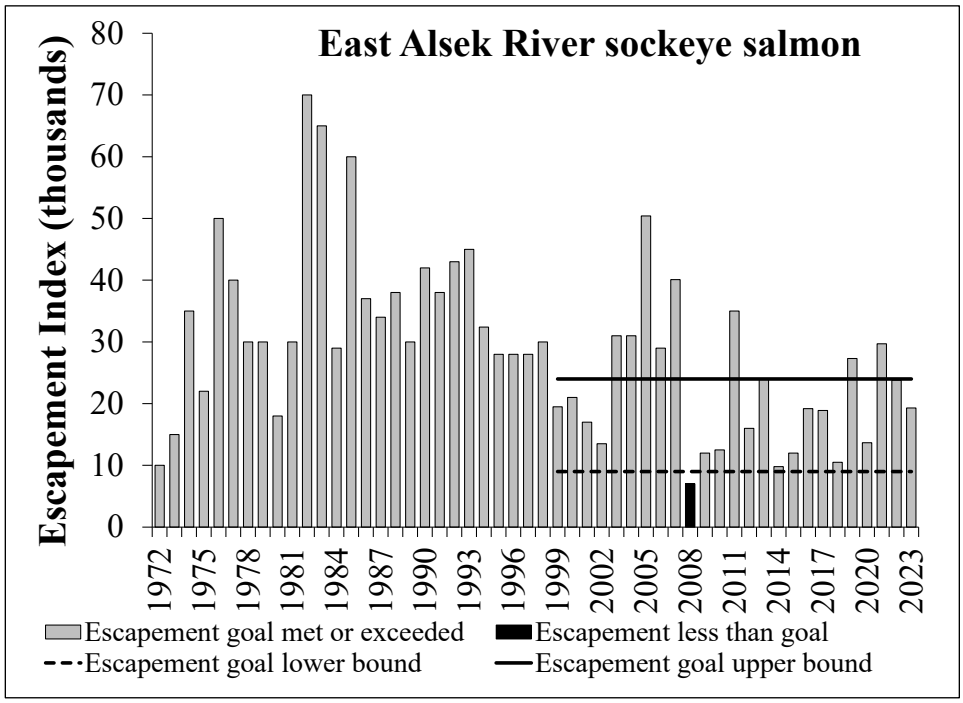


Appendix Figure B2.–Klukshu River sockeye salmon escapement (weir counts adjusted for upstream removals), 1976–2023, and biological escapement goal range of 7,500–11,000 spawners.

Appendix B3.–East Alsek River sockeye salmon.

The East Alsek River is located on the Alsek River flood plain approximately 90 km southeast of Yakutat, Alaska. The East Alsek River was historically a distributary channel of the Alsek River but is now fed solely by groundwater and has no direct connection to the Alsek River (Smith et al. 2006). The adjacent Doame River is a clearwater system with 2 lakes, located just east of the East Alsek River. The Doame River once entered the Gulf of Alaska directly, but a 1966 earthquake caused the river to flow west and empty into the East Alsek River (Clark et al. 2003). Sockeye salmon are harvested in the District 182-20 commercial set gillnet fishery in the East Alsek River lagoon below the confluence of the 2 rivers. Sockeye salmon escapements have been assessed through aerial surveys since the early 1970s (Clark et al. 2003).

Escapement Goals and Stock Status: The East Alsek River run has undergone dramatic response to environmental changes over the past century due to rapid post-glacial uplift of the Alsek River floodplain: colonization of the river by sockeye salmon in the early 1900s, population explosion in the 1970s–1980s, and population decline due to deteriorating spawning habitat in the 1990s, which was thought to be the result of increased sedimentation and growth of aquatic vegetation (Smith et al. 2006; Faber 2008). In 1995, ADF&G established a biological escapement goal range of 26,000–57,000 sockeye salmon counted on peak aerial surveys in the East Alsek-Doame Rivers combined, based on a stock–recruit analysis (Clark et al. 1995b). In 2003, the escapement goal was revised downward to a biological escapement goal range of 13,000–26,000 sockeye salmon (Clark et al. 2003). In 2018, the escapement goal was revised to a sustainable escapement goal range of 9,000–24,000 fish counted on a peak survey in the East Alsek River (not including Doame River counts), based on the 5th and 65th percentiles of 1999–2016 survey counts (Heinl et al. 2017). Doame River counts were removed from the analysis because that run is thought to be substantially smaller and earlier in run timing than the East Alsek River run (Clark et al. 2003), and because management decisions in the fishery are based on abundance in the East Alsek River. From 2019 to 2023, peak survey counts were within or above the escapement goal range in all 5 years (Appendix Figure B3).

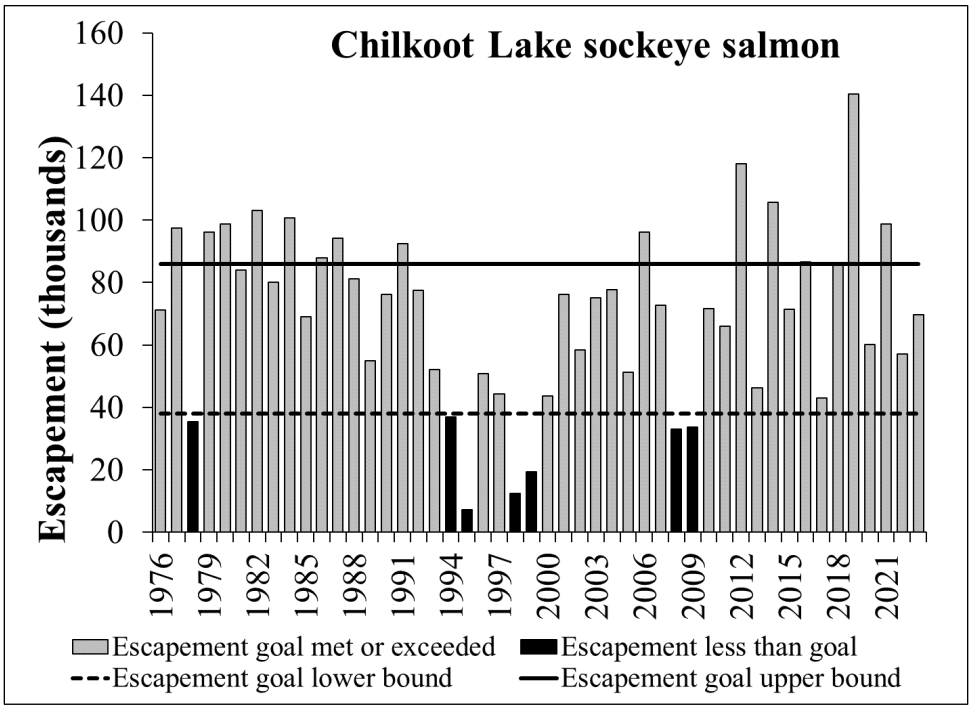


Appendix Figure B3.–East Alsek River sockeye salmon escapement index (peak aerial survey counts), 1972–2023, and recommended sustainable escapement goal range of 9,000–24,000 fish. Counts do not include the Doame River.

Appendix B4.–Chilkoot Lake sockeye salmon.

Chilkoot Lake is a glacial system located on the mainland, approximately 13 km northwest of Haines, Alaska. The Chilkoot River drainage supports one of the larger runs of sockeye salmon in the region, which is harvested primarily in the District 15 Lynn Canal commercial drift gillnet fishery, and in a subsistence fishery in Lutak Inlet. Escapements have been enumerated annually at an adult counting weir in the Chilkoot River, below the outlet of the lake, since 1976.

Escapement Goals and Stock Status: This stock was managed for informal escapement goals of 80,000–100,000 sockeye salmon starting in 1976, and 60,000–80,000 sockeye salmon starting in 1981 (Bergander et al. 1988; McPherson 1990). These former goals were based on limnological and limited stock–recruit analyses. In 1990, ADF&G established a biological escapement goal range of 50,500–91,500 sockeye salmon divided into separate goals for early and late runs, based on a stock–recruit analysis (McPherson 1990). The run underwent an extended downturn in production in the 1990s related to changes in the glacially turbid lake rearing environment; very warm summers increased the silt load in the lake, which greatly reduced zooplankton abundance (Eggers et al. 2009b). Mark–recapture estimates from 1996 to 2011 were greater than weir counts (Bachman et al. 2014), consistent with the idea that weir counts likely underrepresented total escapement, but differences between the 2 estimates were not consistent enough to calibrate weir counts. Geiger et al. (2005) recommended maintaining essentially the same escapement goal range, 50,000–90,000 sockeye salmon, but reclassified the goal as a sustainable escapement goal. In 2009, the escapement goal was changed to a sustainable escapement goal range of 38,000–86,000 sockeye salmon based on an updated stock–recruit analysis (Eggers et al. 2008, 2009b). The goal was revisited in Brenner et al. (2018) and Heinl et al. (2021) using similar methods to Eggers et al. (2009b) but implemented in a Bayesian framework. The updated analyses suggested that the escapement goal should remain unchanged until returns from the very large brood year 2019 escapement can be incorporated into the analysis (returns fully realized in 2025). From 2019 to 2023, escapements were within or above the escapement goal range in all 5 years (Appendix Figure B4).



Appendix Figure B4.–Chilkoot Lake sockeye salmon escapement (weir counts), 1976–2023, and sustainable escapement goal range of 38,000–86,000 fish.

Appendix B5.–Chilkat Lake sockeye salmon.

Chilkat Lake is located in the Chilkat River drainage, approximately 44 river km upstream from the city of Haines, Alaska. The lake supports one of the region's larger sockeye salmon runs, which is harvested primarily in the District 15 Lynn Canal commercial drift gillnet fishery. Escapements have been variously estimated through weir counts (1967–1995, 1999–2007), mark–recapture estimates (1994–2016), and dual-frequency identification sonar (DIDSON), which has been used as the primary assessment method since 2008 (Eggers et al. 2010; Bednarski et al. 2017).

Escapement Goals and Stock Status: Prior to 1990, the Chilkat Lake sockeye salmon run was managed for informal escapement goals of 60,000–70,000 fish (1976–1980) and 70,000–90,000 fish (1981–1989) (Bergander et al. 1988). In 1990, ADF&G established a biological escapement goal range of 52,000–106,000 sockeye salmon (with separate goals for early and late runs), based on a stock–recruit analysis (McPherson 1990). Later efforts to update the escapement goal were hindered by concerns regarding accuracy of weir counts and lake stocking of sockeye salmon fry in the 1990s, which caused severe declines in zooplankton populations (Geiger et al. 2005). In 2006, the existing goal was converted into mark–recapture units and revised to a sustainable escapement goal range of 80,000–200,000 sockeye salmon (Geiger et al. 2005). In 2009, the goal was revised to the current biological escapement goal range of 70,000–150,000 sockeye salmon, based on an autoregressive stock–recruit model with weir counts scaled to mark–recapture estimates and accounted for fry stocking production (Eggers et al. 2008, 2010).

Following comprehensive review of historical stock assessment data (Bednarski et al. 2017), the escapement goal analysis was updated using age-structured state-space stock–recruit models to better account for multiple overlapping methods of escapement enumeration and missing data (Miller and Heinl 2018). Resulting parameter estimates from the analysis were very similar to those estimated by Eggers et al. (2010). The most recent review (in this report) followed methods by Miller and Heinl (2018), with data updated to include brood years 2013−2018, recommended maintaining the current biological escapement goal of 70,000–150,000 sockeye salmon. From 2019 to 2023, escapements were within the escapement goal range in 3 of 5 years (Appendix Figure B5).

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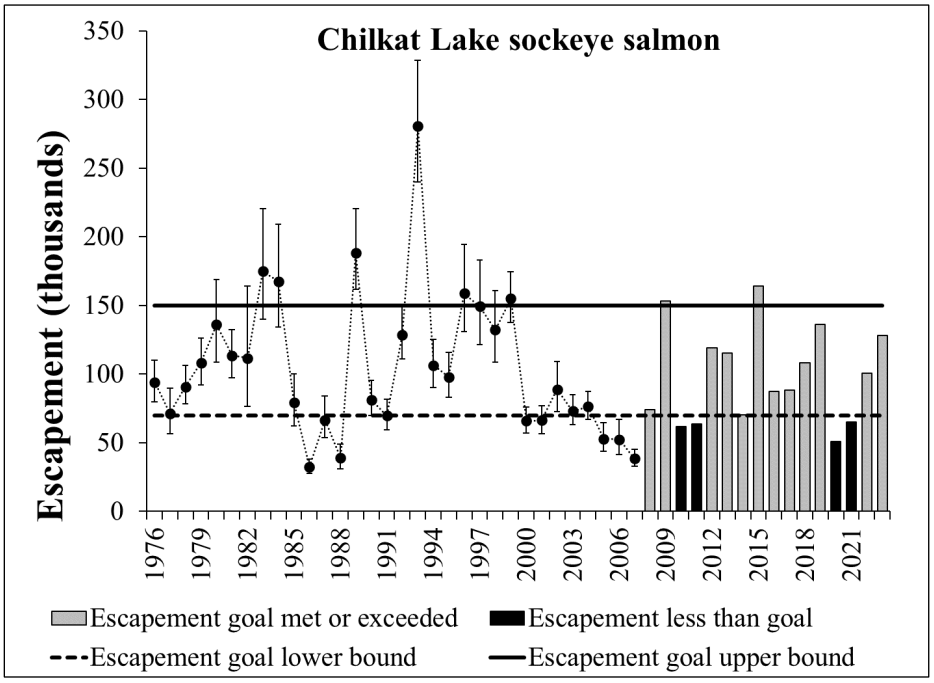
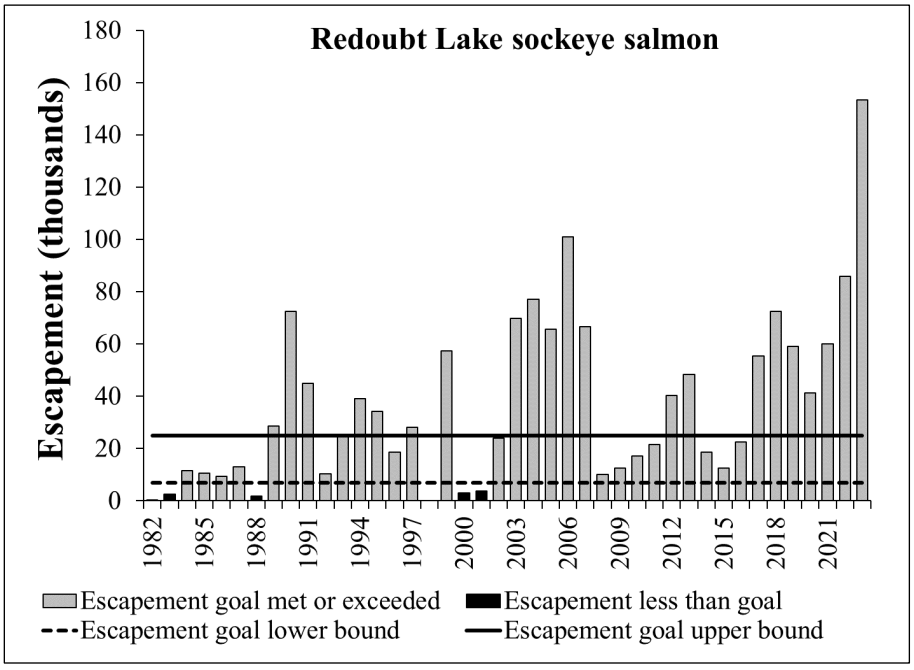


Appendix Figure B5.–Estimated Chilkat Lake sockeye salmon escapements, 1976–2023, and biological escapement goal range of 70,000–150,000 fish. Expanded DIDSON counts are shown as columns, 2008–2023; escapements estimated from model outputs from the most recent review in this report (posterior medians and 95% credible intervals) are shown as data points, 1976–2007.

Appendix B6.–Redoubt Lake sockeye salmon.

Redoubt Lake is located on Baranof Island, approximately 19 km south of Sitka, Alaska. Redoubt Lake sockeye salmon are harvested primarily in terminal subsistence and sport fisheries and, to a lesser extent, mixed stock commercial fisheries in Sitka Sound. Sockeye salmon escapements have been enumerated annually at an adult counting weir at the outlet of the lake in all but one year since 1982 (the U.S. Department of Agriculture [USDA] Forest Service has operated the weir since the mid-1990s).

Escapement Goals and Stock Status: In 2003, ADF&G recommended a biological escapement goal range of 10,000–25,000 sockeye salmon based on a stock–recruit analysis (Geiger 2003). In 2003, the Board of Fisheries adopted a management plan for Redoubt Lake and set an optimal escapement goal range of 7,000–25,000 sockeye salmon (5 AAC 01.760 *Redoubt Bay and Lake Sockeye Salmon Fisheries Management Plan*). The management plan provides guidelines for allocation of Redoubt Lake sockeye salmon between subsistence, sport, and commercial fisheries based on projected inseason run strength. Redoubt Lake was intensively fertilized during most years when stock–recruit observations were made (1984–1987 and 1990–1995). Lake fertilization was discontinued from 1996 to 1998, but a less intensive fertilization program has been conducted annually by the USDA Forest Service since 1999. An attempt to assess the effect of the lake fertilization project on freshwater production and adult recruitment of sockeye salmon was limited by lack of data from non-fertilized years (Beauchamp and Overman 2004). All but 3 brood years since 1982 (1987, 1995, 1996) experienced some level of lake fertilization. The most recent escapement goal analysis by Heinl et al. (2021) was based on a Ricker stock–recruit analysis of brood years 1982 through 2013 and recommended maintaining the current biological escapement goal range of 10,000–25,000 sockeye salmon, counted annually at the Redoubt Lake weir. The current goal is an optimal escapement goal of 7,000–25,000 fish (5 AAC 01.760) developed by the Board of Fisheries in 2003. From 2019 to 2023, escapements were above the escapement goal range in all 5 years (Appendix Figure B6).

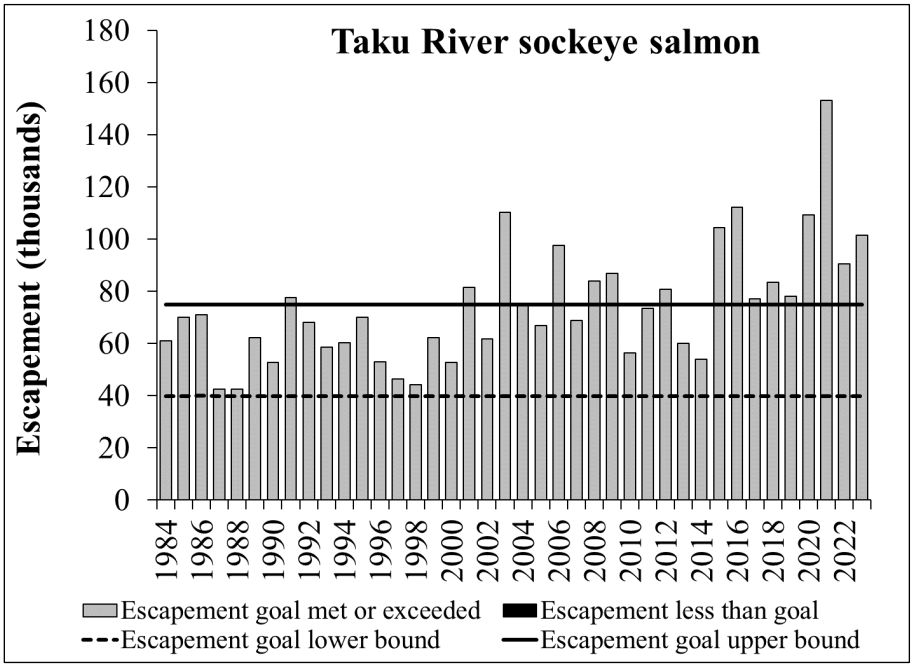


Appendix Figure B6.–Redoubt Lake sockeye salmon escapement (weir counts), 1982–2023, and optimal escapement goal range of 7,000–25,000 fish. The Redoubt Lake weir was not operated in 1998.

Appendix B7.–Taku River sockeye salmon.

The Taku River is a large transboundary river located on the mainland, approximately 30 km northeast of Juneau, Alaska. Taku River sockeye salmon are harvested primarily in Alaska commercial drift gillnet fisheries in District 11 and Canadian inriver fisheries. Harvests have been estimated through postseason run-reconstruction analysis by the Transboundary Technical Committee of the Pacific Salmon Commission (PSC). Sockeye salmon escapements have been estimated through joint U.S./Canada mark–recapture studies conducted annually since 1984.

Escapement Goals and Stock Status: In 1985, the Transboundary Technical Committee established an escapement goal range of 71,000–80,000 sockeye salmon in Canadian spawning areas of the Taku River drainage. The goal was based on professional judgment and was long considered an "interim" goal (TTC 2014). In 2003, the department classified the goal as a sustainable escapement goal (Geiger et al. 2004). Provisions of the 2019 U.S./Canada Pacific Salmon Treaty called for development of a bilaterally approved maximum sustainable yield escapement goal to be established prior to the 2020 fishing season. A Taku River Sockeye Working Group was created to review the stock assessment program, update historical data, and conduct stock–recruit analysis of revised estimates of abundance (Miller and Pestal 2020; Pestal et al. 2020). A biological escapement goal range of 40,000 to 75,000 naturally spawned sockeye salmon was adopted by the PSC Transboundary River Panel prior to the start of the 2020 fishing season, which was based on a Bayesian state-space Ricker model that included a one year-lag autoregressive component and data through brood year 2014 (TTC 2020). The spawner–recruit analysis was recently updated (results in this report) with the inclusion of recently completed brood years (2015–2018), updates to historical data, and use of improved analytical techniques, which ultimately improved precision from the Miller and Pestal (2020) analysis. The escapement goal review committee's findings are to maintain the current Taku River sockeye salmon BEG of 40,000–75,000 naturally spawned Taku River sockeye salmon. From 2019 to 2023, estimated escapements were above the new biological escapement goal range in all 5 years (Appendix Figure B7).

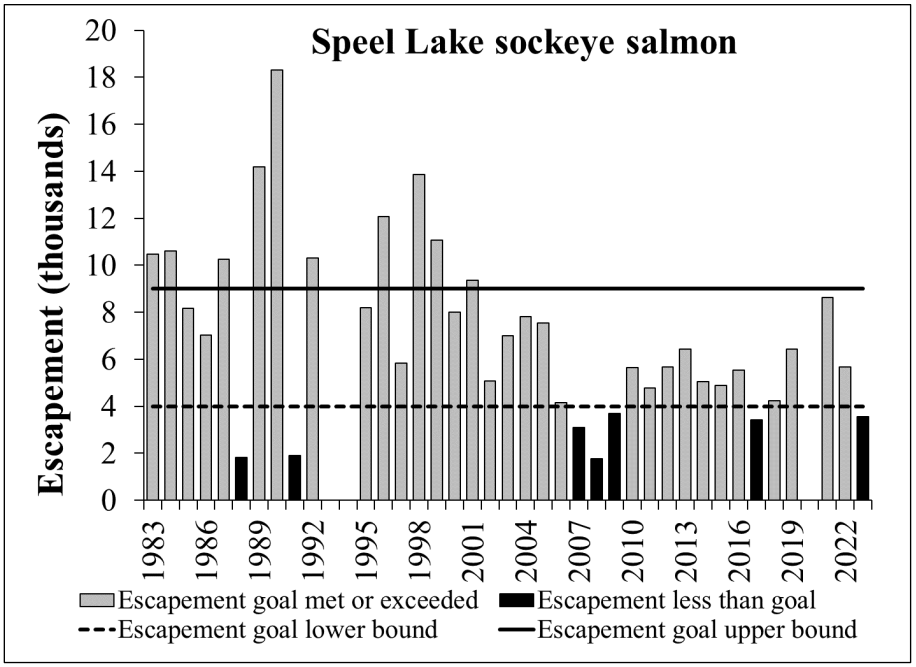


Appendix Figure B7.– Estimated Taku River sockeye salmon escapements, 1984–2023, and biological escapement goal range of 40,000–75,000 fish.

Appendix B8.–Speel Lake sockeye salmon.

Speel Lake is located on mainland Alaska, in the Speel Arm of Port Snettisham, approximately 50 km southeast of Juneau, Alaska. Speel Lake sockeye salmon are harvested in traditional mixed stock commercial drift gillnet fisheries in District 11 and in terminal hatchery fisheries in Speel Arm. Escapements have been enumerated annually at an adult counting weir at the outlet of the lake in all but 2 years since 1983 (the weir has been operated by Douglas Island Pink and Chum, Inc., since 1996). Weir counts during most of the 1980s and 1990s underestimated the escapement, however, due to early removal of the weir. Speel Lake harvests have been estimated annually in conjunction with U.S./Canada stock identification programs to allocate harvests in the District 11 drift gillnet fisheries.

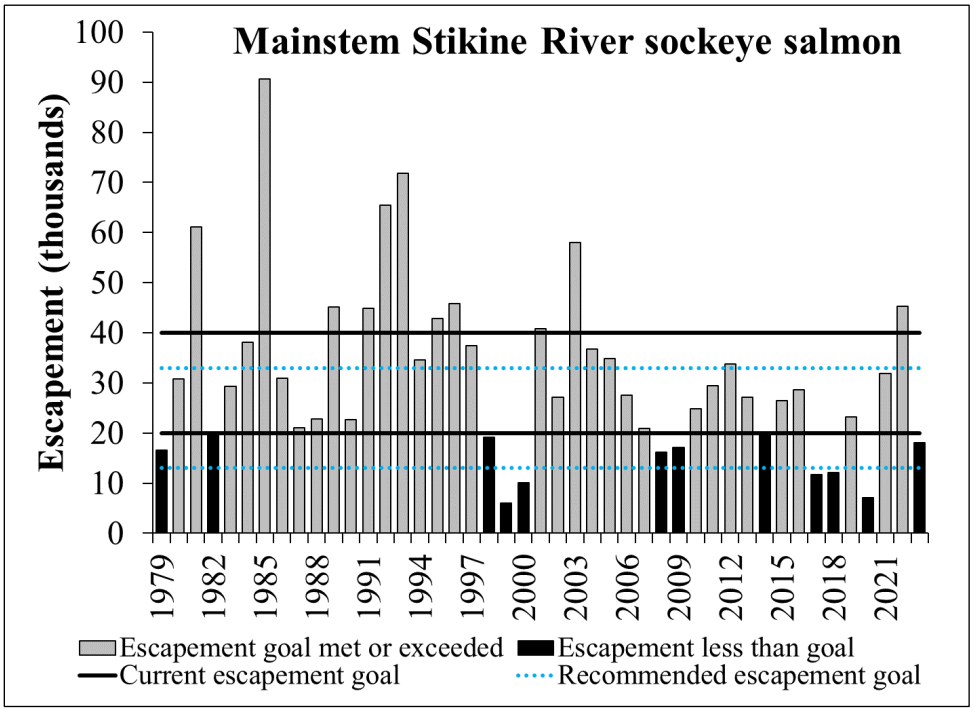
Escapement Goals and Stock Status: The Speel Lake sockeye salmon run was managed for informal escapement goals of 10,000 fish in the 1980s, then 5,000 fish starting in 1992. In 2003, ADF&G established a biological escapement goal range of 4,000–13,000 sockeye salmon, the range of escapements estimated to provide for greater than 80% of maximum sustained yield (Riffe and Clark 2003). Riffe and Clark (2003) recommended the Speel Lake weir continue to be operated through late September to ensure complete enumeration of the escapement and recommended the escapement goal be reviewed once sufficient new information had been collected. Heinl et al. (2014b) reviewed and updated Speel Lake sockeye salmon stock assessment information and updated the stock–recruit analysis. As a result, the goal was changed to a sustainable escapement goal range of 4,000–9,000 fish based on the range of escapements estimated to provide for 70–80% of maximum sustained yield. A recent review (Heinl et al. 2021) suggests the escapement goal should remain unchanged. From 2019 to 2023, escapements were within the escapement goal range in 3 of 4 years (Appendix Figure B8); the weir was not operated in 2020.



Appendix Figure B8.–Estimated Speel Lake sockeye salmon escapements (expanded weir counts 1984–2001 and weir counts 1983, 2002–2023), 1983–2023, and sustainable escapement goal range of 4,000–9,000 fish. The Speel Lake weir was not operated in 1993, 1994, or 2020.

The Stikine River is a large transboundary river located on the mainland, approximately 15 km north of Wrangell, Alaska. The mainstem Stikine stock includes all Stikine River sockeye salmon populations aside from wild and hatchery runs at Tahltan and Tuya Lakes (TTC 2014). Mainstem Stikine sockeye salmon are harvested primarily in Alaska commercial drift gillnet fisheries in Districts 6 and 8 and in Canadian inriver fisheries. Harvests and escapements have been estimated through postseason run-reconstruction analysis of fishery data by the Transboundary Technical Committee of the Pacific Salmon Commission.

Escapement Goals and Stock Status: In 1987, the Transboundary Technical Committee established an interim escapement goal range of 20,000–40,000 sockeye salmon for the mainstem Stikine stock based on professional judgment regarding stock productivity, the ability of existing systems to manage to them, precision and accuracy of stock assessment abundance estimates, and the degree of risk considered acceptable (TTC 1987; unpublished Wood and Johnston 1990 report;[1] TTC 1993). ADF&G considered the goal to be a sustainable escapement goal in 2003 (Geiger et al. 2004). The spawner–recruit analysis was recently updated (results in this report) using a linearized Ricker spawner–recruit function with an autoregressive lognormal process error with a lag of 1 year using brood years 1983 to 2014. The escapement goal review committee recommends replacing the current SEG with a BEG range of 13,000 to 33,000 sockeye salmon, a range that has an 80% probability of achieving ≥80% of maximum sustained yield at the lower and upper bounds. From 2019 to 2023, estimated escapements were within or above the current escapement goal range in 3 of 5 years (Appendix Figure B9).

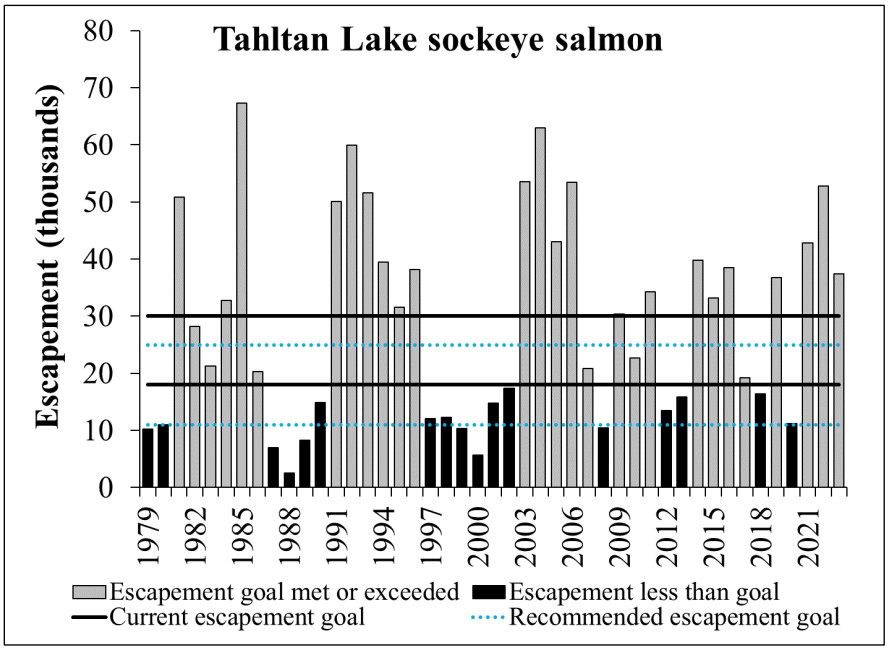


Appendix Figure B9.–Mainstem Stikine River sockeye salmon escapement (run-reconstruction estimates), 1979–2023, with the current sustainable escapement goal range (20,000–40,000 fish) and recommended biological escapement goal range (13,000–33,000 fish).

[1] Wood, C. C., and R. A. C. Johnston. *Unpublished*. Stock status of Stikine sockeye. Pacific Stock Assessment Review Committee Working Paper S90-7 (drafted in 1990).

Tahltan Lake is the largest producer of sockeye salmon in the transboundary Stikine River drainage. The lake is located in Canada, approximately 170 km north of Wrangell, Alaska. Tahltan sockeye salmon are harvested primarily in Alaska commercial drift gillnet fisheries in Districts 6 and 8 and in Canadian inriver fisheries. Sockeye salmon escapements have been enumerated annually at an adult counting weir at the outlet of the lake since 1959.

Escapement Goals and Stock Status: In 1987, the Transboundary Technical Committee of the Pacific Salmon Commission established an interim Tahltan Lake escapement goal range of 20,000 to 40,000 sockeye salmon with a management objective of 30,000 fish based on professional judgment regarding stock productivity, the ability of existing systems to manage to them, precision and accuracy of estimates of stock assessment abundance estimates, and the degree of risk considered acceptable (TTC 1987; unpublished Wood et al. 1993 report;[2] TTC 1993). In 1993, the committee revised the escapement goal to a range of 18,000–30,000 sockeye salmon (TTC 1993; Humphreys et al. 1994). ADF&G considered the goal to be a biological escapement goal in 2003 (Geiger et al. 2004). The escapement goal represents a mix of naturally spawning fish and a maximum of approximately 4,000 fish used for hatchery broodstock for stocking into Tahltan and Tuya Lakes under the bilateral enhancement program specified in the U.S./Canada Pacific Salmon Treaty (TTC 1993). The spawner–recruit analysis was updated (results in this report) using a linearized Ricker spawner–recruit function with an autoregressive lognormal process error with a lag of 1 year using brood years 1983 to 2014. The escapement goal review committee recommends replacing the current BEG with a BEG range of 11,000 to 25,000 sockeye salmon, a range that has an 80% probability of achieving ≥80% of maximum sustained yield at the lower and upper bounds. From 2019 to 2023, escapements were above the current escapement goal range in 4 of 5 years (Appendix Figure B10).

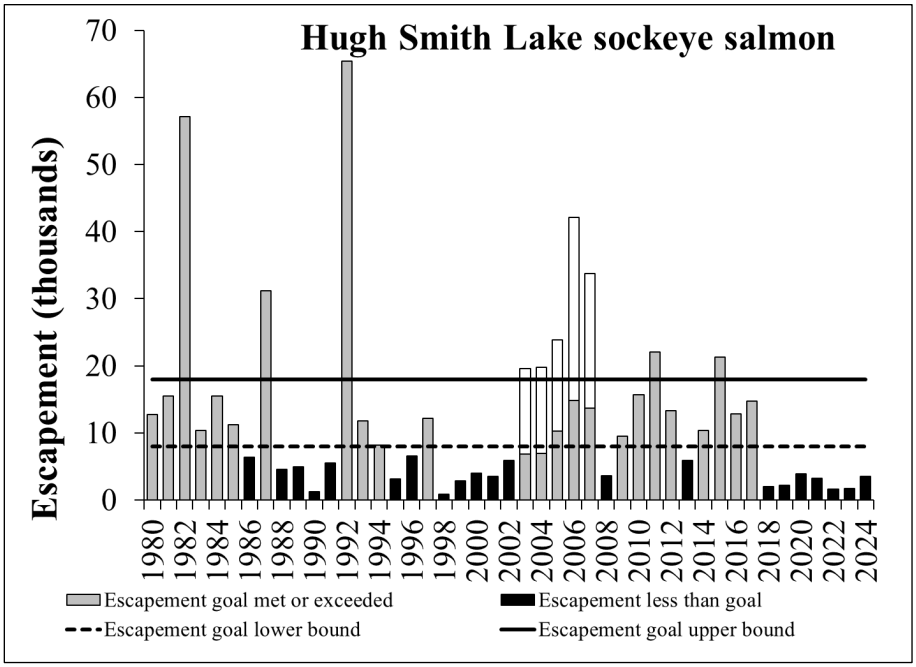


Appendix Figure B10.–Tahltan Lake sockeye salmon escapement (weir counts), 1979–2023, with current biological escapement goal range (18,000–30,000 fish) and recommended biological escapement goal range (11,000–25,000 fish).

[2] Wood, C. C., R. B. Morely, M. R. S Johannes, R. A. C. Johnston, and P. Etherton. *Unpublished*. Review of spawning escapement target for Tahltan Lake sockeye salmon. Department of Fisheries and Oceans Canada, Pacific Stock Assessment Review Committee Working Paper S93-1 (drafted in 1993).

Hugh Smith Lake is located on the mainland, approximately 65 km southeast of Ketchikan, Alaska. Hugh Smith sockeye salmon are harvested in mixed stock commercial net fisheries throughout the Northern Boundary area of Alaska and Canada. Sockeye salmon escapements have been enumerated annually at an adult counting weir at the outlet of the lake since 1980.

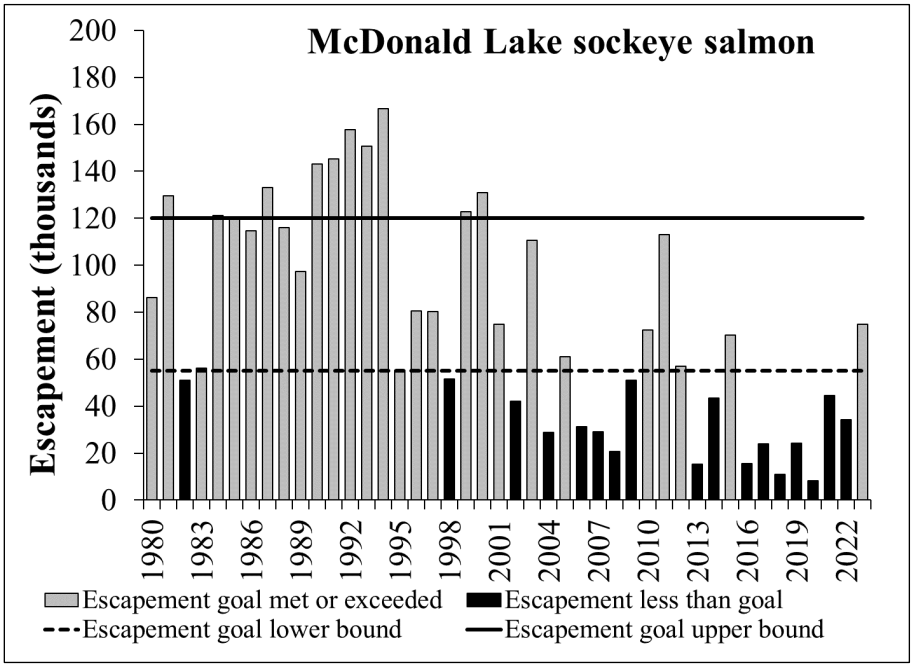
Escapement Goals and Stock Status: An escapement goal range of 15,000–35,000 sockeye salmon was established for Hugh Smith Lake in the early 1990s, based on professional judgment. The current optimal escapement goal range of 8,000–18,000 fish was established by the Board of Fisheries in 2003, based on escapement goal analyses outlined in Geiger et al. (2003); the goal included spawning salmon of both wild and hatchery origin (5 AAC 33.390). Escapements were below goal for 5 consecutive years 1998–2002 (Appendix Figure B11), and the stock was formally designated as a stock of management concern by the Board of Fisheries in 2003 (Geiger et al. 2005). The board adopted an action plan that included fishery restrictions to reduce harvests in nearby District 1 commercial drift gillnet and purse seine fisheries. Various stocking projects were conducted at the lake in most years, 1986–2003, most of which were thought to be unsuccessful (Geiger et al. 2003); however, large numbers of adults from the last pre-smolt stocking project returned from 2003 to 2007, and escapements exceeded the upper bound of the escapement goal range in each of those years. As a result of improved escapements, the Hugh Smith Lake sockeye salmon run was removed from stock of concern status in 2006 (Geiger et al. 2005). Escapements generally improved from low levels observed in the 1990s, and the escapement goal was met or exceeded in 13 of 15 years from 2003 to 2017. From 2019 to 2023, however, escapements were below the escapement goal range in all 5 years (Appendix Figure B11).



Appendix Figure B11.–Hugh Smith Lake sockeye salmon escapements (weir counts), 1980–2023, and optimal escapement goal range of 8,000–18,000 fish. The optimal escapement goal includes both wild and hatchery-stocked fish. Escapements from 2003 to 2007 show estimated wild (gray bars) and hatchery-stocked (white bars) fish. Estimates of the contributions of wild and hatchery-stocked fish are not available for years prior to 2003.

McDonald Lake, located on the mainland, approximately 65 km north of Ketchikan, Alaska, supports one of the largest runs of sockeye salmon in southern Southeast Alaska. McDonald Lake sockeye salmon are harvested in mixed stock commercial net fisheries throughout the Northern Boundary area of Alaska and Canada. McDonald Lake was the target of a lake fertilization enhancement project conducted from 1982 to 2004 (Johnson et al. 2005). Escapements have been estimated from calibrated foot survey counts conducted annually since 1980.

Escapement Goals and Stock Status: In 1989, ADF&G established an informal McDonald Lake escapement goal of 85,000 sockeye salmon based on a euphotic volume habitat model (Burkett et al. 1989). In 1993, the goal was revised to a range of 65,000–85,000 sockeye salmon based on an undocumented stock–recruit analysis; the goal was considered a biological escapement goal in 2003 (Geiger et al. 2004). In 2006, the escapement goal was changed to a sustainable escapement goal range of 70,000–100,000 sockeye salmon based on a simple yield analysis (Johnson et al. 2005). The goal was revised again to the current sustainable escapement goal range of 55,000–120,000 fish in 2009, based on a stock–recruit analysis of recalibrated escapement estimates and assumed average commercial harvest rate of 41% (Eggers et al. 2009a). The goal was considered a sustainable escapement goal due to limited information on harvest rates and uncertainty regarding the effects of lake fertilization on stock productivity. Poor recruitment starting in the late 1990s resulted in a downward trend in escapements, which fell below the escapement goal range in 5 of 7 years during 2002–2008 (Appendix Figure B14). The stock was formally designated as a stock of management concern by the Board of Fisheries in 2009 (Bergmann et al. 2009). Escapements were within the escapement goal range for 3 consecutive years, 2010–2012, and the stock of concern designation was removed in 2012; however, escapements again fell below the escapement goal range in 4 of 5 years during 2013–2017, and the stock was designated as a stock of management concern by the Board of Fisheries in 2018 (Walker et al. 2018). From 2019 to 2023, estimated escapements were within the escapement goal range in 1 of 5 years (Appendix Figure B12).



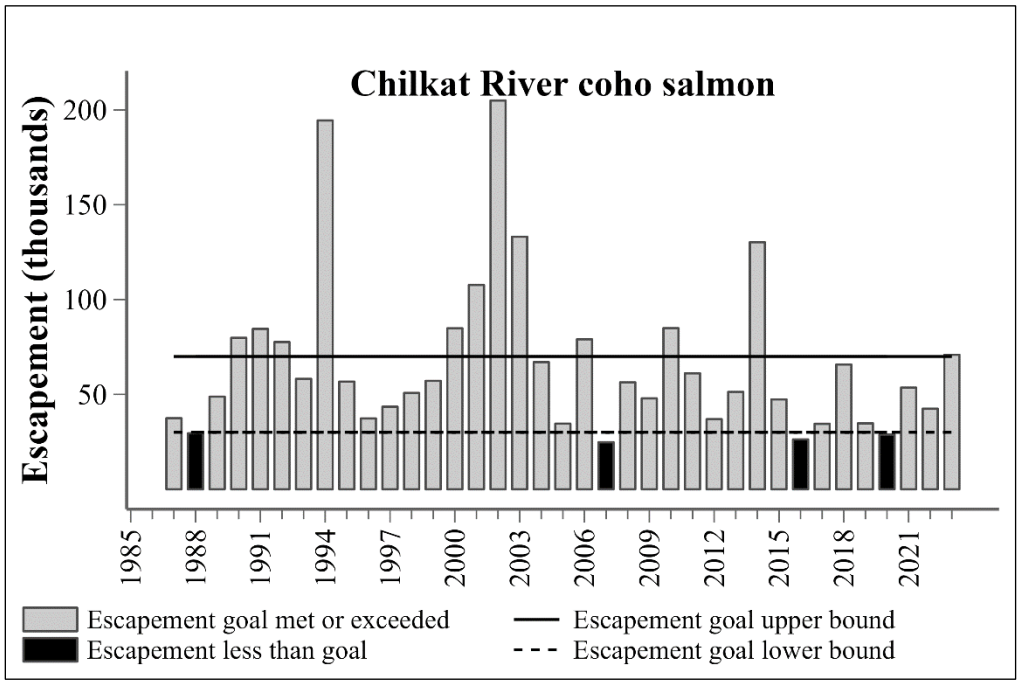
Appendix Figure B12.–McDonald Lake sockeye salmon escapements (expanded foot surveys), 1980–2023, and sustainable escapement goal range of 55,000–120,000 fish.

APPENDIX C.
COHO SALMON ESCAPEMENT GOAL PERFORMANCE

Appendix C1.–Chilkat River coho salmon.

The Chilkat River, a large glacial system located near Haines, Alaska, supports one of the largest coho salmon runs in Southeast Alaska. The Chilkat River coho salmon run exhibits typical late migratory timing; however, the run also includes earlier segments that enter the river beginning in late August and early September and spawn primarily during October. Chilkat River coho salmon are harvested primarily in the northern Southeast Alaska troll fishery and the Lynn Canal drift gillnet fishery, with lesser harvest rates by purse seine fisheries and marine sport fisheries. The Chilkat River sport fishery is one of the largest in Southeast Alaska and, along with freshwater subsistence harvest, also contributes to fishing mortality (Elliott 2013). Coded wire tagging studies conducted annually since 1999 have provided estimates of harvest, smolt production, and marine survival. Standardized foot survey index counts at 4 Chilkat River tributaries have been performed annually since 1987; total Chilkat River coho salmon escapement was also concurrently estimated from mark–recapture studies conducted in 1990, 1998, 2002, 2003, and 2005 (Elliott 2009, 2013). Comparison of index counts with the 5 mark–recapture estimates yielded a peak index count expansion factor of 33.6 (SE = 6.5; Elliott 2009).

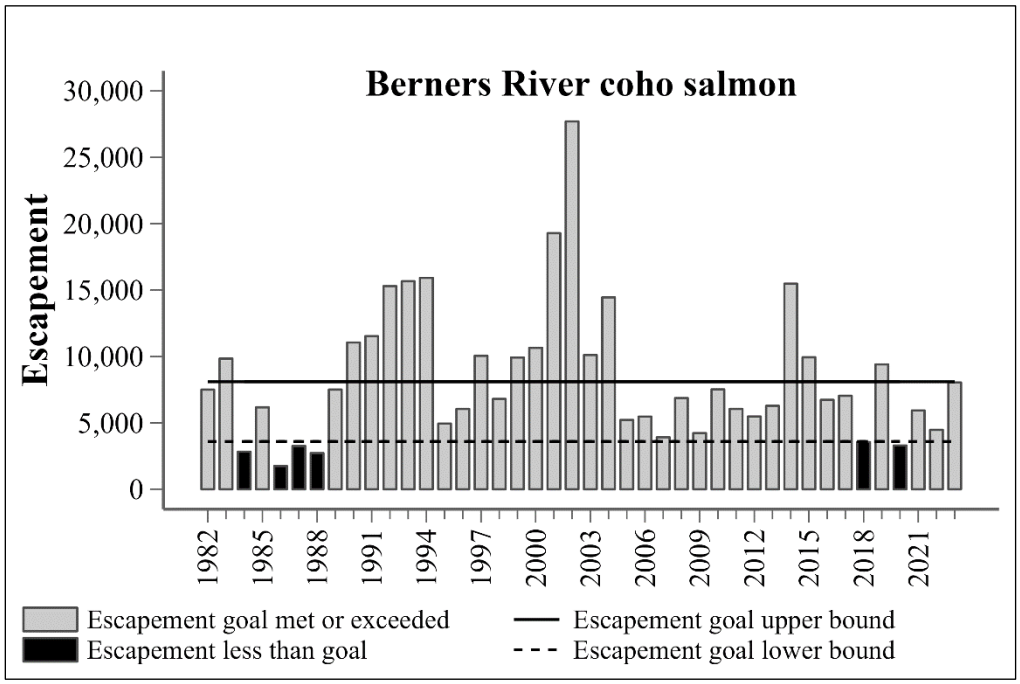
Escapement Goals and Stock Status: In 2006, a biological escapement goal range of 30,000–70,000 coho salmon was established for the Chilkat River based on a stock–recruit analysis (Ericksen and Fleischman 2006). From 2019 to 2023, escapements were above or within the escapement goal range in 4 of 5 years (Appendix Figure C1). Over the most recent 5 years, the total Chilkat River coho salmon run has averaged about 50% lower than the long-term average. A major contributor towards recent below-average total runs is below-average smolt estimates leaving the Chilkat River drainage. Estimated smolt populations during outmigration years 2012–2022 averaged 766,098 compared to the 1999–2011 average of 1,325,000 Chilkat coho salmon smolt. Marine survival estimates for the smolt populations leaving the Chilkat River during the 2012–2022 time period have been average and highly variable, ranging from 4.3% (SE = 1.4%) in return year 2016 to 18.1% (SE = 3.7%) in return year 2014.



Appendix Figure C1.–Total estimated escapement of Chilkat River coho salmon, 1982–2023, and biological escapement goal range of 30,000–70,000 spawners.

The Berners River is located in Berners Bay, Lynn Canal, approximately 65 km northwest of Juneau, Alaska. The Berners River is a compact system with concentrated, high-quality coho spawning and rearing habitat. Coded wire tagging studies of the Berners River coho salmon run have provided annual estimates of harvest, escapement, smolt production, marine survival, and age composition since 1982 (Shaul et al. 2017, 2019). As a result, the Berners River coho salmon run is an important indicator of the commercial troll harvest rate on northern inside stocks and is used for inseason estimation of regional wild coho salmon abundance. It is a late run that typically increases in the outside troll harvest throughout August, primarily in the vicinity of Cross Sound and northward, peaks around 1 September, and continues to contribute to the troll harvest until late September. Berners River coho salmon also contribute to the Lynn Canal drift gillnet fishery and, to a lesser extent, purse seine and marine and freshwater sport fisheries. Compressed timing of spawning, combined with the specific physical features of the Berners River drainage, make it possible to consistently observe and count a high proportion of the total escapement during foot and helicopter surveys in mid- to late October.

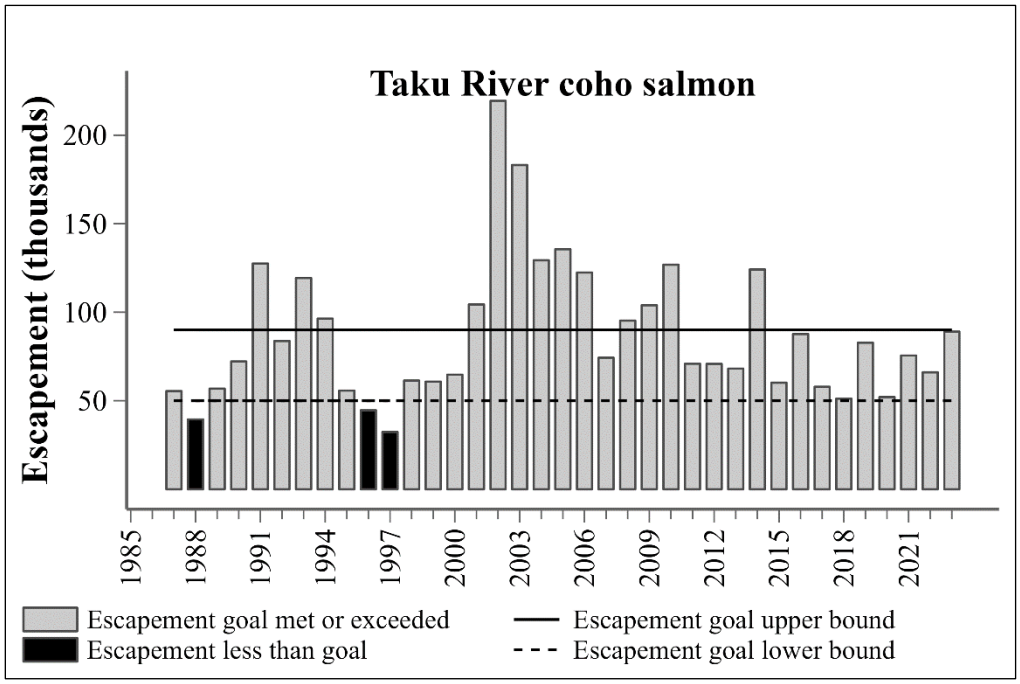
Escapement Goals and Stock Status: In 1994, ADF&G established a biological escapement goal range of 4,000–9,200 coho salmon for the Berners River based on stock–recruit analysis of unexpanded peak survey counts (Clark et al. 1994). In 2018, the Berners River goal was revised to a biological escapement goal range of 3,600–8,100 coho salmon counted on a peak survey, based on updated stock–recruit analysis of the 1989–2010 brood years (Shaul et al. 2017). Similar to other coho salmon indicator stocks in Southeast Alaska (e.g., Auke Creek and Hugh Smith Lake), smolt production at the Berners River has been similar to long-term values, but marine survival rates have been near record lows (Priest et al. 2021). Over the 4-year period of 2019–2022, smolt production was 19% below average but marine survival rates decreased approximately 53% during 2019–2023. From 2019 to 2023, escapements were within or above the escapement goal range in 4 of 5 years (Appendix Figure C2).



Appendix Figure C2.–Total estimated escapement of Berners River coho salmon, 1982–2023, and current biological escapement goal range of 3,600–8,100 fish counted on a peak survey.

The Taku River is a transboundary system that originates in the Stikine plateau of northwestern British Columbia and terminates at Taku Inlet, approximately 30 km northeast of Juneau, Alaska. The Taku River is probably the largest coho salmon-producing system in the region, and it supports a diversity of run components. Early-run stocks that spawn in high interior tributaries are harvested incidentally in U.S. drift gillnet and Canadian inriver fisheries that target sockeye salmon. Fall-run stocks that spawn primarily in mainstem tributaries are harvested in U.S. drift gillnet and Canadian inriver fisheries that target coho salmon. All run components are harvested by the U.S. troll and sport fisheries. Joint U.S./Canada mark–recapture studies have provided inriver estimates of abundance since 1987, and coded wire tagging studies have provided estimates of harvest, smolt production, and marine survival since 1992 (Pestal and Johnston 2015; Williams et al. 2016). Results of a 1992 radiotelemetry study indicated that the inriver mark–recapture abundance estimate represented about 78% of the total Taku River drainage escapement, and as much as 22% of the total escapement spawned in Alaska below the U.S.-Canada border (Eiler et al. *unpublished*).[1]

Escapement Goals and Stock Status: In 1986, the Transboundary Technical Committee of the Pacific Salmon Commission established an interim Taku River escapement goal of 27,500–35,000 coho salmon based on professional judgement (TTC 1986). Starting in 1999, the management intent of the U.S. was to ensure a minimum above-border run of 38,000 coho salmon until a maximum sustained yield escapement goal could be developed as outlined in the U.S./Canada Pacific Salmon Treaty. In 2015, a biological escapement goal range of 50,000–90,000 coho salmon was established based on a stock–recruit analysis of the 1987–2009 brood years (Pestal and Johnston 2015). From 2019 to 2023, escapements were within the escapement goal range in all 5 years (Appendix Figure C3).



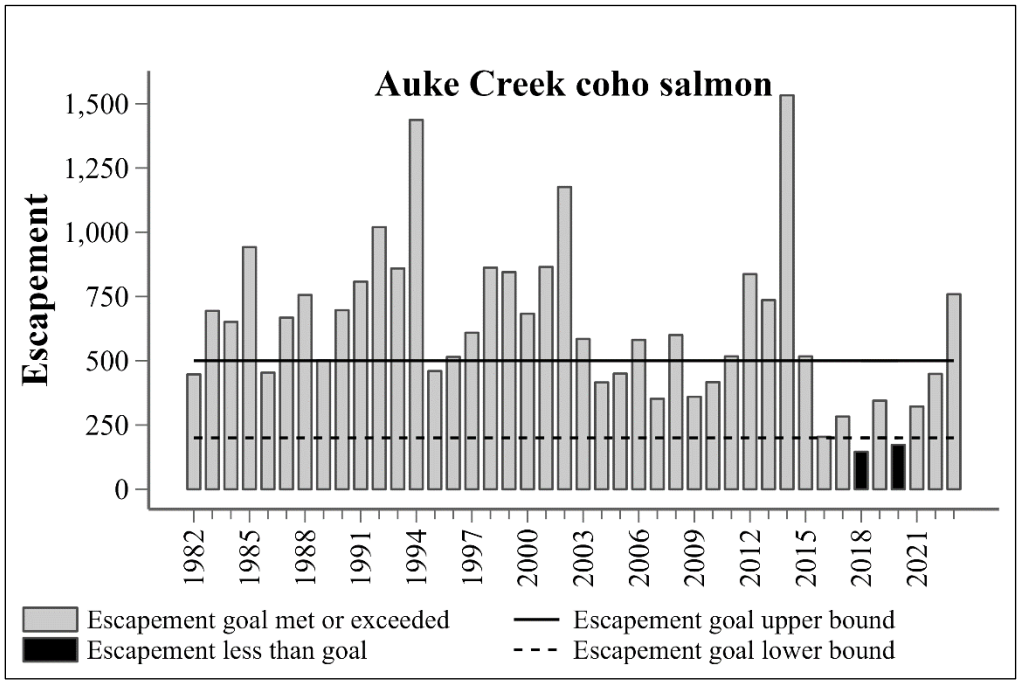
Appendix Figure C3.–Total estimated escapement of Taku River coho salmon, 1987–2023, and biological escapement goal range of 50,000–90,000 spawners.

[1] Eiler, J. H., M. M. Masuda, and H. R. Carlson. *Unpublished*. Stock composition, timing, and movement patterns of adult coho salmon in the Taku River Drainage, 1992. National Marine Fisheries Service report, Juneau.

Appendix C4.–Auke Creek coho salmon.

Auke Creek, located in Juneau, Alaska, supports a small run of coho salmon. Annual smolt and adult spawning populations have been precisely counted at a weir (operated by the National Marine Fisheries Service), and coded wire tagging studies have provided estimates of harvest, marine survival, and age composition since 1980 (Shaul et al. 2019). As a result of the high coded wire tagging rate (100%) on smolts and precise total accounting of returning adults, the Auke Creek stock is an important indicator of the commercial troll harvest rate on northern inside stocks and is used for inseason estimation of regional wild coho salmon abundance. The Auke Creek stock has migratory characteristics similar to the nearby Berners and Chilkat Rivers; however, because of its location outside the boundaries of major commercial drift gillnet fishing areas, it is subjected to slightly lower harvest rates than stocks that are targeted in drift gillnet fisheries. Rearing habitat in the Auke Creek drainage is dominated by the environment of Auke Lake.

Escapement Goals and Stock Status: In 1994, ADF&G established a biological escapement goal range of 200–500 coho salmon at Auke Lake based on a stock–recruit analysis (Clark et al. 1994). Similar to other coho salmon indicator stocks in Southeast Alaska (e.g., Berners River and Hugh Smith Lake), though smolt production at Auke Creek has been slightly below average, the total return and escapement has been lowered by poor marine survival rates. Over the 4-year period of 2019–2022, smolt production was 7% below average, but marine survival rates decreased approximately 52%. From 2019 to 2023, escapements were within or above the escapement goal range in 4 of 5 years (Appendix Figure C4).

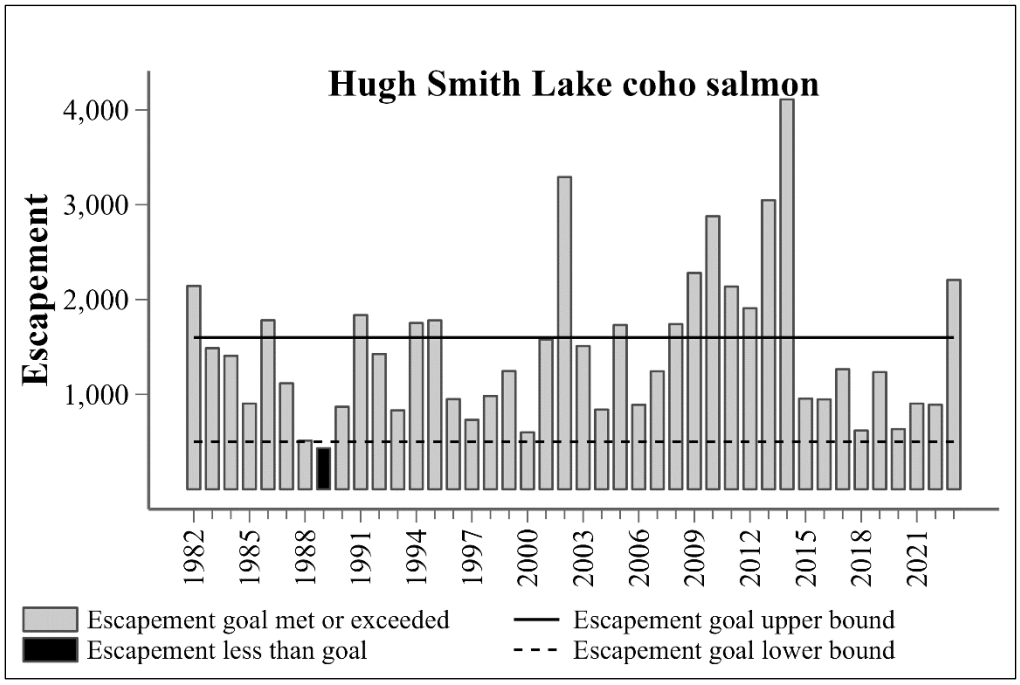


Appendix Figure C4.–Total estimated escapement (weir counts) of Auke Creek coho salmon, 1980–2023, and biological escapement goal range of 200–500 spawners.

Appendix C5.–Hugh Smith Lake coho salmon.

Hugh Smith Lake is located on the mainland, approximately 65 km southeast of Ketchikan, Alaska. The Hugh Smith Lake coho salmon run is currently the only wild, coded-wire-tagged coho salmon indicator stock in southern Southeast Alaska. Coded wire tagging studies and weir counts have provided annual estimates of harvest, escapement, smolt production, marine survival, and age composition since 1982 (Shaul et al. 2009, 2019). Thus, the Hugh Smith Lake coho salmon run is an important indicator of the commercial troll harvest rate on southern inside stocks and is used for inseason estimation of regional wild coho salmon abundance. Returning adults are exposed to a broad array of troll, net, and sport fisheries from northern Southeast Alaska to northern British Columbia, and average harvest rates are higher for Hugh Smith Lake coho salmon than for coho salmon indicator stocks in northern Southeast Alaska. Escapements are counted at a weir across the short lake outlet stream, and fish spawn in 2 inlet streams. Since rearing habitat in the inlet streams is limited, most juvenile coho salmon rear around wood and rock structure along the steep-sided lakeshore and in an extensive log jam at the lake outlet.

Escapement Goals and Stock Status: In 1994, ADF&G established a biological escapement goal range of 500–1,100 coho salmon at Hugh Smith Lake, based on a stock–recruit analysis (Clark et al. 1994). In 2009, the escapement goal was revised to a biological escapement goal range of 500–1,600 coho salmon, based on stock–recruit analysis of brood years 1982–2004 (Shaul et al. 2009). Similar to coho salmon indicator stocks in northern Southeast Alaska (e.g., Berners River and Auke Creek), though smolt production at Hugh Smith Lake has been slightly below average, the total return and escapement have been lowered by poor marine survival rates. Over the 4-year period of 2019–2022, smolt production was 13% below average but marine survival rates decreased approximately 35%. From 2019 to 2023, escapements were within or above the escapement goal range in all 5 years (Appendix Figure C5).

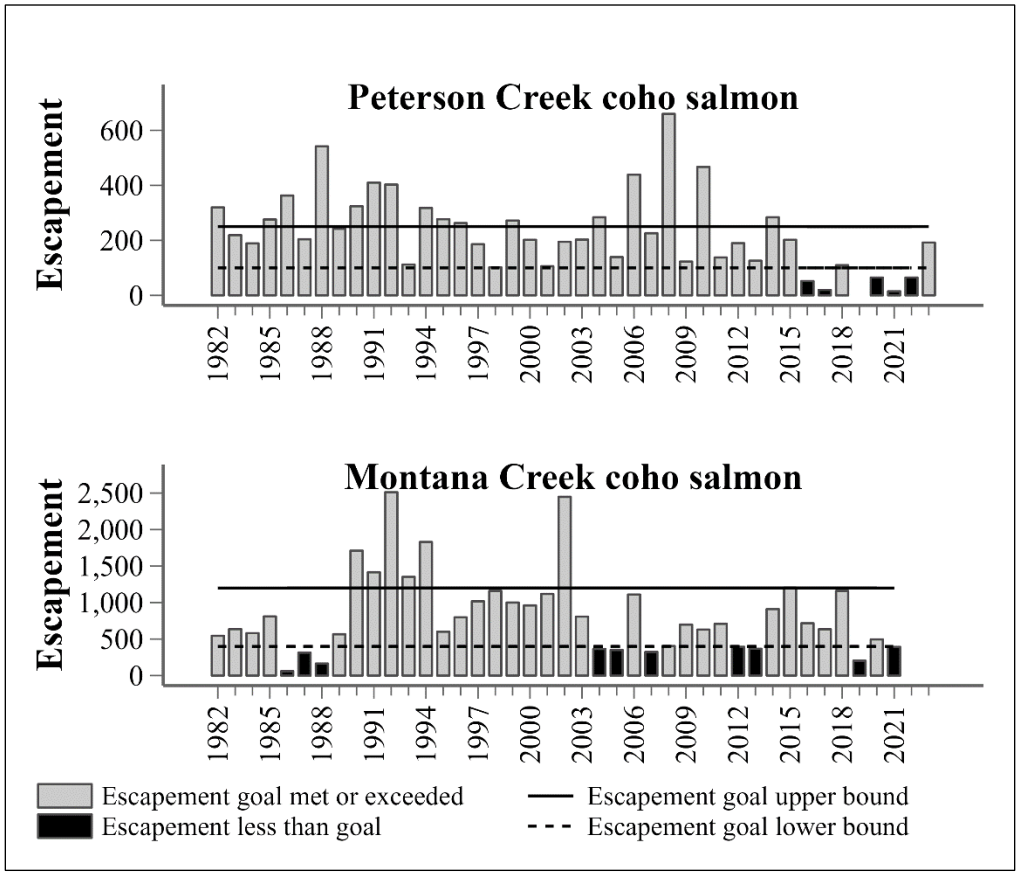


Appendix Figure C5.–Total estimated escapement (weir counts) of Hugh Smith Lake coho salmon, 1982–2023, and biological escapement goal range of 500–1,600 spawners.

Coho salmon escapements along the Juneau road system have been monitored by multiple foot surveys conducted annually since 1981 (Clark 2005). Comparable peak escapement surveys have been consistently conducted in recent years on 2 streams, Montana and Peterson Creeks.

Escapement Goals and Stock Status: In 1995, ADF&G established biological escapement goals for 5 Juneau area coho salmon stocks based on peak survey counts and stock–recruit analysis (Clark 1995b), including biological escapement goal ranges of 200–500 fish for Montana Creek and 100–350 fish for Peterson Creek. In 2006, escapement goals for Montana and Peterson Creeks were revised to sustainable escapement goal ranges of 400–1,200 fish for Montana Creek and 100–250 fish for Peterson Creek, as counted on peak foot surveys (Clark 2005). The goals were based on theoretical stock–recruit analysis; harvest rates were assumed to be similar to the coded-wire-tagged wild indicator stock at nearby Auke Creek, and a range of probable productivity values were examined to estimate escapement counts that would encompass 90% or more of maximum sustained yield (Clark 2005).

From 2019 to 2023, peak survey counts were within the escapement goal range in 1 of 4 years at Peterson Creek and 1 of 3 years at Montana Creek (Appendix Figure C6); valid peak survey counts were not able to be obtained for Peterson Creek in 2019 or for Montana Creek in 2022 or 2023.

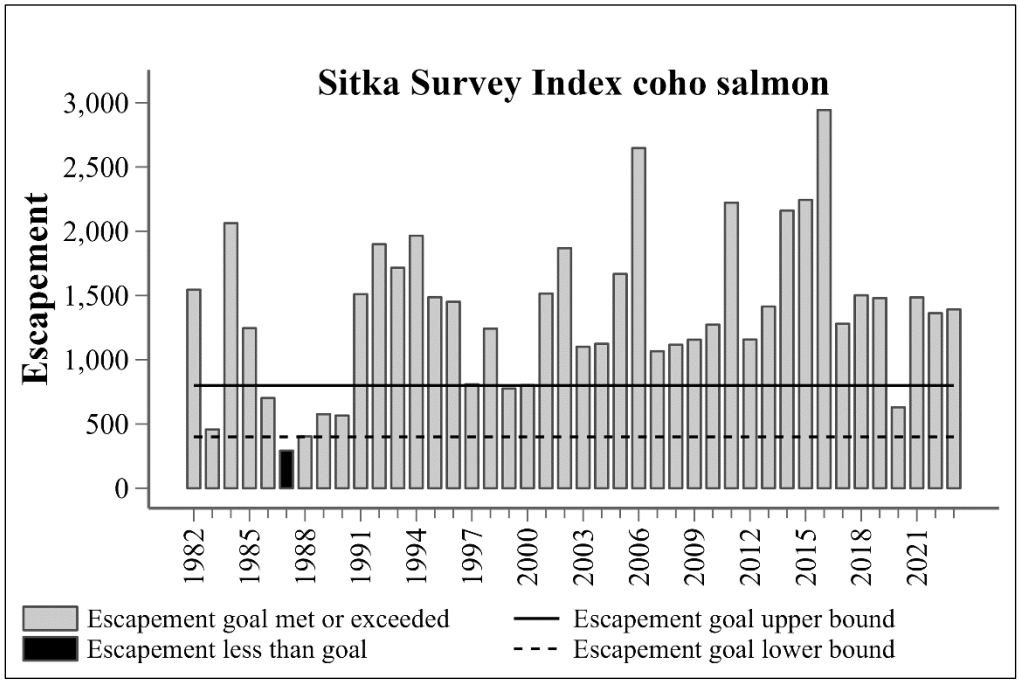


Appendix Figure C6.–Coho salmon escapement index counts (peak foot survey counts) and sustainable escapement goal ranges for 2 Juneau roadside streams, Montana Creek and Peterson Creek, 1981–2023. Missing bars indicate that a valid survey count was not obtained for that year.

Appendix C7.–Sitka Area coho salmon survey index.

The Sitka area coho salmon survey index consists of 5 small streams within and north of Sitka Sound that have been surveyed annually since 1982. Foot surveys are conducted at Starrigavan Creek, Sinitsin Creek, and the Nakwasina River, and snorkel surveys are conducted at St. John Baptist Head Creek and the Eagle River (Chadwick 2016). The largest (peak) survey count for each stream is summed with the others in the total index. Only peak survey counts that meet standards for timing, survey conditions, and completeness are included in the annual index, and missing counts are interpolated in order to maintain a comparable aggregate escapement index (Shaul et al. 2011).

Escapement Goals and Stock Status: In 2006, ADF&G established a biological escapement goal range of 400–800 coho salmon for the aggregate survey counts in the 5 Sitka area index streams (Shaul and Tydingco 2006). The goal was based on a theoretical stock–recruit analysis that assumed marine survival and harvest rates of Sitka area stocks were similar to the coded-wire-tagged wild indicator stock at the nearby Nakwasina River, and productivity (smolts per spawner at maximum sustained yield) was assumed to be average compared to other coho salmon stocks that have been studied. Since 1982, escapement counts were within or exceeded the escapement goal range in almost every year; from 2019 to 2023, escapements were within or above the escapement goal range in all 5 years (Appendix Figure C7).

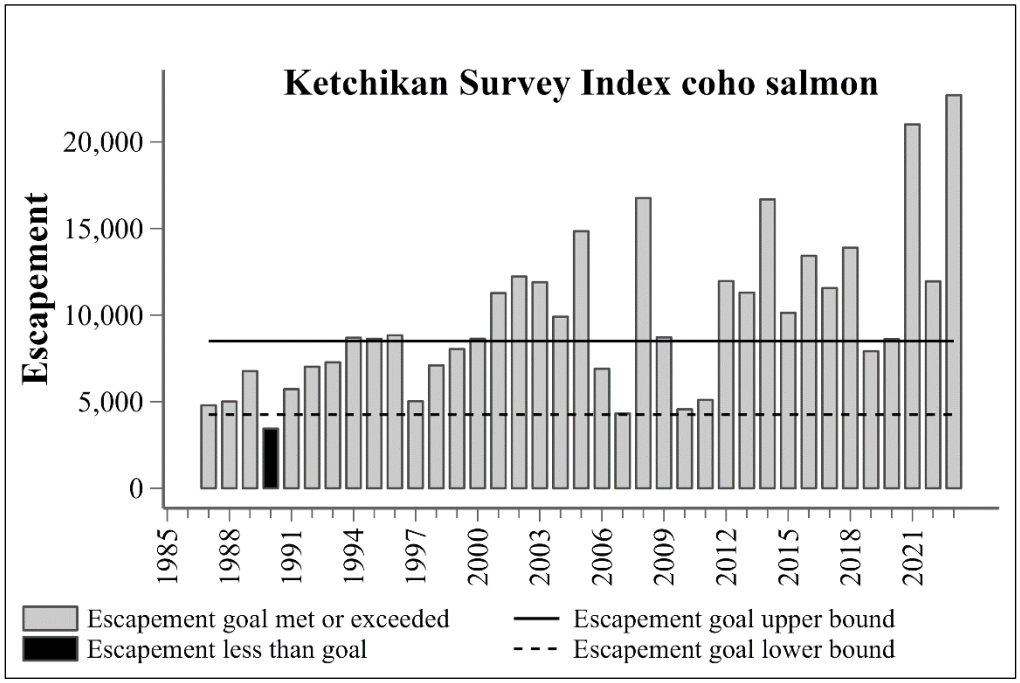


Appendix Figure C7.–Aggregate peak coho salmon escapement survey counts and biological escapement goal range of 400–800 fish for 5 index streams in the Sitka area, 1982–2023.

Appendix C8.–Ketchikan Area coho salmon survey index.

The Ketchikan area coho salmon survey index consists of 14 streams in District 1 that have been surveyed annually since 1987. Surveys are conducted by helicopter and are usually done separately in 2 circuits: the northern circuit includes tributaries of the Chickamin River (Indian River, Barrier Creek, King Creek, Choca Creek) and streams in Burroughs Bay, near the mouth of the Unuk River (Herman Creek, Grant Creek, Eulachon River, Klahini River); and the southern circuit includes the Carroll, Blossom, Keta, Marten, and Tombstone Rivers and Humpback Creek. Two surveys of each stream are scheduled (contingent on favorable weather and water conditions): an early survey scheduled for 28 September–1 October and a later survey scheduled for 15–20 October. The largest (peak) survey count for each stream is summed with the others in the total index. Only peak survey counts that meet standards for timing, survey conditions, and completeness are included in the annual index, and missing counts are interpolated in order to maintain a comparable aggregate escapement index (Shaul et al. 2011).

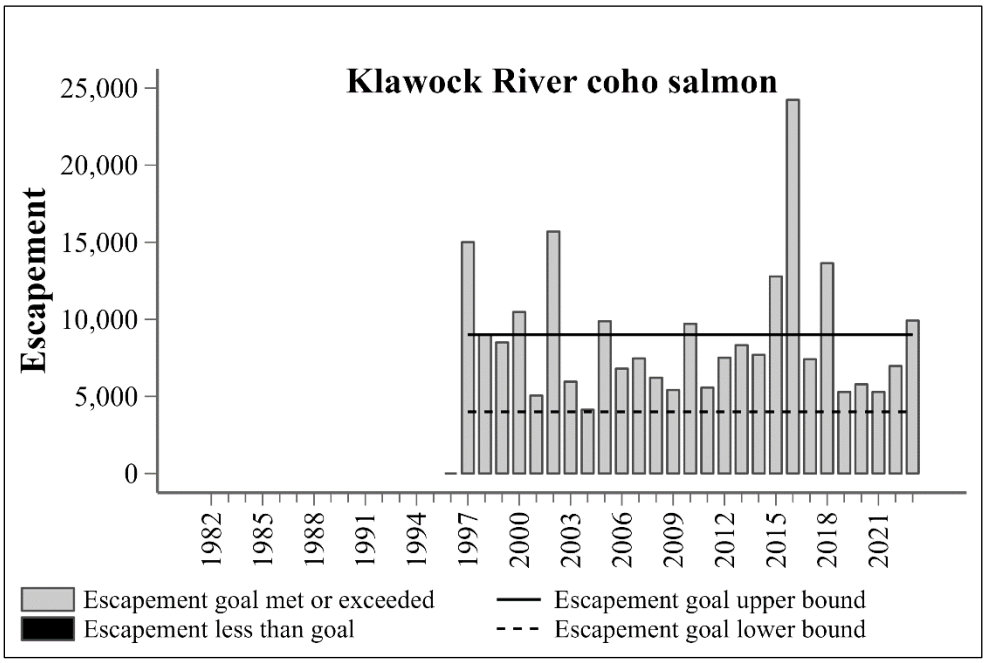
Escapement Goals and Stock Status: In 2006, ADF&G established a biological escapement goal range of 4,250–8,500 coho salmon for the aggregate survey counts in the 14 Ketchikan area index streams (Shaul and Tydingco 2006). The goal was based on theoretical stock–recruit analysis that assumed marine survival and harvest rates of Ketchikan area stocks were similar to the coded-wire-tagged wild indicator stock at nearby Hugh Smith Lake, and productivity (smolts per spawner at maximum sustained yield) was assumed to be average compared to other coho salmon stocks that have been studied. Since 1987, escapement counts were within or exceeded the escapement goal range in almost every year; from 2019 to 2023, escapements were within or above the escapement goal range in all 5 years (Appendix Figure C8).



Appendix Figure C8.–Aggregate peak coho salmon escapement survey counts and biological escapement goal range of 4,250–8,500 fish for 14 index streams in the Ketchikan area, 1987–2023.

The Klawock River is located on the west coast of Prince of Wales Island, near the town of Klawock, Alaska. During 1977–1978, the State of Alaska built a hatchery on the river, 300 m below Klawock Lake (Stopha 2016). The state operated the hatchery through the early 1990s, after which management of the hatchery was transferred to the Prince of Wales Hatchery Association (1996–2015), followed by the Southern Southeast Regional Aquaculture Association (since 2016). Hatchery-produced coho salmon (Klawock Lake broodstock) have been released annually in the lake, river, and estuary since 1980; over the past decade, the hatchery released an average 4.1 million coho smolt per year. A portion of the annual coho salmon escapement is allowed to pass into the lake to spawn naturally, the remainder is used for broodstock and cost recovery.

Escapement Goals and Stock Status: Prior to 2007, an informal, maximum escapement target of 6,000 coho salmon was established for the Klawock River (Der Hovanisian 2013). A sustainable escapement goal range of 4,000–9,000 coho salmon was established in 2007, although the goal was not formally adopted until 2013 (Der Hovanisian 2013; and see Appendix E in Munro and Volk 2014). The goal was based on smolt-per-spawner and theoretical stock–recruit analyses, because, although some Klawock River coho salmon run abundance and escapement data were available for 1999–2005, harvest rate, marine survival rate, and age composition information were not available, and estimates from a wild coho salmon coded wire tagging study at nearby Chuck Creek were used as surrogates (Der Hovanisian 2013). The annual hatchery management plan[1] includes stipulations for the hatchery to operate the weir from early July through 30 November and includes a weekly escapement schedule with a target escapement of 6,500 coho salmon. Although "most of the run now comprises hatchery returns" (Stopha 2016), the purpose of the escapement schedule was to maintain the historical escapement timing of the run. Escapements were within or above the escapement goal range in all years since 1997 (Appendix Figure C9).



Appendix Figure C9.–Klawock River coho salmon escapement (weir counts), 1997–2023, and sustainable escapement goal range of 4,000–9,000 fish.

[1] 2024 Annual Management Plan, Southern Southeast Regional Aquaculture Association, unpublished document. http://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesPlanning.annual (Accessed 8/07/2024).

Appendix C10.–Yakutat Area coho salmon.

Yakutat area coho salmon stocks are harvested primarily in commercial set gillnet and sport fisheries that target runs to discrete systems, though commercial trollers fishing on mixed stocks off the coast also account for some of the harvest. Yakutat area escapements have been assessed through foot, boat, and aerial surveys. Most surveys have been conducted early in the run to support inseason management of the set gillnet fisheries. Comparable peak escapement surveys have been conducted relatively consistently in recent years at 3 systems: Lost, Situk, and Tsiu-Tsivat Rivers.

Escapement Goals and Stock Status: Escapement goals based on peak survey counts and stock–recruit analysis were developed for 7 Yakutat area coho salmon stocks in 1994 (Clark and Clark 1994), including biological escapement goal ranges of 2,200–6,500 fish for Lost River, 3,300–9,800 fish for Situk River, and 10,000–29,000 fish for Tsiu-Tsivat Rivers. In 2009, the Lost River goal was modified into a lower bound sustainable escapement goal of 2,200 coho salmon, following a geological shift that resulted in the Lost River draining into the Situk-Ahrnklin Lagoon instead of directly into the Gulf of Alaska (Shaul et al. 2008). This shift made it difficult to actively manage the commercial set gillnet fishery for a goal specific for Lost River (Burkholder 2000).

In 2015, the Lost River goal was revised to a sustainable escapement goal range of 1,400–4,200 coho salmon counted on a peak survey, based on the 15th and 75th percentiles of historical counts obtained in Tawah Creek, a primary tributary where the majority of historical survey counts were conducted, and the name of the goal was changed to Tawah Creek (Heinl et al. 2014a). In 2018, the Tsiu-Tsivat goal was changed to a sustainable escapement goal based on the 5th and 65th percentiles of historical survey counts; however, the target range remained 10,000–29,000 coho salmon (Heinl et al. 2017). Finally, a recent analysis (in this report) supports a recommendation to revise the Situk River goal to a sustainable escapement goal range of 3,800–9,600 coho salmon, based on the 25th and 75th pecentiles of historical survey counts.

The utility of peak survey counts in assessing historical coho salmon escapement in the Yakutat area is limited by deteriorating weather conditions after mid-September, frequently not allowing surveys to occur. Mark–recapture studies were conducted to estimate escapements of coho salmon in both the Situk (2004–2006) and Lost (2003–2004) Rivers in hopes of providing a calibration for index counts; however, mark–recapture estimates were not consistent with index counts, and meaningful expansion factors could not be estimated (Shaul et al. 2010). Index counts were substantially lower than total escapement in all years and accounted for minor and variable portions of total escapements. Subsequent escapement goal reviews of Yakutat area coho salmon stocks, therefore, have been based on the percentile method, because stock assessment information is limited primarily to maximum survey counts.

When surveys have been able to be conducted, escapement indices in the Yakutat area show peaks in coho salmon abundance in the early to mid-1990s through early 2000s, and relatively strong escapements in the Tsiu River since 2013 (Appendix Figure C10). From 2019 to 2023, only 4 peak survey counts were only able to be conducted: Tawah Creek in 2019, Situk River in 2019 and 2023, and the Tsiu River in 2019. All 4 surveys were above the lower bound escapement goal.

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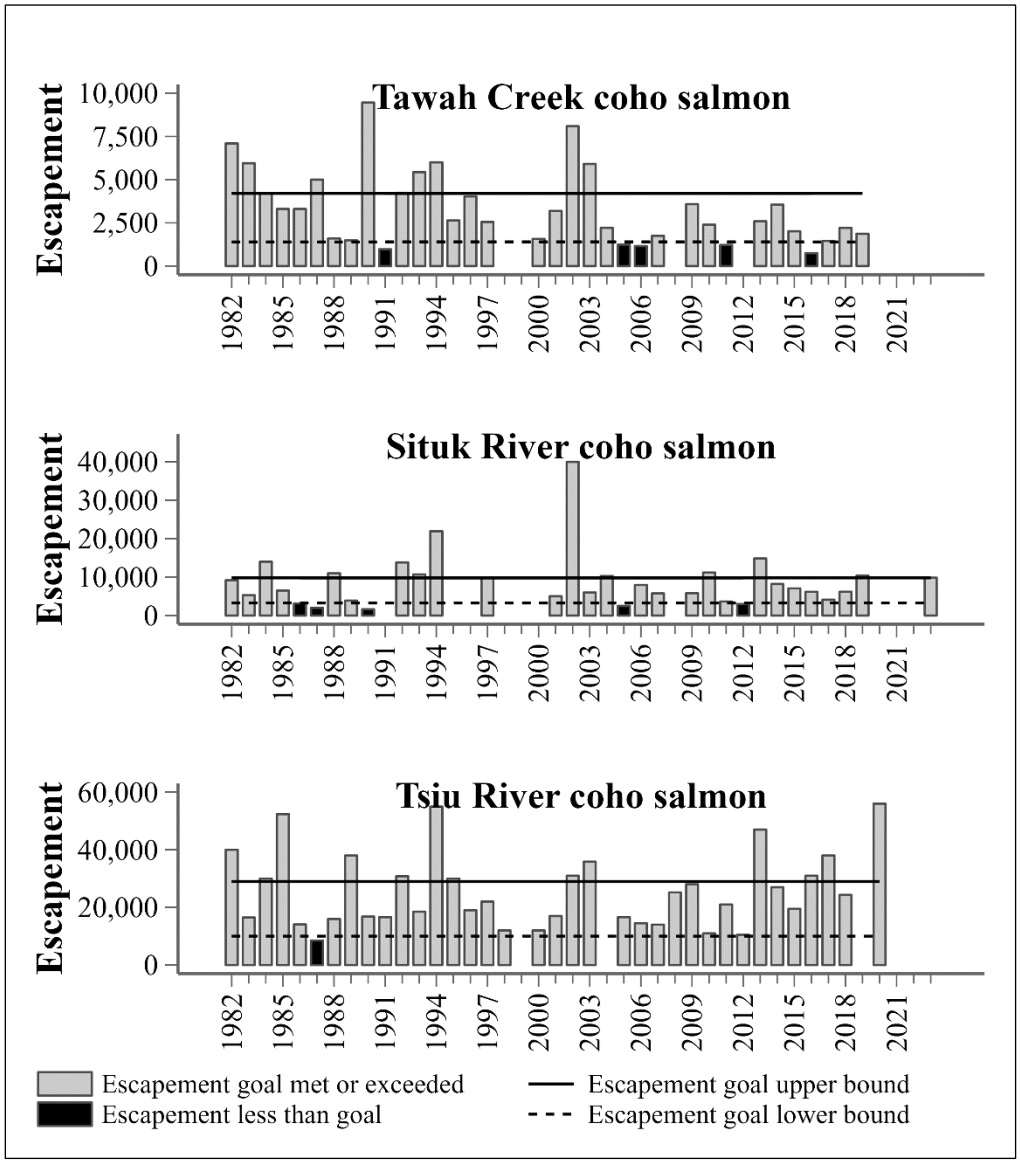


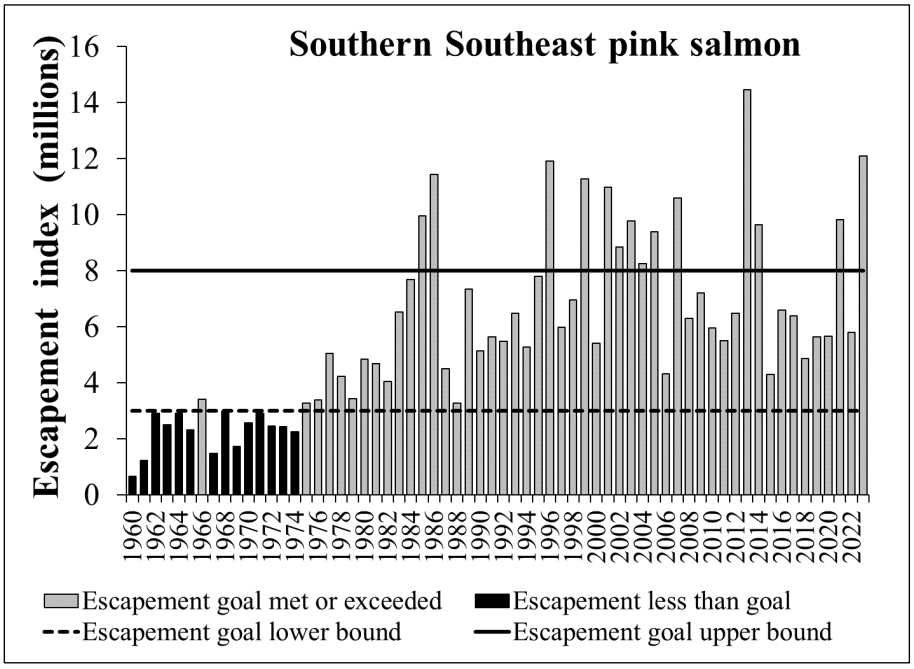
Appendix Figure C10.–Peak coho salmon escapement survey counts in the Yakutat area, compared to current escapement goal ranges, 1972–2023. Blank columns in the time series indicate that peak survey counts were not available in those years.

APPENDIX D.
PINK SALMON ESCAPEMENT GOAL PERFORMANCE

The Southern Southeast Subregion is composed of pink salmon stocks from Sumner Strait south to Dixon Entrance (Districts 1–8) and includes a total of 366 pink salmon index streams.

Escapement Goals and Stock Status: The department has maintained an annual index of the pink salmon escapement in Southeast Alaska, generated from aerial survey observations, conducted at intervals during most of the migration period. Zadina et al. (2004) developed biological escapement goals for Southeast Alaska pink salmon based on the "tabular approach" described by Hilborn and Walters (1992); a yield analysis that is useful for setting escapement goals when the form of the stock–recruit relationship is not known. Heinl et al. (2008) updated the goals in 2009 using the same yield analysis. This yield analysis has been updated on a triennial basis in conjunction with the Alaska Board of Fisheries regulatory cycle, but no goal changes have been recommended since 2009 (Piston and Heinl 2011a, 2014b, 2018, 2020a; Piston and Fish 2024b). The current biological escapement goal range for pink salmon in the Southern Southeast Subregion is 3.0–8.0 million index spawners, as measured by the sum of annual peak survey counts to the aggregate 366 index streams.

The harvest of pink salmon in the Southern Southeast Subregion averaged 19 million fish per year over the past decade, 2014–2023, which was down from an average harvest of 31 million in the 1990s, but right at the 1960 to 2023 average of 19 million fish (Piston and Fish 2024b). Harvests have been highly variable over the past decade and have ranged from a low of 5.4 million in 2018 to 38.1 million in 2021. From 2019 to 2023, escapement indices were within or above the escapement goal range in all 5 years, and the escapement index of 12.1 million in 2023 was the second highest since statehood (Appendix Figure D1).



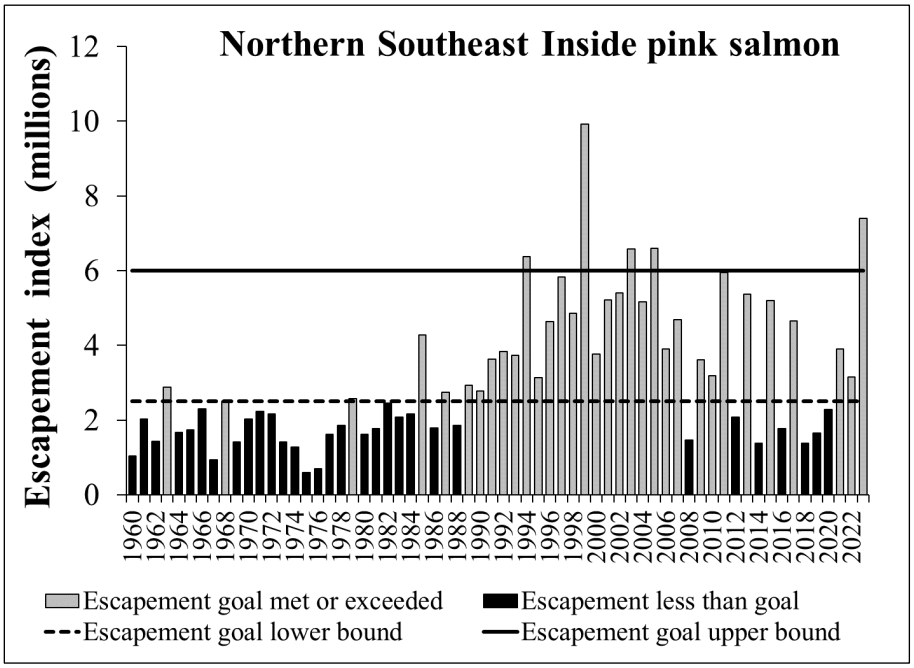
Appendix Figure D1.–Southern Southeast Subregion pink salmon escapement index, 1960–2023, and biological escapement goal range of 3.0–8.0 million index fish.

Appendix D2.–Northern Southeast Inside Subregion pink salmon.

The Northern Southeast Inside Subregion is composed of pink salmon stocks on inside waters of Southeast Alaska north of Sumner Strait (Districts 9–15), and includes 295 pink salmon index streams.

Escapement Goals and Stock Status: The department has maintained an annual index of the pink salmon escapement in Southeast Alaska, generated from aerial survey observations, conducted at intervals during most of the migration period. Zadina et al. (2004) developed biological escapement goals for Southeast Alaska pink salmon based on the "tabular approach" described by Hilborn and Walters (1992); a yield analysis that is useful for setting escapement goals when the form of the stock–recruit relationship is not known. Heinl et al. (2008) updated the goals in 2009 using the same yield analysis. This yield analysis has been updated on a triennial basis in conjunction with the Alaska Board of Fisheries regulatory cycle, but no goal changes have been recommended since 2009 (Piston and Heinl 2011a, 2014b, 2018, 2020a; Piston and Fish 2024b). The current biological escapement goal range for pink salmon in the Northern Southeast Inside Subregion is 2.5–6.0 million index spawners, as measured by the sum of annual peak survey counts to the aggregate 295 index streams.

Pink salmon runs to the Northern Southeast Inside Subregion developed an extreme odd-even cycle starting in 2008 (Appendix Figure D2), with some very high odd-year harvests, including the all-time record harvest of 40.6 million fish in 2011, and very low even-year harvests. The harvest of pink salmon in the subregion averaged 6.0 million fish per year over the past decade, 2014–2023 (Piston and Fish 2024b), which was below the average harvest of 16.5 million fish from 1991–2007, and below the average harvest of 8.8 million fish since 1960. From 2019 to 2023, escapement indices were within or above the escapement goal range in 3 of 5 years (Appendix Figure D2). In 2022, the escapement goal was reached during an even-year for the first time since 2012, and harvest opportunity increased in the subregion (Piston and Fish 2024b). The escapement index of 7.4 million fish in 2023 was the second highest index since 1960.

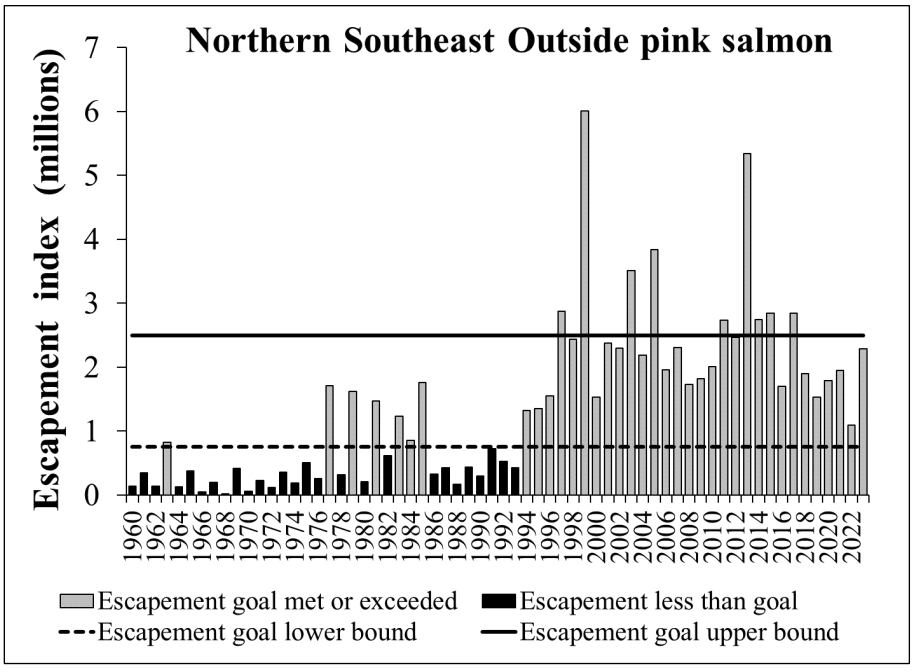


Appendix Figure D2.–Northern Southeast Inside Subregion pink salmon escapement index, 1960–2023, and biological escapement goal range of 2.5–6.0 million index fish.

The Northern Southeast Outside Subregion is composed of pink salmon stocks along the outer coasts of Chichagof and Baranof Islands (District 13, excluding Peril Straits and Hoonah Sound Subdistricts 51–59, which are considered part of the Northern Southeast Inside Subregion), and includes 41 pink salmon index streams.

Escapement Goals and Stock Status: The department has maintained an annual index of the pink salmon escapement in Southeast Alaska, generated from aerial survey observations, conducted at intervals during most of the migration period. Zadina et al. (2004) developed biological escapement goals for Southeast Alaska pink salmon based on the "tabular approach" described by Hilborn and Walters (1992); a yield analysis that is useful for setting escapement goals when the form of the stock–recruit relationship is not known. Heinl et al. (2008) updated the goals in 2009 using the same yield analysis. This yield analysis has been updated on a triennial basis in conjunction with the Alaska Board of Fisheries regulatory cycle, but no goal changes have been recommended since 2009 (Piston and Heinl 2011a, 2014b, 2018, 2020a; Piston and Fish 2024b). The current biological escapement goal range for pink salmon in the Northern Southeast Outside Subregion is 0.75–2.5 million index spawners, as measured by the sum of annual peak survey counts to the aggregate 41 index streams.

The harvest of pink salmon in the Northern Southeast Outside Subregion averaged 2.9 million fish per year over the past decade, 2014–2023, which was below the average harvest of 4.1 million fish in the prior 10-year period but above the average of 1.9 million since 1960 (Piston and Fish 2024b). The escapement index averaged 2.1 million over the past 10 years (2014–2023). Escapement indices were within or above the escapement goal range in all years since 1994 (Appendix Figure D3).

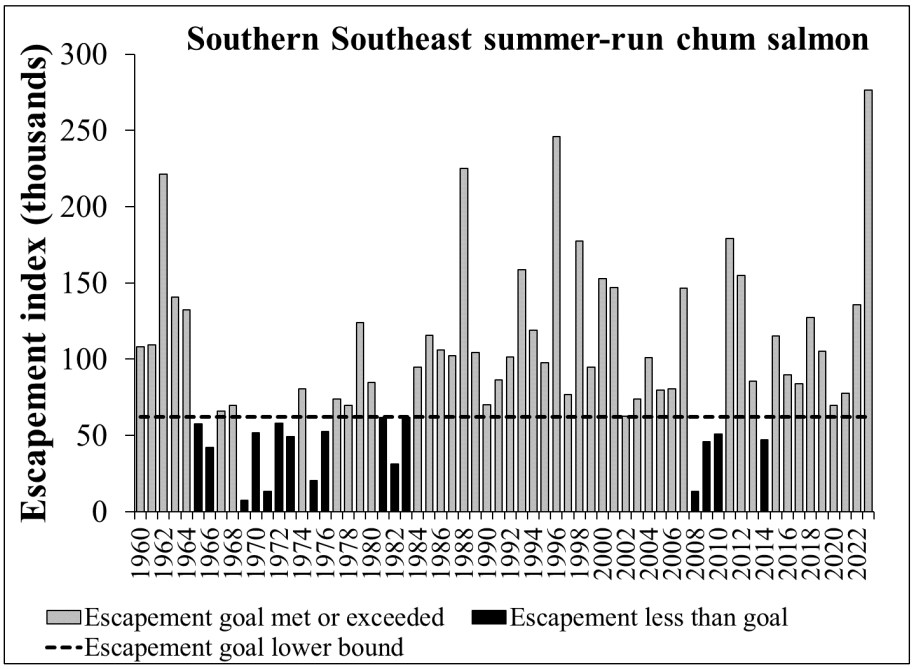


Appendix Figure D3.–Northern Southeast Outside Subregion pink salmon escapement index, 1960–2023, and biological escapement goal range of 0.75–2.5 million index fish.

APPENDIX E.
CHUM SALMON ESCAPEMENT GOAL PERFORMANCE

The Southern Southeast Subregion includes 15 summer-run chum salmon index streams located on the islands and mainland of Southeast Alaska from Sumner Strait south to Dixon Entrance.

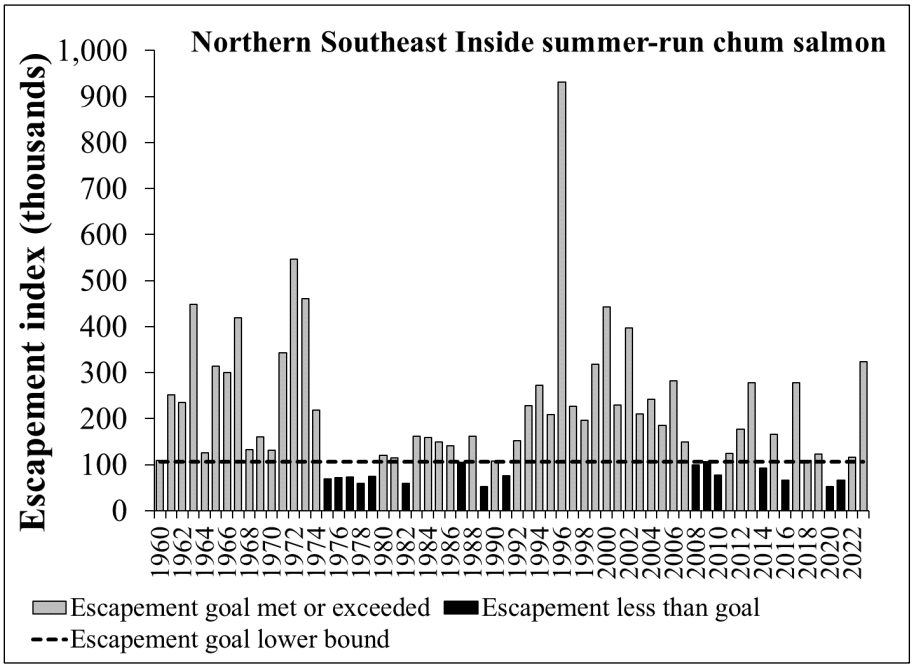
Escapement Goals and Stock Status: The current lower bound sustainable escapement goal of 62,000 chum salmon counted on peak surveys to the aggregate set of index streams was established in 2015, based on the 25th percentile of historical escapement data (Piston and Heinl 2017). The goal is a lower bound sustainable escapement goal, rather than an escapement goal range, because summer-run chum salmon are harvested in mixed stock commercial fisheries and their escapements cannot be effectively managed to fall within a range. Escapement indices were at low levels during the mid-1960s to late 1970s, exhibited an increasing trend into the 1990s, and have generally remained above the goal over the past 2 decades, with the exception of poor escapement years from 2008 to 2010 and in 2014. From 2019 to 2023, escapement indices were above the lower bound sustainable escapement goal in all 5 years, and the escapement index of 276,000 fish in 2023 was an all-time record (Appendix Figure E1; Piston and Fish 2024a).



Appendix Figure E1.–Southern Southeast Subregion summer-run chum salmon escapement index (peak aerial and foot surveys), 1960–2023, and lower bound sustainable escapement goal of 62,000 fish.

The Northern Southeast Inside Subregion includes 63 summer-run chum salmon index streams located on the inside waters of Southeast Alaska north of Sumner Strait.

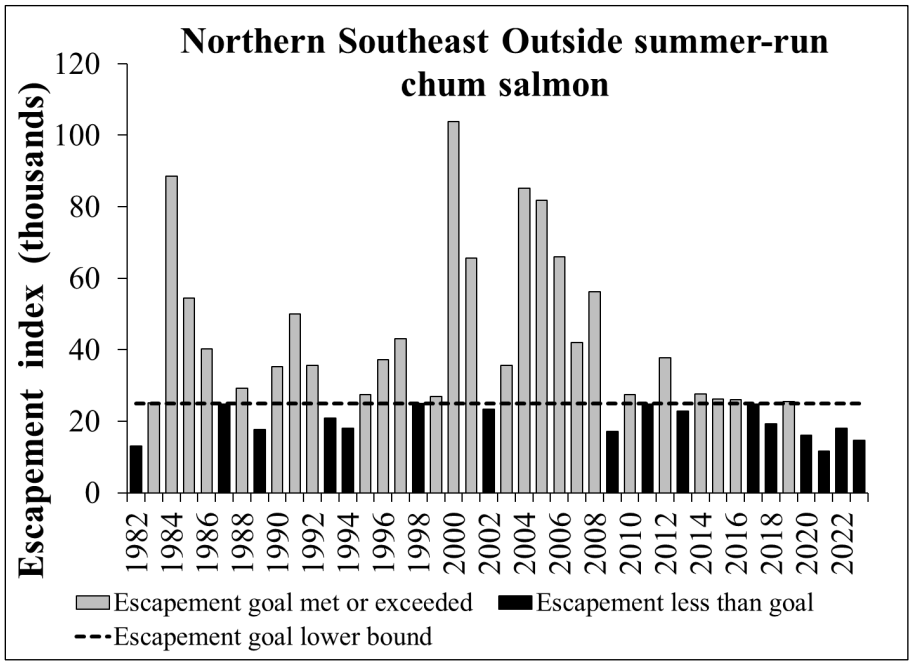
Escapement Goals and Stock Status: The current lower bound sustainable escapement goal of 107,000 chum salmon counted on peak surveys to the aggregate set of index streams was established in 2018 based on the 25th percentile of historical escapement data (Piston and Heinl 2017). The goal is a lower bound sustainable escapement goal, rather than an escapement goal range, because summer-run chum salmon are harvested in mixed stock commercial fisheries and their escapements cannot be effectively managed to fall within a range. Escapement indices were at high levels in the 1960s, then declined to low levels in the 1970s–1980s. The escapement index trended upward into the late 1990s, trended downward through 2010, and has fluctuated considerably since that time. From 2019 to 2023, escapement indices were above the lower bound sustainable escapement goal in 3 of 5 years (Appendix Figure E2; Piston and Fish 2024a).



Appendix Figure E2.–Northern Southeast Inside Subregion summer-run chum salmon escapement index (peak aerial and foot surveys), 1960–2023, and lower bound sustainable escapement goal of 107,000 fish.

The Northern Southeast Outside Subregion includes 9 summer-run chum salmon index streams on the outside waters of Chichagof and Baranof Islands in northern Southeast Alaska.

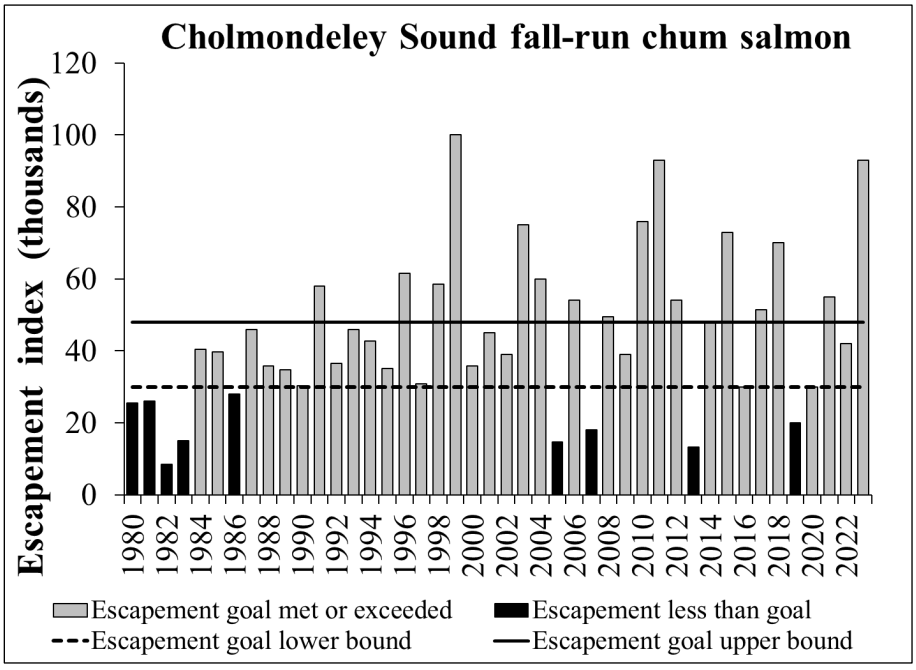
Escapement Goals and Stock Status: The current lower bound sustainable escapement goal of 25,000 chum salmon counted on peak surveys to the aggregate set of index streams was established in 2015, based on the 25th percentile of historical escapement data (Piston and Heinl 2017). The goal is a lower bound sustainable escapement goal, rather than a range, because summer-run chum salmon are harvested in mixed stock commercial fisheries and their escapements cannot be effectively managed to fall within a range. From 2019 to 2023, escapement indices were above the lower bound sustainable escapement goal in 1 of 5 years (Appendix Figure E3; Piston and Fish 2024a).



Appendix Figure E3.–Northern Southeast Outside Subregion summer-run chum salmon escapement index (peak aerial and foot surveys), 1982–2023, and lower bound sustainable escapement goal of 25,000 fish.

Disappearance and Lagoon Creeks, located approximately 40 km west of Ketchikan, on Prince of Wales Island, are the 2 most productive fall-run chum salmon systems in Cholmondeley Sound. Cholmondeley Sound fall-run chum salmon support a terminal commercial purse seine fishery (statistical area 102-40) that has historically provided commercial fishers with a valuable opportunity to extend the fishing season beyond the directed pink salmon purse seine season that typically ends in late August (Piston and Heinl 2014a). Escapements have been assessed annually through aerial surveys since 1980.

Escapement Goals and Stock Status: In 2009, ADF&G established a sustainable escapement goal range of 30,000–48,000 chum salmon counted on combined peak aerial surveys at Disappearance and Lagoon Creeks, based on the 25th and 75th percentiles of historical escapement data (Eggers and Heinl 2008; Piston and Heinl 2017). From 2019 to 2023, escapement indices were above or within the sustainable escapement goal range in 4 of 5 years (Appendix Figure E4; Piston and Fish 2024a).

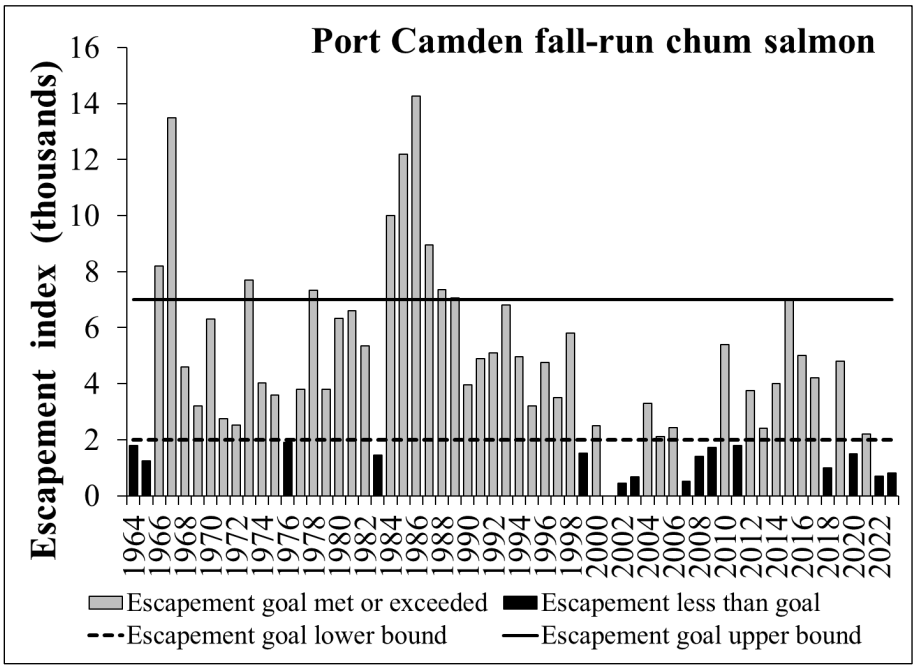


Appendix Figure E4.–Cholmondeley Sound fall-run chum salmon escapement index (peak aerial surveys), 1980–2023, and sustainable escapement goal range of 30,000–48,000 fish.

Appendix E5.–Port Camden fall-run chum salmon.

Port Camden (Kuiu Island) fall-run chum salmon have been harvested in a terminal commercial purse seine fishery (statistical area 109-43) in years when run strength appeared adequate to provide a harvest of fish surplus to escapement needs. Management of the Port Camden stock is based on aerial surveys conducted annually since the early 1960s at each of the 2 primary fall-run chum salmon streams, Port Camden South Head Creek and Port Camden West Head Creek. Both are relatively short streams in terms of spawning habitat; chum salmon runs average slightly smaller in the west head creek and run timing is about 10–14 days later than in South Head Creek (Eggers and Heinl 2008).

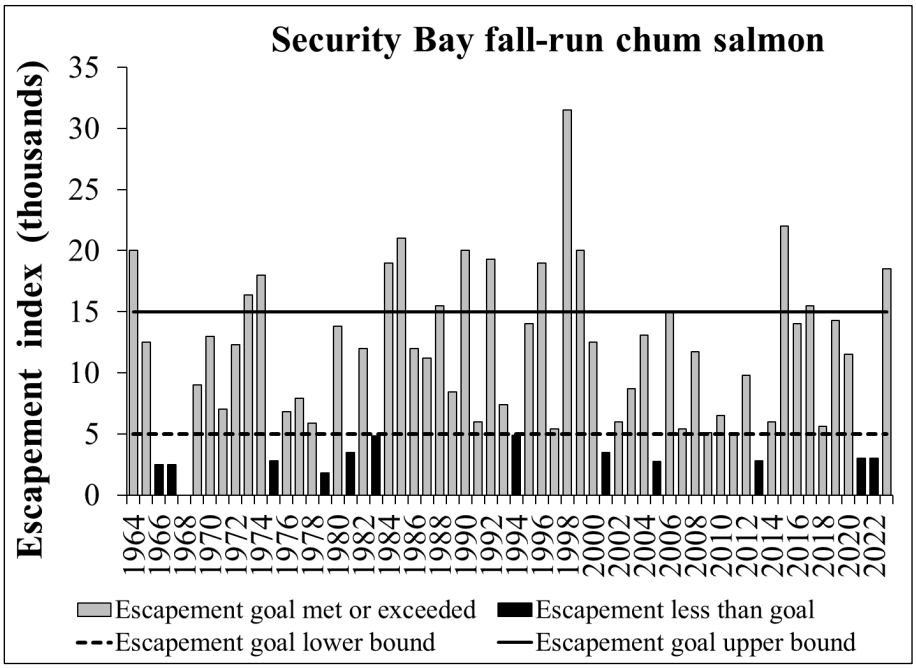
Escapement Goals and Stock Status: In 2009, ADF&G established a sustainable escapement goal range of 2,000–7,000 chum salmon counted on combined peak aerial surveys at Port Camden South Head and Port Camden West Head Creeks based on the 25th and 75th percentiles of historical escapement data (Eggers and Heinl 2008; Piston and Heinl 2017). From 2019 to 2023, escapement indices were within the sustainable escapement goal range in 2 of 5 years (Appendix Figure E5; Piston and Fish 2024a).



Appendix Figure E5.–Port Camden fall-run chum salmon escapement index (peak aerial surveys), 1964–2023, and sustainable escapement goal range of 2,000–7,000 fish.

Security Bay (Kuiu Island) fall-run chum salmon have been harvested in a terminal commercial purse seine fishery (statistical area 109-45) in years when run strength appeared adequate to provide a harvest of fish surplus to escapement needs. Management of the Security Bay stock is based on aerial surveys at Salt Chuck Creek, which have been conducted annually since the early 1960s (Eggers and Heinl 2008).

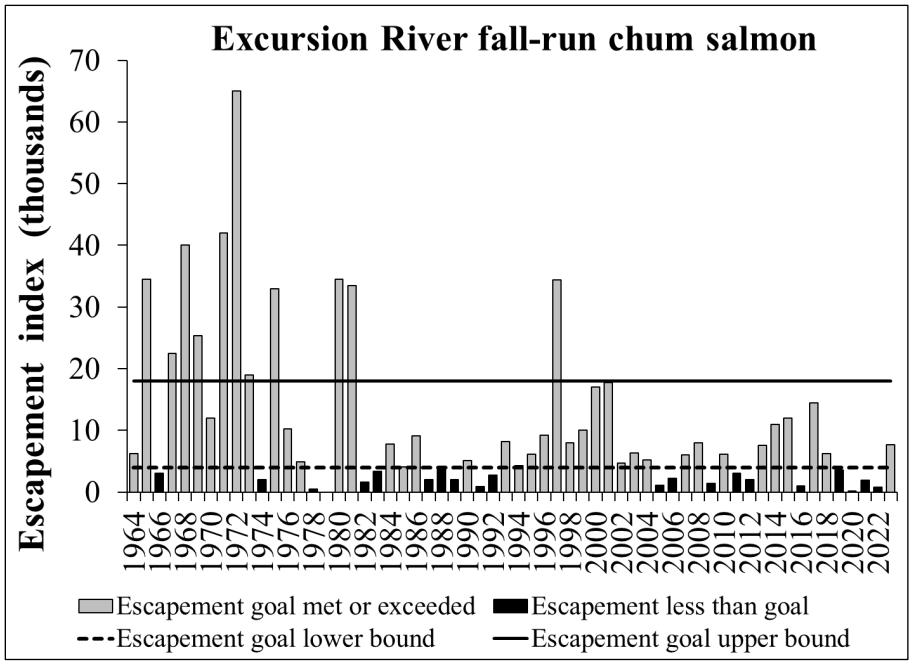
Escapement Goals and Stock Status: In 2009, ADF&G established a sustainable escapement goal range of 5,000–15,000 chum salmon counted on a peak aerial survey at Salt Chuck Creek, based on the 25th and 75th percentiles of historical escapement data (Eggers and Heinl 2008; Piston and Heinl 2017). From 2019 to 2023, escapement indices were above or within the sustainable escapement goal range in 3 of 5 years (Appendix Figure E6; Piston and Fish 2024a).



Appendix Figure E6.–Security Bay fall-run chum salmon escapement index (peak aerial surveys), 1964–2023, and sustainable escapement goal range of 5,000–15,000 fish.

Excursion Inlet fall-run chum salmon have been harvested in a terminal commercial purse seine fishery (statistical area 114-80) during years when run strength appeared adequate to provide a harvest of fish surplus to escapement needs. Escapements at the Excursion River (approximately 17 km northwest of Gustavus, Alaska), the primary chum salmon producing stream in Excursion Inlet, have been assessed annually through aerial surveys since 1960.

Escapement Goals and Stock Status: In 2009, ADF&G established a sustainable escapement goal range of 4,000–18,000 chum salmon counted on a peak aerial survey at Excursion River based on the 25th and 75th percentiles of historical escapement data (Eggers and Heinl 2008; Piston and Heinl 2017). From 2019 to 2023, escapement indices were within the sustainable escapement goal range in 1 of 5 years (Appendix Figure E7; Piston and Fish 2024a).

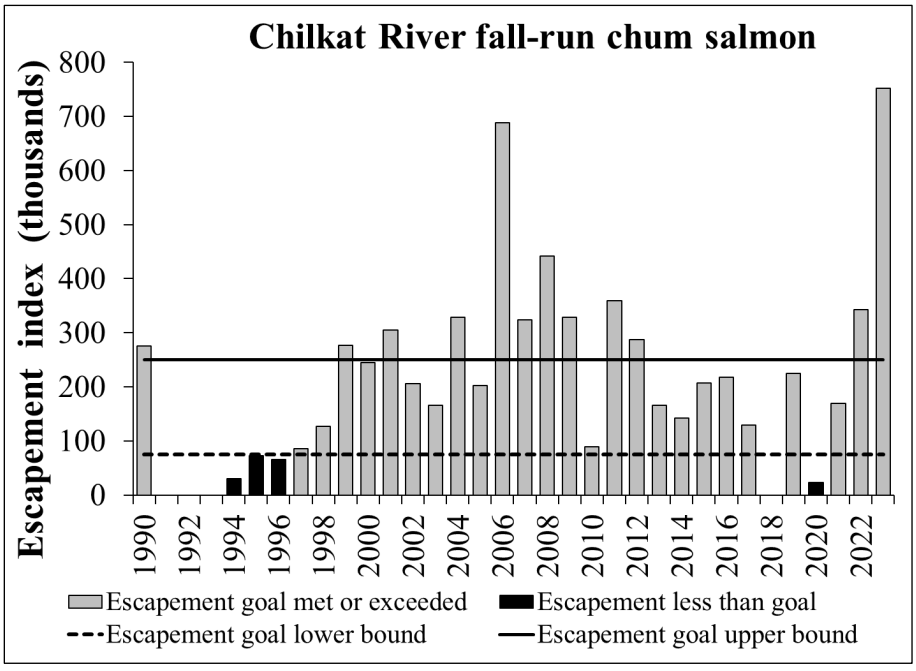


Appendix Figure E7.–Excursion River fall-run chum salmon escapement index (peak aerial surveys), 1964–2023, and sustainable escapement goal range of 4,000–18,000 fish.

Appendix E8.–Chilkat River fall-run chum salmon.

The Chilkat River drainage, near Haines, Alaska, supports the largest fall-run chum salmon population in the region (Halupka et al. 2000). Most spawning takes place in the mainstem and side channels of the Chilkat River and a major tributary, the Klehini River. Chilkat River fall-run chum salmon are primarily harvested in the Lynn Canal (District 15) commercial drift gillnet fishery, although they are likely also harvested to some degree in other mixed stock fisheries prior to reaching Lynn Canal. Escapements by age have been estimated through a fish wheel project operated by ADF&G on the river since 1994 (Bednarski et al. 2017). ADF&G conducted inriver mark–recapture studies in 1990 and from 2002 to 2005 that were designed to estimate the spawning population of chum salmon and relate those estimates to the fish wheel catches and aerial surveys of the primary spawning areas. The cumulative fish wheel catch, which averaged 1.53% of total escapement, was used to estimate the total chum salmon escapement for years when mark–recapture estimates were not available.

Escapement Goals and Stock Status: In 2009, ADF&G established a sustainable escapement goal range of 75,000–170,000 fish or, equivalently, a fish wheel index catch of 1,125–2,550 fish, based on a stock–recruit analysis of the 1994–2002 brood years (Eggers and Heinl 2008). In 2015, the sustainable escapement goal was revised to a range of 75,000–250,000 fish or, equivalently, a fish wheel index catch of 1,160–3,875 fish based on an updated stock–recruit analysis of the 1994–2008 brood years (Piston and Heinl 2014a). The escapement goal represents the range of escapements estimated to provide 70–100% probability of achieving greater than 70% of maximum sustained yield. The goal is considered a sustainable escapement goal due to uncertainty in escapement estimates (Piston and Heinl 2014a). From 2019 to 2023, estimated escapements were within or above the escapement goal range in 4 of 5 years (Appendix Figure E8; Piston and Fish 2024a).



Appendix Figure E8.–Chilkat River fall-run chum salmon escapements (expanded fish wheel counts), 1990–2023, and sustainable escapement goal range of 75,000–250,000 fish. Escapement estimates are not available for 1991–1993 and 2018.