YUKON RIVER SALMON 2018 SEASON SUMMARY AND 2019 SEASON OUTLOOK

Prepared by

THE UNITED STATES AND CANADA
YUKON RIVER JOINT TECHNICAL COMMITTEE

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Regional Information Report 3A19-01
Alaska Department of Fish and Game
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Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, 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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The Regional Information Report Series was established in 1987 and was redefined in 2007 to meet the Division of Commercial Fisheries regional need for publishing and archiving information such as area management plans, budgetary information, staff comments and opinions to Alaska Board of Fisheries proposals, interim or preliminary data and grant agency reports, special meeting or minor workshop results and other regional information not generally reported elsewhere. Reports in this series may contain raw data and preliminary results. Reports in this series receive varying degrees of regional, biometric and editorial review; information in this series may be subsequently finalized and published in a different department reporting series or in the formal literature. Please contact the author or the Division of Commercial Fisheries if in doubt of the level of review or preliminary nature of the data reported. Regional Information Reports are available through the Alaska State Library and on the Internet at: http://www.adfg.alaska.gov/sf/publications/

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1.0 ABSTRACT

The Yukon River Joint Technical Committee (JTC) of the United States and Canada meets twice a year to analyze and discuss harvest and escapement goals, management trends, postseason reviews, preseason outlooks, and results of cooperative research projects. This report summarizes the status of Chinook *Oncorhynchus tshawytscha*, coho *O. kisutch*, and summer and fall chum salmon *O. keta* stocks in 2018, presents a 2019 season outlook, and provides data about salmon harvests in commercial, subsistence, aboriginal, personal use, domestic, and sport or recreational fisheries. Summaries of Yukon River research projects are also included. For 2018, the preliminary estimate of Chinook salmon (mainstem) spawning escapement into Canada was approximately 54,000 fish, near the upper end of the interim management escapement goal (IMEG) range of 42,500–55,000 fish. A preliminary estimate of the total Canadian-origin Chinook salmon run was approximately 76,000 fish. The preliminary estimate of fall chum salmon spawning escapement in the Canadian mainstem Yukon River was approximately 154,000 fish, exceeding the upper end of the IMEG range of 70,000–104,000 fish. The preliminary estimate of fall chum salmon spawning escapement in the Fishing Branch River (Porcupine River), obtained from a weir count combined with sonar estimates, was approximately 10,200 fish and well below the IMEG range of 22,000–49,000 fish. Recommended interim management escapement goals for Canadian-origin mainstem Yukon River Chinook and fall chum salmon and Fishing Branch (Porcupine River) fall chum salmon in 2019 remain the same as for 2018.

Key words: Chinook salmon *Oncorhynchus tshawytscha*, chum salmon *O. keta*, coho salmon *O. kisutch*, Yukon River, Yukon River Salmon Agreement, Joint Technical Committee, escapement, escapement goal, interim management escapement goal IMEG, management strategy, season outlook.

2.0 INTRODUCTION

The purpose of this annual *Yukon River Season Summary and Season Outlook* report is to present data for the Canadian-origin Yukon River salmon stocks subject to the *Yukon River Salmon Agreement*. In 2001, after many years of negotiation, the *Yukon River Salmon Agreement* was signed by the governments of Canada and the United States. The Agreement continues to represent an international commitment to the restoration, conservation, and management of Yukon River salmon. The Agreement also established the Yukon River Panel as the main instrument to implement the treaty and the Joint Technical Committee (JTC) as the body responsible for acquiring the best science and management expertise possible to support the Yukon River Panel.

The JTC was established as an international advisory committee to evaluate management plans and escapement goals for the transboundary stocks of salmon within the Yukon River drainage. The JTC is comprised of representatives from both State, Territorial, and Federal agencies, and local and regional organizations in the U.S. and Canada. The JTC meets twice a year and is charged with various tasks related primarily to Yukon River salmon stock assessment and management, including reporting on preseason outlooks and postseason reviews, examining management regimes and recommending how they may be improved to achieve management and escapement goals, and evaluating the status of Canadian-origin salmon stocks and making recommendations for adjustments to rebuilding programs. This report fulfils several of the JTC's functions as well as serving as a repository for important data related to Yukon River salmon stocks that is used by fisheries managers, Tribal and First Nation governments, fishers, and other stakeholders as the primary record for Yukon River salmon.

This report focuses on Chinook *Oncorhynchus tshawytscha*, fall chum *O. keta*, and coho salmon *O. kisutch* stocks that originate in Canadian waters and are covered by the *Yukon River Salmon Agreement*. Summer chum salmon occur entirely within the U.S. portion of the Yukon River drainage and have overlapping run timing with Chinook salmon and fall chum salmon. Where they overlap, the management of summer chum salmon is affected by the management of Chinook salmon and vice-versa. As such, this report contains information about summer chum salmon to

provide context for fisheries assessment and management decisions that affect Canadian-origin Chinook and fall chum salmon. Like summer chum salmon, few coho salmon are bound for the upper reaches of the Yukon River in Canada, therefore discussion of coho salmon is primarily limited to the Porcupine River population. This annual report covers salmon fishery and management topics addressed by the JTC following the 2018 season and preceding the 2019 season.

YUKON RIVER SALMON AGREEMENT MANAGEMENT PERFORMANCE SUMMARY

The following is a summary of information contained in the main body of the report, tables, figures, and appendices. This summary is provided at the request of the Yukon River Panel to summarize specific information about outcomes of the 2018 season, size of the 2019 salmon runs, and 2019 escapement goal recommendations related to the Yukon River Salmon Agreement.

2018 Total Run Size, Harvest, and Escapement of Canadian-Origin Chinook Salmon

The preliminary estimate of the 2018 Canadian-origin Chinook salmon run in the mainstem Yukon River was 76,530 fish and was near the low end of the 2018 preseason outlook range of 71,000–103,000 fish. The harvest of Canadian-origin Chinook salmon in the U.S. was estimated to be 19,266 fish. The U.S./Canada border passage of Chinook salmon was 57,264. The mainstem harvest of Chinook salmon in Canada was estimated to be 2,790 fish. The spawning escapement of mainstem Canadian-origin Yukon River Chinook salmon was estimated to be 54,474 fish, near the upper end of the Interim Management Escapement Goal (IMEG) range of 42,500–55,000 fish.

2018 Total Run Size, Harvest, and Escapement of Canadian-Origin Fall Chum Salmon

The preliminary estimate of the 2018 Canadian-origin fall chum salmon run in the mainstem Yukon River was approximately 279,000 fish and was below the preseason outlook range of 400,000–450,000 fish. The preliminary harvest of Canadian-origin fall chum salmon in the U.S. was approximately 122,000. The U.S. harvest is not known with certainty and was approximated as 25% of the total U.S. harvest of fall chum salmon that occurred downstream of Eagle sonar (441,955 fish) plus the fall chum salmon harvested between the Eagle sonar and U.S./Canada border (11,715). The U.S./Canada border passage of mainstem fall chum salmon was 157,083. The harvest of fall chum salmon in Canada was 2,957. The spawning escapement of mainstem Canadian-origin fall chum salmon was estimated to be 154,126 fish and above the upper end of the IMEG range of 70,000–104,000 fish.

The total run size estimate for 2018 Fishing Branch fall chum salmon was 29,000 fish and is highly uncertain. Total harvest of Fishing Branch fall chum in the U.S. was approximately 17,700 fish and assumed that 4% of the total U.S. harvest of fall chum salmon downriver from Eagle sonar were bound for the Fishing Branch River. The total harvest of Fishing Branch fall chum salmon in Canada was approximately 1,031 and assumed that 55% of the fall chum harvested by the community of Old Crow were bound for the Fishing Branch. Escapement past the Fishing Branch weir was 10,151 and below the IMEG range of 22,000–49,000 fish.

2019 Outlooks

The preseason outlook range presented by the Joint Technical Committee for Canadian-origin salmon stocks:

- Chinook salmon: 69,000–99,000
- Mainstem fall chum salmon: 233,000–290,000
- Fishing Branch fall chum salmon: 37,000–46,000

2019 Escapement Goals

There will be no changes in 2019 to the interim management escapement goals (IMEGs) for any Yukon River salmon stocks subject to the *Yukon River Salmon Agreement*. IMEGs for the 2019 season will be:

- Chinook salmon: 42,500–55,000
- Mainstem fall chum salmon: 70,000–104,000
- Fishing branch fall chum salmon: 22,000–49,000

At the April 2017 meeting, the Yukon River Panel acted to implement the current Chinook salmon IMEG for 3 years, 2017–2019. At the 2018 April meeting the Yukon River Panel acted to implement the mainstem and Fishing Branch fall chum salmon IMEGs for 2 years, 2018 and 2019.

3.0 ALASKA MANAGEMENT OVERVIEW

3.1 CHINOOK AND SUMMER CHUM SALMON

The Yukon River drainage in Alaska (Yukon Area) is divided into fishery districts and subdistricts for management purposes (Figure 1). Management of the Yukon Area summer season mainstem commercial salmon fisheries is in accordance with the *Policy for the Management of Sustainable Salmon Fisheries* 5 ACC 39.222, the *Yukon River Drainage King Salmon Management Plan* 5 ACC 05.360, and the *Yukon River Summer Chum Salmon Management Plan* 5 ACC 05.362. The summer chum salmon management plan establishes run size thresholds needed to allow subsistence, commercial, sport, and personal-use fishing, prioritizing subsistence among uses, and prioritizing escapement over consumptive uses. Because summer chum and Chinook salmon migrate concurrently, regulations in the management plans allow for using selective gear types that target summer chum salmon during times of Chinook salmon conservation and allow immediate, live release of Chinook salmon back to the water. These regulations help ensure Chinook salmon escapement objectives will be met in years of low Chinook salmon run sizes and provide fishing opportunity on the more abundant summer chum salmon runs.

During the “summer season” (early May–July 15 in District 1), management and research staff are based in the Emmonak office and the focus is on assessing and managing the summer chum and Chinook salmon runs. After July 15, in Emmonak, Chinook salmon are nearly done entering the river and the summer chum salmon run transitions to the fall chum salmon run. On July 16, management transitions to the “fall season” and assessment and management become focused on fall chum and coho salmon runs.

Throughout most of the fishing season, weekly teleconferences were facilitated by the Yukon River Drainage Fisheries Association (YRDFA) to provide managers, fishermen, tribal/traditional council representatives, and other stakeholders the opportunity to share information, provide input, and discuss inseason management options. During these weekly teleconferences, the Alaska

Department of Fish and Game (ADF&G) and the U.S. Fish and Wildlife Service (USFWS) staff provided inseason run assessment information (Figure 2) and upcoming management strategies and subsistence fishermen reported on fishing effort and water conditions in their respective communities along the river.

Preseason Management Strategy Planning

The Canadian-origin run of Chinook salmon in 2018 was projected to be approximately 71,000–103,000 fish, and the Yukon River drainagewide run (U.S. and Canada stocks) was expected to be 173,000–251,000 fish. For Canadian-origin Chinook salmon, the IMEG range recommended by the Yukon River Panel was 42,500–55,000 fish.

The summer chum salmon outlook was projected to be over 2 million fish, which was a run size sufficient to meet escapement and subsistence needs and provide a harvestable surplus for commercial fisheries. However, the management of a summer chum salmon-directed commercial fishery would be affected by the need to conserve Chinook salmon and would depend on Chinook salmon run timing and abundance.

Initial fishery management would be conservative until inseason assessment indicated the Chinook salmon run size would be toward the upper end of the projected range and therefore was expected to be strong enough to meet escapement objectives and provide a harvestable surplus; however, as in recent years, conservation measures were still anticipated to be necessary. Before the season, YRDFA facilitated a meeting with U.S. management agencies, fishermen, tribal/traditional council representatives, and other stakeholders to develop a preseason management strategy. The purpose of this meeting was to cooperatively identify practical management strategies that would achieve the following goals: achieve escapement objectives and harvest sharing of Canadian-origin salmon stocks subject to the *Yukon River Salmon Agreement*; ensure adequate numbers of Chinook salmon reach their spawning grounds in Alaska and Canada; provide some opportunity to harvest Chinook salmon; and provide ample opportunity to harvest abundant summer chum salmon and non-salmon species.

An annual informational flyer detailing the outlooks for Chinook, chum, and coho salmon and likely fishery management strategies was mailed preseason to approximately 2,700 Yukon River households.

Chinook and Summer Chum Salmon Inseason Management

Managers waited for increased Chinook salmon catches at the Lower Yukon test fishery (LYTF; Figure 3) before restricting the subsistence gillnet fishery. This was to provide fishermen early opportunity to target sheefish and other non-salmon species when there would be little effect on the Chinook salmon run. In District 1, fishermen were placed on a reduced regulatory schedule of two 18-hour periods per week starting on June 8.

Subsistence fishing efforts in the Lower Yukon Area were affected by river conditions for much of the early part of the season. During the YRDFA teleconferences throughout the first 2 weeks of June, callers remarked on high water, bank erosion, presence of lots of “drift” debris, and poor fishing/preserving weather.

The 2018 Chinook salmon run had later than average run timing. The early and first 2 pulses of Chinook salmon assessed at the mainstem Yukon River sonar located near the community of Pilot

station (Pilot Station sonar; Figure 4) were relatively weak compared to preseason forecasts. Run strength improved by the third and fourth pulses.

Like the Chinook salmon run, the summer chum salmon run was later than average, causing the 2 runs to overlap more than usual and further complicating management. This meant that very large numbers of summer chum salmon were passing at the same time as Chinook salmon. Species overlap can have a self-limiting effect on the harvest of Chinook salmon for fishermen in Districts 1–4, particularly when 6-inch mesh (chum salmon gear) is the maximum mesh size allowed.

In most districts, the normal regulatory schedule consists of 2 fishing periods per week but varies by duration and days of the week (Table 1). In 2018, once Chinook salmon were in the river, districts were put on a reduced regulatory schedule in which each period was shortened to about half the usual fishing time. However, the low passage of Chinook salmon counted at the Pilot Station sonar triggered cancelation of 1 fishing period per week in most districts to protect each pulse of fish and to spread the harvest across all pulses. To further protect Chinook salmon, fishing was also limited to 6-inch or smaller mesh gillnets at times. This was to allow fishermen opportunity to harvest summer chum salmon for subsistence while restricting harvests of Chinook salmon. Some districts were put on alternating periods of 6-inch and 7.5-inch gear, so that for 1 period per week, some Chinook-directed subsistence harvest would be possible, though time for fishing was still reduced by half.

Table 1.–Yukon Area regulatory subsistence salmon fishing schedule.

Area	Regulatory subsistence fishing periods	Open fishing times
Coastal District	7 days per week	M/T/W/TH/F/SA/SU - 24 hours/day
District 1	Two 36-hour periods per week	Mon 8 pm to Wed 8 am / Thu 8 pm to Sat 8 am
District 2	Two 36-hour periods per week	Wed 8 pm to Fri 8 am / Sun 8 pm to Tue 8 am
District 3	Two 36-hour periods per week	Wed 8 pm to Fri 8 am / Sun 8 pm to Tue 8 am
District 4	Two 48-hour periods per week	Sun 6 pm to Tue 6 pm / Wed 6 pm to Fri 6 pm
Koyukuk and Innoko Rivers	7 days per week	M/T/W/TH/F/SA/SU - 24 hours/day
Subdistricts 5-A, -B, -C	Two 48-hour periods per week	Tue 6 pm to Thu 6 pm / Fri 6 pm to Sun 6 pm
Subdistrict 5-D	7 days per week	M/T/W/TH/F/SA/SU - 24 hours/day
Subdistrict 6	Two 42-hour periods per week	Mon 6 pm to Wed Noon / Fri 6 pm to Sun Noon
Old Minto Area	5 days per week	Friday 6 pm to Wednesday 6 pm

Note: This schedule was altered during the 2018 season based on Chinook salmon run strength. In the Upper Yukon Area, fishing times are longer by regulation to help account for longer travel times and lower numbers of fish available as fish leave the mainstem Yukon River to spawn in U.S. tributaries.

The assessment of Chinook salmon run strength had improved by the time the run reached District 5, and it was no longer warranted to cancel fishing periods. However, fishing remained on half the regulatory fishing schedule with 6-inch and smaller mesh gillnets and fish wheels through most of the run. The management rationale for these upriver actions was that there are far fewer summer chum salmon present as most have entered tributaries such as the Anvik and the Tanana rivers, which makes targeting Chinook salmon easier in these areas, even when using “chum salmon gear”. Furthermore, using 6-inch or smaller mesh gear may have the effect of reducing the harvest of the largest and oldest fish. With a below-average run size overall, trying to let older and larger fish escape to spawning areas may be an added benefit to using this mesh size in the upper river.

More detail on management and conservation measures implemented[1] are also summarized in Appendix B19.

3.2 FALL CHUM AND COHO SALMON

Management of the Yukon Area fall season commercial salmon fisheries is in accordance with the *Policy for the Management of Sustainable Salmon Fisheries* 5 ACC 39.222, the *Yukon River Drainage Fall Chum Salmon Management Plan* 5 ACC 1.249, the *Yukon River Coho Salmon Management Plan* 5 ACC 05.369, and the *Tanana River Salmon Management Plan* 5 AAC 05.367. The fall chum salmon plan incorporates *Yukon River Salmon Agreement* objectives for border passage and harvest shares of fall chum salmon and provides guidelines necessary for escapement and prioritized uses (Table 2). The intent of the plan is to align management objectives with the established escapement goals, provide flexibility in managing subsistence harvests when stocks are low, and bolster salmon escapement as run abundance increases. The sustainable escapement goal (SEG) range for the Yukon River drainage is 300,000–600,000 fall chum salmon (Fleischman and Borba 2009). The IMEG for Canadian-origin Mainstem Yukon River is 70,000–104,000 fall chum salmon, and the IMEG for Fishing Branch River is 22,000–49,000 fall chum salmon. There are provisions in the plan to allow incremental levels of subsistence salmon fishing balanced with requirements to attain escapement objectives during low runs. The threshold number of fall chum salmon needed to allow commercial fishing is 550,000 fish and commercial fishing is generally allowed only on the surplus projected above that level.

Table 2.–Yukon River drainage fall chum salmon management plan overview.

Run size estimate [b] (point estimate)	Recommended management action [a] Fall chum salmon directed fisheries				Targeted drainagewide escapement
	Commercial	Personal Use	Sport	Subsistence	
300,000 or Less	Closure	Closure	Closure	Closure [c]	300,000
300,001 to 500,000	Closure	Closure [c]	Closure [c]	Possible restrictions [c, d]	to
Greater than 500,001	Open [e]	Open	Open	No restrictions	600,000

[a] Considerations for the Canadian mainstem rebuilding plans may require more restrictive management actions.

[b] Alaska Department of Fish and Game will use the best available data, including preseason projections, mainstem river sonar passage estimates, test fisheries indices, subsistence and commercial fishing reports, and passage estimates from escapement monitoring projects.

[c] The fisheries may be opened or less restrictive in areas where indicator(s) suggest the escapement goal(s) in that area will be achieved.

[d] Subsistence fishing will be managed to achieve a minimum drainagewide escapement goal of 300,000 fall chum salmon.

[e] Drainagewide commercial fisheries may be open and the harvestable surplus above 550,000 fall chum salmon will be distributed by district or subdistrict (in proportion to the guidelines harvest levels established in 5 AAC 05.365 and 5 AAC 05.367).

The coho salmon plan allows a coho salmon directed commercial fishery as long as the incidental catch of fall chum salmon remains above a 500,000 threshold, a harvestable surplus of coho salmon

[1] To look up a news release for the Yukon River fisheries in the U.S. go to the following website: http://www.adfg.alaska.gov/index.cfm?adfg=cfnews.search

is identified, and a commercial fishery will not have a significant impact on fall chum salmon escapement and allocation. The Tanana River plan specifies that commercial fishing in Subdistrict 5-A and District 6 are based on the assessment and timing of salmon stocks bound for the Tanana River drainage.

Fall Chum Salmon Management Overview

Alaska Department of Fish and Game monitored a suite of assessment projects in the lower river that provided salmon run timing, relative abundance, and stock composition information. Projects operated (Figure 2) included: 2 drift gillnet test fisheries that provided timing information and relative abundance, the Pilot Station sonar that provided abundance estimates, and harvest/effort information from both subsistence and commercial fisheries. Genetic samples collected from chum salmon at the mainstem sonar provided stock composition information. Additionally, escapement projects were operated in the upper Yukon River tributaries and the upper mainstem of the Yukon River. Assessment projects operated in the upper river included sonars in the mainstem Yukon River near the U.S./Canada border as well as in 2 tributaries (Teedriinjik-Chandalar and Upper Porcupine rivers), and a weir/sonar combination on the Fishing Branch River (Porcupine River headwater). Data from these projects were analyzed collectively inseason and used to determine whether escapement goals would be achieved. Age, sex, and length information were also collected at the lower river test fisheries, District 1 commercial fishery, mainstem Yukon River sonar near Eagle (Eagle sonar), as well as escapements in the Fishing Branch and Delta rivers.

By regulation, the fall season began in District 1 on July 16 and all chum salmon caught in the LYTF until the end of the season were considered fall chum salmon. The Mountain Village drift gillnet test fishery (MVTF) began operating on July 18, and the Pilot Station sonar began counting fall chum salmon on July 19. The subsequent transition of upriver districts and subdistricts to the fall season was based on the migration timing of fall chum salmon. In anticipation that the fall chum salmon run size in 2018 would meet both escapement needs and provide for a commercial surplus, all districts and subdistricts were placed on their regulatory subsistence fishing schedules upon transitioning to fall season management. Based on sufficient inseason run size projections, ADF&G liberalized subsistence fishing schedules on the Yukon River mainstem. Upon transitioning to fall season management, subsistence fishermen were allowed to use gillnets up to 7.5-inch mesh size and use of dip net gear was discontinued.

Subsistence salmon fishing in the mainstem Porcupine River within Alaska was placed on a reduced schedule of one 96-hour period per week beginning September 6. Subsistence salmon fishing on Porcupine River tributaries, such as the Sheenjek and Black rivers, remained open 7 days a week, 24 hours per day. The reduced schedule was an attempt to increase the number of fall chum salmon reaching the Canadian portion of the Porcupine River drainage. On October 3, a full subsistence salmon fishing closure was implemented in the U.S. portion of the Porcupine River mainstem when assessment at both the Porcupine River sonar and Fishing Branch river weir continued to be poor.

The LYTF completed operations on September 10 (Yukon Delta Fisheries Development Association conducted drifts in late August through the end of the season, after ADF&G ceased operations) and had a preliminary total catch per unit effort (CPUE) for fall chum salmon of 2,954 fish, which was above the 2001–2017 median of 1,521 fish. The MVTF ceased operations on September 12 with a preliminary cumulative CPUE for fall chum salmon of 3,025, which was above the 1997–2017 (excluding 2013) median of 2,051 fish. The Pilot Station sonar ceased

operations on September 7. The preliminary fall chum salmon passage estimate at the Pilot Station sonar was 928,664 fish ±55,042 (90% CI), which was well above the 1995–2017 (excluding 1996 and 2009) median of 707,000 fish.

The 2018 fall chum salmon run entered the Yukon River in 7 distinct pulses (Figure 5). The first pulse contained a high proportion of summer chum salmon and the transition date was delayed due to the late arrival of the fall chum salmon stocks. Each of the successive 5 pulses was larger than the last except for the final pulse which was the smallest of the season. The fourth and fifth pulses entered in short succession and the sixth pulse was the largest with 188,000 fall chum salmon passage at the mainstem sonar in 3 days, peaking on August 30.

Cumulative fall chum salmon passage past the mainstem sonar tracked slightly below the historical median (1995–2017, excluding 1996 and 2009) through the middle of August, then exceeded the median after August 29 when the largest pulse entered the river. Based on the harvest levels through mid-August, the inseason run projections followed the 550,000 fall chum salmon threshold necessary to allow fall chum salmon directed commercial fishing but once the late large pulses arrived the preseason projection was exceeded. Run timing for fall chum salmon was on average 7 days late over all the assessment projects in both the lower and upper river.

Coho Salmon Management Overview

The preliminary coho salmon passage estimate at the Pilot Station sonar was 136,347 fish ± 11,895 (90% CI), which was well below the historical median (1995–2017, excluding 1996 and 2009) of 160,300 fish. The cumulative coho salmon passage past the Pilot Station sonar was tracking below the historical median throughout the season (Figure 6). Both the preliminary total cumulative CPUE for coho salmon at the LYTF and MVTF were well below their respective historical medians. The run reconstruction was below median until August 31, when a large pulse of coho salmon entered the Yukon River. Coho salmon directed commercial fisheries occurred in District 1, during September 1–10, and in District 6, as a terminal harvest area during October 1–28.

4.0 ALASKA HARVEST SUMMARIES

4.1 SUBSISTENCE SALMON FISHERY

Subsistence salmon fishing activities in the Yukon River drainage typically begin in late May and continue through mid-October (Jallen et al. 2017). Fishing opportunity in the Lower Yukon Area (Districts 1–3) in May and the Upper Yukon Area (Districts 4–6) in October is highly dependent upon river ice conditions. Throughout the drainage, most Chinook salmon harvested for subsistence use are dried, smoked, or frozen for later human consumption. Summer chum, fall chum, and coho salmon harvested in the lower Yukon River are primarily utilized for human consumption, often dried, smoked, or frozen for later use. In the Upper Yukon Area, summer chum, fall chum, and coho salmon are an important human food source, but a larger portion of the harvest is fed to dogs used for recreation and transportation (Andersen 1992).

Documentation of the subsistence salmon harvest is necessary to determine if sufficient salmon are returning to the Yukon Area and enough fishing opportunities are being provided to meet subsistence needs. In years with fishery restrictions, estimates of harvest can be used to assess the effect of the management actions taken to meet escapement goals to maintain future salmon production. The primary method of estimating subsistence harvest is voluntary participation in the annual subsistence salmon harvest survey program conducted by ADF&G, Division of

Commercial Fisheries. The survey is conducted in 33 communities (including the 2 coastal communities of Hooper Bay and Scammon Bay) during the fall, after most households have completed fishing for salmon. Additional information about harvest timing is obtained from harvest calendars that are sent to households and filled out voluntarily. Fishing permit information also provides information about harvest timing for areas of the river where permits are required.

In 2018, subsistence harvest surveys identified approximately 2,737 households in the Yukon Area in 31 communities. Of these, an estimated 1,379 households fished for salmon. Permits are not required for subsistence fishing throughout most of the Yukon Area, except for the urban areas around Fairbanks and other areas accessible by road. Therefore, the largest share of subsistence harvest in the Yukon Area is estimated from the detailed postseason survey results. Two hundred-eighty subsistence salmon fishing permits were issued in 2018, approximately 89% of the subsistence salmon permits had been returned at the time of this publication, and 152 salmon permits reported fishing.

All 2018 subsistence harvest data are considered preliminary as of the publication date of this report. Final results will be included in an ADF&G Fishery Data Series publication after the analysis is completed and reviewed. Based on survey and permit data, the 2018 preliminary subsistence salmon harvest in the Alaska portion of the Yukon River drainage was estimated to be 31,812 Chinook; 76,926 summer chum; 64,494 fall chum; and 5,527 coho salmon (Appendices B2–B5). For comparison, recent 2013–2017 average subsistence salmon harvest estimates were 16,625 Chinook; 92,220 summer chum; 92,451 fall chum; and 13,159 coho salmon (Appendices B2–B5) from communities in the Alaska portion of the Yukon River drainage. The estimated 2018 harvest of Chinook, fall chum, and coho salmon were below levels defined by the Alaska Board of Fisheries as Amounts Reasonably Necessary for Subsistence[2] (Brown and Jallen 2012).

Of the 31,812 Chinook salmon harvested in Alaska waters, 19,266 fish were of Canadian-origin based on genetic samples taken from the subsistence harvest in 2018 (Appendix B18). Samples were collected from communities in each of the 5 mainstem fishing districts and the proportion of Canadian-origin fish in each set of samples was then applied to that district's harvest. The estimated Canadian-origin harvests from each district were then summed for a total Canadian-origin harvest estimate (DuBois 2018). Subsistence fish harvested in the Black River, Koyukuk drainage, Chandalar River, Birch Creek, and District 6 (Tanana River) are presumed to not be Canadian-origin and therefore are not included in Canadian-origin harvest total. Small amounts of salmon harvests from some tributary community residences are harvested on the mainstem Yukon River; however, they were not included in the Canadian-origin analysis.

4.2 COMMERCIAL FISHERY

Summer Season Harvest

With the forecasted large run of summer chum salmon, liberal commercial fishing opportunity was provided in Districts 1, 2, 4, and 6. Because Chinook salmon are encountered incidentally in the commercial summer chum salmon fishery, a suite of strategies were used to conservatively manage the fishery in order to minimize the impact to the Chinook salmon run. In Districts 1 and 2, dip nets and beach seines were used, and in District 4, manned fish wheels were used. Chinook salmon are required to be released alive from these selective gear types. Once commercial fishing was

[2] Amounts reasonably necessary for subsistence are set by the Alaska Board of Fisheries for stocks which are determined to have customary and traditional use. See http://www.adfg.alaska.gov/index.cfm?adfg=subsistence.reasonable for further definition.

allowed with gillnets (in Districts 1, 2 and 6), all Chinook salmon could be kept for subsistence use or continued to be released alive.

For the eleventh consecutive year, no commercial periods targeting Chinook salmon were allowed in the Yukon or Tanana rivers during the summer season (Figure 7). Sale of incidentally-caught Chinook salmon was prohibited in both summer and fall seasons.

During the 2018 summer season, the total commercial harvest in the Alaska portion of the Yukon River drainage was 576,700 summer chum salmon (Appendix A2), the largest harvest since 1989. The commercial harvest of summer chum salmon in the Lower Yukon Area (Districts 1–3) was 446,381 and in the Upper Yukon Area (Districts 4–6) was 130,319 fish. Harvest using selective gear accounted for over 64% of the total commercial summer chum salmon harvest in Yukon Area. In the Yukon Area commercial fisheries, approximately 12,326 Chinook salmon were reported as caught and released.

Fall Season Harvest

There was a total of 65 commercial periods in 2018 during the fall season, the majority of which occurred in the lower river districts. Commercial fishing periods were established in Subdistrict 4-A, 5-B, 5-C and in District 6, but limited markets resulted in low fishing effort and relatively small harvests in these Upper Yukon Areas. The total commercial harvest for the Yukon River in the Alaska portion of the drainage was 387,788 fall chum salmon and 110,587 coho salmon (Figures 8 and 9; Appendix A2). The 2018 commercial harvest of fall chum salmon was above the 2013–2017 5-year average of 300,044 and the 2008–2017 10-year average of 217,670 (Appendix B4). The 2018 commercial harvest of coho salmon was below the 2013–2017 5-year average of 128,198 and above the 2008–2017 10-year average of 84,083 (Appendix B5). The average weight of fall chum salmon caught commercially in Districts 1 and 2 was approximately 7.4 lbs. The average weight of coho salmon was approximately 6.4 lbs.

4.3 SPORT FISHERY

Sport fishing effort for wild salmon in the Yukon River drainage is directed primarily at Chinook and coho salmon, with little effort directed at chum salmon. All chum salmon harvested in the sport fishery are categorized as summer chum salmon because these fish are mostly caught incidental to Chinook salmon during mid-summer in clearwater tributaries. Some harvest of fall chum salmon entering clearwater tributaries after Chinook salmon spawning occurs but is considered negligible relative to summer chum salmon harvests.

Alaska sport fishing effort and harvests are monitored annually through a statewide sport fishery postal survey.[3] Harvest estimates are not available until approximately 1 calendar year after the fishing season; therefore, 2018 estimates were not available for this report. Total sport harvest of salmon during 2017 in the Alaska portion of the Yukon River drainage (including the Tanana River) was estimated to be 18 Chinook, 186 chum, and 291 coho salmon (Appendices B2, B3, and B5). The 2013–2017 average sport salmon harvest within the Alaska portion of the Yukon River drainage was estimated to be 43 Chinook, 488 chum, and 735 coho salmon (Appendices B2, B3, and B5).

[3] Alaska Sport Fishing Survey database [Internet]. 1996–2017. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited November 7, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

Most of the sport fishing effort for the Yukon River occurs in the Tanana River drainage along the road system (Baker 2018). From 2013 to 2017, sport harvests in the Tanana River represented, on average, 29%, 3%, and 38% of the total Yukon River drainage Chinook, summer chum, and coho salmon sport fish harvest, respectively. In the Tanana River, most Chinook and chum salmon are harvested from the Chena, Salcha, and Chatanika rivers, whereas most coho salmon are harvested from the Delta Clearwater and Nenana river systems. In the Yukon River drainage, excluding the Tanana River, most sport fishing effort for salmon takes place in the Anvik and Andreafsky rivers.

Since 2005, all freshwater sport fishing guides and guide businesses operating in Alaska have been required to be licensed. In addition, sport fishing guides and businesses are required to report sport fish harvest and fish released in logbooks. From 2012–2016, guided sport harvests in the Yukon River drainage (excluding the Tanana River drainage) averaged 33 Chinook and 322 coho salmon. Data for 2018 is unavailable for this report.

For 2018, all waters of the Alaska portion of the Yukon River drainage (excluding the Tanana River drainage) were closed to sport harvest of Chinook salmon effective May 11, 2018. However, a limited sport harvest of 1 annual Chinook salmon of 20 inches and greater in length was allowed in the Tanana River drainage.

4.4 PERSONAL USE FISHERY

The Fairbanks Nonsubsistence Area, located in the middle portion of the Tanana River, contains the only personal use fishery within the Yukon River drainage. Subsistence or personal use permits have been required in this portion of the drainage since 1973. Personal use fishing regulations were in effect from 1988 until July 1990, and from 1992 until April 1994. In 1995, the Joint Board of Fisheries and Game reestablished the Fairbanks Nonsubsistence Area which has subsequently been managed consistently under personal use regulations. Historical harvest data must account for these changes in status.

Subdistrict 6-C is completely within the Fairbanks Nonsubsistence Area and therefore falls under personal use fishing regulations. Personal use salmon or whitefish/sucker permits and a valid resident sport fishing license are required to fish within the Fairbanks Nonsubsistence Area. The harvest limit for a personal use salmon household permit is 10 Chinook, 75 summer chum, and 75 fall chum and coho salmon combined. The personal use salmon fishery in Subdistrict 6-C also has a harvest limit of 750 Chinook; 5,000 summer chum; and 5,200 fall chum and coho salmon combined.

In 2018, the personal use salmon fishery followed the regulatory fishing schedule of two 42-hour periods per week starting at 6:00 pm Mondays and 6:00 pm Fridays. Fishermen were required to release Chinook salmon alive from fish wheels and dip nets. A total of 99 personal use salmon permits were issued. The 2018 preliminary harvest results, based on 98% of the personal use salmon permits returned in Subdistrict 6-C, included 201 Chinook, 509 summer chum, 514 fall chum, and 131 coho salmon. The 2013–2017 average personal use harvest was 46 Chinook, 241 summer chum, 330 fall chum, and 179 coho salmon (Appendices B2–B5) in the Alaska portion of the Yukon River drainage.

5.0 CANADIAN MANAGEMENT OVERVIEW

5.1 CHINOOK SALMON

The Yukon River drainage in Canada contains numerous tributaries, towns, and commercial fishing boundaries used for effective management (Figure 10). The total run of Canadian-origin mainstem Yukon River Chinook salmon in 2018 was expected to be below average, with a preseason outlook range of 71,000–103,000 Chinook salmon.

Prior to the season, meetings were held between the Yukon Salmon Sub-Committee (YSSC), Fisheries and Oceans Canada (DFO), Yukon First Nation Governments, Renewable Resources Councils (RRCs), and the public to discuss the 2018 forecast and possible management scenarios. The below average preseason forecast, coupled with the failure to achieve minimum escapement targets in 4 of the last 10 years, resulted in continued concern over the long-term health of Canadian-origin Yukon River Chinook salmon stocks.

Each year, in advance of the salmon season, DFO develops an Integrated Fisheries Management Plan (IFMP) for Yukon River Chinook and fall chum salmon. The IFMP identifies the main objectives and requirements for the Canadian Yukon River salmon fishery and the management measures that will be used to achieve these objectives from July 1 of the current year to June 30 of the subsequent year.[4]

Canadian management decisions were based on the application of inseason assessment information to the management decision matrix, a component of the IFMP. The decision matrix provides detailed guidance for the management of fisheries and is linked to specific inseason run abundance levels. The 2018 decision matrix summarized the management reference points, general allocation plans, and anticipated management responses under different run size scenarios (Table 3). At the recommendation of the YSSC, the inseason fishery management decision matrix for Yukon River Chinook salmon in Canada reflects the escapement goal range (42,500–55,000) recommended by the Yukon River Panel pursuant to the *Yukon River Salmon Agreement*. In addition, to improve the likelihood of achieving escapement objectives, Canadian management decisions were made based on a midpoint management target of 48,750 Chinook salmon to guide inseason management decisions.

As a result of additional recommendations brought forth by the YSSC, the allowable catch of Chinook salmon in commercial, domestic, and public angling fisheries was set to zero for the beginning of the season. Furthermore, the YSSC recommended that First Nations take a conservative approach in the early season by reducing harvest, using 6-inch or smaller mesh and releasing large and female Chinook salmon in an effort to maximize the quality of escapement. With an under-representation of females and age-6 and age-7 Chinook salmon in recent runs, the YSSC further recommended that DFO consider the quality of escapement in determining inseason management actions and that allocations for the commercial, domestic, and the public angling fishery only be considered if 1) projections indicated that there was sufficient abundance of Chinook salmon to achieve the upper end of the escapement goal range, 2) a female to male ratio of at least 45%, and 3) a fully allocated First Nation fishery.

[4] The IFMP is available online at http://science-libraries.canada.ca/eng/fisheries-oceans/.

Inseason Management Yukon River Mainstem Chinook Salmon

Early in the 2018 season, information from the ADF&G projects such as LYTF near Emmonak and the Pilot Station sonar in the Lower Yukon Area suggested that the Canadian-origin Chinook salmon run would probably be nearer to the lower end of the preseason outlook range of 71,000–103,000 fish. Throughout the early to mid-portion of the run, the total allowable catch (TAC) available for commercial, domestic, and public angling fisheries remained at zero and the conservative approach described above was maintained in the First Nation fishery. DFO and YSSC held regular teleconferences with First Nation managers to update them about run projection scenarios.

Table 3.–Inseason fishery management decision matrix for Yukon River mainstem Chinook salmon in Canada.

Canadian allowable catch zones[a]	Run size indicator (*based on Eagle sonar passage projections*)[b]	Fishery			
		First Nation	Recreational	Commercial	Domestic
0	<42,500	**Closed** Removal of allocation for conservation purposes.	**Closed** No retention permitted. Additional closures possible.	**Closed**	**Closed**
0 to ~ 10,000	42,500 to 55,000 *Management Target: 48,750* [c]	**Varies** **42,500 to 48,750** Harvest of less than 10% of historical catch. **48,750 to 55,000** Harvest of between 10% and 90% of historical catch and varies with abundance	**Closed** No retention permitted	**Closed**	**Closed**
>10,000	>55,000	**Open** Unrestricted	**Potentially open**[d] Retention permitted	**Potentially open**[d] Allocation varies with run size	**Potentially open**[d] Allocation varies with run size

[a] The allowable catch is determined based on numerical abundance and sex ratio of returning salmon in relation to the long-term historical sex ratio. It considers the estimate of total allowable catch and the harvest sharing provisions of the *Yukon River Salmon Agreement*.

[b] In some years, a portion of the passage of adult salmon into Canada is comprised of fish allocated for harvest in U.S. fisheries but not actually harvested. When this occurs, these fish are not available for allocation to Canadian fisheries. Rather, this portion of the return is permitted to migrate to spawning areas and is complementary to the salmon which are allowed to escape to spawn under the provisions of the *Yukon River Salmon Agreement*.

[c] The Management Target of 48,750 is the minimum number of salmon intended to reach the spawning grounds.

[d] Allocations (harvest opportunities) are subject to run abundance and international harvest sharing provisions. Allocations to the recreational, domestic, and commercial fisheries are considered after there is a full allocation to the First Nations fishery and the upper end of the escapement goal is reached.

Border passage projections from the midpoint of the season onward, as determined by Eagle sonar, indicated that the border passage of Canadian–origin Chinook salmon was projected to meet the upper end of the escapement goal range of 42,500–55,000 fish and allow for a First Nation harvest (Table 3). Following discussions with the YSSC and First Nation Governments, the preseason approach for a conservative harvest was relaxed. However, the recommendation for a reduced mesh

size and release of healthy females was maintained and several First Nation Governments maintained community-based management plans that called for a conservative harvest.

In the public angling fishery, the daily catch and possession limits were reduced to zero, effective July 4, to coincide with the arrival of Chinook salmon in Canadian portions of the Yukon River. Given the limited opportunity provided to First Nation subsistence fisheries, Chinook salmon commercial and domestic fisheries in Canada remained closed throughout the 2018 season. A summary of management and conservation measures implemented in Canada are presented in Appendix B19.

Inseason Management Porcupine River Chinook Salmon

In the absence of stock-specific information about Porcupine River Chinook salmon in Canada, the early season management of this stock is based on information and management of mainstem Yukon River Chinook salmon. Given the below average outlook for mainstem Chinook salmon in 2018, it was recommended that Porcupine River subsistence fishing activities proceed in a conservative manner. Consistent with the approach adopted for mainstem Chinook salmon, the fishery was to open early in the season with a recommendation to harvest in a conservative manner until such time that a more robust inseason estimate may be derived from information collected through the Porcupine River Chinook salmon sonar assessment program. It was further recommended that, when possible, female Chinook salmon caught in subsistence gillnets would be released if it were likely that the fish would survive, and that gillnets have a mesh size of 6-inches or less.

By late July, the inseason assessment of run strength at the Porcupine River sonar indicated that the return of Chinook salmon was weaker than anticipated. Following discussion with the Vuntut Gwitch'in Government, a precautionary approach was maintained throughout the season.

5.2 Fall Chum Salmon

Mainstem Yukon River

The 2018 preseason forecast for the Canadian-origin fall chum salmon run to the mainstem Yukon River was expected to be an above average run with a range of 400,000–450,000 fish. The interim management escapement goal (IMEG) range recommended by the Yukon River Panel was 70,000–104,000 Canadian-origin fall chum salmon.

Canadian management decisions were based on the application of inseason assessment information to the management decision matrix – a component of the IFMP. The decision matrix provides detailed guidance for the management of fisheries linked to specific inseason run abundance levels. The 2018 decision matrix summarized the management reference points, general allocation plans, and anticipated management responses under different run size scenarios (Table 4). The decision matrix is being reviewed to seek to realign it with the Yukon River Panel's current IMEG. This work was not yet concluded at time of publication of this report.

Table 4.–Inseason fishery management decision matrix for mainstem Yukon River fall chum salmon in Canada, 2018.

Eagle sonar passage projections	Fishery			
	First Nation	Recreation	Commercial	Domestic
<40,000 (Red zone)	**Closed** Removal of allocation for conservation purposes	**Closed** No retention permitted	**Closed**	**Closed**
40,000 to 73,000 (Yellow zone)	**Varies** Catch target to vary with abundance within zone	**Closed** No retention permitted	**Closed**	**Closed**
>73,000 (Green zone)	**Open** Unrestricted	**Open** Retention permitted. No catch anticipated	**Open** Allocation varies with run size	**Open** Allocation varies with run size

Inseason Management Mainstem Yukon Fall Chum Salmon

Inseason decisions about fishery openings and closures in Canada for fall chum salmon were made in a similar way to those for Chinook salmon. In 2018, early inseason information from the lower Yukon River suggested that border escapement would be strong enough to support a normal aboriginal harvest and to provide opportunities in the commercial fishery. Inseason projections of the Canadian component of the fall chum salmon run were first based on run estimates and genetic apportionment of Canadian-origin fall chum salmon from the Pilot Station sonar and assessment information from the LYTF. As fall chum salmon approached and entered Canada, estimates from the mainstem Yukon River sonar near Eagle provided robust projections. As per the decision matrix, a border escapement projection of greater than 73,000 fish was required before commercial fishing opportunities were allowed. Because it was anticipated, based on harvest in recent years, that the Alaska subsistence fishery upstream of the sonar site near Eagle would take about 15,000 fall chum salmon, a projection greater than 88,000 fish at the sonar site was required to meet the border escapement objective.

The intention of management actions in 2018 was to ensure that the IMEG range of 70,000–104,000 fall chum salmon was achieved. By late August, information from the Pilot Station sonar and LYTF data indicated that the total run would likely be below the pre-season forecast range but estimates of border passage indicated that the return of chum salmon to Canada would be strong enough to support harvest in the First Nation, commercial/domestic and public angling fisheries. Given the relative strength of the return and anticipated low harvest, the commercial and domestic fisheries opened for 24 hours per day, 7 days a week in all areas defined in regulation and remained open until October 19.

Fishing Branch (Porcupine) River

The 2018 preseason forecast estimate for Porcupine River fall chum salmon (at Fishing Branch River) was 64,000–72,000 fish. The current IMEG for the Fishing Branch River recommended by the Yukon River Panel is 22,000–49,000 adult fall chum salmon. Considering that the minimum spawning escapement of fall chum salmon to the Fishing Branch River had not been achieved in 5 of the last 10 years, a conservative approach was warranted. Following discussion with Vuntut

Gwitchin First Nation, the North Yukon Renewable Resources Council, and the YSSC, it was recommended that a conservative chum salmon fishery occur in the Porcupine River until such a time that an inseason projection of greater than 22,000 to the Fishing Branch River could be determined.

Inseason Management Porcupine River Fall Chum Salmon

Canadian fishery management considered early season information from the Pilot Station sonar. Estimates of fall chum salmon passage in combination with genetic mixed stock analysis (MSA) cannot be used to project the return to Fishing Branch River. Because the Fishing Branch River component at the Pilot Station sonar is such a small part of the total run, the uncertainty associated with these estimates is very high; therefore, management decisions cannot be based on this information.

In 2018, the Old Crow-based Porcupine River sonar was unable to provide a full estimate of the return of fall chum salmon to the Canadian portion of the Porcupine River due to environmental conditions hampering operations. Escapement to the Fishing Branch River was monitored by a counting weir/sonar. Only a portion of the fall chum salmon that return to the Canadian Porcupine River are destined for the Fishing Branch River. Based on concurrent sonar and weir counts (2015–2017; Appendix B15) approximately 55% of Canadian-origin Porcupine River fall chum salmon are destined for the Fishing Branch River. As the season progressed, late run timing and low sonar counts at the Porcupine River sonar contributed to uncertainty as to whether the escapement goal would be achieved. The Vuntut Gwitchin First Nation maintained a conservative approach to harvest.

6.0 CANADIAN HARVEST SUMMARIES

6.1 First Nation Subsistence Fisheries

Harvest estimates of salmon in the First Nation fisheries on the Yukon and Porcupine rivers are determined from locally-conducted inseason and postseason interviews using a catch calendar and a voluntary recording system.

Mainstem Yukon River Chinook Salmon

Based on a preseason outlook for a below average run of 71,000–103,000 Canadian-origin Yukon Chinook salmon, YSSC recommended a conservative approach early in the 2018 fishing season. Inseason border escapement projections indicated that the run strength was toward the lower end of the preseason forecast, Yukon First Nation governments continued to follow conservative management plans throughout the 2018 season, resulting in a significantly reduced harvest compared to long term historical averages. The First Nation harvest in the Canadian mainstem drainage was estimated to be 2,789 fish (Appendix B7). This compares to the 2013–2017 average of 1,854 fish and long-term (1961–2017) average of 5,009 fish (Appendix B7).

Mainstem Yukon River Fall Chum Salmon

The preseason outlook for Canadian-origin fall chum salmon in 2018 indicated an above average run of 400,000–450,000 fish. The border passage estimate at this run projection would place Canadian management in the green zone and therefore no restrictions were expected in the First Nation fisheries. As inseason information became available, the First Nation fisheries proceeded without restrictions. The preliminary 2018 fall chum salmon harvest in the First Nation fisheries

in the Canadian mainstem drainage was estimated was estimated to be 1,000 fish (Appendix B8). This was slightly below the 2008–2017 average of 1,016 fall chum salmon and below the long-term average (1961–2017) of 2,254 fall chum salmon (Appendix B8).

Porcupine River Chinook, Fall Chum, and Coho Salmon

In the aboriginal fishery at Old Crow, the Vuntut Gwitchin First Nation (VGFN) reported a season total harvest of 308 Chinook salmon in 2018 (Appendix B7). The 2008–2017 average was 244 Chinook salmon (Appendix B7). A total of 1,874 fall chum salmon was harvested in the Old Crow-based VGFN fishery (Appendix B8), which was slightly below the 2008–2017 average harvest of 2,028 fall chum salmon (Appendix B8). The VGFN reported a harvest of 25 coho salmon on the Porcupine River in 2018.

6.2 COMMERCIAL FISHERY

Mainstem Yukon River Chinook Salmon

The commercial Chinook salmon fishery remained closed throughout the 2018 summer fishing season. One Chinook was accidentally caught and retained in the fall chum commercial fishery in early September.

Mainstem Yukon River Fall Chum Salmon

A strong return of fall chum salmon resulted in opportunities for commercial fishery openings throughout the fall season. A total of 1,957 fall chum salmon were harvested during commercial fishery openings (Appendix B8). This level of harvest was 30% below the 2008–2017 average of 2,792 fall chum salmon and 24% below the 2013–2017 average of 2,573 fish (Appendix B8). Since 1997, there has been a marked decrease in commercial catches of Upper Yukon River fall chum salmon as a result of a limited market. Between 1961 and 2018, the commercial fall chum salmon catch ranged from a low of 293 fish in 2009, when the run was late and the fishery was closed most of season due to conservation concerns, to a high of 40,591 fish in 1987.

Mainstem Yukon River Coho Salmon

Commercial harvest of coho salmon in the mainstem Yukon River in Canada is usually very small. This is thought to be related to a combination of low abundance and limited availability of this species to fisheries due to late migration timing. There were no coho salmon harvested in the 2018 commercial fishery.

6.3 DOMESTIC SUBSISTENCE FISHERY

The domestic fishery was closed during the Chinook salmon season (Appendix B7). For fall chum salmon, there were openings (concurrent with commercial fishery openings) during the season; however, there were no catches reported. This compares to a long-term (1974–2017) average of 423 fall chum salmon and a recent (2013–2017) average of 14 fish (Appendix B8).

6.4 LICENSED PUBLIC ANGLING FISHERY

In 1999, the Salmon Sub-Committee introduced a mandatory Yukon Salmon Conservation Catch Card (YSCCC) to improve harvest estimates and to serve as a statistical base to ascertain the importance of salmon to the Yukon River public angling fishery. Anglers are required to report their catch and harvest by late fall. The information reported includes the number, species, fate (kept or released), sex, size, date, and location of all salmon caught. From preliminary catch card

information received at the time of this publication, no Chinook salmon were caught or retained in the Yukon River or its tributaries in the 2018 public angling fishery. Over the last 10 years retention (harvest) of Chinook salmon in the public angling fishery was only permitted in 2009 and 2011 (Appendix B7). For the 2018 season, the daily catch and possession limits of fall chum salmon in the public angling fishery remained at 2 and 4, respectively. There were no reports of fall chum salmon caught at the time of this publication.

7.0 TOTAL RUN AND ESCAPEMENT ASSESSMENTS FOR 2018

7.1 CHINOOK SALMON

Total 2018 Chinook salmon passage at the Pilot Station sonar was approximately 161,800 fish[5] ± 24,539 (90% CI, Table 10, Appendix A1). This is considered an index of drainagewide Chinook salmon run, rather than a total run size estimate, because some salmon are harvested or enter spawning areas below this sonar site. This passage was below the recent historical average[6] of approximately 182,600 fish. Chinook salmon entered the river in 4 pulses consisting of 26,400 fish; 28,900 fish; 57,000 fish; and 25,000 fish. Inseason run analysis was focused on making comparisons to years with similar run timing. The first quarter point, midpoint, and third quarter point for the Pilot Station sonar were on June 19, June 26, and July 1, respectively. The 2018 Chinook salmon run was 2 days later than average based on the midpoint at the Pilot Station sonar.

Total Chinook salmon passage at Eagle sonar in 2018 was 57,893 fish (Appendix B11). After subtracting estimated U.S. subsistence harvest taken upriver from the Eagle sonar site (629 fish) and the estimated Canadian harvest of Chinook salmon (2,790 fish) (Figure 11), the estimated mainstem border escapement was 57,264 and the estimated spawning escapement of Canadian-origin Yukon River Chinook salmon (mainstem) was 54,474 (Figure 12; Appendix B11). This escapement was near the upper end of the IMEG of 42,500–55,000 fish. Combining the spawning escapement estimate with the U.S. and Canadian harvests of Canadian-origin Chinook salmon indicates the total Canadian-origin run size was approximately 76,530 Chinook salmon (Appendix B18). Post-season calculation of the total allowable catch based on this total run size indicates that the harvest share objectives, as outlined in the Yukon River Salmon Agreement, were also met (Appendix B18).

Age, sex, and length (ASL) composition was assessed at both mainstem sonar sites and in various escapement projects. The ASL samples collected at the Pilot Station sonar are thought to be representative of all Chinook salmon stocks passing the site and include both U.S. and Canadian stocks. The ASL samples collected at the Eagle sonar are exclusively from Canadian-origin fish. Mesh sizes used to sample the runs differ at each location. Age-5 Chinook salmon were the most common age class observed at the Pilot Station sonar, whereas age-6 fish were the most common at Eagle sonar. Female proportion was above the 2008–2017 average at both sonars. Females comprised roughly 48% of the samples collected at the Pilot Station sonar and 43% of the samples at the Eagle sonar (Table 5; Appendices A4–A5).

[5] Some estimates in this section are rounded.

[6] Average includes years 1995, 1997, 2000, 2002-2008, and 2010-2018. The sonar did not operate in 1996 and project difficulties occurred in 1998–1999, 2001, and 2009.

Table 5.–Yukon River Chinook salmon age and female percentage estimated from samples collected at the Pilot Station and Eagle sonar projects, 2018.

	Chinook salmon age or sex composition (percentage of test fishery samples)			
	Pilot Station Sonar		Eagle Sonar	
Age/sex	Historical average (2008–2017)	2018	Historical average (2008–2017)	2018
Age-4	10.8	12.1	6.1	10.3
Age-5	50.6	49.5	41.9	43.1
Age-6	35.9	37.0	48.6	44.9
Female	38.7	48.4	42.6	43.4

Note: Sampling at the Pilot station sonar uses a range of 6 mesh sizes (2.75–8.5 inch) whereas sampling at Eagle sonar uses a range of 4 mesh sizes (5.25–8.5 inch). This difference in mesh sizes can possibly affect the difference in observed age classes. In addition, sex is determined through visual inspection of external body characteristics only at both projects. Sexual dimorphism is more pronounced by the time fish reach Eagle making sex identification more accurate at that site. These factors need to be considered when comparing between projects.

Chinook salmon escapement in U.S. tributaries was assessed at 1 weir, 3 counting towers, and with 3 aerial surveys (Table 6; Figure 13). Existing escapement goals for all but 2 U.S. tributary stocks were met or exceeded (Liller and Savereide 2018; Table 6; Appendix B10). The West Fork Andreafsky and Nulato aerial surveys fell below their respective escapement goals. High water events on the Salcha and Chena rivers hindered estimating passage. In addition, the Gisasa River weir did not operate because of lack of funding and Henshaw Creek weir had high water issues preventing weir deployment. Note that these stocks do not contribute to the border passage objective or Canadian escapement, but their performance relative to the Canadian stock may provide a comparative indicator of production trends among different stock groups.

Table 6.–Summary of 2018 Chinook salmon escapement estimates in Alaska tributaries compared to existing escapement goals.

Location	Assessment method	Escapement goal (type)	2018 Escapement
E. Fork Andreafsky	Weir	2,100–4,900 (SEG)	4,114
W. Fork Andreafsky	Aerial survey	640–1,600 (SEG)	455
Anvik (drainagewide)	Aerial survey	1,100–1,700 (SEG)	1,109
Nulato (forks combined)	Aerial survey	940–1,900 (SEG)	870
Gisasa	Weir	none	[a]
Henshaw	Weir	none	[b]
Chena	Tower/Sonar	2,800–5,700 (BEG)	4,227 [c]
Salcha	Tower/Sonar	3,300–6,500 (BEG)	4,053 [c]
Goodpaster	Tower	none	2,480

Note: Sustainable escapement goal (SEG) and biological escapement goal (BEG).

[a] No count. Weir did not operate due to lack of funding.

[b] No count. High water prevented operation of weir.

[c] Visual and sonar counts were combined for missed days to derive a preliminary estimate.

Escapement of Chinook salmon to tributaries in Canada was assessed at the Whitehorse Rapids Fishway and on the Pelly, Big Salmon, Takhini, and Porcupine rivers (Appendix B12). On the Big Salmon River, 5,159 Chinook salmon were counted, which was 5% below the 2008–2017 average count of 5,414 fish (Appendix B12). At the Whitehorse Rapids Fishway, 691 Chinook salmon were counted, which was 40% below the 2008–2017 average count of 1,145 fish (Appendix B12). Hatchery-produced fish accounted for 37% of the fish that returned to the Whitehorse fishway in 2018. A count of 612 Chinook was observed at the Blind Creek weir (Pelly River tributary), which was above the 2008–2017 average of 480 fish. On the Pelly River a preliminary estimate of 9,491 Chinook salmon was counted using sonar, which was slightly higher than the 2017 count of 9,081

(Appendix B12). The second year of the sonar project on the Takhini River estimated 1,554 Chinook salmon which was below the 2017 count of 1,872 Chinook salmon. On the Porcupine River, 3,414 Chinook salmon were counted using sonar, which was the third highest count since the start of the project in 2014 (Appendix B12).

7.2 SUMMER CHUM SALMON ALASKA (U.S. ONLY)

In 2018, an estimated 1.6 million summer chum salmon ±107,000 (90% CI) passed the Pilot Station sonar (Table 10, Appendix A1), which was lower than the 1995–2017 (excluding 1996, 1998, 1999, 2001 and 2009) median of 1.9 million fish for the project. The first quarter point, midpoint, and third quarter point were June 21, June 29, and July 5, respectively, which was consistent with historical average run timing. Four large pulses of summer chum salmon were detected at the sonar project, with the largest group consisting of approximately 550,000 fish passing from July 2–July 7. A summer chum salmon drainagewide biological escapement goal (BEG) with a range of 500,000–1,200,000 was adopted in 2016 (Liller and Savereide 2018; Table 7), and the 2018 escapement exceeded this goal. The summer chum salmon escapement into the East Fork Andreafsky River of 36,330 fell just short of the SEG of greater than 40,000 fish (Table 7; Appendices B13). Escapement into the Anvik River was 305,098 summer chum salmon, which was below the lower bound BEG of 350,000 fish. In addition to towers, sonars were used to supplement and corroborate tower counts for Chena and Salcha river salmon. Both assessment projects were hindered by high water and flooding events and passage estimates for both rivers are still considered preliminary and incomplete (Table 7; Appendix B13).

Table 7.–Summary of 2018 summer chum salmon escapement estimates in Alaska compared to existing escapement goals.

Location	Assessment method	Escapement goal (type)	2018 Summer chum salmon escapement
Drainagewide	Sonar	500,000–1,200,000 (BEG)	1,468,759 [a]
E. Fork Andreafsky	Weir	>40,000 (SEG)	36,330
Anvik	Sonar	350,000–700,000 (BEG)	305,098
Gisasa	Weir	none	[b]
Henshaw	Weir	none	[c]
Chena	Tower/sonar	none	9,088 [d]
Salcha	Tower/sonar	none	22,782 [d]

Note: Sustainable escapement goal (SEG) and biological escapement goal (BEG).

[a] Drainagewide escapement based on the Pilot Station sonar and Andreafsky weir minus harvest estimates above the sonar site.

[b] No count. Weir did not operate because lack of funding.

[c] No count. High water prevented operation of weir.

[d] Due to high water events during the season and terminating the project earlier than normal, the passage estimate is considered incomplete.

7.3 FALL CHUM SALMON

The initial method of determining total drainagewide (i.e., U.S.-origin and Canadian-origin) fall chum salmon run size inseason was based on the Pilot Station sonar passage estimate and the estimated inriver harvest of fall chum salmon downstream of the sonar site. The inseason run size model primarily uses the commercial fishery, which is the largest harvest component below the sonar site, to produce overall projections of abundance used to manage the fishery. The inseason total run size using this method was estimated to be 1,200,000 fall chum salmon in 2018.

Postseason, a Bayesian state-space model was used to estimate drainagewide escapement (Fleischman and Borba 2009). The total drainagewide run size is then derived by adding the estimated total harvest (U.S. and Canada) to the estimate of drainagewide escapement. In 2018 this method resulted in a total drainagewide run size estimate of 1,100,000 fall chum salmon, which was below the 2018 forecast of 1,600,000–1,800,000 fish. The total run size was however higher than the inseason projection of 700,000–900,000 fall chum salmon, based on the relationship between summer and fall chum salmon total run sizes.

The drainagewide escapement estimate produced by the Bayesian state-space model was 643,000 fall chum salmon, which exceeded the upper end of the escapement goal range (Liller and Savereide 2018; Table 8; Figure 14). The model utilized historical escapement data from the Toklat, Delta, Teedriinjik (Chandalar), Sheenjek, Fishing Branch, and Canadian mainstem Yukon rivers, as well as mark–recapture estimates of abundance from the upper Tanana, and Kantishna projects (Appendices B14–B16). Individually the fall chum salmon escapements to Chandalar, Canadian mainstem Yukon, and Delta rivers each exceeded the upper end of the individual escapement goals (Liller and Savereide 2018; Table 8; Figure 15; Appendices B14, B16).

Table 8.–Summary of 2018 fall chum salmon escapement estimates compared to existing escapement goals in Alaska.

Location	Assessment method	Escapement goal (type)	2018 fall chum salmon escapement [a]
Drainagewide	Bayesian	300,000–600,000 (SEG)	643,000
Chandalar River [b]	Sonar	74,000–152,000 (BEG)	170,000
Tanana River	none	61,000–136,000 (BEG)	–
Delta River	Ground Surveys	6,000–13,000 (BEG)	39,600

Note: Biological escapement goal (BEG) and sustainable escapement goal (SEG).

[a] Numbers are rounded.

[b] The Chandalar River and North Fork collectively were renamed the Teedriinjik River and the Middle Fork was renamed Ch'idriinjik in September of 2015.

In 2018, the proportions by age class for fall chum salmon caught in the LYTF were used to represent the drainagewide run and included 3% age-3, 68.4% age-4, 28.4% age-5, and less than 1% age-6 fish. The age-4 component was above average while ages-3, 5, and 6 were slightly below average when compared to LYTF weighted even-year averages for years 1977–2017. Fall chum salmon ASL composition estimates from data collected in the Delta River included 10.0% age-3, 71.9% age-4, 16.9% age-5, and 1.3% age-6 (Appendix A11). Samples were also collected for the escapement into Canada based on test fishing near the Eagle sonar site, and included less than 0.8% age-3, 51.4% age-4, and 47.8% age-5 fall chum salmon (Appendix A11).

Mainstem Yukon River Canadian-Origin Fall Chum Salmon

The U.S./Canada border passage estimate for fall chum salmon was 157,083. This was calculated by subtracting U.S. harvest between the sonar and the border (11,715 fish) from the Eagle sonar passage estimate (168,798 fish; Appendix B16). After subtracting the preliminary Canadian harvest of 2,957 fish (Figure 16; Appendix B8) the estimated spawning escapement of Yukon River mainstem Canadian-origin fall chum salmon was 154,126 fall chum salmon and above the upper end of the IMEG of 70,000–104,000 fish (Figure 17; Table 9).

The preliminary reconstruction of the total 2018 Canadian-origin Yukon River mainstem fall chum salmon run was approximately 279,000 fish. Total run size was approximated using the expanded

estimate of fall chum salmon past the Eagle sonar near the U.S./Canada border (168,798 fish) plus 25% of the U.S. harvest of fall chum salmon that occurred downstream of Eagle sonar (441,955 fish) and then rounded to the nearest 1,000. This run size estimate is well below the preseason outlook range of 400,000–450,000 Canadian-origin Yukon River mainstem fall chum salmon.

Porcupine River (including the Fishing Branch River) Canadian-Origin Fall Chum Salmon

In 2018, the Porcupine River sonar, immediately downstream of the community of Old Crow, fall chum salmon project undertook its seventh year of operation. Due to environmental conditions (high water and early freeze up), sonar operation was compromised for a substantial period. As a result, there is insufficient data to extrapolate missing periods of fall chum salmon passage at both the beginning and end of the run. Based on the number of sonar targets counted, it is likely that passage at the Porcupine sonar was less than 25,000 fall chum salmon (Table 9). An estimated 1,874 fish were harvested in the Old Crow fishery (Appendix B8; details are presented in Section 8.3).

DFO operated the Fishing Branch River weir in 2018 and installed a sonar unit to monitor fish passage through a constrained opening in the weir. The 2018 spawning escapement estimate for fall chum salmon at the Fishing Branch River was 10,151 fish (Figure 17). The Canadian harvest of Fishing Branch River fall chum salmon in 2018 is estimated at 1,031 fish. This assumes that 55% of the fall chum salmon in the Porcupine River drainage are destined for Fishing Branch (1,874 fish harvested in Old Crow X 0.55 = 1,031). The total run size estimate for 2018 Fishing Branch fall chum salmon is 29,000 fish. This is calculated as the sum of the weir passage (10,151), the estimated Canadian harvest (1,031), and the estimated U.S. harvest of Fishing Branch fall chum (4% of the total U.S. fall chum harvest downstream of Eagle sonar, 441,955 x 0.04 = 17,678) and then rounded to the nearest 1,000.

Table 9.–Summary of 2018 preliminary fall chum salmon spawning escapements in Canada in comparison with existing international interim management escapement goals (IMEG).

Location	Assessment method	Escapement goal (type)	2018 fall chum salmon escapement
Fishing Branch River	Weir/sonar count	22,000–49,000 (IMEG)	10,151
Yukon River Mainstem	Sonar and harvest	70,000–104,000 (IMEG)	154,126
Porcupine River (Canadian portion)	Sonar and harvest	none	<25,000

8.0 PROJECT SUMMARIES

8.1 ALASKA, U.S.

Salmon assessment programs operated throughout the U.S. portion of the Yukon River Drainage are collaborative. This report summarizes salmon run, harvest, and escapement monitoring results from numerous projects. Data were provided by various entities including: Mountain Village Test Fishery (Sandone Consulting LLC); East Fork Andreafsky River Weir (USFWS); Gisasa River weir (USFWS); Henshaw Creek weir (Tanana Chiefs Conference and USFWS); Goodpaster River tower (Bering Sea Fisherman's Association); and chum salmon genetic stock identification (USFWS). Other project results were provided by ADF&G Division of Commercial Fisheries and Division of Sport Fisheries. Partner organizations that assisted with data collection include Spearfish Research, Yukon Delta Fisheries Development Association, Yukon River Drainage

Fisheries Association, and DFO. A more in-depth overview of select stock assessment programs are described in the following sections of this report.

Lower Yukon Test Fishery

The LYTF program is designed to assess salmon run timing and relative abundance and consists of 2 Chinook salmon test fisheries. An 8.5-inch mesh set gillnet test fishery operated in the Middle and South mouths of the Yukon River and an 8.25-inch mesh drift gillnet operated at Big Eddy in the South Mouth, near Emmonak. The LYTF also has a summer chum salmon-directed drift gillnet test fishery using 5.5-inch mesh gear operated in the Middle and South mouths. These test fisheries provide CPUE, which gives an index of abundance and indicates the presence of large groups of fish, or "pulses", entering the mouths of the river. Chinook salmon that were caught in the test fishery and were unable to be released back into the water alive were brought back to the ADF&G dock in Emmonak and sampled for tissues and ASL, before the fish were distributed to local community members.

In 2018, the LYTF was fully operational at the South Mouth drift gillnet site on June 10 and at the Middle Mouth site on June 7. The initial start-up at the LYTF was earlier; however, the first week of operation was hindered due to a high amount of woody debris present in the river. The Big Eddy set gillnet site was fished until June 28. The LYTF set gillnets concluded operations on July 12 with a cumulative CPUE of 24.32, which was similar to the historical[7] average CPUE of 24.44 (Figure 3). The first quarter point, midpoint, and third quarter point were June 20, June 23, and June 29, respectively, for the Chinook salmon run.

In 2018, the 8.25-inch drift gillnet project for Chinook salmon operated in Big Eddy from May 20 to July 15 and provided valuable supplemental run timing information for Chinook salmon entering the South Mouth of the Yukon River. A total of 282 Chinook salmon were caught in the drift gillnet and the cumulative CPUE was 433.52, which was above the historical[8] average CPUE of 393.95. All but 1 Chinook salmon caught in the net were released alive.

Pilot Station Sonar

The goal of the Pilot station sonar project is to estimate daily upstream passage of Chinook (Figure 4), chum (Figure 5), and coho salmon (Figure 6). The project has been in operation since 1986. Both split-beam and Adaptive Resolution Imaging Sonar (ARIS)[9] are used to estimate total fish passage, and CPUE from the drift gillnet test fishing portion of the project is used to estimate species composition. The project's sonar equipment and apportionment methodologies have evolved over time (Pfisterer et al. 2017; Schumann et al. 2017).

Fish passage estimates at the Pilot Station sonar project are based on a sampling design in which sonar equipment is operated daily in three 3-hour periods and drift gillnets 25 fathoms long with mesh sizes ranging from 7.0 cm to 21.6 cm (2.75- to 8.5-inch) are fished twice each day between sonar periods to apportion the sonar counts to species. During the 2018 season, both banks were fully operational on June 1 and continued operations through September 7. The ice went out on the mainstem Yukon River on May 13 based on National Weather Service data.[10] Test fishing

[7] Includes years 1989-2000, 2002-2008, 2010, 2011, and 2014-2017.

[8] Includes years 2002, 2003, 2005, 2006, and 2010-2017.

[9] Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

[10] https://www.weather.gov/aprfc/breakupDB?site=488

began on May 31, with the first Chinook and summer chum salmon both caught on June 2. The first coho salmon was caught on July 31.

An estimated 4,077,096 fish passed through the sonar sampling area between June 1 and September 7 (Table 10). Drift gillnetting resulted in a catch of 10,005 fish including 563 Chinook; 2,856 summer chum; 2,699 fall chum; and 730 coho salmon. A total of 3,154 fish of other species were also caught. Chinook salmon were sampled for ASL; sex (external) and length were collected from chum, pink *O. gorbuscha*, sockeye *O. nerka*, and coho salmon without aging structures; for all other non-salmon species, only length was collected. Genetic samples were taken from Chinook and chum salmon. Any captured fish that were not successfully released alive were distributed daily to residents in Pilot Station.

The right bank bottom profiles at the sonar site remained similar to prior years with little or no change throughout the season. Left bank profiles remained linear throughout the field season, and there were no detection problems caused by silt or other environmental factors. Water levels observed near Pilot Station were above the most recent 10-year average (2007-2017)[11] throughout the summer season, dropped below average on July 26, increased again and exceeded the average level on August 26 and continued to rise throughout the end of the season.

Table 10.–Cumulative fish passage estimates by species with 90% confidence intervals (CI), at the Pilot Station sonar in 2018.

		90% CI	
Species	Total passage	Lower	Upper
Large Chinook [a]	122,394	103,707	141,081
Small Chinook [b]	39,437	23,533	55,341
All Chinook	161,831	137,292	186,370
Summer chum	1,612,688	1,505,340	1,720,036
Fall chum	928,664	873,622	983,706
Coho	136,347	124,452	148,242
Pink	689,607	641,640	737,574
Cisco *Coregonus*	334,832	293,008	376,656
Humpback whitefish *C. pidschian*	124,576	109,547	139,605
Broad whitefish *C. nasus*	14,695	11,148	18,242
Sheefish *Stenodus leucicthys*	26,485	17,156	35,814
Other [c]	47,371	41,513	53,229
Total [d]	4,077,096		

[a] Large Chinook salmon >655 mm.

[b] Small Chinook salmon ≤655 mm.

[c] Includes sockeye salmon, cisco, whitefish, sheefish, burbot *Lota*, long nose sucker *Catostomus*, Dolly Varden *Salvelinus malma*, and northern pike *Esox lucius*.

[d] All Chinook subtotal not included in total passage sum.

In 2018, all project goals were met, and passage estimates were provided to fisheries managers daily during the season. Information generated at the Pilot Station sonar was also discussed weekly through multi-agency international teleconferences that included stakeholders from the Lower

[11] https://nwis.waterdata.usgs.gov/ak/nwis/uv?cb_00010=on&cb_00020=on&cb_00065=on&format=html&site_no=15565447&period=&begin_date=2018-06-01&end_date=2018-06-02

Yukon River to the headwater communities in Canada. Preliminary daily salmon passage estimates were available online and disseminated daily to the general public via a list serv.

Chinook Salmon Genetic Sampling 2018

In 2018, ADF&G and other collaborators collected 2,903 tissue samples from adult Chinook salmon harvested in test and subsistence fisheries that occurred in the Alaska portion of the Yukon River. These samples were from mixed stock fisheries in the mainstem Yukon River in Districts 1–5. Samples collected from Yukon River mainstem test fisheries totaled 1,330 fish and included 559 fish from the Pilot Station sonar, and 771 fish from the Eagle Sonar. Samples collected from subsistence fisheries in Alaska totaled 1,573 fish from 13 locations: 46 from Hooper Bay and Scammon Bay (Coastal District); 241 from Alakanuk, Emmonak, and Kotlik (District 1); 283 from St. Mary's and Mountain Village (District 2); 170 from Russian Mission (District 3); 556 from Nulato, Kaltag, Galena, and Ruby (District 4); and 277 from Tanana (District 5). Sample collection from the subsistence harvest was coordinated by Spearfish Research, which contracted individual fishermen to sample their harvest. In Alaska, a total of 91 baseline samples of Chinook salmon were collected from 2 locations: 49 from the Salmon Fork of the Black River and 42 from the Coleen River.

Mixed Stock Analysis of Yukon River Chinook Salmon Sampled at the Pilot Station Sonar, 2005-2018

The ADF&G Gene Conservation Laboratory (GCL) generates inseason stock composition estimates using genotypes of samples from the Pilot Station sonar project test fishery in genetic MSA. This project provides fishery managers an important "first look" at the Canadian-origin Chinook salmon run strength and timing before those fish migrate through most Alaska fisheries. Without genetic MSA at the Pilot Station sonar, fishery managers lack clear indication of Canadian-origin run strength and timing until fish arrive at Eagle sonar, when most of the run has already passed through 1,900 kilometers of fisheries. Knowledge of Canadian-origin Chinook salmon run strength and timing early in the run and lower in the river allows more appropriate and timely management actions to ensure escapement and harvest sharing objectives will be met in a given year.

Data collected through this project from 2005–2018 has provided a more complete understanding of stock-specific run dynamics and has proven to be a critical component of inseason management of salmon fisheries in Alaska. Project data has been used to estimate the total proportion of Canadian-origin Chinook salmon each year since 2005. Postseason estimates from this project indicate that the Canadian stock makes up 41% of the total run on average (2005–2017) and has ranged from 34%–52% (Table 11). Over this 14-year timeframe, the contribution of the Canadian-origin stock to the total run has been relatively stable; however, this project has highlighted a considerable amount of within-year variability in the relative abundance of Canadian-origin Chinook salmon (Table 11). In nearly all years (2005–2018), the proportion of Canadian-origin stocks has been highest, often exceeding 50%, during the early portion of the run, but typically decreases to about 30% or less as the run progresses. This project, combined with the Pilot Station sonar passage estimates, has shown that while the proportion of Canadian-origin stocks are typically highest in the early portion of the run, the abundance (i.e., numbers of fish) of Canadian-origin fish is generally higher during the middle part of the run (Table 11). Knowledge of relative abundance and migration timing from this project has led to improved inseason projections of total

run size of Canadian-origin Chinook salmon and more refined management strategies to meet border passage goals.

Tissue samples were taken from most Chinook salmon caught in the test fishery at the Pilot Station sonar in 2018 and analyzed in 4 strata for genetic MSA. The 4 strata periods were June 1–June 13 (number sampled (*n*) = 98), June 14–June 24 (*n* = 192), June 25–July 3 (*n* = 178), and July 4–August 5 (*n* = 89). Genetic MSA indicated the proportion of the total Chinook salmon run past the Pilot Station sonar that were Canadian-origin was 53% (approximately 9,000 fish) in stratum 1, 47%, (approximately 26,000 fish) in stratum 2, 41%, (approximately 23,000 fish) in stratum 3, and 29% (approximately 9,000 fish) in stratum 4. The total season Canadian percentage was 42% (weighted by passage) which is slightly above the 2005–2017 average of 41% (Table 11).

Table 11.–Pilot Station sonar Chinook salmon passage and Canadian-origin proportion by strata, 2005–2018.

Year	Strata	Dates	Pilot Station passage	Proportion of run	Canadian proportion [a]	Estimated number of Canadian fish
2005	Stratum 1	06/04 - 06/17	91,136	0.35	0.60	54,335
	Stratum 2	06/18 - 07/03	119,627	0.46	0.45	53,533
	Stratum 3	07/04 - 08/20	48,451	0.19	0.29	14,002
	Total		259,214	1.00	0.47	121,871
2006	Stratum 1	06/07 - 06/24	63,374	0.28	0.44	28,106
	Stratum 2	06/25 - 07/26	165,389	0.72	0.39	64,312
	Total		228,763	1.00	0.40	92,417
2007	Stratum 1	06/06 - 06/19	50,083	0.29	0.53	26,629
	Stratum 2	06/20 - 06/30	62,907	0.37	0.37	23,502
	Stratum 3	07/01 - 08/16	57,256	0.34	0.21	11,772
	Total		170,246	1.00	0.37	61,903
2008	Stratum 1	06/07 - 06/23	41,294	0.24	0.47	19,532
	Stratum 2	06/24 - 06/29	42,554	0.24	0.33	13,958
	Stratum 3	06/30 - 08/02	90,559	0.52	0.31	27,711
	Total		174,407	1.00	0.35	61,201
2009	Stratum 1	06/09 - 06/16	7,000	0.04	0.68	4,750
	Stratum 2	06/17 - 06/22	27,229	0.15	0.53	14,347
	Stratum 3	06/23 - 06/29	83,866	0.47	0.41	34,509
	Stratum 4	06/30 - 07/19	59,701	0.34	0.17	10,265
	Total		177,796	1.00	0.36	63,871
2010	Stratum 1	06/12 - 06/21	28,885	0.21	0.49	14,110
	Stratum 2	06/22 - 06/27	45,306	0.33	0.50	22,860
	Stratum 3	06/28 - 09/05	63,708	0.46	0.28	17,891
	Total		137,899	1.00	0.40	54,861
2011	Stratum 1	06/01 - 06/18	31,273	0.21	0.58	18,148
	Stratum 2	06/19 - 06/27	67,686	0.45	0.36	24,611
	Stratum 3	06/28 - 08/07	49,838	0.33	0.16	8,034
	Total		148,797	1.00	0.34	50,792
2012	Stratum 1	06/10 - 06/24	31,998	0.25	0.45	14,463
	Stratum 2	06/25 - 07/02	63,648	0.50	0.47	30,042
	Stratum 3	07/03 - 07/30	31,909	0.25	0.34	10,753
	Total		127,555	1.00	0.43	55,258

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Table 11.–Page 2 of 2.

Year	Strata	Dates	Pilot Station passage	Proportion of run	Canadian proportion [a]	Estimated number of Canadian fish
2013	Stratum 1	06/14 - 06/27	78,133	0.57	0.72	56,568
	Stratum 2	06/28 - 08/02	58,672	0.43	0.26	15,137
	Total		136,805	1.00	0.52	71,706
2014	Stratum 1	06/01 - 06/14	45,236	0.28	0.49	22,347
	Stratum 2	06/15 - 06/24	82,146	0.50	0.42	34,255
	Stratum 3	06/25 - 08/04	36,513	0.22	0.18	6,718
	Total		163,895	1.00	0.39	63,320
2015	Stratum 1	05/30 - 06/17	30,600	0.21	0.50	15,178
	Stratum 2	06/18 - 06/26	51,172	0.35	0.37	18,780
	Stratum 3	06/27 - 08/17	65,087	0.44	0.33	21,218
	Total		146,859	1.00	0.38	55,176
2016	Stratum 1	05/30 - 06/14	37,511	0.21	0.52	19,136
	Stratum 2	06/15 - 06/25	86,622	0.49	0.34	29,114
	Stratum 3	06/26 - 08/24	52,765	0.30	0.54	28,282
	Total		176,898	1.00	0.43	76,532
2017	Stratum 1	05/31 - 06/13	30,088	0.11	0.43	12,857
	Stratum 2	06/14 - 06/20	79,913	0.30	0.49	38,929
	Stratum 3	06/21 - 06/25	69,392	0.26	0.43	30,121
	Stratum 4	06/26 - 08/11	83,621	0.32	0.41	34,008
	Total		263,014	1.00	0.44	115,915
2018	Stratum 1	06/02 - 06/13	16,275	0.10	0.53	8,621
	Stratum 2	06/14 - 06/24	56,270	0.35	0.47	26,357
	Stratum 3	06/25 - 07/03	57,070	0.35	0.41	23,227
	Stratum 4	07/04 - 08/05	32,216	0.20	0.29	9,402
	Total		161,831	1.00	0.42	67,609
Average 2005–2017	Stratum 1		43,585	0.25	0.53	23,551
	Stratum 2		73,298	0.41	0.41	29,491
	Stratum 3		59,031	0.34	0.32	19,183
	Total		177,858	1.00	0.41	72,679

[a] Total Canadian Proportion is weighted with "Proportion of Run".

Mixed Stock Analysis of Yukon River Chinook Salmon Harvested in Alaska, 2018

Three broad-scale stock (reporting) groups are used to apportion Chinook salmon harvest by Alaska fisheries within the Yukon River drainage. The Lower and Middle Yukon River stock groups spawn in Alaska and the Upper Yukon River stock group spawns in the Canadian mainstem. Scale pattern analysis, age composition estimates, and geographic distribution were used by ADF&G from 1981–2003 to estimate Chinook salmon stock composition in Yukon River harvests. From 2004–present, genetic analysis has been the primary method for stock identification (DuBois 2018). Harvest percentages by stock group from 2014–2018 include the harvest from the Coastal District, whereas the Coastal District was not included in years prior to 2014. The 2018 subsistence harvest and stock composition estimates are still considered preliminary as of the publication date of this report.

Genetic MSA results indicate that the weighted U.S. harvest of Yukon River Chinook salmon was comprised of 8.9% Lower, 30.1% Middle, and 61.0% Upper (Canadian-origin) stock groups. U.S. harvest composition for 2018 was below the 2013–2017 average for the Lower and Middle stock groups and above the 2013–2017 average for the Upper stock group (Appendix A6).

Yukon River Chum Salmon Mixed Stock Analysis, 2018

Chum salmon were sampled from the Pilot Station sonar from June 1–September 7 and analyzed by the USFWS gene lab to provide stock composition estimates for most of the summer and fall chum salmon runs. Populations in the baseline are reported in aggregated stock groups (Table 12). Results from analysis of these samples were reported for each pulse or time stratum and distributed by email to fishery managers within 24-48 hours of receiving the samples. For summer chum salmon, the lower river stock group comprised 64% of the run and the middle river stock group comprised 36%. The Tanana component of the middle river stock group comprised 9% of the total summer chum salmon run and peaked in passage at the Pilot Station sonar during the sampling period of July 19–25. The run transition from summer to fall chum salmon occurred during the second period of the fall management season (July 26–August 8) when 65% of the mixture was comprised of fall chum salmon. For fall chum salmon, 70% of the run was of U.S.-origin and 30% of Canadian-origin. The composition of the U.S. contribution was 42% Tanana and 28% U.S. border (Teedriinjik-Chandalar, Sheenjek, and Black rivers). The composition of the Canadian contribution was 9% mainstem Yukon, 2% Porcupine, and 19% White rivers. Preparations are underway to continue the project for the 2019 season.

Table 12.–The microsatellite baseline is comprised of 37 stocks used to estimate stock composition from chum salmon sampled in the test drift gillnet program at the Pilot Station sonar in 2018.

Stock aggregate name	Populations in baseline
Lower	Andreafsky, Anvik, California, Chulinak, Clear, Dakli, Kaltag, Nulato, Gisasa, Melozitna, Rodo, Tolstoi
Upper Koyukuk+Main	Henshaw, Jim, South Fork Koyukuk (early and late run), Tozitna
Tanana Summer	Chena, Salcha
Tanana Fall	Bluff Cabin, Delta, Nenana, Kantishna, Toklat, Tanana mainstem
Border U.S.	Big Salt, Chandalar, Sheenjek, Black
Porcupine	Fishing Branch
Mainstem	Big Creek, Minto, Pelly, Tatchun
White	Donjek, Kluane
Teslin	Teslin
Aggregate name	**Aggregate within aggregate**
Summer	Lower, Middle
Middle	Upper Koyukuk+Main, Tanana Summer
Fall	Tanana Fall, Border U.S., Border Canada, Upper Canada
Fall U.S.	Tanana Fall, Border U.S.
U.S.	Lower, Middle, Tanana Fall, Border U.S.
Border Canada	Porcupine, Mainstem
Upper Canada	White, Teslin
Canada	Border Canada, Upper Canada

8.2 EAGLE SONAR

ADF&G and DFO collaborate to jointly assess the passage of Yukon River mainstem Chinook and chum salmon just downstream of the international border. Since 2006, Chinook and fall chum salmon passage has been estimated using split-beam and imaging sonar near the community of Eagle, Alaska at the Eagle sonar project (McDougall and Lozori 2018). Additionally, drift gillnets (5.25-, 6.5-, 7.5-, and 8.5-inch mesh), 25 fathoms in length, and approximately 4.3 fathoms in depth are fished daily to determine species composition, and collect ASL and genetic samples from Chinook and fall chum salmon passing the sonar site. Although there is some minor overlap,

Chinook and fall chum salmon runs are largely discrete in time based on test fishery results, local knowledge of catches, and data collected in Canada.

Overall in 2018, there were no significant operational problems and both sonars performed well throughout the season. The 2018 Chinook salmon passage estimate at the project was 57,893 fish (90% CI: 57,299–58,487) for the dates July 1 through August 19 (Appendix B11). The fall chum salmon passage estimate was 136,732 fish (90% CI: 135,533–137,931) for the dates August 20 through October 6. Because of continued high passage at the termination of the project, the fall chum salmon estimate was subsequently adjusted to 168,798 fish (Appendix B16). This expansion was calculated using a second order polynomial calculated for each day through October 23, longer than the usual expansion (October 18) due to late run timing.

In 2018, ADF&G implemented a regional effort to evaluate the accuracy of external sex identification methods used at key assessment projects, including Eagle Sonar. A total of 250 adult Chinook salmon were sampled from the Eagle Sonar test fishery for this purpose. While working on the test fish boat, field staff followed standard project methods to determine the sex of each fish based on external characteristics. Sampled fish were tagged with a uniquely numbered external tag, and tag number was paired with the result of the external sex determination. Sampled fish were transported to the shore before the true sex was determined by visual internal examination of the fish's gonads. Comparison of internal (true) sex and sex based on external characteristics revealed that, in 2018, the Eagle Sonar test fishery staff correctly identified sex 100% of the time. All fish studied as part of this project were distributed to residents in the community of Eagle and included as part of the community total subsistence harvest. The location of where each fish was caught relative to the Eagle sonar was recorded and accounted for in the estimate of border passage.

8.3 YUKON, CANADA

Yukon River (Mainstem) Adult Chinook Salmon Assessment

Blind Creek Weir

The Blind Creek weir project has enumerated Chinook salmon escapement from 1997–1999 and 2003–present (Appendix B12). The weir has been situated at the same location during this period, on Blind Creek approximately 1 km upstream of the confluence with the Pelly River. In 2018, operation of the weir began on July 22 and continued to August 18. The first Chinook salmon passed the weir on July 22. A total of 612 Chinook salmon passed through the weir (Appendix B12). This escapement was 32% above the 2008–2017 10-year average (480 fish), and the ninth highest ranking escapement in the 18 years of operation. The peak daily count of 80 fish occurred on August 3, where 41% of the run had passed the weir. Approximately 50% of the run had passed the weir by August 6, one day later than the average midpoint.

A total of 394 Chinook salmon were sampled randomly for ASL data throughout the period of weir operation. Within this sample, 203 (52%) were female and 191 (48%) were male. Mean length from mid eye to tail fork (METF) for female and male samples was 778 mm and 657 mm, respectively[12]. Of the 332 samples that were aged, 0.3% (0.6% of the males and no females) were age-3, 10.8% (22.0%% of the males and no females) were age-4, 42.5%% (57.3% of the males and 28.0% of the females) were age-5, 40.7% (17.1% of the males and 63.7% of the females) were age-6, and 5.7% (3.1% of the males and 8.3% of the females) were age-7.

[12] Jane Wilson, J. Wilson & Associates, personal communication

Big Salmon Sonar

An ARIS Explorer 1800 multi-beam sonar was used to enumerate the Chinook salmon escapement to the Big Salmon River in 2018. This was the fourteenth year of escapement monitoring at a site approximately 1.5 km upstream of the confluence of the Yukon River. Sonar operation began on July 15 and continued without interruption through to August 21, producing a count of 5,053 fish. An expansion was used to interpolate the end of the run to August 28, using a log regression based on daily counts of the previous 18 days. The expansions resulted in a total passage estimate of 5,159 Chinook salmon (Appendix B12). This escapement is the eighth highest escapement recorded and was near the average 2008–2017 estimate of 5,414 fish. The peak daily count of 333 fish occurred on August 4, when 58% of the run passed the sonar site. Approximately 50% of the run had passed the sonar by August 3 (the average midpoint of the run from 2008–2017 is also August 3[13]. Project reports will be publicly available through the YRP website [14] after submission to the Pacific Salmon Commission, R&E Fund Administrator.

Carcass samples were collected from August 22–25, over approximately 155 km of the Big Salmon River, yielding 205 Chinook salmon samples. Of this total, 128 (64%) fish were female and 73 (36%) fish were male. Mean lengths of mid eye to tail fork for female and male samples were 815 mm and 778 mm, respectively (Brian Mercer, Metla Environmental Inc.; personal communication). Of the 154 samples which were successfully aged, 3.9% (9.3% of the males and 1.0% of the females) were age-4, 37.7% (55.6% of the males and 28.0%% of the females) were age-5, 54.5% (33.3% of the males and 66.0% of the females) were age-6, and 3.9% (1.9% of the males and 5.0% of the females) were age-7.

Pelly River Sonar

On the Pelly River, an ARIS Explorer 1800 multi-beam (left bank), and an ARIS Explorer 1200 multi-beam (right bank) sonar systems were used to estimate the 2018 Chinook salmon passage. This was the third year of assessment undertaken by the Selkirk First Nation in collaboration with Environmental Dynamics Incorporated (EDI), at a site approximately 20 km upstream of the confluence of the Pelly and Yukon rivers. Sonar operation began on July 9 and concluded on August 25, with a preliminary passage estimate of 9,491 fish. The peak daily count of 520 fish on July 30 occurred when 58% (un-interpolated counts) of the run had passed. Approximately 50% of the run (un-interpolated counts) had passed by June 29[15]. Project reports will be publicly available through the YRP website [16] after submission to the Pacific Salmon Commission, R&E Fund Administrator.

Whitehorse Rapids Fishway Chinook Salmon Enumeration

The Whitehorse Rapids Fishway is a fish ladder bypassing the Whitehorse dam. It has an observation window into a chamber with upstream and downstream gates. The viewing window allows visual enumeration of migrating adult Chinook salmon. Fishway staff counted 691 adult Chinook salmon at the Whitehorse Rapids Fishway between July 30 and September 6 (Appendix B12). This escapement was well below the 2008–2017 average of 1,145 Chinook salmon. Of these

[13] Brian Mercer, Metla Environmental Inc., personal communication).
[14] https://www.yukonriverpanel.com/restoration-enhancement-fund/r-e-project-reports/

[15] Scott Cavasin, EDI, personal communication
[16] https://www.yukonriverpanel.com/restoration-enhancement-fund/r-e-project-reports/

salmon, 186 (27% of return) were of hatchery origin and 505 (73% of return) were considered to be wild origin. The hatchery component included 51 females and 135 males, comprising 27% female and 73% male fish. The wild component included 177 females and 328 males, comprising 35% female and 65% male fish. Female Chinook salmon made up 33% of the total return to the fishway.

The Whitehorse Rapids Fishway program is a joint initiative of the Yukon Fish and Game Association, Yukon Energy Corporation, and DFO. Students count all adult salmon migrating through the Fishway, record the sex and size category (small, medium, or large) of each salmon, and identify hatchery-origin fish based on the absence of the adipose fin. Students also assist the Whitehorse Rapids Hatchery with broodstock collection at the Fishway.

Whitehorse Hatchery Operations

The Whitehorse Rapids Hatchery has a current annual release target of 150,000 Chinook salmon fry (2.0 gram). Fry are released upstream of the dam. This target has been in place since 2002; releases since that time have ranged from 85,306 fry in 2008 to 176,648 fry in 2003; the 10-year average (2008–2017) is 136,149 fry clipped and released upstream of the dam.

In 2018 all Chinook salmon fry released from the Whitehorse Rapids Hatchery into the Yukon River were marked. Fish released to sites upstream of the dam were coded wire tagged and had their adipose fin removed, (except for fish that were too small to tag) and were therefore only adipose fin-clipped. The tagging procedure included the application of separate tag codes to distinguish groups released to 4 locations. This marking facilitates determination of the hatchery contribution to the return through visual observation of adult Chinook salmon migrating upstream through the viewing chamber at the Whitehorse Rapids Fishway; it also allows hatchery managers to identify origin of fish during broodstock collection. Fin clipping also enables researchers to distinguish hatchery fry from wild fry when investigating juvenile Chinook salmon habitat use. Marked fish are recovered in marine studies, in in-river stock assessment of juvenile and adult Yukon River Chinook salmon, and in harvests.

A total of 121,214 Chinook salmon fry[17] from the 2017 brood year were reared and marked (clipped and/or tagged) at the Whitehorse Rapids Hatchery and then released to 3 locations upstream of the Whitehorse Rapids hydroelectric dam between June 3 and June 5, 2018. Average weight of the tagged fry groups at the time of release was 2.63 grams and ranged from 2.32 grams (Wolf Creek release group) to 3.03 grams (Michie Creek release group).

Tag retention estimated 2–4 days after tagging, for the 2018 release (2017 brood year) was 99%. The total 2018 release above the dam included an estimated 117,754 adipose-clipped fish with coded wire tags and 3,460 fish that were clipped but not tagged, including the fish that were estimated to have lost their tags and 2,144 small (or unfit) fish.

Additionally, 6,623 fry from Whitehorse Rapids Hatchery, including fry from the classroom incubation program, were marked and released to Fox Creek, a tributary to Lake Laberge, on June 17, 2018.

Brood stock collection in 2018 began on August 10, after 53 Chinook salmon had migrated through the Whitehorse Rapids Fishway and ended on August 31. A total of 64 males, including 43 wild

[17] The fish released are referred to as fry; however, virtually all of them emigrate to the ocean shortly after release, and they may more accurately be referred to as pre-smolts.

and 21 adipose-clipped (hatchery) Chinook salmon, were removed from the fishway for the brood stock program. Ten Chinook salmon were released back to the fishway after milt collection. The hatchery removed 13.8% of the total 463 returning Chinook salmon males.

In total, 38 female Chinook salmon (16.7% of the total 228 female Chinook salmon return to the fishway), including 32 wild and 6 adipose-clipped (hatchery) salmon were removed for hatchery brood stock. Eggs were taken between August 25 and September 6 from 36 full (or nearly full) ripe females, and 2 partially spent (with less than 70% eggs remaining) females. One female (wild) died in holding prior to ripening. Fecundity estimates, excluding egg takes estimated to be partial, averaged approximately 5,000 eggs, and ranged from 3,054–7,611 eggs.

The total estimated egg take was 180,763 green eggs. The fertilization rate was estimated to be 99%. Removals including 370 egg samples to assess development, 1,849 dead eggs prior to the eyed stage, and 8,236 at shocking (between October 15 and October 21) resulted in a green egg to eyed egg survival estimate of 94.2%. Thereafter 1,300 eggs were provided to the Stream to Sea classroom incubation program. After additional mortalities of 11,014 eyed eggs and 4,634 alevins, an estimated 153,360 Chinook salmon fry were being held in rearing tanks on January 1, 2019.

Porcupine River Investigations

Porcupine River Chinook Salmon Sonar

In 2018, the Vuntut Gwitchin First Nation Government and DFO collaborated to enumerate Chinook salmon on the Porcupine River near Old Crow using multi-beam ARIS Explorer 1200 (long range) sonars located on each bank. Both sonars alternated every 30 minutes between inshore ranges (1–20 m) and offshore ranges (20–40 m) 24 hours a day. Set gillnets were deployed throughout the run to assess species composition and collect ASL data from Chinook salmon. This was the fifth year of Chinook salmon sonar enumeration on the Porcupine River.

Chinook salmon sonar operations occurred from June 29 to August 15, producing a passage estimate of 3,381 Chinook salmon, including interpolated estimates for short periods of sonar downtime. High water required sonars to be removed from the river on August 16. A linear equation based on the previous 5 days of sonar counts was used to select August 18 as the last date of Chinook salmon passage, and a quadratic equation (Crane and Dunbar 2011) was used to create an end of season expansion, for a final passage estimate of 3,414 Chinook salmon (Appendix B12). Peak daily passage of 238 Chinook salmon occurred July 17, when 36% of the run had passed by the sonar site. Approximately 50% of the run has passed the sonars on July 22 (the average midpoint of the run from 2014–2017 is also July 22). The majority of Chinook salmon migrated within the first 10 m of the sonar transducer (59% of fish on right bank and 70% of fish on left bank). Passage rates were relatively consistent throughout the day with no discernable diurnal pulses.

The estimated passage of Chinook salmon was the third highest reported in 5 years of sonar operation and was near the average (2014–2017) estimate. Subtracting the local harvest estimate of Chinook salmon above the sonar (308) results in an escapement estimate of 3,106 Chinook salmon to the Porcupine River above Old Crow.

Porcupine River Chum Salmon Sonar

In 2018, the Vuntut Gwitchin First Nation Government and DFO collaborated to enumerate fall chum salmon on the Porcupine River near Old Crow using multi-beam ARIS sonars on each bank

at the same location used for Chinook salmon enumeration. Drift and set gillnets were deployed throughout the run to assess species composition and collect ASL samples. This was the eighth year of Porcupine fall chum salmon sonar enumeration. Note that during the first 2 years of this project (2011 and 2012), the assessment did not cover the entire duration of the chum salmon run. Data from these years will be reviewed and adjusted before being presented in future versions of this report (Appendix B15).

The first chum salmon was caught in the drift gillnet test fishery on August 7, however high water prevented sonar operation during the beginning of the chum salmon run. The right bank sonar was not operational from August 16–27. The left bank sonar was not operational from August 16 to September 6, and only recorded inshore (0–20 m) until September 15. Both sonars were removed on October 2 due to river freeze up, while chum passage was still occurring. Due to the compromised amount of time the sonars were operational, there was insufficient data to extrapolate missing passage at both the beginning and end of the run. The fall chum salmon run on the Porcupine River is typically bimodal, but only 1 peak was observed in the available 2018 counts. A late second peak was observed at the Fishing Branch River weir and, based on the fall chum salmon run being late at other assessment projects; it is likely a second pulse was not captured by the Porcupine River sonars. Additionally, an unknown amount of passage was not monitored at the beginning of the run. However, based on the enumerated sonar targets and the average number of operational days within a normal season, it is unlikely that fall chum passage at the Porcupine sonar was greater than 25,000 fish. This is corroborated by the very low number of fall chum salmon that were observed at the Fishing Branch River weir this year.

The maximum daily passage estimate during the time period when both sonars were fully operational was 830 fall chum salmon on September 27. Most fall chum salmon enumerated (an estimated 90%) migrated along the left bank. As in previous years, the majority of fall chum salmon migrated within the first 10 m of the sonar transducer (69% on right bank and 84% on left bank).

Fishing Branch River Chum Salmon Weir

Fall chum salmon returns to the Fishing Branch River have been assessed annually since 1971. A weir has been used in most years, aerial surveys were used in some years, and in 2013–2014 estimates were based on proportion of radio tag recoveries combined with the sonar-based passage estimate on the Porcupine River mainstem (Appendix B15). Spawning escapement estimates for the Fishing Branch River have ranged from 5,100 to 353,300 fall chum salmon in 2000 and 1975, respectively (Appendix B15). In 2018, Fishing Branch River enumeration of fall chum salmon was conducted using a combination of weir and sonar. An ARIS 1200 (long range) sonar was installed immediately upstream of the weir site to observe fish passage through a constrained weir opening (trap box). The weir was partially installed, and sonar operations began on September 3, and ran continuously until weir disassembly on October 25. Weir completion was delayed to October 4 due to high water conditions; however, sonar was used over the entire period to enumerate fish passage across the river and through the weir. When the weir was operational, daily visual counts were used to verify sonar counts.

No preseason expansion was applied. A small correction factor was applied for a period at the beginning of the season when the entire river width was not ensonified (20.9% proportion added to daily counts for this period based on comparative fish passage distance during full ensonification). A postseason expansion estimate of 31 fish between weir removal and October 31

was also added to reflect the later 2018 run timing. The total weir-sonar passage estimate of 10,151 fall chum salmon (Appendix B15) is well below the Fishing Branch River interim escapement goal range of 22,000–49,000 fish. This escapement is the second lowest count in the past 10 years of weir operation, and the fourth lowest over the 35 years of weir operation.

The run was bimodal with the initial peak daily count of 457 fish occurring on September 28 (39% of the run had passed), and a second peak of 491 fish occurring on October 16 (87% of run had passed). Approximately 50% of the run had passed the weir by October 2; the average midpoint of the run from the past 10 years (2006–2012 and 2015–2017) of observations is September 23. The observation of a late 2018 run is consistent with observations elsewhere in the drainage.

ASL data were collected from 396 chum salmon between September 27 and October 24. Of the 393 samples which were successfully aged, 1.8% (0.7% males and 2.5% females) were age-3, 55.2% (48.3% males and 58.9% females) were age-4, 41.2% (49.0% males and 36.9% females) were age-5, and 1.8% (2.0% males and 1.7% females) were age-6 (Appendix A11). The mean METF length was 591 mm for fall chum salmon in the samples. Although sex composition was not available from the sonar data, overall sex ratios of sampled fish was 62% female (unweighted by passage and over a restricted amount of time).

Aerial Surveys

An aerial survey of the Kluane River was conducted on October 17, 2018. Prior to the 2017 survey, the Kluane River has not been surveyed since 2006. The survey area involves many discrete spawning areas (sloughs and side channels) and ranges from low to high densities of fish. The Kluane River index count for 2018 was 1,734. Observer efficiency was moderate due to weather and variable water clarity. Historical data are presented in Appendix B15.

Genetic Stock Identification and Stock Composition of Canadian Yukon River Chinook and Fall Chum Salmon

Genetic samples of Chinook and fall chum were collected from the drift gillnet test fishing program at the Eagle sonar project. However, the 2018 samples of Chinook and fall chum were not analyzed prior to the publication of this report, hence 2018 regional stock contribution estimates are not available.

Environmental Conditions Report

This annual summary of environmental conditions was intended to describe conditions influencing fish habitat in the Canadian sub-basin of the Yukon River, the area upstream of the Alaska/Yukon border that includes the Yukon River and the Porcupine River. The sub-basin encompasses a large expanse of salmon habitat including over 100 documented spawning streams and many more rearing streams. In lieu of annual surveys throughout these widespread spawning and rearing habitats, this brief summary serves to record significant environmental conditions that may influence Yukon River Chinook salmon spawning and rearing habitat.

Due to the spatial scale, specific salmon habitat information is not collected extensively from year to year; therefore, the following information is provided as a high-level synopsis of what was experienced in the Canadian sub-basin for a given year. Various weather records and stream discharge data from other agencies are applied as a means to 1) determine if environmental conditions are within normal ranges on record, 2) identify unusual trends and/or events, and 3) consider implications for salmon. Conditions reported are informed through observations based on

relevant activities, projects, or studies carried out by the public, fishers, consultants, and DFO. Through scientific evidence, local knowledge, experience, and professional judgment, this information is applied to fish habitat to determine general conditions experienced for the year.

November 2017 to April 2018

The 2017–2018 winter involved a range of conditions throughout the territory. Temperatures over this period were generally warmer than average, with departure from the average increasing with distance north. Specific anomalies included warm events in January, and a colder March. Mean March air temperatures in the Canadian Yukon River sub-basin over this time ranged from 1 degree Celsius below normal between Mayo, Faro, and Whitehorse, and up to 5 degrees above normal in parts of the northern region (Porcupine River drainage)[18]. Warmer events were generally dry, except for Southern Yukon, with above average spring snowfall (March and April). Overall winter precipitation was average to below normal for most of the territory.[19] Spring snowpack values ranged from well below normal around some areas of Pelly and Mayo to above normal in the Porcupine and White river drainages. Spring streamflow conditions were generally typical, except for the Stewart and Pelly rivers which were well below normal, and the Porcupine River, which was well above normal.[20] Streamflow during the November to April period represents base flow and generally provides an indication of groundwater contributions. These conditions represent the incubation and alevin development periods for Chinook and chum salmon.

May 2018 to July 2018

Air temperatures were average over this period, except for the southernmost extent of the Yukon River basin where they were above normal.[21] A high pressure system in southern Yukon brought record heat at the end of July. Precipitation over this time period was below normal in the southern extent of the basin and above normal in northern and central Yukon.[22] Specific anomalies include the Dawson area which experienced the second driest July on record[23], and record heat in southern Yukon at the end of July. Initially, cooler spring temperatures caused above normal snowpack conditions heading into May. In central and southern Yukon, spring melt occurred later than normal, with a later freshet and high-country melt in systems like the Pelly and Big Salmon. River levels were generally typical during this period, and water temperatures in the beginning of the period were generally below average in May, reflecting a later spring. Water temperatures monitored in representative tributaries in the mid-mainstem (Little Salmon River) exceeded the recent average in late July by up to 2°C, reaching 18°C.

Conditions in this period align with age-1+ Chinook salmon outmigration, and age-0+ emergence and movement downstream, followed by age-0+ juvenile upstream migration into non-natal tributaries. Adult Chinook salmon upstream migration also occurs in this time period, with adult Chinook salmon entering the Yukon River in late May/early June and reaching the mainstem Canadian border at the beginning of July. Water temperatures above 18°C pose a risk to migrating and spawning Chinook salmon.

[18] Yukon Snow Survey Bulletin and Water Supply Forecast, March 1, 2018, April 1, 2018 www.env.gov.yk.ca/snowbulletin
[19] Environment Canada Forecast Verification https://weather.gc.ca/saisons/ver_e.html
[20] Yukon Snow Survey Bulletin and Water Supply Forecast, April 1, 2018 www.env.gov.yk.ca/snowbulletin
[21] Environment Canada Forecast Verification https://weather.gc.ca/saisons/ver_e.html
[22] Environment Canada Forecast Verification https://weather.gc.ca/saisons/ver_e.html
[23] Environment Canada Quarterly Bulletin, Climate Impacts and Outlook https://tinyurl.com/yd4jeggf

August 2018 to October 2018

Temperatures were above average, and fall precipitation was typical across the Canadian portion of the drainage.[24] River levels showed no significant events other than the Porcupine River drainage with high water during August-September. High water may have affected the end of the Chinook salmon run and the beginning of the fall chum salmon migration in this drainage. Water temperatures cooled from peaks in late July, decreased through the fall, and were below average in many areas. Water temperatures during this time period likely did not pose a risk to adult upstream migration and spawning.

Summary

Migration, spawning, and rearing conditions in the Canadian sub-basin of the Yukon River were varied throughout the drainage in 2017–2018. Moderate winter conditions were likely favorable for incubation of the 2017 brood year juveniles, but decreased spring water temperatures from late freshet and upper altitude snow melt likely impacted juveniles, possibly through delayed growth and outmigration timing. High water levels in some drainages during Chinook and chum migration may have affected returning adults. While higher water temperatures may have occurred during some specific spawning locations, negative drainage-wide impacts were not observed, and cooler air temperatures in August likely kept water temperatures cool. With increased climate variability, increased habitat monitoring and assessment in the Yukon River Canadian Sub-basin is encouraged to inform management, research, restoration strategies, and habitat considerations for Yukon River Pacific salmon populations.

9.0 MARINE FISHERIES INFORMATION

9.1 INTRODUCTION

Yukon River salmon migrate into the Bering Sea during the spring and summer after spending 0, 1, or 2 winters rearing in fresh water. Information about stock of origin from tagging, scale patterns, parasites, and genetic analysis indicate that Yukon River salmon are present throughout the Bering Sea, in regions of the North Pacific Ocean, south of the Aleutian Chain, and the Gulf of Alaska during their ocean migration (Healey 1991; Salo 1991). Yukon River salmon have the potential to be captured by fisheries that harvest mixed stocks of salmon, other species of fish (bycatch), and by illegal fishing activities throughout their oceanic distribution. Coded-wire tag recoveries in these fisheries and in research surveys provide a key descriptor of the oceanic distribution of Yukon River Chinook salmon. However, genetic stock identification has become the primary tool for identifying Yukon River Chinook salmon in marine habitats (Larson et al. 2013; Guthrie et al. 2016). The U.S. groundfish trawl fisheries in the Gulf of Alaska (GOA) and Bering Sea-Aleutian Islands (BSAI) management areas are managed to limit the incidental harvest (bycatch) of salmon. Bycatch amounts and bycatch management in these trawl fisheries are summarized below.

9.2 SALMON BYCATCH IN THE BERING SEA AND GULF OF ALASKA GROUNDFISH FISHERIES

The U.S. groundfish fisheries in the BSAI and GOA regions are managed under the Magnuson-Stevens Fisheries Conservation and Management Act by the North Pacific Fishery Management

[24] Environment Canada Forecast Verification https://weather.gc.ca/saisons/ver_e.html

Council (NPFMC) and are regulated by the National Marine Fisheries Service (NMFS) Alaska Regional Office. Annual summaries and in-season information about Pacific salmon bycatch in the Bering Sea and Gulf of Alaska groundfish fisheries are provided by the Alaska Regional Office as part of the NMFS catch accounting system. Chinook and chum salmon from throughout the Pacific Rim contribute to the bycatch in eastern Bering Sea groundfish fisheries (Guthrie et al. 2016; Kondzela et al. 2016). Annual bycatch of Chinook salmon in Bering Sea groundfish fisheries in 2018 (n = 17,379) was significantly lower than the previous 3 years (Appendix A8). Bycatch numbers of Chinook salmon are not equivalent to numbers of Chinook salmon returning to freshwater due to the natural mortality that occurs within marine habitats; the number of salmon captured as bycatch need to be converted to adult equivalents before the impact to terminal runs can be estimated (Ianelli and Stram 2014). Bycatch of non-Chinook salmon species (predominately chum salmon) in the BSAI groundfish fisheries increased to 471,362 in 2017, the second highest in this dataset dating back to 1991 (Appendix A8). Pollock directed fisheries are the primary groundfish fishery of concern for salmon bycatch in the Bering Sea, accounting for approximately 88% of the total Chinook salmon bycatch and 99% of the non-Chinook salmon bycatch (Appendix A8). Pollock harvests are managed in the BSAI pollock fishery by setting an annual total allowable catch (TAC) for pollock and allocating the catch to various sectors of the fishery as specified by the American Fisheries Act in 1998. These allocations are divided into the winter roe season (January 20 to June 10; A-season) and the summer/fall season (June 10 to November 1; B-season). Chinook salmon bycatch occurs in both the winter season (61%) and the summer/fall season, whereas non-Chinook salmon are caught predominately during the summer/fall season (99%; Appendix A8).

A range of regulatory measures are or have been used to limit salmon bycatch in the GOA and BSAI groundfish fisheries. These measures include classifying salmon as a prohibited species, salmon savings areas, voluntary rolling hotspot system (VRHS), salmon excluder devices, and bycatch incentive plan agreements (IPAs). Prohibited species within U.S. groundfish fisheries must be either discarded or donated through the Pacific Salmon Donation Program, which allows for distribution of salmon taken as bycatch to economically disadvantaged individuals by tax exempt organizations. Chinook and Chum Salmon Savings Areas were created in the mid-1990s. Savings areas enabled cap-and-closure measures to limit salmon bycatch in the Bering Sea pollock fishery and were based on locations with historically high spatial and temporal levels of salmon bycatch. In 2006, fishing vessels participating in VRHS were exempted from the salmon savings areas. VRHS minimizes bycatch by adaptively defining area closures with in-season bycatch information.

Escalating numbers of Chinook salmon captured as bycatch in the BSAI pollock fishery in 2006 and 2007 prompted an environmental impact assessment of Chinook salmon bycatch in the Bering Sea pollock fishery and a review of alternative management measures to limit the bycatch of Chinook salmon (NMFS 2009a, NMFS 2009b). Following these reviews, the NPFMC recommended Amendment 91 be added to the *BSAI Groundfish Fisheries Management Plan* for the Bering Sea pollock fishery[25]. Amendment 91 was implemented by NMFS during the 2011 fishing season and established a bycatch hard-cap of 60,000 Chinook salmon and a performance cap of 47,591 Chinook salmon for vessels participating in a bycatch IPA. Chinook salmon bycatch quotas were allocated to each season and sector of the fishery based on the bycatch cap, historical Chinook salmon bycatch, and pollock harvest allocations. Amendment 91 establishes benchmark

[25] https://alaskafisheries.noaa.gov/rules-notices/search)

performance criteria for IPAs that have been used or may be used in the future to avoid salmon bycatch in the Bering Sea pollock fishery. Sectors that exceed their proportion of the performance cap more than 2 times in any 7-year period will have their hard cap reduced to their proportion of the performance cap. Amendment 110 added additional salmon bycatch avoidance measures to the Bering Sea pollock fishery in 2016, including the use of abundance-based Chinook salmon bycatch caps. When the combined in-river run size of Unalakleet, Upper Yukon, and Kuskokwim River stock groups of Chinook salmon is below 250,000 fish, the bycatch hard cap is reduced to 45,000 and the performance cap is reduced to 33,318 the following year. In 2018, the estimated aggregate in-river run size of Unalakleet, Upper Yukon, and Kuskokwim River stock groups of Chinook salmon was below 250,000 fish, so the bycatch hard cap and performance cap are reduced for the 2019 Bering Sea pollock fishery.

10.0 RUN OUTLOOKS 2019

10.1 YUKON RIVER CHINOOK SALMON

Over the years, the JTC has used a range of methods to produce an annual preseason outlook of Canadian-origin Chinook salmon run abundance. Run outlooks are used by fishery managers and stakeholders as a tool for guiding the development of preseason harvest strategies. In general, the Canadian-origin Chinook salmon outlook provided by the JTC has been similar to the observed run size estimated postseason (Figure 18).

Canadian-origin Brood Table

The brood table for Canadian-origin Yukon River Chinook salmon (Appendix A3) is the basis of the current spawner-recruitment model (Figure 19) which is used to forecast returns in future years. Age-specific returns have been estimated from harvest and escapement data by age class in the return years. Because assessment methods have changed over time, the brood table is constructed from a variety of data sources. For the years 1982–2001, initial estimates were derived from the DFO Chinook salmon mark–recapture program, but information from several sources, reviewed in 2008, indicated that these data were probably biased low. Subsequently, the 1982–2001 Canadian spawning escapement estimates were reconstructed using a linear regression of the estimated total spawning escapements for 2002–2007 against a 3-area aerial survey index of combined counts from Big Salmon, Little Salmon, and Nisutlin rivers. Spawning escapement estimates for years 2002–2004 were from radiotelemetry studies. Since 2005, spawning escapement estimates have been estimated by subtracting both Canadian and U.S. harvests that occurred upriver from the sonar project site from the passage estimates at Eagle sonar.

Canadian-origin Yukon River Chinook Salmon

The 2019 preseason outlook for Canadian-origin Chinook salmon is for a run size of 69,000–99,000 and is based on an average of 2 forecast ranges devised using 2 methods. The first method was based on an average of the spawner-recruitment and sibling models corrected to generate an adjusted outlook range. The second method was based on juvenile abundance estimates from Northern Bering Sea trawl surveys.

Spawner-recruit and Sibling Model Average

Spawner-recruitment and sibling models predict the 2019 run size of Canadian-origin Chinook salmon will be approximately 91,900 and 108,400 fish, respectively (Table 13). The average of those 2 models indicates a return of about 100,000 Chinook salmon. However, these models do not

account for uncertainty associated with lower productivity and poor model performance observed in recent years. Over the last 10 years, observed run sizes were approximately 29% lower than preseason outlooks developed with the spawner-recruitment model, 28% lower than preseason outlooks developed with the sibling model, and 30% lower than preseason outlooks developed by averaging the 2 models.

The 2019 forecast range was developed by adjusting the uncorrected spawner-recruit and sibling average of 100,000 Canadian-origin Chinook salmon to account for poor model performance observed from 2007–2013 and improved model performance observed from 2014–2018. An annual correction factor was calculated for each year since 2007 as the ratio of observed to predicted run size. The 2007–2013 average correction was 0.60. The 2014–2018 average correction was 0.82. The forecast range was developed by multiplying the uncorrected forecast of 100,000 by 0.60 and 0.82 respectively. This method is consistent with JTC forecasts produced in 2016 and 2017. The corrected spawner-recruit and sibling model produced a forecast range of 60,000–82,000 Canadian-origin Chinook salmon.

Juvenile-based Forecast

Fisheries and oceanographic research surveys in the northern Bering Sea shelf were initiated in 2002 as part of the Bering-Aleutian Salmon International Survey (BASIS; NPAFC 2001). The BASIS project was developed by member nations of the North Pacific Anadromous Fish Commission (NPAFC; United States, Russia, Japan, Canada, and Korea) to improve our understanding of marine ecology of salmon in the Bering Sea. These surveys use pelagic rope trawls to sample fish at or near the surface. The surveys are designed to support broad-scale marine ecosystem research. Although the investigators, vessels, funding support, and research objectives of these trawl surveys have varied with time, attempts have been made to occupy a core station grid to improve the consistency of data collected during these research surveys. Stations are typically sampled during September along a systematic latitude and longitude grid with stations separated by approximately 30 nautical miles.

Pelagic trawl surveys in the northern Bering Sea capture Yukon River salmon stocks during their first summer at sea (juvenile life-history stage). Canadian-origin juvenile Chinook salmon are the primary stock group encountered during the northern Bering Sea trawl surveys (Murphy et al. 2009). Since 2003, juvenile Chinook salmon catch from the trawl surveys, coupled with genetic MSA, has been used to provide stock-specific juvenile abundance estimates (Figure 20; Murphy et al. 2017). Juvenile Chinook salmon experience relatively stable marine survival following their first summer in the northern Bering Sea, suggesting that cohort strength is determined prior to the pelagic trawl surveys. As a result of this stable marine survival, the relationship between juvenile Chinook salmon abundance in the northern Bering Sea correlates to adult returns to the Yukon River (Figure 21). This relationship is pivotal to the juvenile-based forecasting tool used to predict adult returns up to 3 years in advance.

Juvenile abundance-based forecasts of Canadian-origin Chinook salmon have been provided to the JTC and Yukon River Panel since 2013 (Table 13). Since 2014, the juvenile-based forecast has been used as auxiliary information about future year run sizes. The JTC decided to explicitly incorporate the juvenile-based forecast as part of the formal outlook beginning in 2018. Recent changes were made to the methods used to forecast adult returns to the Yukon River[26]. The 2019

[26] K. Howard, Alaska Department of Fish and Game, personal communication

forecast presented here was calculated using the new methodology. Earlier forecasts from 2013–2018 will remain unchanged in this report as they reflect the information available at that time.

Juveniles in the Bering Sea in 2015 and 2016 would be the primary contributors to the 2019 adult run (returning as age-6 and age-5, respectively), and both years had above average juvenile abundances (Figure 20). The juvenile-based forecasting tool produced a range of 77,000–115,000 Canadian-origin Chinook salmon returning to the Yukon River in 2019. Early indications suggest that Canadian-origin adult returns to Yukon River will decrease in 2020 and 2021. The forecasted 2020 run abundance should be comparable to the 2016 run, and the 2021 run is expected to be similar in size to the 2014 run (Figure 22).

Table 13.–Preseason Canadian-origin Yukon River Chinook salmon outlooks for 2013–2019.

	Expected run size (preseason)									Postseason estimate
				Adjusted outlook range[a]		Juvenile-based model range		Average of adjusted outlook and juvenile-based model ranges [b]		
Year	Spawner-recruit	Sibling	Model average	Low end	High end	Low end	High end	Low end	High end	Estimated run size[c]
2013	109,984	79,160	95,000	**49,000**	**72,000**	43,000	61,000			37,000
2014	100,159	53,287	77,000	**32,000**	**61,000**	45,000	65,000			65,000
2015	96,083	103,701	100,000	**59,000**	**70,000**	55,000	79,000			87,000
2016	96,983	108,003	102,000	**65,000[d]**	**88,000[d]**	61,000	88,000			83,000
2017	93,724	135,105	114,000	**73,000[d]**	**97,000[d]**	93,000	134,000			93,000
2018	89,356	120,834	105,000	63,000[d]	88,000[d]	78,000	117,000	**71,000**	**103,000**	77,000
2019	91,947	108,365	100,000	60,000[d]	82,000[d]	77,000	115,000	**69,000**	**99,000**	

Note: Bold numbers represent the outlook range used in each year.

[a] From 2013–2015, the Spawner-recruitment model and Sibling model based outlooks have been adjusted by applying average (2007–2015) model performance (percent difference from expected) to the projection and rounding to the nearest 1,000 to create an "adjusted outlook range".

[b] Average of the lower ends of the adjusted outlook and the juvenile ranges determines lower end. Average of the upper ends of the adjusted outlook and the juvenile ranges determines upper end.

[c] Estimated run size is the border passage estimate plus the U.S. and Canada harvest of Canadian-origin Chinook salmon. U.S. harvest estimates are determined using Canadian stock genetic proportion estimates applied to U.S. harvest.

[d] Starting in 2016, the adjusted outlook uses the average of the 2 model forecasts and applies a correction factor (2007–2014 average performance) for the lower end and the correction factor seen in 2014 through current year for the upper end.

2019 Canadian-origin Chinook Salmon Outlook

The outlook for 2019 Canadian-origin run was developed by averaging the forecast ranges based on the adjusted spawner-recruit/sibling method and the juvenile-based method. A simple model average was chosen to give equal weight to both methods. The 2019 forecast range is for a run size of 69,000–99,000 Canadian-origin Chinook salmon which suggests a run size of similar or slightly smaller than the run size observed 2018 (Table 13). A run of this size would be similar to the 2009–2018 average of 71,000 Chinook salmon (Appendix B18), but below the 1982–1997 average of 153,000 Chinook salmon.

The Chinook salmon runs on the Yukon River are typically dominated by age-5 and age-6 fish. The brood years producing these age classes in 2019 are 2013 (age-6) and 2014 (age-5). The

Canadian-origin Yukon River Chinook salmon spawning escapement in 2013 of 28,669 was the second smallest since 1982 but the 2014 escapement of 63,331 was above the 1982–2011 average escapement of approximately 48,000 fish. (Appendix A3; Figure 14). In 2015, 2016, and 2018 the estimated returns of age-4 fish were the largest since 1993 and subsequently the returns of age-5 fish in 2016 and 2017 were the largest since 1996 and 2006 respectively (Appendix A3). The large return of age-4 fish in 2018 is indicating the potential for a strong age-5 return in 2019.

10.2 YUKON RIVER SUMMER CHUM SALMON

The strength of the summer chum salmon run in 2019 will be dependent on production from the 2015 (age-4 fish) and 2014 (age-5 fish) escapements, because these age classes generally dominate the run. The total runs during 2014 and 2015 were approximately 2.5 million and 2.1 million summer chum salmon, respectively. The escapement goal on the Anvik River (350,000–700,000 fish) was achieved in 2014 and 2015, and the escapement goal on the East Fork Andreafsky River (>40,000 fish) was just shy of the goal in 2014 but was met in 2015. It is expected that the 2019 run will be similar or slightly smaller than the 2018 run of approximately 2.1 million fish.

The 2019 run is anticipated to provide for escapements, a normal subsistence harvest, and a surplus for commercial harvest. Summer chum salmon runs have provided for a harvestable surplus in each of the last 15 years (2004–2018). If inseason indicators of run strength suggest sufficient abundance exists to allow for a commercial fishery, the commercially harvestable surplus in Alaska could range from 700,000–1,200,000 summer chum salmon. Similar to the last 5 years, commercial harvests of summer chum salmon in 2019 are expected to be affected by measures taken to protect Chinook salmon from incidental harvest in chum salmon-directed fisheries.

10.3 YUKON RIVER FALL CHUM SALMON

Drainagewide Fall Chum Salmon

Preseason outlooks are determined using estimates of escapement and resulting production. Yukon River drainagewide estimated escapement of fall chum salmon for the period 1974 through 2012 have ranged from approximately 224,000 (2000) to 2,200,000 (1975) fish, based on Bayesian analysis of escapement assessments to approximate overall abundance (Fleischman and Borba 2009). Escapements between 1974 and 2012 resulted in subsequent returns that ranged in size from approximately 317,000 (1996 production) to 2,900,000 (2001 production) fish. Corresponding return per spawner rates ranged from 0.3–8.9, averaging 1.74 for all years combined (1974–2012; Appendix A9).

A considerable amount of uncertainty has been associated with these run forecasts, particularly in the last decade, because of unexpected run failures (1998–2002) followed by strong runs from 2003 through 2008. Weakness in these salmon runs prior to 2003 was generally attributed to reduced productivity in the marine environment and not to low levels of parental escapement. Similarly, improvements in productivity (2007–2010, 2102–2014) have been attributed to the marine environment.

Beginning in 1999, Yukon River fall chum salmon preseason outlooks have been presented as a range, in order to better represent uncertainty in the expected run size. In all years, the expected run size (point estimate) was forecast using estimates of brood year escapement, estimates of returns per spawner (production), and maturity schedules developed for even and odd years based on historical averages. In 1998, the forecast method overestimated run size due to an unexpected

poor return. To account for this, the point estimate was used as the upper bound of the forecast range in subsequent years (1999–2005). The lower end of the forecast range was generated by adjusting the point estimate based on the average forecast performance (i.e., ratio of observed to predicted). Forecast performance from 1998–2003 were used to inform the 1999–2004 outlooks. As run sizes increased over the early to mid-2000s, the forecast performance improved, and in 2005 the lower bound of the forecast range was based on the 2001–2004 average forecast performance. Beginning in 2006, adjustments to the point estimate were no longer applied. Instead, the outlook range was based on a statistical confidence interval around the point estimate. Since 2006, the annual forecasts have been informed by different odd and even year maturity schedules based on the historical averages available at the time and assumptions of stock productivity. For example, in 2006 and 2007 average age composition from years 1974–1983 were used to represent high productivity years, whereas in 2008–2012 data from 1984–2012 was used to represent low productivity years. Since 2013, the average odd and even year maturity schedules have been calculated from the complete historical dataset.

The 2019 Yukon River fall chum salmon forecast was based on similar methods used since 2006. The majority of fall chum salmon return at age-4 and age-5, and a smaller proportion return as age-3 and age-6 (Appendix A9). As such, the 2019 run will be composed of brood years 2013–2016 (Table 14). Estimates of returns per spawner (R/S) were used to estimate production for 2013 and 2014, and an auto-regressive Ricker spawner-recruit model was used to predict returns from 2015 and 2016. The average odd and even year maturity schedule was calculated from the complete historical dataset since 1974. That maturity schedule was applied to the estimated production (i.e., returns) for each contributing brood year and summed to estimate the total number of fall chum salmon that were expected to return in 2019. The result was an outlook point estimate of 1,045,000 fall chum salmon returning in 2019. The outlook range was based on the 80% confidence bounds for the point estimate. Confidence bounds were calculated using deviation of point estimates and observed returns from 1987 through 2018. Therefore, the 2019 forecasted run size is expressed as a range from 930,000–1,160,000 fall chum salmon (Table 14). This forecasted drainagewide fall chum salmon run size is near average (1998–2018; Table 15).

The dominant parent year escapements contributing to this outlook are 2014 and 2015. The escapement in 2014 exceeded the upper end of the drainagewide escapement goal range of 300,000–600,000 fall chum salmon while escapement in 2015 was within the goal range. The major contributor to the 2019 fall chum salmon run is anticipated to be age-4 fish returning from the 2015 parent year (Table 14).

Table 14.–Forecasted 2019 total run size of fall chum salmon based on parent year escapement for each brood year and predicted return per spawner (R/S) rates, Yukon River, 2013–2016.

Brood year	Escapement	Estimated production (R/S)	Estimated production	Age	Contribution based on age	Current return
2013	825,100	2.68	2,211,268	6	1.7%	18,271
2014	724,800	1.61	1,166,928	5	33.1%	345,991
2015	538,650	1.69	907,919	4	61.9%	647,026
2016	833,100	1.33	1,112,180	3	3.2%	33,502
Total expected run (unadjusted)						1,045,000
Total 2019 run size expressed as a range based on the forecasted vs. observed returns from 1987 to 2018 (80% CI):						930,000 to 1,160,000

For fall chum salmon, the sibling relationship is best between the age-5 and age-6 component (R^2 = 0.56). Typically, the sibling relationship between the age-3 and age-4 fish (R^2 = 0.50) is better than the age-4 and age-5 fish (R^2 = 0.27). Brood year returns of age-3 fish range from zero to 199,000 chum salmon. Returns of age-4 fish from odd-numbered brood years during the time period 1974–2012 averaged 832,000 fall chum salmon, and in all years ranged from a low of 174,000 for brood year 1996 to a high of 2,053,000 for brood year 2001. Returns of age-5 fish from the same time period for even-numbered brood years averaged 215,000 fall chum salmon, and in all years ranges from a low of 59,000 fish for brood year 1998 to a high of 705,000 fish for brood year 2001. Considering the sibling relationship described, the contribution of age-5 fish should be average while the age-4 component should be slightly above average.

The forecast models rarely predict extreme changes in production. The fluctuations observed in fall chum salmon run sizes (postseason run size estimates) in comparison with the expected run sizes (preseason outlooks) are reflected in the outlook performance; i.e., proportions of the expected run size, observed for the 1998–2018 period (Table 15).

Table 15.–Preseason Yukon River drainagewide fall chum salmon outlooks 1998–2019 and estimated run sizes for 1998–2018.

Year	Expected run size (preseason)	Estimated run size (postseason) [a]	Performance of preseason outlook (preseason/postseason)
1998	880,000	352,000	0.40
1999	1,197,000	419,000	0.35
2000	1,137,000	252,000	0.22
2001	962,000	374,000	0.39
2002	646,000	427,000	0.66
2003	647,000	794,000	1.23
2004	672,000	652,000	0.97
2005	776,000	2,180,000	2.81
2006	1,211,000	1,190,000	0.98
2007	1,106,000	1,130,000	1.02
2008	1,057,000	834,000	0.79
2009	791,000	600,000	0.76
2010	690,000	573,000	0.83
2011	740,000	1,220,000	1.65
2012	1,114,000	1,080,000	0.97
2013	1,029,000	1,180,000	1.15
2014	932,000	938,000	1.01
2015	1,060,000	821,000	0.77
2016	666,000	1,390,000	2.09
2017	1,560,000	2,230,000	1.43
2018	1,700,000	1,100,000	0.65
2019	1,045,000		

Note: The expected run sizes are point estimates (rounded). Ranges were used since 1999 but until 2006 were not always distributed around the point estimate. Starting in 2006, expected run sizes are the midpoint of the outlook range.

[a] Postseason estimates are updated annually based on the Bayesian space-state modeling of the drainagewide escapement estimates and may include refined harvest estimates.

During the 2019 fall fishing season, estimated strength of the projected run of fall chum salmon will be adjusted using the relationship to summer chum salmon run abundance and assessed based on various inseason monitoring project data. With a forecasted run size range of 930,000–1,160,000 fall chum salmon (midpoint 1,045,000 fish; Table 14), it is anticipated that escapement goals will be met while supporting normal subsistence fishing activities. The forecast suggests a commercial surplus between 380,000 and 610,000 fall chum salmon may be available. However, commercially harvestable surpluses will be determined inseason and applied to the guidelines outlined in the management plan with further considerations of fishing effort and buying capacity.

Canadian-origin Upper Yukon River Fall Chum Salmon

To develop an outlook for the 2019 Canadian-origin Yukon River fall chum salmon, the drainagewide outlook range of 930,000–1,160,000 fall chum salmon was multiplied by 25% (the estimated contribution of mainstem Yukon River Canadian-origin fall chum salmon), producing an outlook range of 233,000–290,000 fish with a midpoint of 262,000 fish (rounded to the nearest 1,000; Table 16). Recent genetic stock identification analyses have indicated that the assumption of 25% is reasonable.

Table 16.–Preseason Canadian-origin mainstem Yukon River fall chum salmon outlooks for 1998–2019 and observed run sizes for 1998–2018.

Year	Expected run size (preseason)	Estimated run size (postseason)	Performance of preseason outlook (preseason/postseason)
1998	198,000	70,000	2.83
1999	336,000	116,000	2.90
2000	334,000	66,000	5.06
2001	245,000	49,000	5.00
2002	144,000	113,000	1.27
2003	145,000	182,000	0.80
2004	147,000	193,000	0.76
2005	126,000	558,000	0.23
2006	126,000	330,000	0.38
2007	147,000	347,000	0.42
2008	229,000	269,000	0.85
2009	195,000	128,000	1.52
2010	172,000	143,000	1.20
2011	184,000	326,000	0.56
2012	273,000	238,000	1.15
2013	257,000	303,000	0.85
2014	230,000	223,000	1.03
2015	265,000	205,000	1.29
2016	166,000	298,000	0.56
2017	388,000	563,000	0.69
2018	425,000	279,000	1.57
2019	262,000		

Note: The 2009 through 2019 preseason expected run sizes are the midpoint of the outlook range. Estimated run sizes are calculated by adding estimated U.S. harvest of Canadian-origin fall chum salmon to the mainstem Yukon River sonar passage estimate. In recent years, the proportion of Canadian mainstem fall chum salmon in the total U.S. harvest is assumed to be equal to the proportion of Canadian-origin fall chum salmon in the drainagewide escapement (i.e. 25%).

Canadian-origin Porcupine River Fall Chum Salmon

In the Canadian section of the Porcupine River, over half of the production of fall chum salmon originates from the Fishing Branch River. Canadian-origin Porcupine River stocks have been estimated to comprise 5% of the drainagewide run. Fishing Branch River fall chum salmon are estimated to comprise up to 80% of the Canadian-origin Porcupine River stocks, and approximately 4% of the drainagewide run, though estimates have ranged from 1.3%–7%. Applying the 4% average estimate to the drainagewide outlook range of 930,000–1,160,000 fish yields a Fishing Branch River outlook of 37,000 –46,000 fish, with a midpoint of 42,000 fish (rounded to the nearest 1,000 fish; Table 17). This outlook is considered uncertain due to the high variation in contributions of Fishing Branch River fall chum salmon to drainagewide stocks.

Though the models used to develop forecasts have varied from year-to-year, the postseason run size estimates of Fishing Branch River fall chum salmon have been consistently below preseason outlooks since 1998, except for 2003–2005, 2016, and 2017.

Table 17.–Preseason Fishing Branch River fall chum salmon outlooks for 1998–2019 and observed run sizes for 1998–2018.

Year	Expected run size (preseason)	Estimated run size (postseason)[a]	Performance of preseason outlook (preseason/postseason)
1998	112,000	25,000	4.48
1999	124,000	24,000	5.17
2000	150,000	13,000	11.54
2001	101,000	33,000	3.06
2002	41,000	19,000	2.16
2003	29,000	46,000	0.63
2004	22,000	32,000	0.69
2005	48,000	186,000	0.26
2006	54,000	48,000	1.13
2007	80,000	50,000	1.60
2008	78,000	30,000	2.60
2009	49,000	40,000	1.23
2010	43,000	20,000	2.15
2011	37,000	28,000	1.32
2012	55,000	50,000	1.10
2013	52,000	39,000 (52,000)[b]	–
2014	46,000	13,000 (24,000)[b]	–
2015	17,000	13,000	1.31
2016	27,000	54,000	0.50
2017	62,000	73,000	0.85
2018	68,000	29,000	2.34
2019	42,000		

Note: Run sizes are rounded to nearest 1,000. The 2009 through 2019 preseason forecasted run sizes are the midpoint of an outlook range. The Fishing Branch River weir monitors the dominant spawning stock within the Porcupine River drainage.

[a] The total run size is estimated by adding the estimated Canadian (Porcupine) harvest and U.S. harvest of Fishing Branch River fall chum salmon to the Fishing Branch River weir escapement estimate, unless otherwise noted. In recent years, the proportion of Fishing Branch River fall chum salmon in the total U.S. harvest is assumed to be equal to the proportion of Fishing Branch River fall chum salmon in the drainagewide escapement (i.e. 4%). Beginning in 2016, it is also assumed that Fishing Branch River fall chum salmon comprise 80% of Canadian chum salmon harvest in the Porcupine River. Previously 100% of Canadian fall chum salmon harvest in the Porcupine River was included in the Fishing Branch River estimated run size.

[b] Run size was based on Old Crow sonar counts and proportion of tag recoveries. Numbers in parentheses are the corresponding Canadian-origin Porcupine River sonar-based estimates. Outlook performances are not included due to uncertainty in the assessment methods compared with previous years.

10.4 YUKON RIVER COHO SALMON

Although there is little comprehensive escapement information for Yukon River drainagewide coho salmon, it is known that coho salmon primarily return as age-2.1 fish (4-year-old, age in European notation) and overlap in run timing with fall chum salmon. The major contributor to the 2019 coho salmon run will be age-4 fish returning from the 2015 parent year. Based on the run reconstruction index (1995–2018, excluding 1996 and 2009), the 2015 escapement was estimated to be 107,000 coho salmon, which was below the median (166,000) and the second lowest in the index. In 2015, a relatively large amount of coho salmon was harvested incidentally in the directed fall chum salmon commercial fisheries (exploitation estimate at 58%). Subsistence harvest in 2015 was slightly above the 2010–2014 average of 16,000 coho salmon. The last 5 years of returns (2014–2018) have been high abundance years which may indicate good productivity which typically cycles for several years in succession.

Escapements are primarily monitored in the Tanana River drainage. The Delta Clearwater River (DCR) is a major producer of coho salmon in the upper Tanana River drainage and has comparative escapement monitoring data since 1972 (Appendix B17). The DCR parent year escapement of 19,533 fish in 2015 was above the upper end of the SEG range of 5,200–17,000 coho salmon. Six other locations in the Tanana River drainage were surveyed for coho salmon specifically; all but 1 was above average when compared to the 2013–2017 average escapements. Very informal coho salmon outlooks are made preseason based on average survival of the primary parent year escapement estimate, which in 2019 would indicate that the return would be average to above average.

11.0 STATUS OF ESCAPEMENT GOALS

11.1 SPAWNING ESCAPEMENT TARGET OPTIONS IN 2019

Canadian-origin mainstem Yukon River Chinook and fall chum salmon are managed under the umbrella of the *Yukon River Salmon Agreement* (YRSA). The Yukon River Panel meets annually and recommends escapement goals to the Canadian and U.S. management agencies.

Canadian-origin Mainstem Yukon River Chinook Salmon

In 2010, the Yukon River Panel adopted an IMEG range of 42,500–55,000 Chinook salmon. In the absence of a biological escapement goal, i.e., a goal based on a production or population model, the IMEG has been retained each year since then. At the April 2017 meeting, the Yukon River Panel acted to implement the current IMEG range of 42,500–55,000 for 3 years, 2017–2019.

Canadian-origin Mainstem Yukon River Fall Chum Salmon

In 2010, the Yukon River Panel adopted an IMEG range of 70,000–104,000 Canadian-origin mainstem Yukon River fall chum salmon. This range was developed as 0.8–1.2 times the estimated spawners at maximum sustained yield (86,600 fish), which was derived prior to the returns from the exceptional 2005 spawning escapement of over 437,000 fall chum salmon. Run size at the border has been assessed through the joint U.S./Canada sonar program near Eagle since 2006. At the April 2018 meeting, the Yukon River Panel acted to implement the mainstem fall chum salmon IMEG of 70,000–104,000 for 2 years, 2018 and 2019.

Fishing Branch River Fall Chum Salmon

An IMEG range of 22,000–49,000 fall chum salmon for the Fishing Branch River has been extended for 3-year periods since 2008 (Appendix B15). At the 2018 April meeting the Yukon River Panel acted to implement the Fishing Branch fall chum salmon IMEG of 22,000–49,000 for 2 years, 2018 and 2019.

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FIGURES

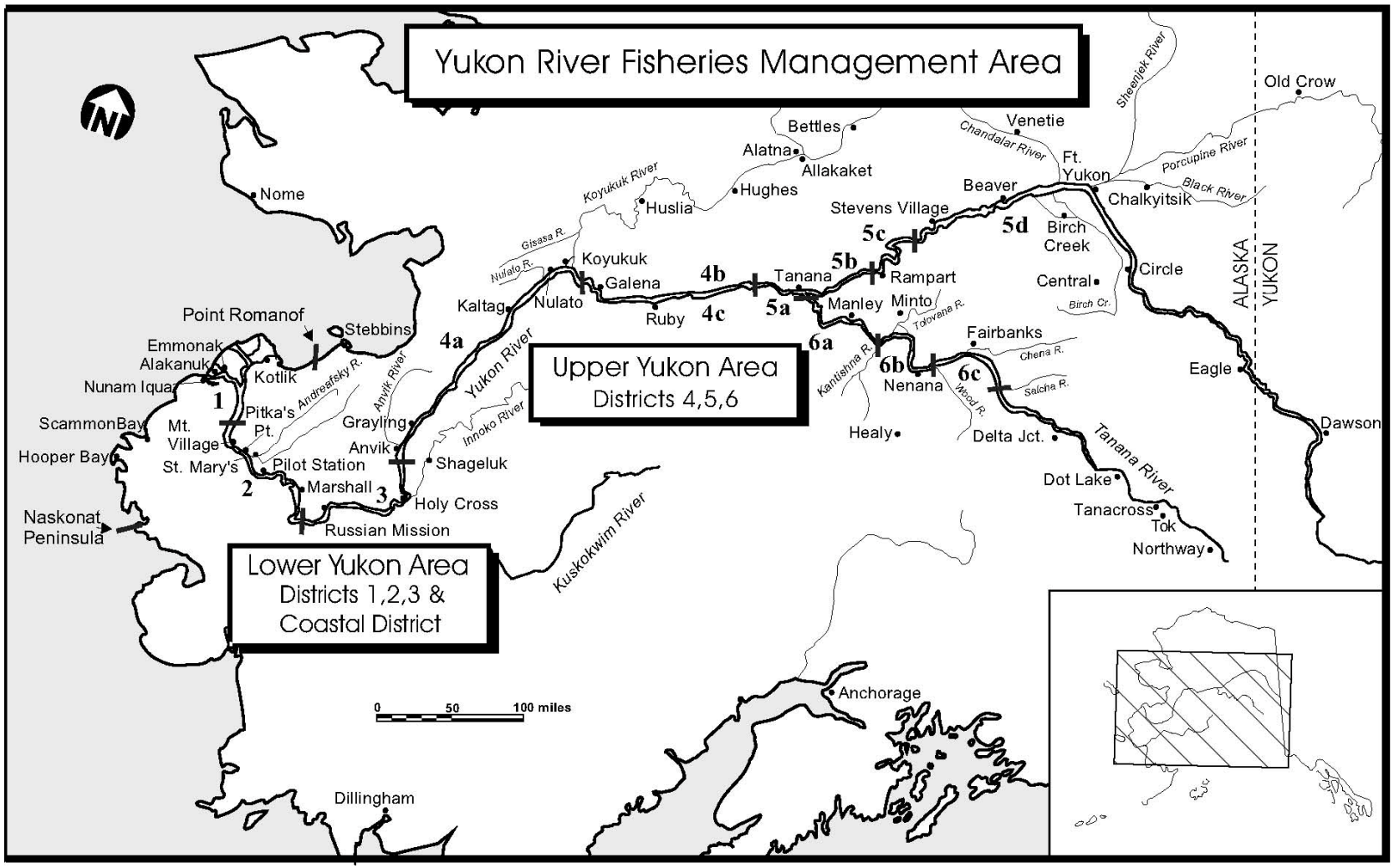

Figure 1.–Map of the Alaska (U.S.) portion of the Yukon River drainage showing communities and fishing districts.

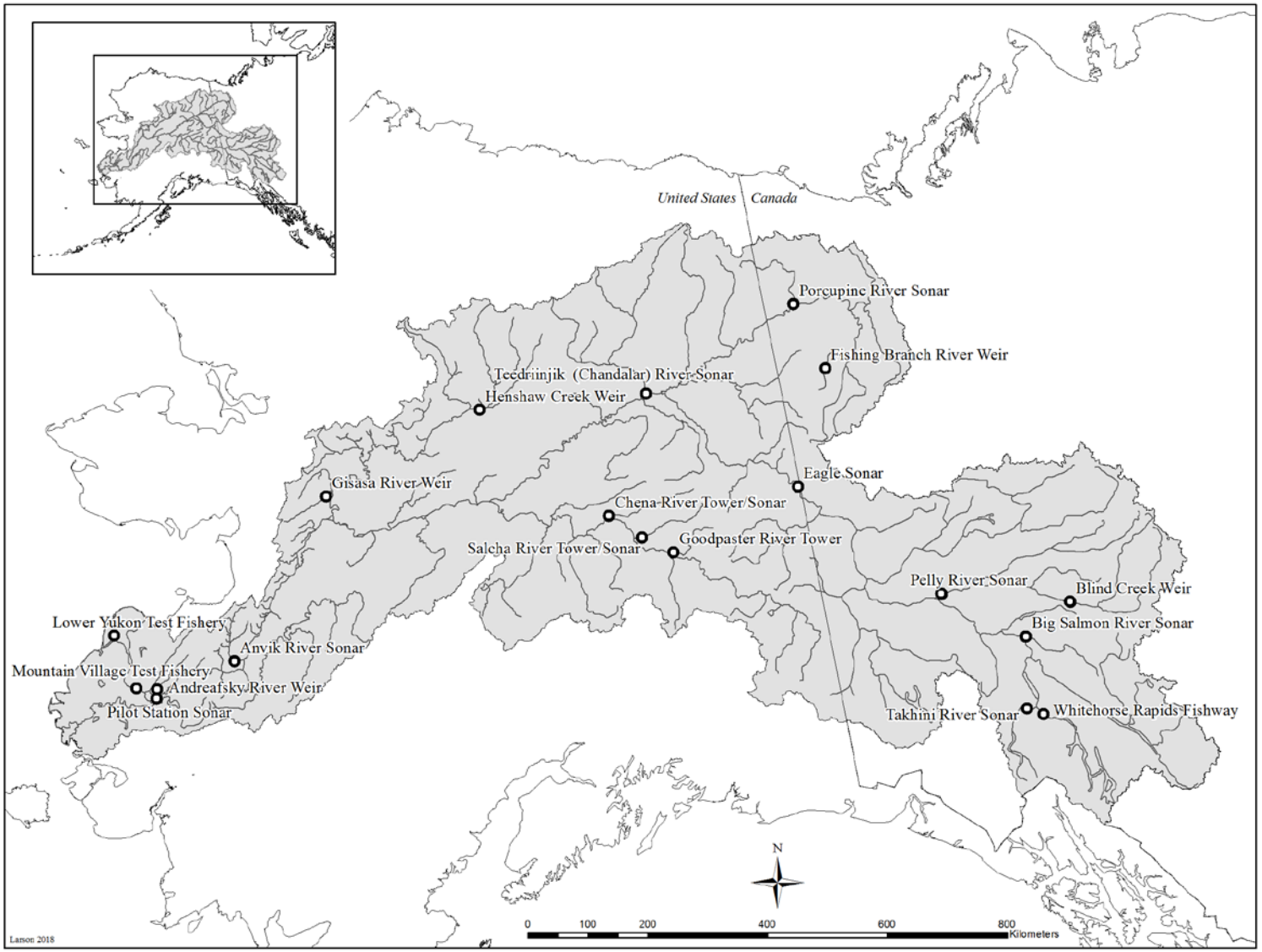

Figure 2.–Primary assessment projects operated in the U.S. and Canada used to assess Chinook and fall chum salmon run strength or escapement.

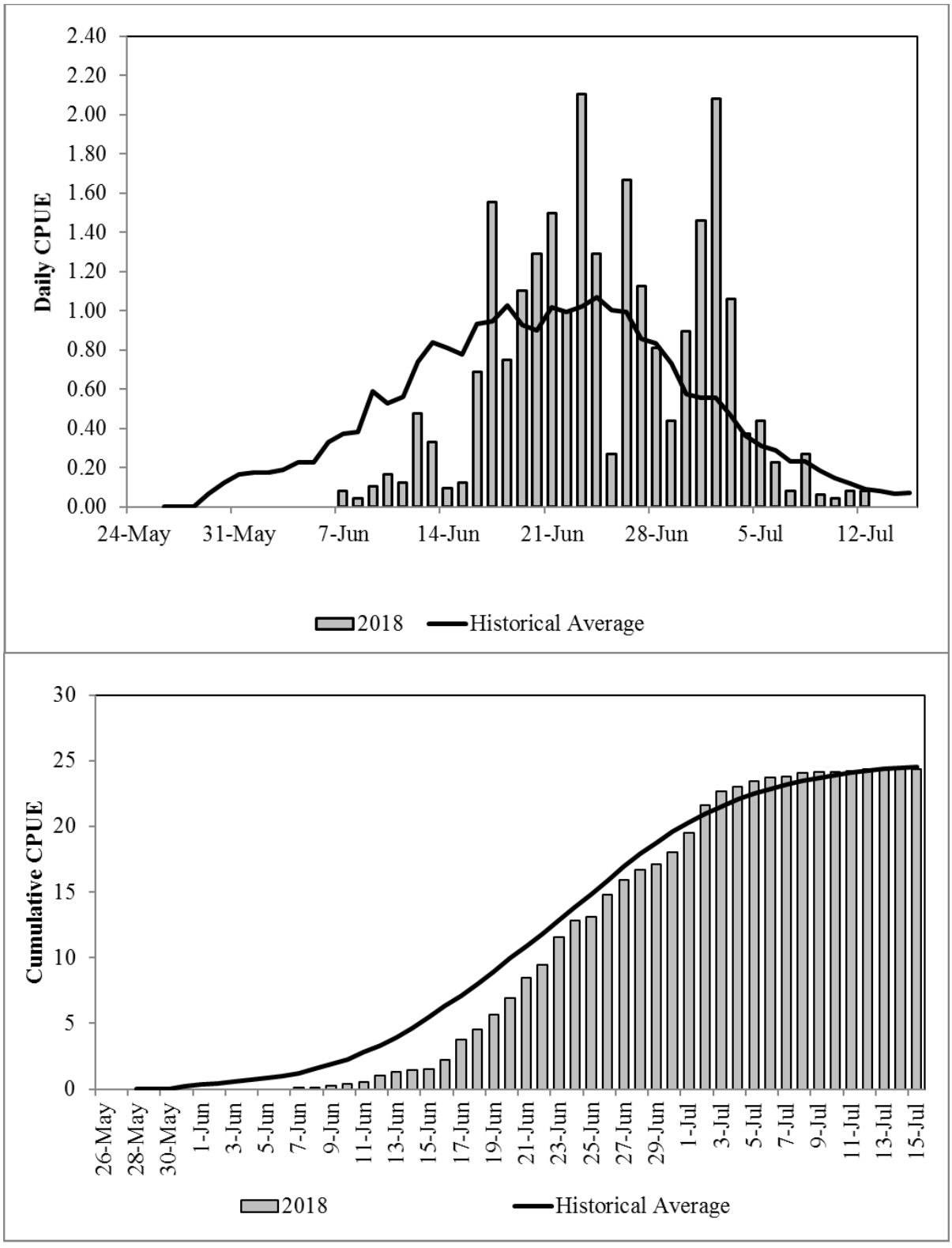

Figure 3.–Daily (top) and cumulative (bottom) catch per unit effort (CPUE) for Chinook salmon in 8.5-inch Lower Yukon set gillnet test fishery in 2018, compared to historic average CPUEs.

Note: Historical average includes 1989–2017, excluding 2001, 2009 and 2012–2013.

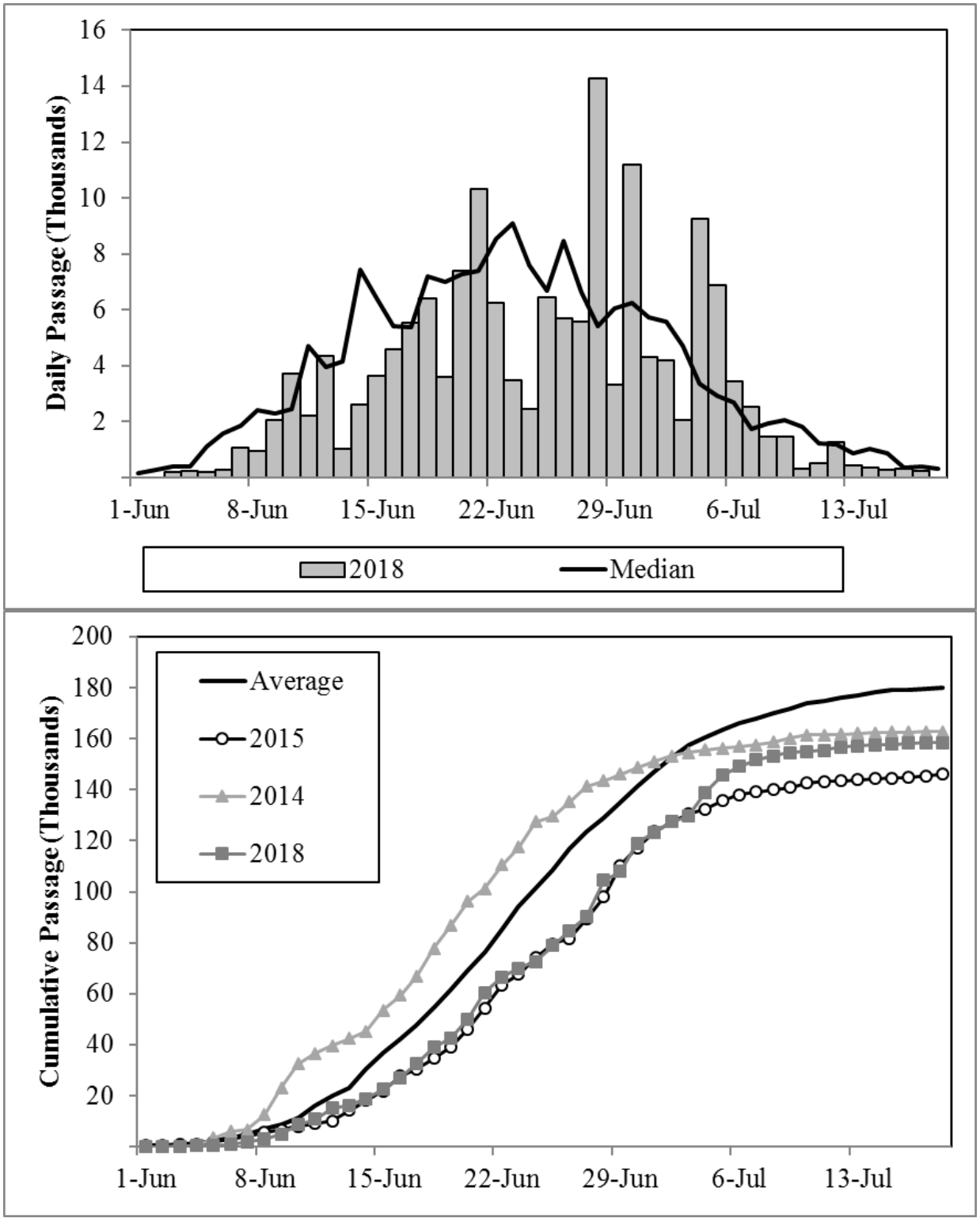

Figure 4.–Daily passage estimates of Chinook salmon at the Pilot Station sonar in 2018 (top) and cumulative passage estimate (bottom) of Chinook salmon in 2018 compared to other runs of similar sizes (2005 and 2016) and to the median.

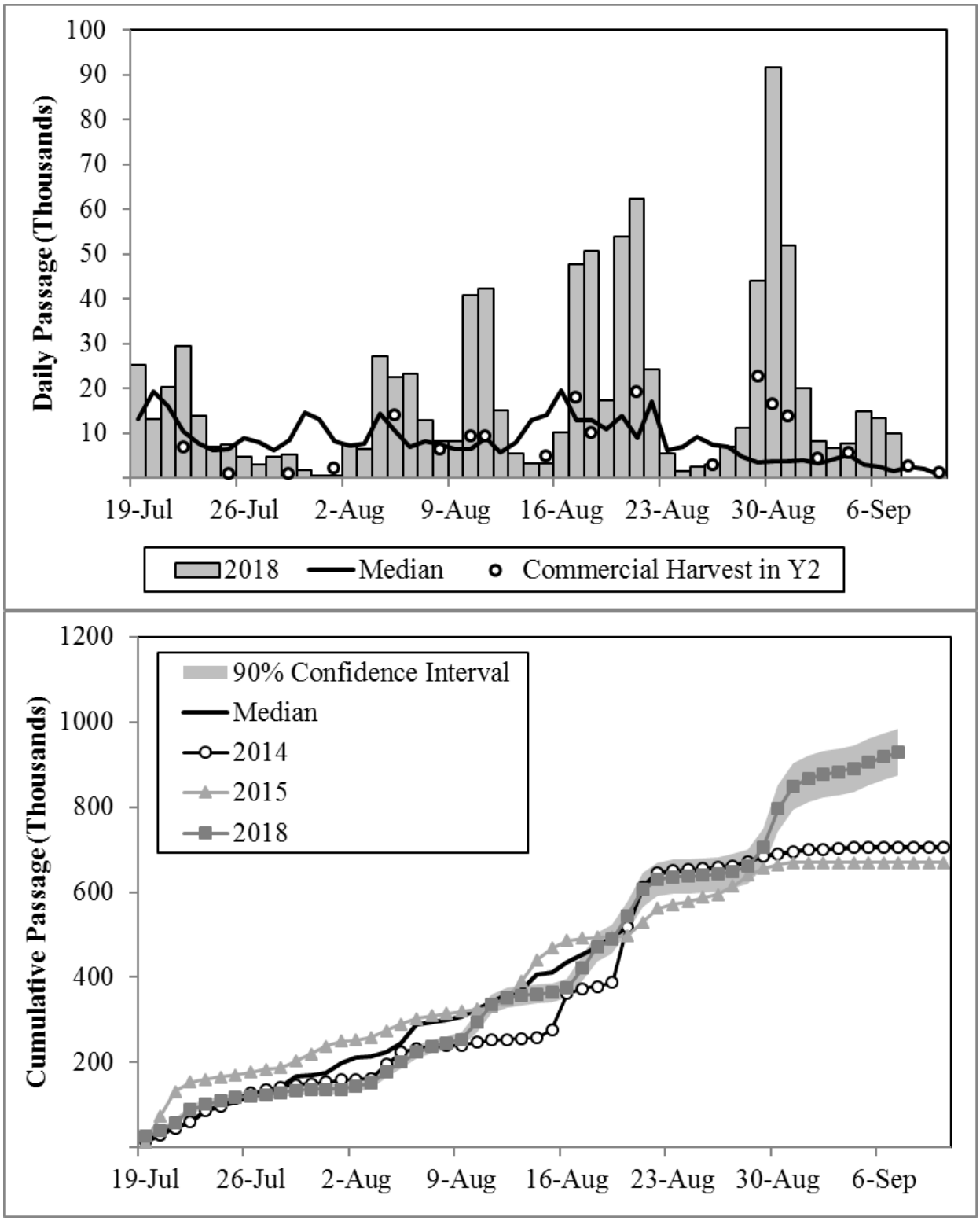

Figure 5.–Daily passage estimates (top), including 90% confidence interval, at the Pilot Station sonar attributed to fall chum salmon in 2018 compared to median daily estimates, and cumulative passage estimates (bottom) compared to other runs of similar size.

Note: Historical median includes 1995–2017, excluding 1996 and 2009.

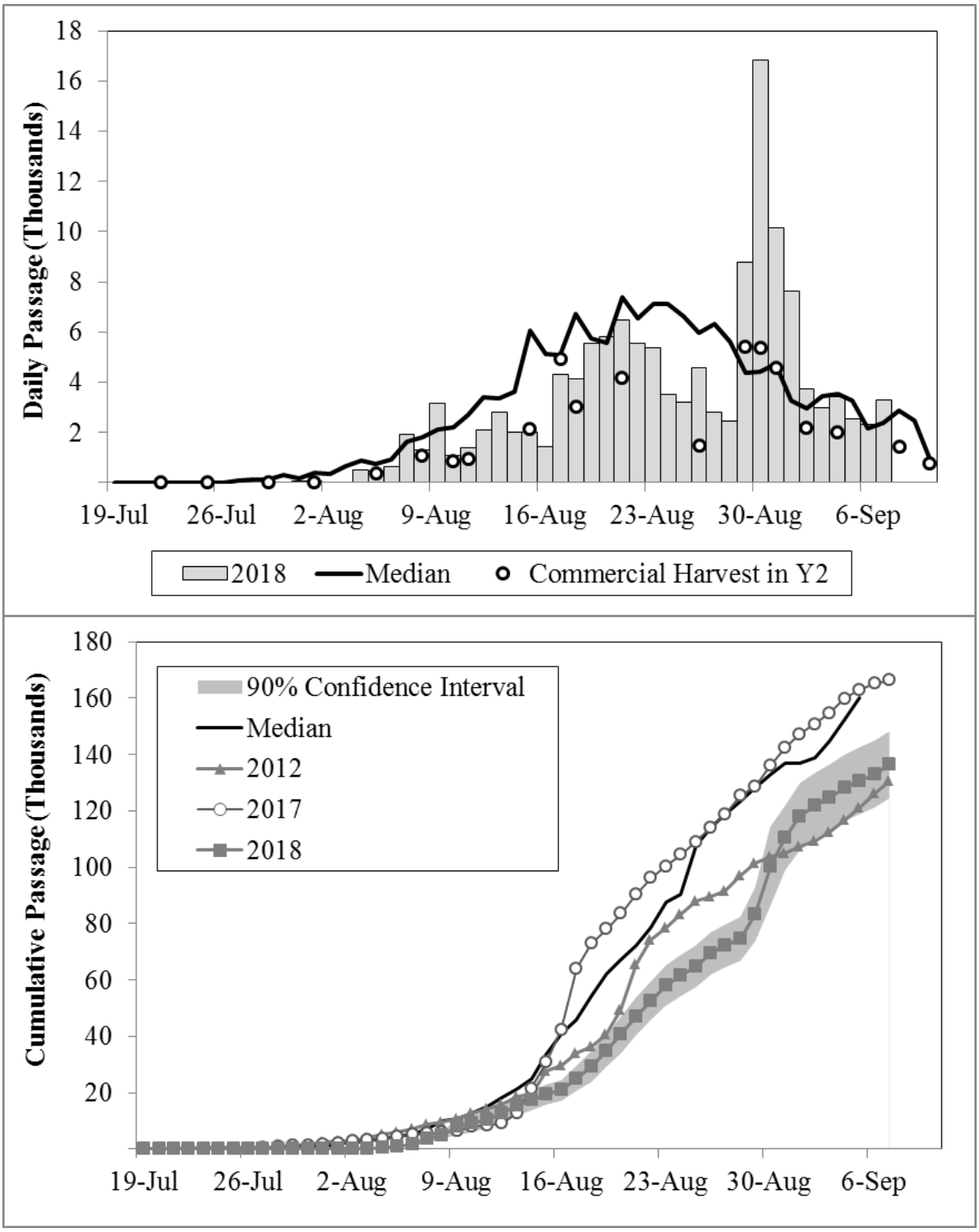

Figure 6.–Daily passage estimates (top), including 90% confidence interval, at the Pilot Station sonar attributed to coho salmon in 2018 compared to median daily estimates, and cumulative passage estimates (bottom) compared to median and other select years.

Note: Historical median includes 1995–2017, excluding 1996 and 2009.

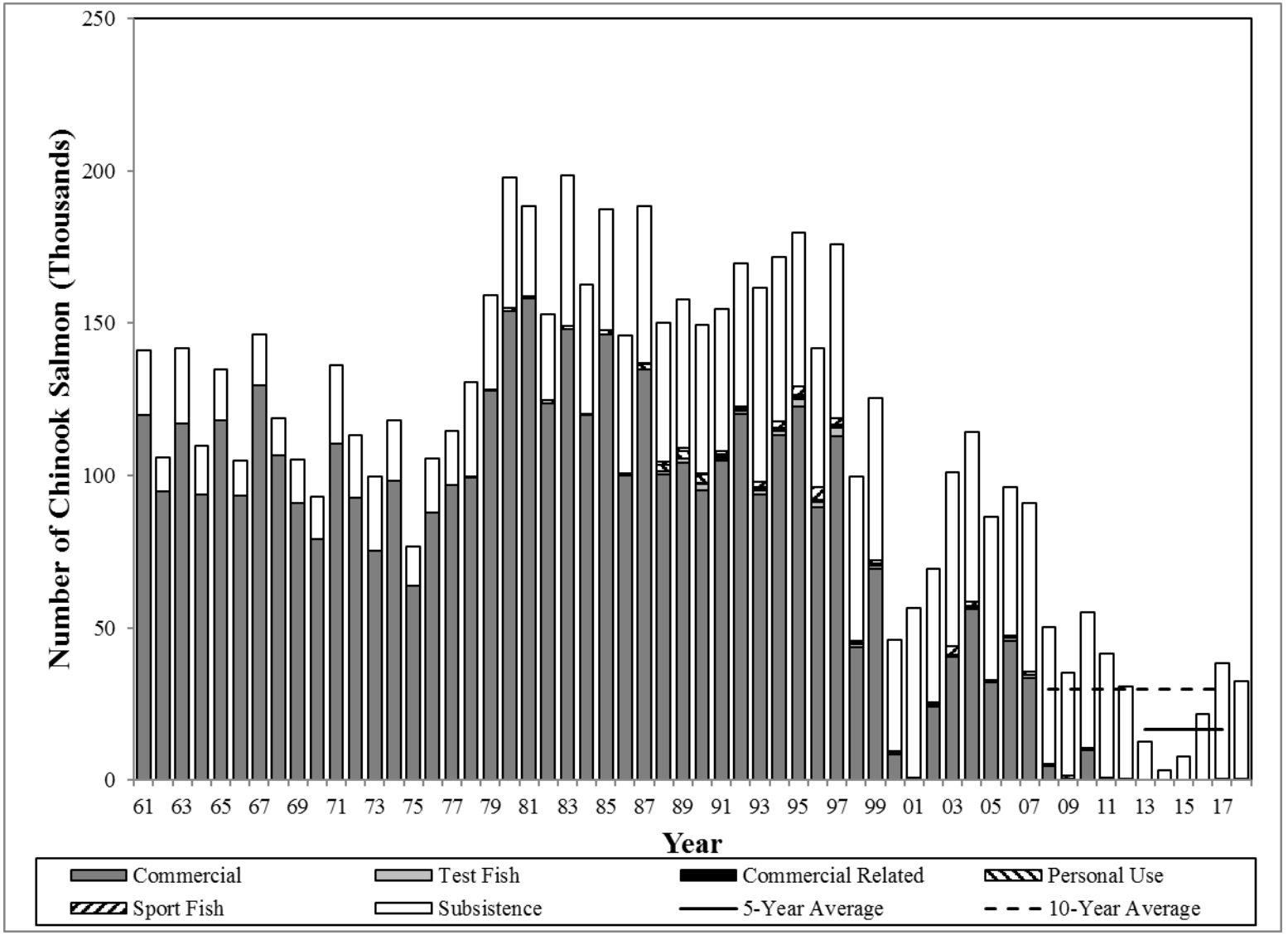

Figure 7.–U.S. (Alaska) harvest of Chinook salmon, Yukon River, 1961–2018.

Note: The 2016–2018 harvest estimates are preliminary.

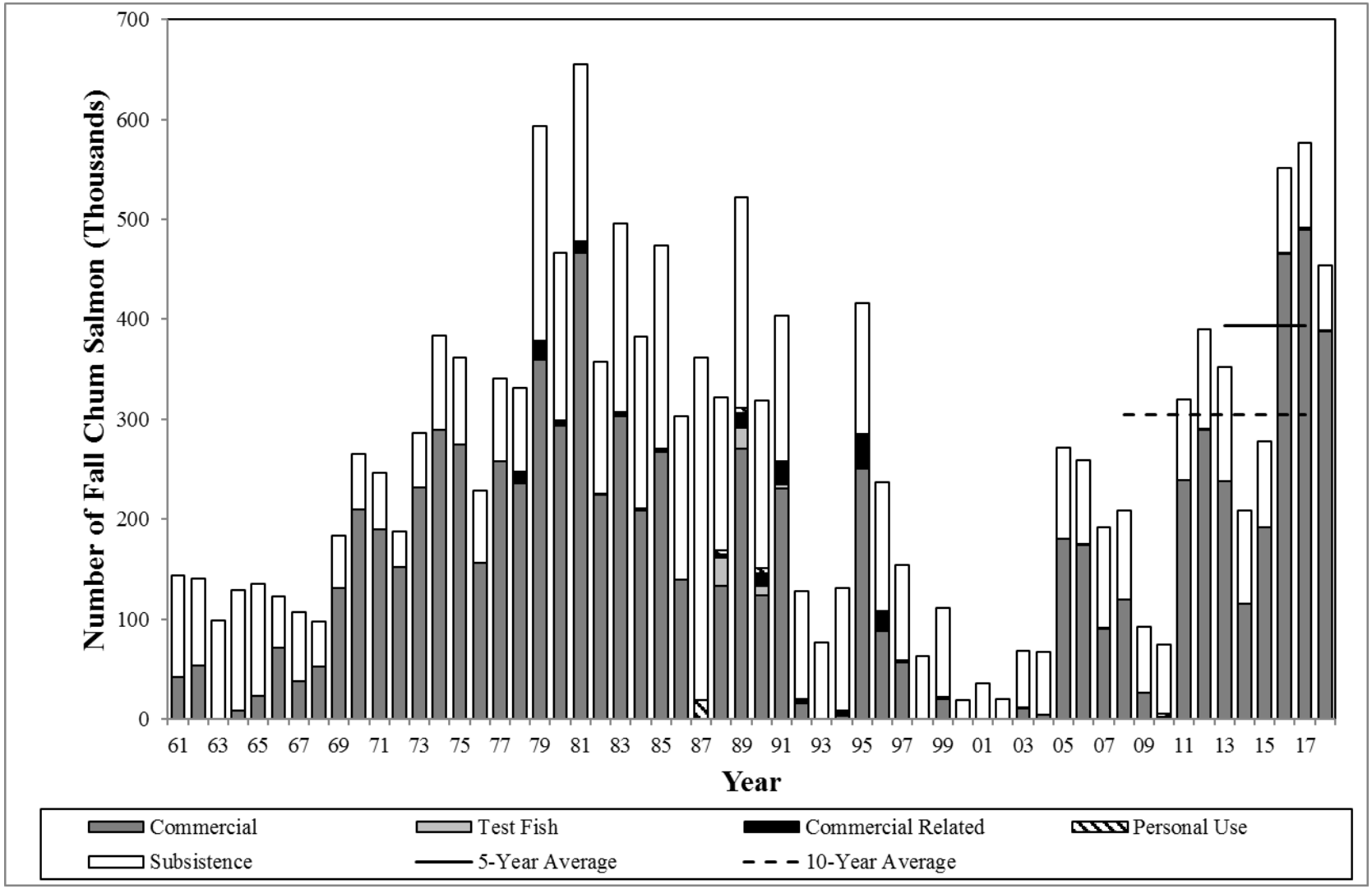

Figure 8.–U.S. (Alaska) harvest of fall chum salmon, Yukon River, 1961–2018.

Note: Subsistence harvest estimates of fall chum salmon are minimal prior to 1979 because of timing of harvest surveys. The commercial fishery was closed 2000–2002. The 2016–2018 harvest estimates are preliminary.

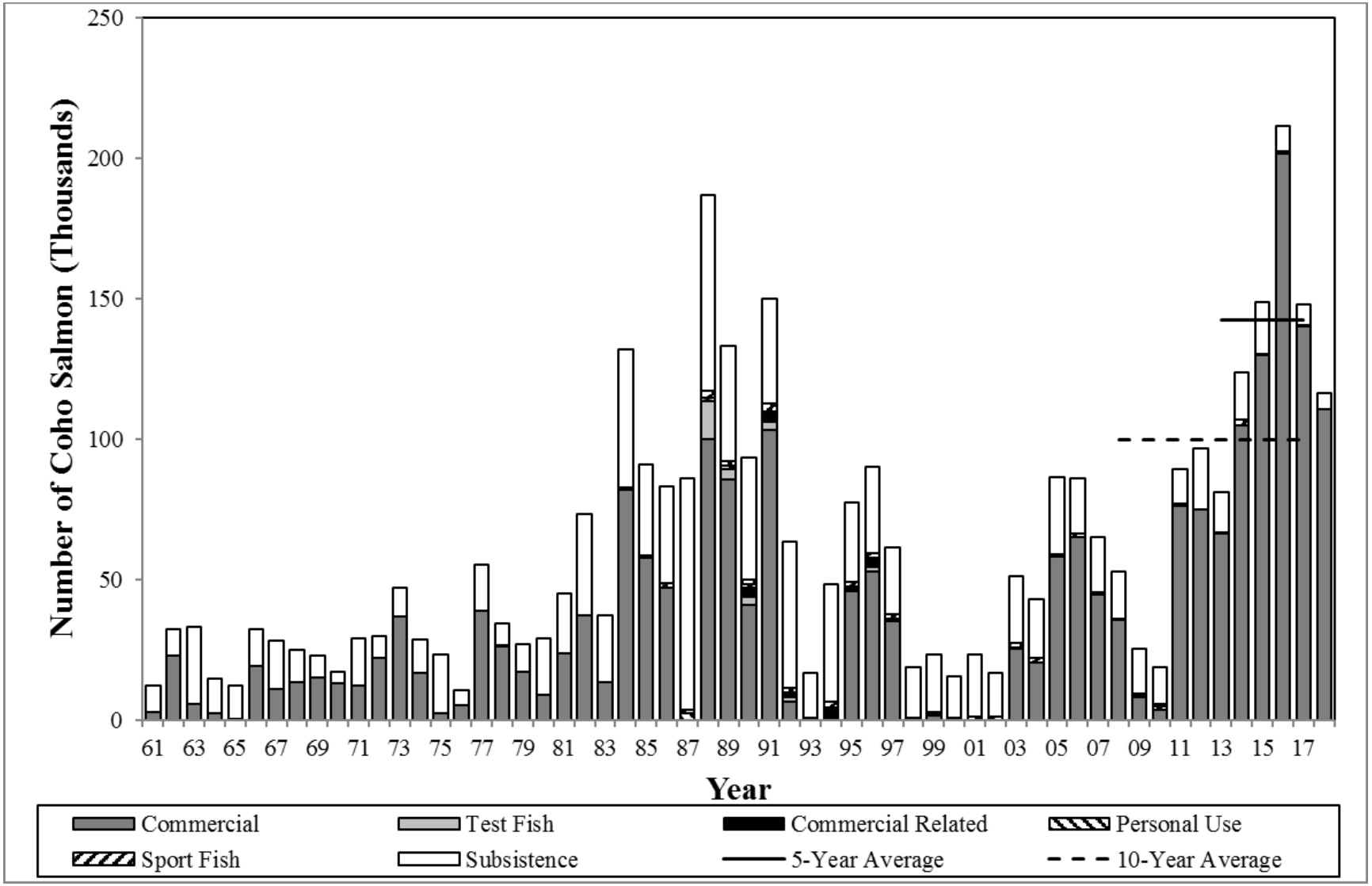

Figure 9.–U.S. (Alaska) harvest of coho salmon, Yukon River, 1961–2018.

Note: Subsistence harvest estimates of coho salmon are minimal prior to 1979 because of timing of harvest surveys. The commercial fishery was closed 2000–2002. The 2016–2018 harvest estimates are preliminary.

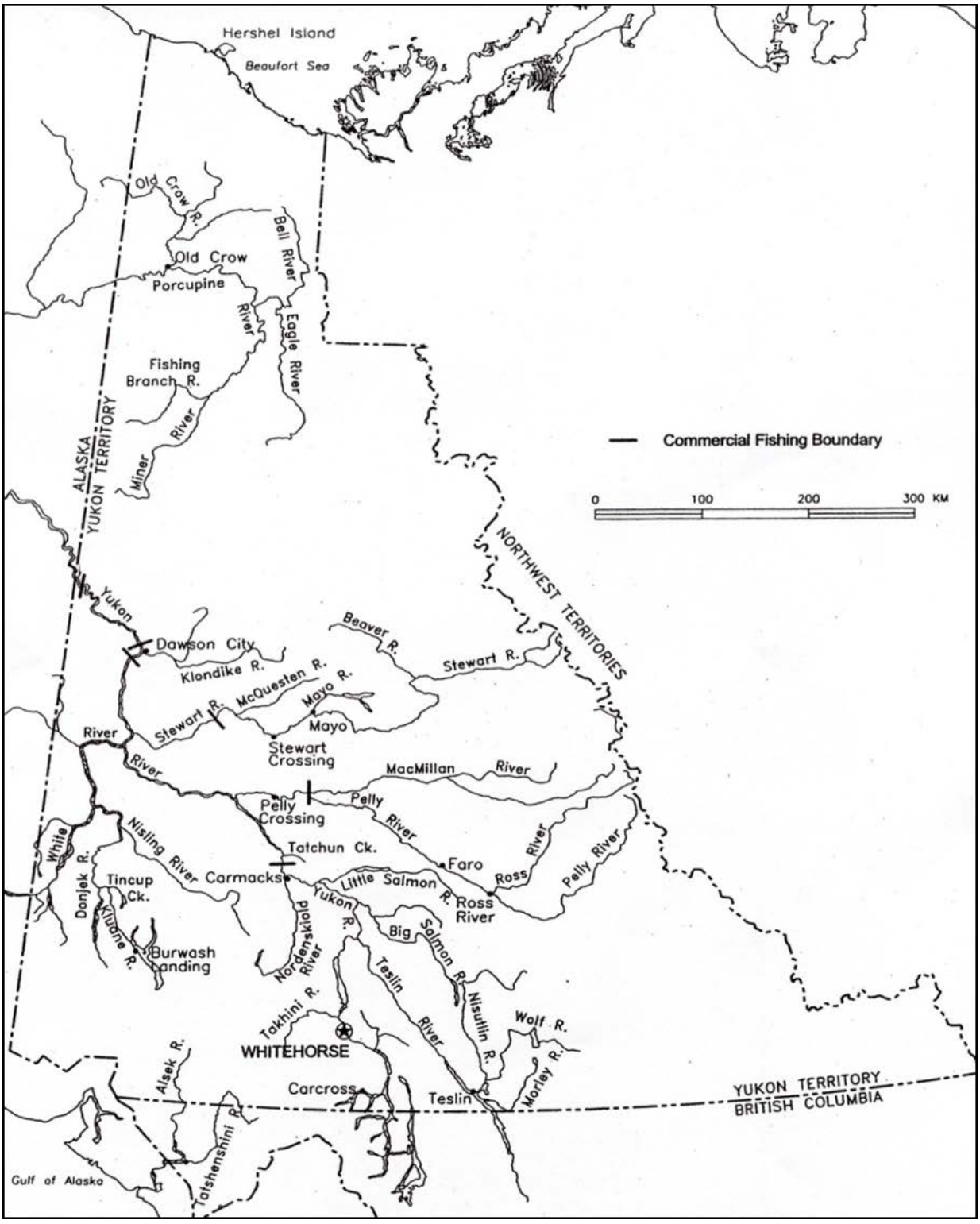

Figure 10.–Commercial fishing boundaries, tributaries, and major towns within the Yukon Territory, Canada.

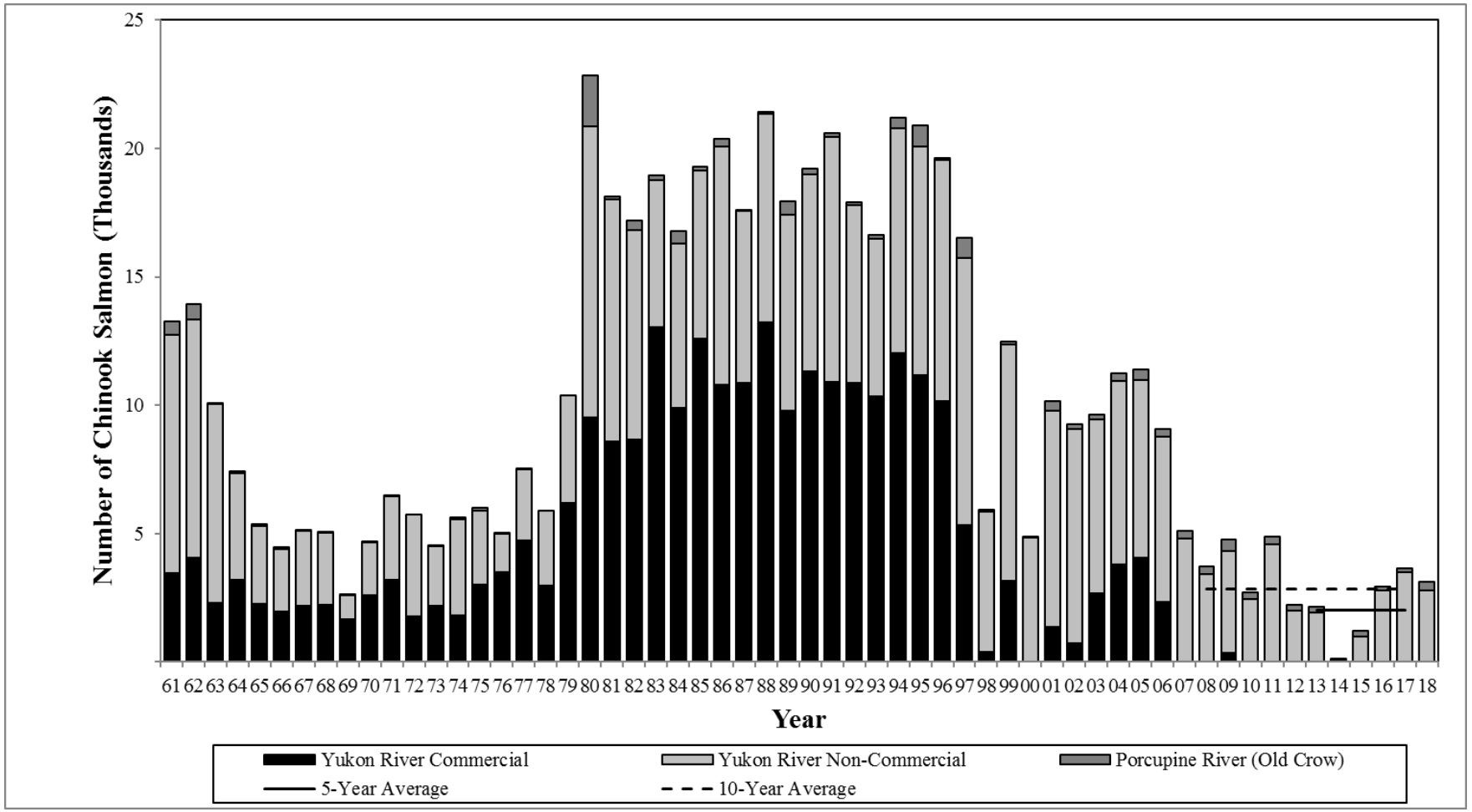

Figure 11.–Canadian harvest of Chinook salmon, Yukon River, 1961–2018.

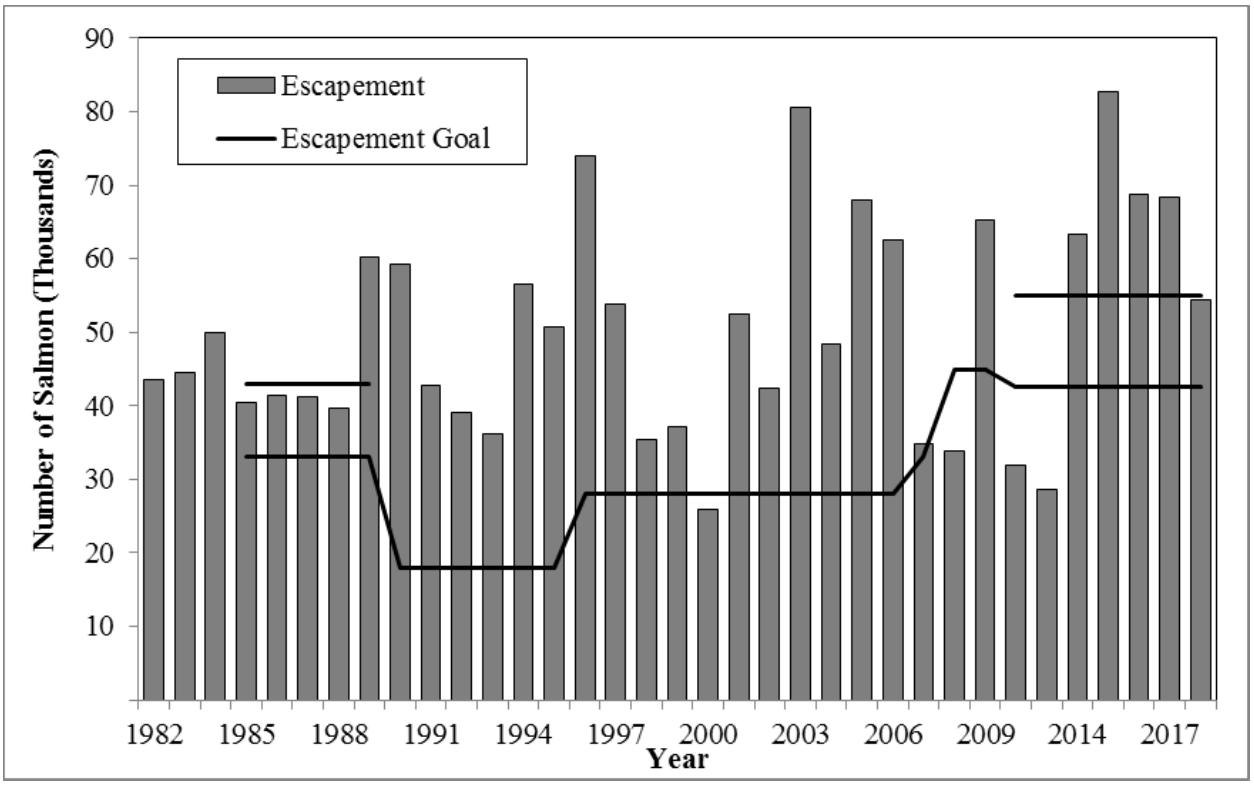

Figure 12.–Spawning escapement estimates for Canadian-origin Yukon River mainstem Chinook salmon, 1982–2018.

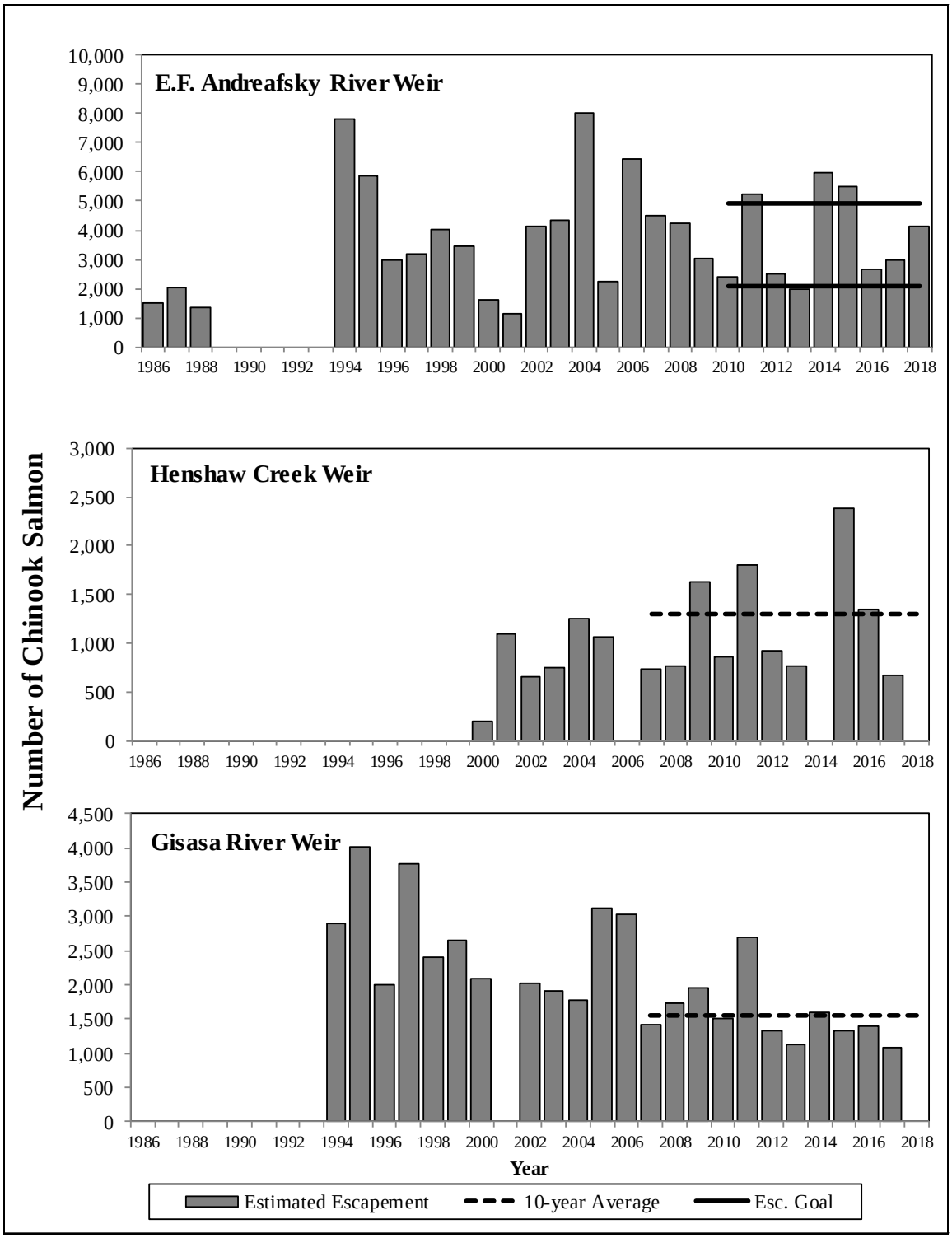

Figure 13.–Chinook salmon ground-based escapement estimates for selected tributaries in the U.S. (Alaska) portion of the Yukon River drainage, 1986–2018.

Note: Esc. Goal = escapement goal range relative to years when the goal was in effect There are no escapement goals at the Henshaw Creek and Gisasa River weirs. Incomplete counts caused by late installation and/or early removal of project or high-water events are excluded from the graphs. Vertical scale is variable.

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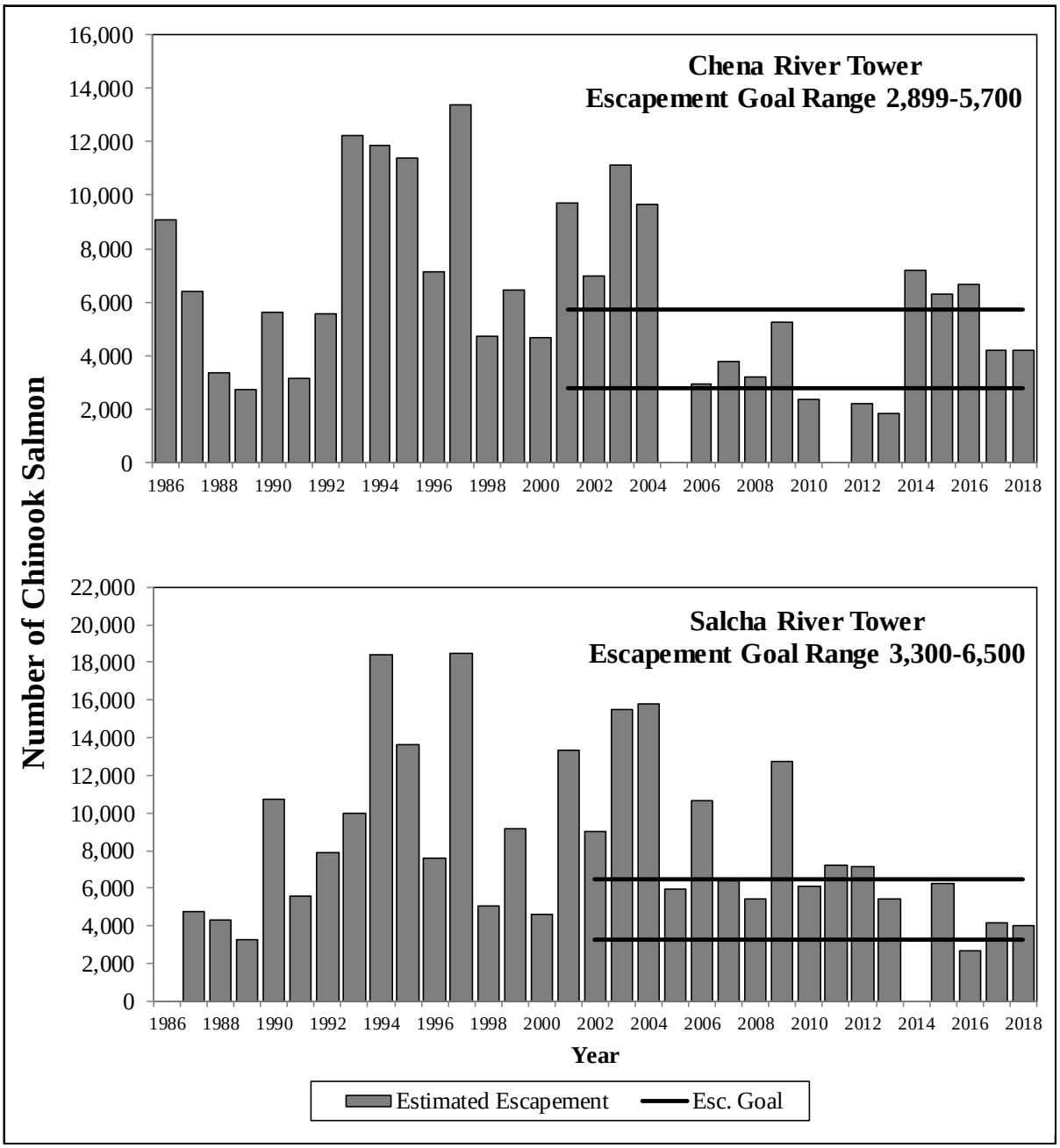

Figure 13.–Page 2 of 2.

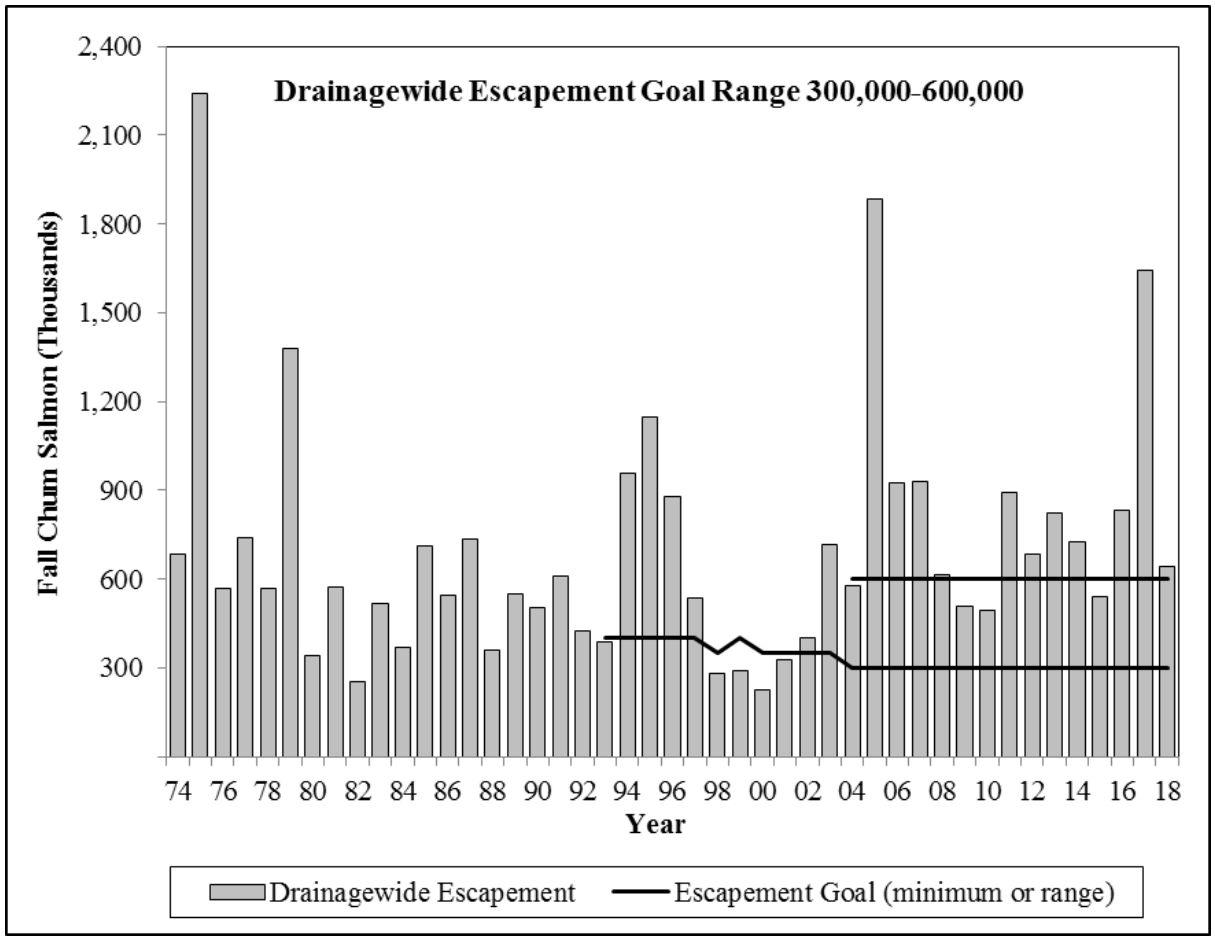

Figure 14.–Estimated drainagewide escapement of fall chum salmon, Yukon River, 1974–2018

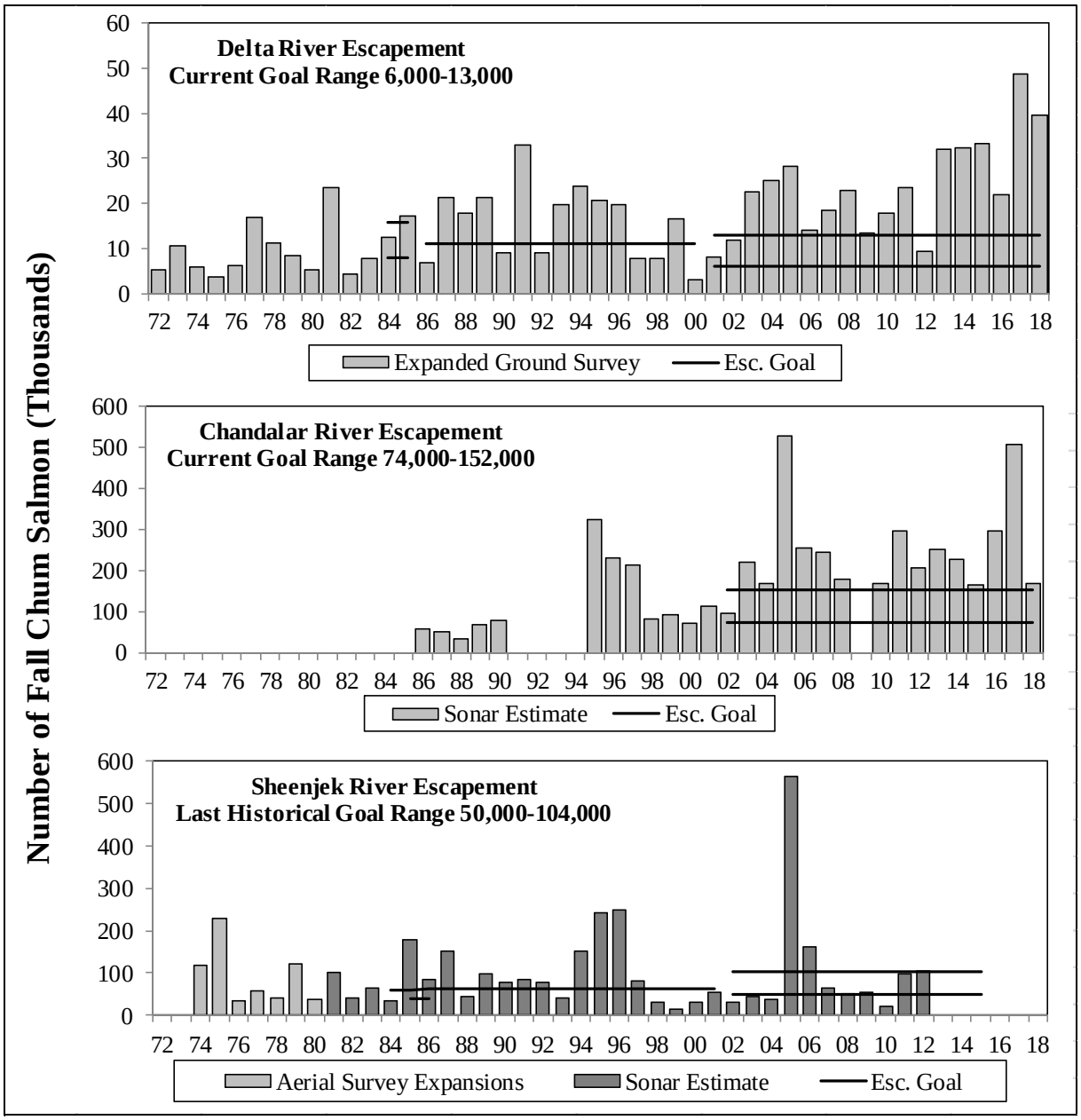

Figure 15.–Fall chum salmon escapement estimates for selected spawning areas in the U.S. (Alaska) portion of the Yukon River drainage, 1972–2018.

Note: Horizontal lines represent escapement goals or ranges. The vertical scale is variable. Esc. = escapement relative to years applied as either goal minimums or ranges. Sheenjek escapement goal was discontinued in 2016.

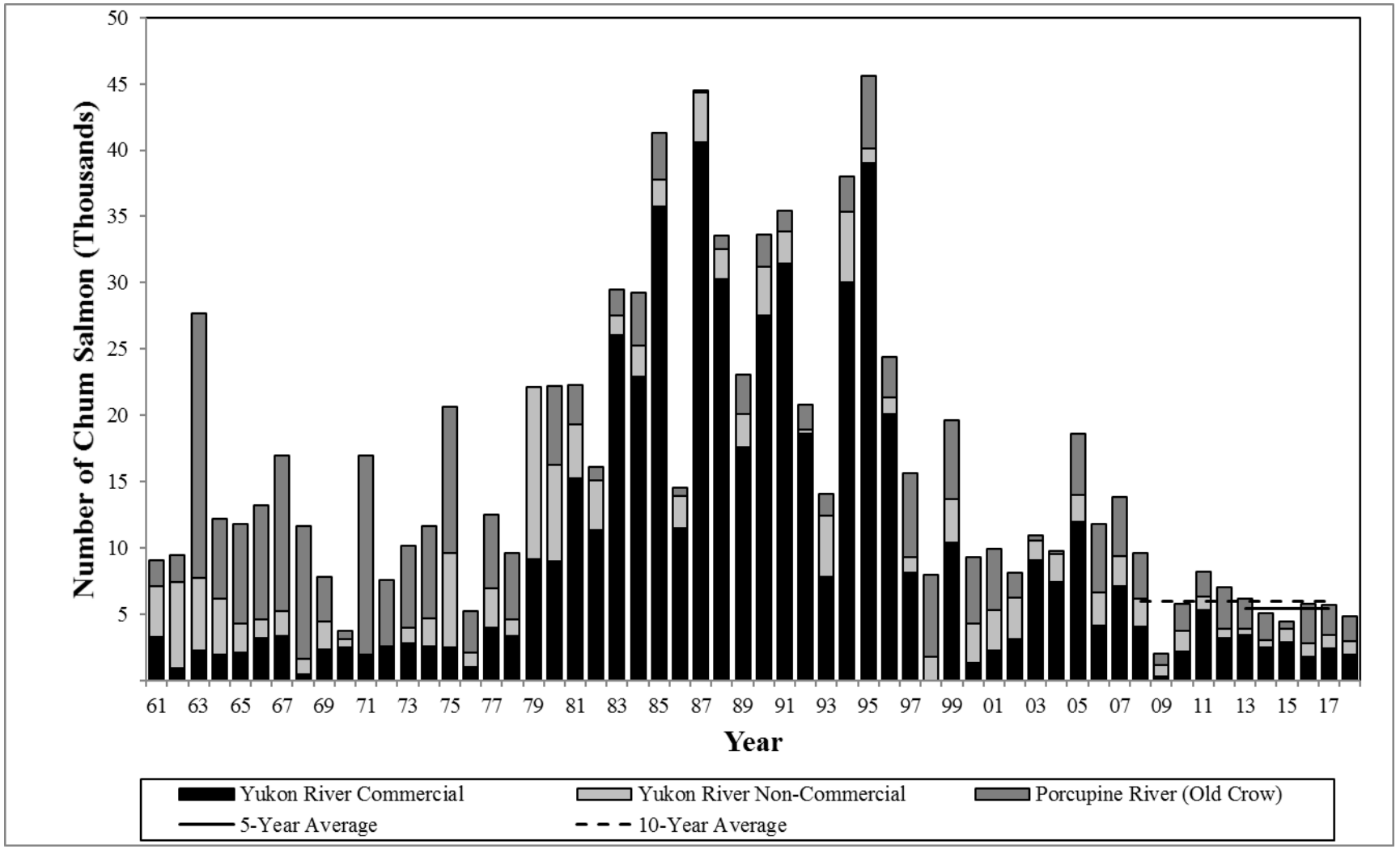

Figure 16.–Canadian harvest of fall chum salmon, Yukon River, 1961–2018.

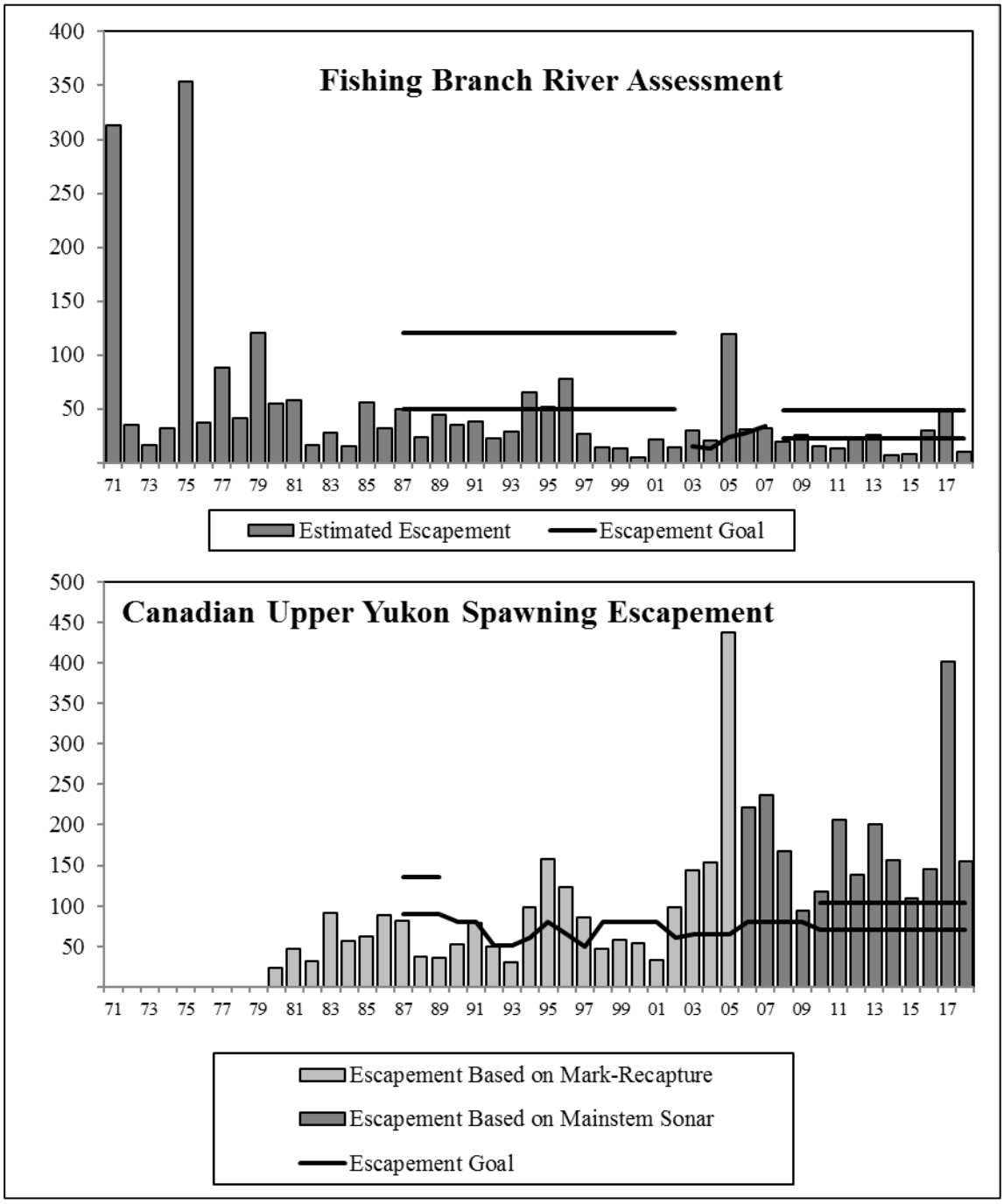

Figure 17.– Spawning escapement estimates for Canadian-origin fall chum salmon at the Fishing Branch River and the mainstem Yukon River, 1971–2018.

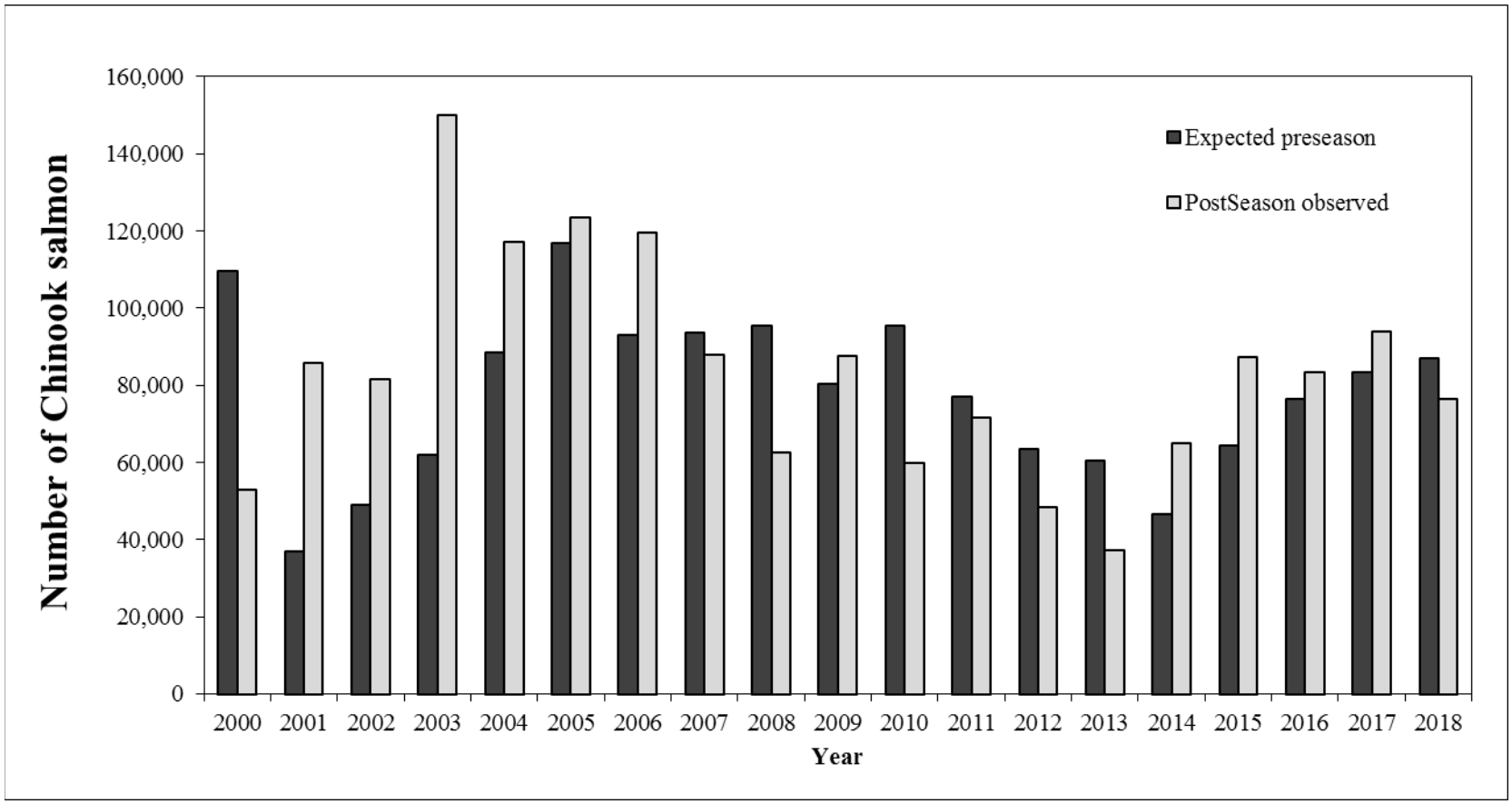

Figure 18.–Expected versus observed number of Canadian-origin Chinook salmon returning to spawn, 2000–2018.

Note: Forecast methods have changed over time and the "expected" value is the published JTC forecast range midpoint. The "observed" is estimated Total Canadian-origin run size. This is calculated as the spawning escapement plus the U.S. harvest and the harvest in Canada.

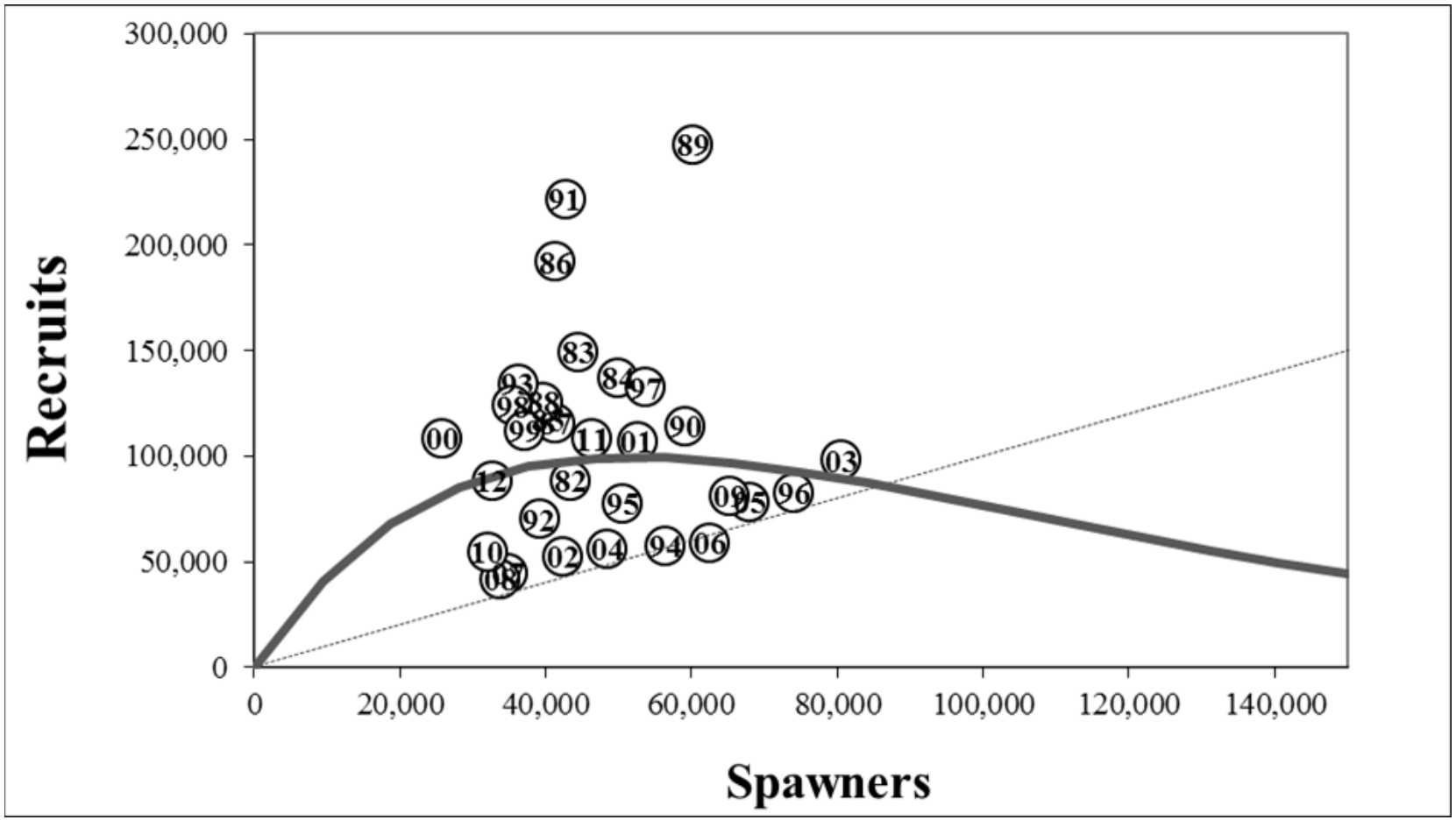

Figure 19.–Yukon River Canadian-origin Chinook salmon recruits versus spawners, Ricker curve (solid line), and 1:1 replacement line (dotted line). Brood years 1982–2012 are included.

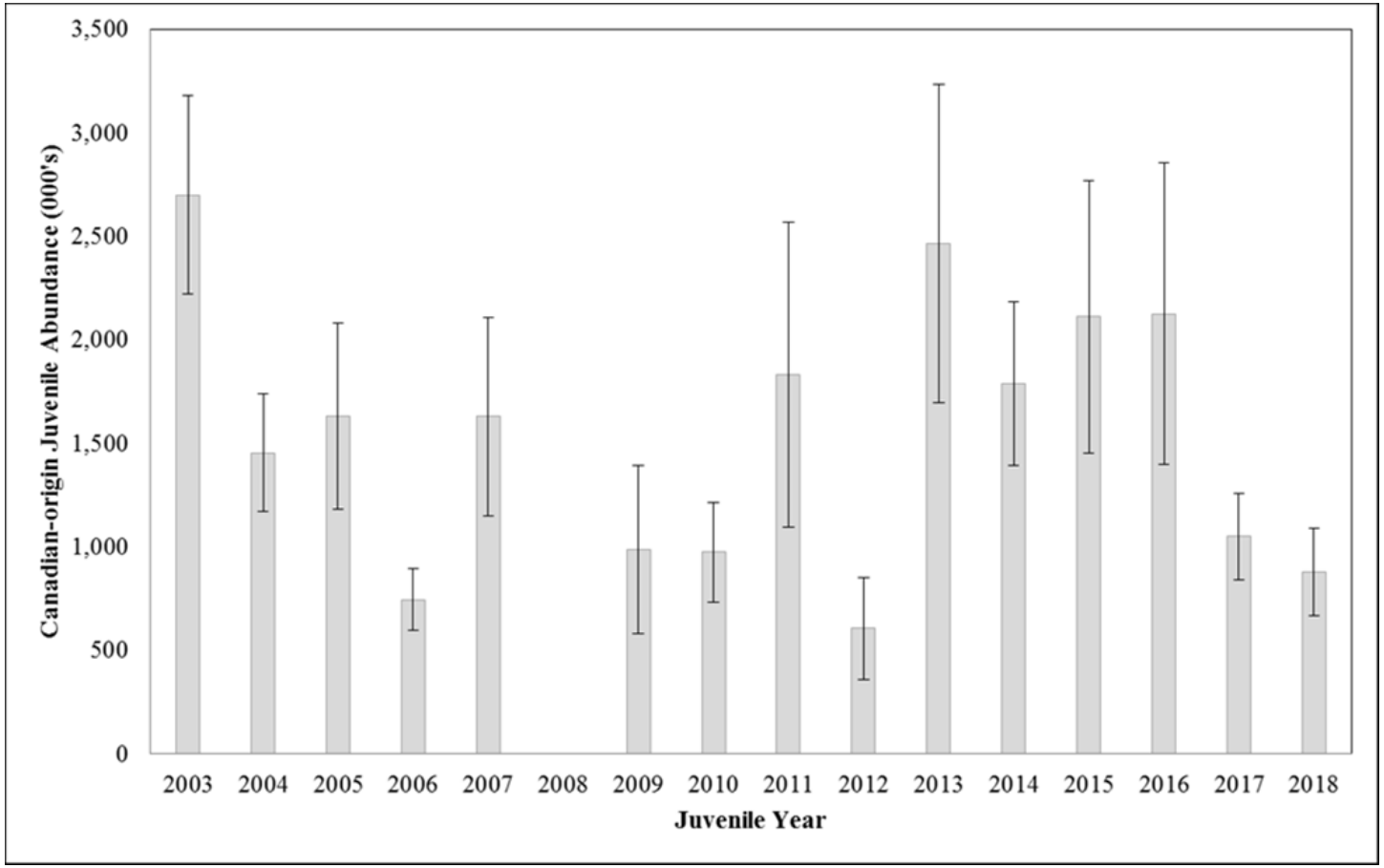

Figure 20.–Juvenile abundance estimates of Canadian-origin Chinook salmon from the Yukon River based on pelagic trawl research surveys in the northern Bering Sea (2003–2018).

Note: Error bars ranges are 1 standard deviation of the abundance estimates. The 2018 estimate is preliminary and subject to change.

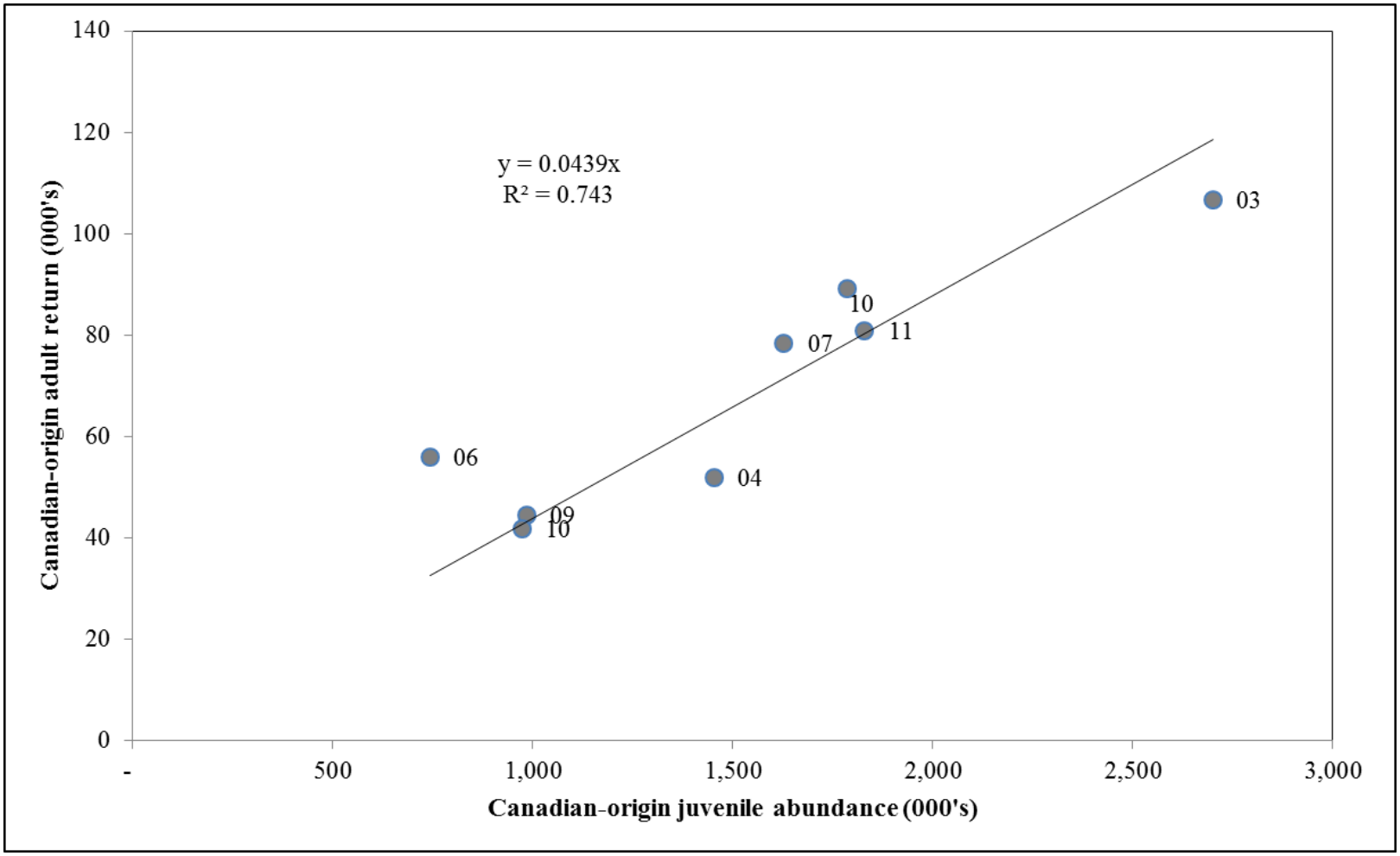

Figure 21.–The relationship between juvenile and adult abundance for Canadian-origin Chinook salmon from the Yukon River. Data labels indicate sampling years for juvenile abundance.

Note: Genetic data are not available for years 2005, 2012, and 2013, therefore, those years are not included in the regression.

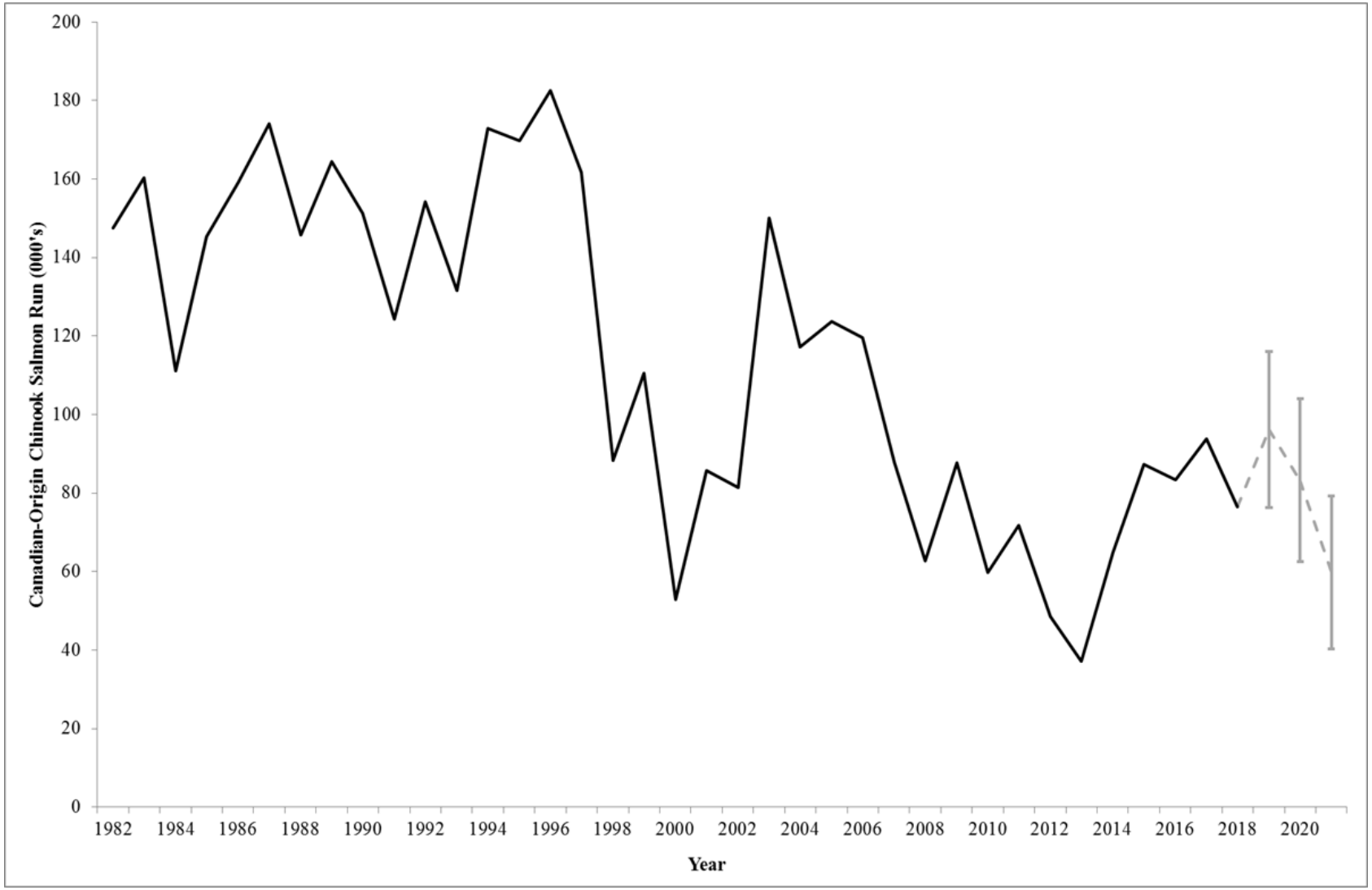

Figure 22.–Historic run size estimates of Canadian-origin Chinook salmon in the Yukon River (solid line 1982–2018) and preliminary projected run sizes based on juvenile abundance (dashed line 2018–2021).

Note: Error bar ranges are one standard deviation above and below the abundance estimate.

APPENDIX A: TABLES

Appendix A1.–Passage estimates from the Pilot Station sonar, Alaska, Yukon River drainage, 1995 and 1997–2018.

	Chinook			Chum						
Year [a]	Large [b]	Small	Total	Summer	Fall [c]	Total	Coho [c]	Pink	Other [d]	Total
1995	164,867	45,874	210,741	3,632,179	1,148,916	4,788,457	119,893	53,277	708,747	5,881,115
1997 [e]	114,519	85,244	199,763	1,359,117	579,767	1,938,884	118,065	3,872	376,841	2,637,425
1998	88,129	19,909	108,038	824,901	375,222	1,200,123	146,365	103,416	210,677	1,768,619
1999	159,805	24,413	184,218	969,459	451,505	1,420,964	76,174	3,947	337,701	2,023,004
2000	48,321	6,239	54,560	448,665	273,206	721,871	206,365	61,389	262,627	1,306,812
2001 [f]	104,060	17,029	121,089	442,546	408,961	851,507	160,272	2,846	265,749	1,401,463
2002	111,290	40,423	151,713	1,097,769	367,886	1,465,655	137,077	123,698	405,534	2,283,677
2003	287,729	30,359	318,088	1,183,009	923,540	2,106,549	280,552	11,370	379,651	3,096,210
2004	138,317	62,444	200,761	1,344,213	633,368	1,977,581	207,844	399,339	391,939	3,177,464
2005 [g]	227,154	31,860	259,014	2,570,697	1,893,688	4,464,385	194,372	61,091	364,250	5,343,112
2006	192,296	36,467	228,763	3,780,760	964,238	4,744,998	163,889	183,006	531,047	5,851,703
2007	119,622	50,624	170,246	1,875,491	740,195	2,615,686	192,406	126,282	761,657	3,866,277
2008	138,220	36,826	175,046	1,849,553	636,525	2,486,078	145,378	580,127	306,225	3,692,854
2009 [h]	128,154	49,642	177,796	1,477,186	274,227	1,751,413	240,779	34,529	589,916	2,794,433
2010	112,605	25,294	137,899	1,423,372	458,103	1,881,475	177,724	919,036	567,454	3,683,588
2011	117,213	31,584	148,797	2,051,501	873,877	2,925,378	149,533	9,754	453,537	3,686,999
2012	106,529	21,026	127,555	2,136,476	778,158	2,914,634	130,734	420,344	464,058	4,057,325
2013	120,536	16,269	136,805	2,849,683	865,295	3,714,978	110,515	6,126	732,009	4,700,433
2014	120,060	43,835	163,895	2,020,309	706,630	2,726,939	283,421	679,126	584,831	4,438,212
2015	105,063	41,796	146,859	1,591,505	669,483	2,260,988	121,193	39,690	853,989	3,422,719
2016	135,013	41,885	176,898	1,921,748	994,760	2,916,508	168,297	1,364,849	355,365	4,981,917
2017	217,821	45,193	263,014	3,093,735	1,829,931	4,923,666	166,320	166,529	796,199	6,315,728
2018	122,394	39,437	161,831	1,612,688	928,664	2,541,352	136,347	689,607	547,959	4,077,096

Note: Historical passage estimates at the Pilot Station sonar were adjusted in 2016 after the adoption of a new species apportionment model.

[a] Estimates for all years were generated with the most current apportionment model and may differ from earlier estimates.

[b] Chinook salmon >655 mm measured mid eye to tail fork length.

[c] This estimate may not include the entire run. Most years operated through August 31, except 1995 (September 3), 1998 (September 9), 2000 (September 14), 2008–2014 and 2017–2018 (September 7).

[d] Includes sockeye salmon, cisco, whitefish, sheefish, burbot, suckers, Dolly Varden, and northern pike.

[e] The Yukon River sonar project did not operate at full capacity in 1996 and there are no passage estimates for this year.

[f] High water levels were experienced at Pilot Station in 2001 throughout the season, and therefore passage estimates are considered conservative.

[g] Estimates include extrapolations for the dates June 10–June 18, 2005 to account for the time before the DIDSON was deployed.

[h] High water levels were experienced at Pilot Station in 2009 during the summer season and extreme low water occurred during the fall season, and therefore passage estimates are considered conservative.

Appendix A2.–Alaska commercial salmon sales (number of fish) by district and subdistrict, 2018.

District/Subdistrict	Number of fishermen [a]	Chinook	Summer chum	Fall chum	Coho	Pink
1	309	–	250,958	198,950	65,431	38,456
2	201	–	195,423	170,648	40,842	787
Subtotal Districts 1 and 2	484	0	446,381	369,598	106,273	39,243
3	–	–	–	–	–	–
Total Lower Yukon Area	484	0	446,381	369,598	106,273	39,243
Anvik River	–	–	–	–	–	–
4-A	8	–	126,892	596	0	0
4-BC	–	–	–	–	–	–
Subtotal District 4	8	–	126,892	596	0	–
5-ABC	3	–	–	896	0	0
5-D	–	–	–	–	–	–
Subtotal District 5	3	–	–	896	0	0
6-ABC	3	0	3,427	16,698	4,314	0
Total Upper Yukon Area	14	0	130,319	18,190	4,314	0
Total Alaska	498	0	576,700	387,788	110,587	39,243

Note: En dash indicates no commercial fishing activity occurred. Does not include ADF&G test fishery sales.

[a] Number of unique permits fished by district, subdistrict or area. Totals by area may not add up due to transfers between districts or subdistricts.

Appendix A3.–Yukon River Canadian-origin Chinook salmon total run by brood year and escapement by year.

Brood year	Age						Return	Spawners	R/S
	3	4	5	6	7	8			
1974						634			
1975					33,080	175			
1976				88,405	22,026	40			
1977			19,491	111,771	19,734	801	151,797		
1978		4,443	22,845	63,235	29,424	1,493	121,439		
1979	1,534	3,388	21,422	100,503	48,253	1,175	176,274		
1980	15	6,604	13,510	70,415	33,978	4,240	128,763		
1981	0	1,122	33,220	114,180	54,845	1,841	205,208		
1982	0	5,141	17,169	37,883	27,763	376	88,330	43,538	2.03
1983	560	7,558	35,117	89,449	16,408	162	149,253	44,475	3.36
1984	69	13,368	34,379	75,041	13,782	138	136,778	50,005	2.74
1985	223	10,738	38,956	62,142	4,756	91	116,906	40,435	2.89
1986	347	20,408	45,928	109,067	15,843	138	191,731	41,425	4.63
1987	0	2,368	33,542	67,697	11,700	18	115,325	41,307	2.79
1988	0	6,641	34,323	75,396	8,937	68	125,366	39,699	3.16
1989	75	13,517	78,826	128,851	25,841	0	247,109	60,299	4.10
1990	56	6,343	24,873	71,641	10,816	9	113,737	59,212	1.92
1991	501	7,107	82,332	121,590	10,182	0	221,712	42,728	5.19
1992	6	2,608	23,981	41,677	1,831	0	70,103	39,155	1.79
1993	14	5,313	36,363	86,880	5,880	0	134,450	36,244	3.71
1994	0	755	19,932	30,683	6,175	0	57,545	56,449	1.02
1995	34	1,784	15,989	52,720	7,026	10	77,562	50,673	1.53
1996	20	276	23,201	44,462	14,610	2	82,571	74,060	1.11
1997	14	3,567	26,386	94,406	7,828	14	132,216	53,821	2.46
1998	0	3,478	39,260	76,502	4,357	0	123,598	35,497	3.48
1999	134	1,692	30,110	76,649	2,870	0	111,455	37,184	3.00
2000	0	2,798	40,704	63,414	1,509	0	108,424	25,870	4.19
2001	8	1,813	50,877	51,785	2,205	0	106,688	52,564	2.03
2002	75	2,262	28,704	20,725	227	9	52,003	42,359	1.23
2003	63	5,898	37,236	52,339	2,261	1	97,797	80,594	1.21
2004	3	2,462	26,833	21,938	4,763	1	56,001	48,469	1.16
2005	9	8,268	29,477	38,855	1,754	0	78,362	67,985	1.15
2006	15	6,009	25,248	25,683	1,568	0	58,522	62,630	0.93
2007	47	2,858	17,746	22,193	1,694	1	44,539	34,904	1.28
2008	1	3,138	11,092	25,750	1,853	0	41,834	33,883	1.23
2009	173	2,324	32,868	44,943	459	0	80,766	65,278	1.24
2010	1	4,379	29,627	19,822	876	0	54,704	32,014	1.71
2011	194	10,645	53,113	42,603	1,264		107,819	46,307	2.33
2012	255	9,819	45,114	32,771			87,959	32,656	2.69
2013	92	5,151	33,489					28,669	
2014	115	8,976						63,331	
2015	29							82,674	
2016								68,798	
2017								68,315	
2018								54,474	
Average 1982–2011							106,082	47,969	2.21
							Contrast	3.12	

Note: Spawner data are derived from a 3-area aerial survey index of combined counts from Big Salmon, Little Salmon, and Nisutlin rivers (1982-2001), radiotelemetry (2002–2004), and the mainstem Yukon River sonar at Eagle (2005–2018). Shaded values are preliminary estimates by brood year. Average includes the years with complete brood information through age-7. Ages used were from samples collected at the mainstem sonar test fishery and fish wheel data for years prior to 2005.

Appendix A4.–Chinook salmon age and sex percentages from selected Yukon River monitoring projects operated in Alaska, 2018.

Location	Sample size		Age 3	4	5	6	7	Total
Coastal District-District 5	1,277	Male	0.2	16.1	37.0	13.7	0.5	67.5
Subsistence harvest		Female	0.1	0.8	9.9	20.4	1.3	32.5
		Total	0.3	16.9	46.9	34.1	1.8	100.0
East Fork	229	Male	0.9	31.0	42.8	0.4	0.0	75.1
Andreafsky River [a]		Female	0.0	5.2	18.8	0.9	0.0	24.9
		Total	0.9	36.2	61.6	1.3	0.0	100.0
Pilot Station	512	Male	0.8	10.7	29.7	10.5	0.0	51.7
test fishery [b]		Female	0.0	1.4	19.9	26.4	0.6	48.3
		Total	0.8	12.1	49.6	36.9	0.6	100.0
Eagle test fishery [b]	700	Male	0.0	10.1	33.1	13.1	0.1	56.4
		Female	0.0	0.1	9.9	31.9	1.6	43.5
		Total	0.0	10.2	43.0	45.0	1.7	100.0

[a] Samples were collected from a weir trap.

[b] Samples were from test fishing with drift gillnets.

Appendix A5.–Yukon River Chinook salmon age, female percentage, and mean length from the Eagle sonar project, 2005–2018.

		Percent by age class						
		Age-3	Age-4	Age-5	Age-6	Age-7		
Year	Sample size	(1.1)	(1.2, 2.1)	(1.3, 2.2)	(1.4, 2.3)	(1.5, 2.4)	Percent female	Mean length
2005	171	0.0	8.2	50.3	38.0	3.5	33.0	779
2006	256	0.0	16.8	60.2	22.7	0.4	38.6	737
2007	389	0.0	5.7	40.1	53.7	0.5	44.3	787
2008	375	0.0	2.7	56.3	36.5	4.5	37.0	780
2009	647	0.0	7.7	33.2	59.0	0.0	40.8	791
2010	336	0.0	7.4	46.4	42.0	4.2	41.0	770
2011	420	0.0	2.1	29.5	60.5	7.9	48.8	809
2012	249	0.4	6.4	30.1	58.6	4.4	46.8	780
2013	265	0.0	4.2	27.5	63.4	4.9	51.0	807
2014	606	0.2	6.6	50.5	40.1	2.6	35.0	763
2015	927	0.3	10.8	34.4	52.3	2.2	41.4	776
2016	666	0.0	9.2	65.1	25.2	0.6	32.4	759
2017	719	0.1	4.2	46.5	48.1	1.1	50.9	797
2018	700	0.0	10.3	43.0	45.0	1.7	43.4	769
Average (2005-2017)	463	0.1	7.0	43.8	46.2	2.8	41.9	780
5-yr Average (2013-2017)	636	0.1	7.0	44.8	45.8	2.3	42.5	780

Note: Length is measured mid eye to the fork of tail to the nearest mm. Age nomenclature (years in freshwater "." years at sea).

Appendix A6.–Yukon River Chinook salmon harvest percentage by stock group for U.S. harvest, U.S. and Canada harvest combined, and the percentage of the upper stock group harvest by each country, 1981–2018.

	Stock groups (U.S. harvest)			Stock groups (U.S. and Canada harvest)			Upper stock group	
Year	Lower	Middle	Upper	Lower	Middle	Upper	U.S.	Canada
1981	5.9	59.8	34.3	5.4	54.5	40.1	78.1	21.9
1982	15.4	27.5	57.1	13.9	24.7	61.4	83.5	16.5
1983	14.2	37.0	48.9	12.9	33.7	53.3	83.7	16.3
1984	28.0	44.3	27.7	25.3	40.2	34.5	72.7	27.3
1985	30.4	24.6	45.1	27.6	22.3	50.1	81.6	18.4
1986	22.3	10.9	66.8	19.5	9.6	70.9	82.7	17.3
1987	17.4	21.4	61.2	15.9	19.6	64.5	86.7	13.3
1988	24.9	18.1	57.0	21.8	15.8	62.5	79.8	20.2
1989	27.2	17.7	55.1	24.4	15.9	59.7	82.9	17.1
1990	22.8	28.4	48.8	20.2	25.2	54.7	79.2	20.8
1991	31.8	28.7	39.6	28.0	25.3	46.7	74.8	25.2
1992	18.0	24.1	57.8	16.3	21.8	61.9	84.5	15.5
1993	23.7	28.0	48.3	21.5	25.4	53.1	82.6	17.4
1994	20.4	24.1	55.5	18.2	21.4	60.4	81.8	18.2
1995	20.0	25.0	55.0	17.9	22.4	59.7	82.4	17.6
1996	24.0	11.8	64.2	21.0	10.4	68.6	81.9	18.1
1997	28.9	18.3	52.8	26.4	16.8	56.9	84.8	15.2
1998	34.7	18.5	46.8	32.7	17.4	49.8	88.8	11.2
1999	44.1	6.9	49.0	40.1	6.3	53.6	83.0	17.0
2000	37.5	13.6	48.9	33.9	12.3	53.8	81.9	18.1
2001	37.5	19.0	43.5	31.6	16.0	52.4	69.8	30.3
2002	22.1	33.3	44.6	19.4	29.2	51.4	76.3	23.5
2003	7.5	31.7	60.8	6.8	28.9	64.3	86.2	13.8
2004	16.9	31.6	51.5	15.3	28.8	55.9	83.7	16.3
2005	23.4	24.2	52.4	20.7	21.4	57.9	80.1	19.9
2006	19.2	30.2	50.5	17.6	27.6	54.9	84.1	15.9
2007	13.7	32.3	54.0	13.0	30.6	56.4	90.5	9.5
2008	18.2	30.0	51.8	17.0	28.0	55.0	88.1	11.9
2009	12.7	35.8	51.6	11.1	31.4	57.5	78.8	21.2
2010	18.7	34.3	47.0	17.8	32.7	49.5	90.5	9.5
2011	15.6	33.3	51.1	13.9	29.8	56.3	81.0	19.0
2012	14.4	37.5	48.2	13.3	34.8	51.9	86.3	13.7
2013	16.0	25.0	59.0	13.4	21.0	65.6	75.5	24.5
2014	29.8	26.0	44.3	25.4	27.8	46.8	93.4	6.6
2015	15.6	36.3	48.1	13.5	31.3	55.2	75.2	24.8
2016	15.1	30.8	54.1	13.3	27.1	59.6	79.9	20.1
2017	9.3	33.3	57.4	8.5	30.5	60.9	86.3	13.7
2018 [a]	8.9	30.1	61.0	8.1	27.7	64.2	87.5	12.5
Average								
2004–2017	16.5	32.2	51.2	14.7	29.4	55.8	83.5	16.5
2013–2017	17.2	30.3	52.6	14.8	27.6	57.6	82.1	17.9
Minimum-17	5.9	6.9	27.7	5.4	6.3	34.5	69.8	6.6
Maximum-17	44.1	59.8	66.8	40.1	54.5	70.9	93.4	30.3

Note: Minimum and maximum indicate year with the lowest and highest values through 2017.

[a] Data preliminary.

Appendix A7.–Stock group percentage by major stock and by country, from chum salmon beginning July 19 at the Pilot Station sonar, 1999–2018.

	Season stock groups		U.S. stock groups		Fall stock country groups	
Year [a]	Summer	Fall	Tanana fall [b]	Border U.S. [c]	Fall U.S.	Canada
1999	16%	84%	–	–	–	–
2000	12%	88%	–	–	–	–
2001	13%	87%	–	–	–	–
2002	19%	81%	–	–	–	–
2003	–	–	–	–	–	–
2004	13%	87%	32%	27%	59%	28%
2005	11%	89%	21%	43%	63%	26%
2006	19%	81%	16%	36%	53%	28%
2007	21%	79%	23%	26%	49%	30%
2008	17%	83%	21%	31%	52%	31%
2009	23%	77%	20%	31%	51%	27%
2010	25%	75%	24%	20%	44%	31%
2011	14%	86%	13%	39%	52%	34%
2012	20%	80%	26%	32%	58%	22%
2013	11%	89%	34%	23%	57%	32%
2014	9%	91%	29%	32%	61%	30%
2015	22%	78%	22%	29%	51%	27%
2016	20%	80%	24%	29%	52%	27%
2017	12%	88%	32%	33%	66%	22%
2018	17%	83%	35%	23%	58%	25%
Average						
2004–2017	17%	83%	24%	31%	55%	28%
2013–2017	15%	85%	28%	29%	58%	28%
Minimum-17	9%	75%	13%	20%	44%	22%
Maximum-17	25%	91%	34%	43%	66%	34%

Note: July 19 is the date when U.S. management switches from a focus on summer chum salmon to fall chum salmon in this section of the river. Minimum and maximum indicate year with the lowest and highest values through 2017. En dash indicates no analysis occurred.

[a] Stock identification methods from 1999 through 2004 were based on allozyme analysis. Beginning in 2004, analysis was based on microsatellite baseline.

[b] Tanana River escapement estimates are based on both fall and average summer (3%) components due to the transition of stocks in this system.

[c] Border U.S. stocks include Big Salt, Teedriinjik (Chandalar), Sheenjek and Black rivers.

Appendix A8.–Estimated bycatch (numbers) of Chinook and non-Chinook salmon in the U.S. Bering Sea-Aleutian Islands (BSAI) groundfish fisheries by season, 1991–2018.

	BSAI Chinook salmon bycatch					
	A-season		B-season		Annual	
Year	Pollock fisheries	All fisheries	Pollock fisheries	All fisheries	Pollock fisheries	All fisheries
1991 [a]	38,791	46,392	2,114	2,488	40,905	48,880
1992 [a]	25,691	31,418	10,259	10,536	35,950	41,954
1993 [a]	17,264	24,688	21,252	21,325	38,516	46,013
1994	28,451	38,921	4,686	4,899	33,137	43,820
1995	10,579	18,939	4,405	4,497	14,984	23,436
1996	36,068	43,316	19,554	19,888	55,622	63,204
1997	10,935	16,401	33,973	34,128	44,908	50,529
1998	16,132	19,869	40,308	40,679	56,440	60,548
1999	6,352	8,793	5,627	5,805	11,979	14,598
2000	3,422	6,567	1,539	1,655	4,961	8,222
2001	18,484	24,871	14,961	15,676	33,445	40,547
2002	21,794	26,276	12,701	13,407	34,495	39,683
2003	33,478	40,058	12,183	13,603	45,661	53,661
2004	24,925	30,766	26,837	29,272	51,762	60,038
2005	27,960	33,622	40,224	41,462	68,184	75,084
2006	58,547	62,547	24,205	24,568	82,752	87,115
2007	72,943	78,156	51,780	51,844	124,723	130,000
2008	16,495	18,828	4,811	5,009	21,306	23,837
2009	9,882	11,289	2,697	2,825	12,579	14,114
2010	7,649	9,480	2,071	2,921	9,720	12,401
2011	7,137	7,602	18,362	19,007	25,499	26,609
2012	7,765	8,981	3,579	3,949	11,344	12,930
2013	8,237	9,186	4,797	6,821	13,034	16,007
2014	11,539	13,837	3,492	4,261	15,031	18,098
2015	12,304	17,502	6,025	7,752	18,329	25,254
2016	16,828	25,721	5,098	6,840	21,926	32,561
2017	21,828	27,008	8,248	9,272	30,076	36,280
2018	8,629	11,249	5,095	6,130	13,724	17,379
Average						
2008–2017	11,966	14,943	5,918	6,866	17,884	21,809
2013–2017	14,147	18,651	5,532	6,989	19,679	25,640
Minimum-17	3,422	6,567	1,539	1,655	4,961	8,222
Maximum-17	72,943	78,156	51,780	51,844	124,723	130,000

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	BSAI non-Chinook salmon bycatch [b]					
	A-season		B-season		Annual	
Year	Pollock fisheries	All fisheries	Pollock fisheries	All fisheries	Pollock fisheries	All fisheries
1991 [a]	2,850	3,015	26,101	27,245	28,951	30,260
1992 [a]	1,951	2,120	38,324	39,329	40,275	41,449
1993 [a]	1,594	1,848	240,597	241,422	242,191	243,270
1994	3,991	5,599	88,681	88,949	92,672	94,548
1995	1,708	3,033	17,556	18,842	19,264	21,875
1996	222	665	77,014	77,395	77,236	78,060
1997	2,083	2,710	63,904	64,285	65,987	66,995
1998	4,090	4,520	60,866	61,177	64,956	65,697
1999	362	393	44,909	46,739	45,271	47,132
2000	213	350	58,358	58,976	58,571	59,326
2001	2,386	2,903	54,621	57,827	57,007	60,730
2002	1,377	1,697	79,274	80,784	80,651	82,481
2003	3,831	3,831	184,513	185,381	188,344	189,212
2004	426	1,020	451,907	461,419	452,333	462,439
2005	594	1,029	710,196	714,599	710,790	715,628
2006	1,323	2,310	305,674	319,654	306,997	321,964
2007	8,481	9,599	84,387	86,779	92,868	96,378
2008	247	442	14,732	16,060	14,979	16,502
2009	48	174	45,397	46,103	45,445	46,277
2010	40	222	13,158	14,195	13,198	14,417
2011	297	414	191,138	192,082	191,435	192,496
2012	11	307	22,265	23,746	22,276	24,053
2013	215	447	125,101	126,345	125,316	126,792
2014	577	1,581	218,851	222,519	219,428	224,100
2015	4,800	6,200	232,996	237,143	237,796	243,343
2016	3,903	4,838	339,098	342,309	343,001	347,147
2017	1,906	2,312	465,772	469,063	467,678	471,375
2018	1,199	2,123	293,862	306,139	295,061	308,262
Average						
2008–2017	1,204	1,694	166,851	168,957	168,055	170,650
2013–2017	2,280	3,076	276,364	279,476	278,644	282,551
Minimum-17	11	174	13,158	14,195	13,198	14,417
Maximum-17	8,481	9,599	710,196	714,599	710,790	715,628

Notes: A-season (winter; January 20-June 10) B-season (summer/fall; June 10-November 1).

Actual fishing dates when fishing starts and stops varies by year.

Source: NMFS https://alaskafisheries.noaa.gov/sites/default/files/reports/chum_salmon_mortality2018.pdf. Minimums and maximum indicate the lowest and highest values for each year presented through 2017.

[a] Community Development Quota (CDQ) bycatch not included.

[b] Non-Chinook salmon is predominantly chum salmon.

Appendix A9.–Drainagewide Yukon River fall chum salmon estimated brood year production and return per spawner estimates 1974–2018.

Brood	Number of salmon by age [a]						Return/
year	3	4	5	6	Return	Spawners [b]	spawner
1974	112,999	659,786	98,123	0	870,908	685,150	1.27
1975	199,426	1,750,465	67,673	125	2,017,689	2,240,500	0.90
1976	145,789	647,486	139,161	4,887	937,323	566,800	1.65
1977	113,146	1,091,853	198,906	5,009	1,408,915	737,800	1.91
1978	22,567	376,136	108,327	0	507,030	566,100	0.90
1979	46,547	920,261	313,609	4,054	1,284,470	1,379,000	0.93
1980	10,019	414,089	217,546	3,889	645,543	340,000	1.90
1981	52,424	994,989	346,509	9,599	1,403,521	571,450	2.46
1982	11,792	498,285	180,096	714	690,888	253,300	2.73
1983	15,644	945,391	234,945	2,412	1,198,393	518,600	2.31
1984	7,656	428,996	181,684	10,077	628,414	367,800	1.71
1985	49,030	912,369	320,663	3,246	1,285,309	712,900	1.80
1986	0	508,536	374,546	5,266	888,348	546,300	1.63
1987	14,688	627,629	351,795	8,312	1,002,424	736,600	1.36
1988	41,674	212,015	164,047	13,054 [c]	430,792	360,000	1.20
1989	3,320	304,591	413,575 [c]	22,207	743,693	551,300	1.35
1990	764	694,356 [c]	457,973	32,733	1,185,826	501,700	2.36
1991	4,389 [c]	1,121,598	396,788	12,930	1,535,706	608,000	2.53
1992	7,402	702,676	209,430	4,119	923,627	423,550	2.18
1993	8,326	479,626	107,965	3,229	599,146	386,700	1.55
1994	4,593	237,440	149,238	1,688 [c]	392,958	956,150	0.41
1995	2,499	266,440	72,562 [c]	374	341,876	1,148,000	0.30
1996	419	174,452 [c]	133,896	8,328	317,096	879,600	0.36
1997	3,250 [c]	239,419	118,815	3,414	364,898	536,500	0.68
1998	636	270,729	59,390	7,107	337,862	281,200	1.20
1999	29,213	722,521	185,167	13,053	949,953	288,150	3.30
2000	8,654	315,305	109,859	0	433,818	223,400	1.94
2001	144,417	2,052,507	705,136	34,037	2,936,097	329,300	8.92
2002	0	463,880	239,734	13,934	717,548	399,600	1.80
2003	25,320	860,796	463,500	17,292	1,366,908	714,900	1.91
2004	0	354,529	156,829	2,064	513,423	575,700	0.89
2005	2,420	399,999	93,924	5,357	501,700	1,885,000	0.27
2006	26,298	394,331	344,939	30,286	795,854	923,850	0.86

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Brood Year	Number of Salmon by Age [a] 3	4	5	6	Return	Spawners [b]	Return/ spawner
2007	83,086	857,174	189,955	6,498	1,136,713	928,900	1.22
2008	10,106	847,383	401,308	7,633	1,266,429	616,400	2.05
2009	12,065	773,359	414,316	23,003	1,222,743	507,100	2.41
2010	1,895	492,060	245,367	9,202	748,523	493,400	1.52
2011	24,008	483,872	182,671	2,240	692,791	890,200	0.78
2012	68,863	1,168,116	319,040	5,732	1,561,751	683,100	2.29
2013	29,212	1,849,080	312,501	18,252	2,209,045	825,100	2.68 [d]
2014	55,462	752,777	359,874		1,168,113	724,800	1.61 [d]
2015	29,436					538,650	
2016						833,100	
2017						1,644,000	
2018						642,600	
Average 1974–2012					943,254	674,718	1.74
Minimum-2012					317,096	317,096	0.27
Maximum–2012					2,936,097	2,936,097	8.92

Note: Spawner data are derived from Bayesian spawner-recruit model. Average includes the years with complete brood information through age-6. Minimums and maximum indicate the lowest and highest values for each year presented through 2012.

[a] Age composition is based on samples from the lower Yukon test fishery gillnets, weighted by test fish catch per unit effort. Prior to 1983 commercial sampling was used to supplement test fishery age samples.

[b] Contrast in escapement data is 10.02.

[c] Based upon expanded test fish age composition estimates for years in which the test fishery terminated early both in 1994 and 2000.

[d] Return per spawner includes preliminary estimates from incomplete brood year (shaded value).

Appendix A10.–Escapement, rebuilding and interim goals for Canadian-origin Chinook and fall chum salmon stocks, 1985–2019.

	Canadian origin stock targets					
	Chinook salmon		Fall chum salmon			
	Mainstem escapement	Stabilization/ rebuilding/	Mainstem escapement	Stabilization/ rebuilding/	Fishing Branch	
Year	goal	interim goals	goal	interim goals	Escapement goal	Interim goal
1985	33,000-43,000					
1986	33,000-43,000					
1987	33,000-43,000		90,000-135,000		50,000-120,000	
1988	33,000-43,000		90,000-135,000		50,000-120,000	
1989	33,000-43,000		90,000-135,000		50,000-120,000	
1990	33,000-43,000	18,000	80,000		50,000-120,000	
1991	33,000-43,000	18,000	80,000		50,000-120,000	
1992	33,000-43,000	18,000	80,000	51,000	50,000-120,000	
1993	33,000-43,000	18,000	80,000	51,000	50,000-120,000	
1994	33,000-43,000	18,000	80,000	61,000	50,000-120,000	
1995	33,000-43,000	18,000	80,000		50,000-120,000	
1996	33,000-43,000	28,000	80,000	65,000	50,000-120,000	
1997	33,000-43,000	28,000	80,000	49,000	50,000-120,000	
1998	33,000-43,000	28,000	80,000		50,000-120,000	
1999	33,000-43,000	28,000	80,000		50,000-120,000	
2000	33,000-43,000	28,000	80,000		50,000-120,000	
2001	33,000-43,000	28,000	80,000		50,000-120,000	
2002	33,000-43,000	28,000	80,000	60,000	50,000-120,000	
2003 [a]	33,000-43,000	28,000 [b]	80,000	65,000	50,000-120,000	15,000
2004	33,000-43,000	28,000	80,000	65,000	50,000-120,000	13,000
2005	33,000-43,000	28,000	80,000	65,000	50,000-120,000	24,000
2006	33,000-43,000	28,000	80,000		50,000-120,000	28,000
2007	33,000-43,000		80,000		50,000-120,000	34,000
2008	33,000-43,000	45,000 [c]	80,000		50,000-120,000	22,000-49,000 [d]
2009	33,000-43,000	45,000	80,000		50,000-120,000	22,000-49,000
2010	33,000-43,000	42,500-55,000 [e]	80,000	70,000-104,000 [f]	50,000-120,000	22,000-49,000
2011	33,000-43,000	42,500-55,000	80,000	70,000-104,000	50,000-120,000	22,000-49,000
2012	33,000-43,000	42,500-55,000	80,000	70,000-104,000	50,000-120,000	22,000-49,000
2013	33,000-43,000	42,500-55,000	80,000	70,000-104,000	50,000-120,000	22,000-49,000
2014	33,000-43,000	42,500-55,000	80,000	70,000-104,000	50,000-120,000	22,000-49,000
2015	33,000-43,000	42,500-55,000	80,000	70,000-104,000	50,000-120,000	22,000-49,000
2016	33,000-43,000	42,500-55,000	80,000	70,000-104,000	50,000-120,000	22,000-49,000
2017	33,000-43,000	42,500-55,000	80,000	70,000-104,000	50,000-120,000	22,000-49,000
2018	33,000-43,000	42,500-55,000	80,000	70,000-104,000	50,000-120,000	22,000-49,000
2019	33,000-43,000	42,500-55,000	80,000	70,000-104,000	50,000-120,000	22,000-49,000

Note: All single numbers are considered minimums.

[a] Treaty was signed by governments in December 2002.

[b] In 2003, the Chinook salmon goal was set at 25,000 fish. However, if the U.S. conducted a commercial fishery the goal would be increased to 28,000 fish.

[c] Interim management escapement goal (IMEG) assessed using sonar near Eagle (previous years were measured by mark–recapture abundance estimates).

[d] Interim Management Escapement Goal (IMEG) established for 2008–2010, based on percentile method, and recommended to continue by default if no new analysis in subsequent years.

[e] IMEG of 42,500–55,000 fish recommended in 2010, based on levels selected from several unpublished analyses.

[f] MEG established in 2010 based on brood table of Canadian-origin mainstem stocks (1982–2003) and recommended to continue by default if no new analysis in subsequent years.

Appendix A11.–Fall chum salmon age and sex percentages with average lengths from selected Yukon River escapement projects, 2018.

Location	Sample size		Age 3	4	5	6	7	Total	Average length (mm) [a]
Delta River, Alaska [b]	160	Males	8.1	47.5	9.4	1.3	0.0	66.3	583.9
		Females	1.9	24.4	7.5	0.0	0.0	33.8	564.9
		Total	10.0	71.9	16.9	1.3	0.0	100.0	577.5
Yukon mainstem [c]	720	Males	0.6	31.0	35.3	0.0	0.0	66.9	617.2
at Eagle, Alaska		Females	0.2	20.4	12.5	0.0	0.0	33.1	584.5
		Total	0.8	51.4	47.8	0.0	0.0	100.0	606.4
Fishing Branch	396	Males	0.3	18.6	18.8	0.8	0.0	38.4	602.4
River, Canada [d]		Females	1.5	36.6	22.4	1.0	0.0	61.6	583.6
		Total	1.8	55.2	41.2	1.8	0.0	100.0	590.8

[a] Length is measured mid eye to fork of tail in millimeters.

[b] Samples were handpicked carcasses from east and middle channels, structure is vertebra.

[c] Samples were from test fishing with drift gillnets, structure is scales.

[d] Samples were collected live at the weir, structure is scales.

APPENDIX B: TABLES

Appendix B1.–Alaska and Canadian total utilization of Yukon River Chinook, chum, and coho salmon, 1961–2018.

	Alaska/U.S. [a,b]			Yukon Territory/Canada [c]			Total		
Year	Chinook	Other salmon	Total	Chinook	Other salmon [d]	Total	Chinook	Other salmon	Total
1961	141,152	461,597	602,749	13,246	9,076	22,322	154,398	470,673	625,071
1962	105,844	434,663	540,507	13,937	9,436	23,373	119,781	444,099	563,880
1963	141,910	429,396	571,306	10,077	27,696	37,773	151,987	457,092	609,079
1964	109,818	504,420	614,238	7,408	12,221	19,629	117,226	516,641	633,867
1965	134,706	484,587	619,293	5,380	11,789	17,169	140,086	496,376	636,462
1966	104,887	309,502	414,389	4,452	13,324	17,776	109,339	322,826	432,165
1967	146,104	352,397	498,501	5,150	16,961	22,111	151,254	369,358	520,612
1968	118,632	270,818	389,450	5,042	11,633	16,675	123,674	282,451	406,125
1969	105,027	424,399	529,426	2,624	7,776	10,400	107,651	432,175	539,826
1970	93,019	585,760	678,779	4,663	3,711	8,374	97,682	589,471	687,153
1971	136,191	547,448	683,639	6,447	17,471	23,918	142,638	564,919	707,557
1972	113,098	461,617	574,715	5,729	7,532	13,261	118,827	469,149	587,976
1973	99,670	779,158	878,828	4,522	10,182	14,704	104,192	789,340	893,532
1974	118,053	1,229,678	1,347,731	5,631	11,646	17,277	123,684	1,241,324	1,365,008
1975	76,705	1,307,037	1,383,742	6,000	20,600	26,600	82,705	1,327,637	1,410,342
1976	105,582	1,026,908	1,132,490	5,025	5,200	10,225	110,607	1,032,108	1,142,715
1977	114,494	1,090,758	1,205,252	7,527	12,479	20,006	122,021	1,103,237	1,225,258
1978	129,988	1,615,312	1,745,300	5,881	9,566	15,447	135,869	1,624,878	1,760,747
1979	159,232	1,596,133	1,755,365	10,375	22,084	32,459	169,607	1,618,217	1,787,824
1980	197,665	1,730,960	1,928,625	22,846	23,718	46,564	220,511	1,754,678	1,975,189
1981	188,477	2,097,871	2,286,348	18,109	22,781	40,890	206,586	2,120,652	2,327,238
1982	152,808	1,265,457	1,418,265	17,208	16,091	33,299	170,016	1,281,548	1,451,564

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	Alaska/U.S. [a,b]			Yukon Territory/Canada [c]			Total		
Year	Chinook	Other salmon	Total	Chinook	Other salmon [d]	Total	Chinook	Other salmon	Total
1983	198,436	1,678,597	1,877,033	18,952	29,490	48,442	217,388	1,708,087	1,925,475
1984	162,683	1,548,101	1,710,784	16,795	29,767	46,562	179,478	1,577,868	1,757,346
1985	187,327	1,657,984	1,845,311	19,301	41,515	60,816	206,628	1,699,499	1,906,127
1986	146,004	1,758,825	1,904,829	20,364	14,843	35,207	166,368	1,773,668	1,940,036
1987	188,386	1,276,066	1,464,452	17,614	44,786	62,400	206,000	1,320,852	1,526,852
1988	150,009	2,360,718	2,510,727	21,427	33,915	55,342	171,436	2,394,633	2,566,069
1989	157,632	2,292,211	2,449,843	17,944	23,490	41,434	175,576	2,315,701	2,491,277
1990	149,433	1,055,515	1,204,948	19,227	34,304	53,531	168,660	1,089,819	1,258,479
1991	154,651	1,335,111	1,489,762	20,607	35,653	56,260	175,258	1,370,764	1,546,022
1992	169,642	880,535	1,050,177	17,903	21,312	39,215	187,545	901,847	1,089,392
1993	161,718	362,551	524,269	16,611	14,150	30,761	178,329	376,701	555,030
1994	171,654	567,074	738,728	21,198	38,342	59,540	192,852	605,416	798,268
1995	179,748	1,455,736	1,635,484	20,884	46,109	66,993	200,632	1,501,845	1,702,477
1996	141,649	1,143,992	1,285,641	19,612	24,395	44,007	161,261	1,168,387	1,329,648
1997	176,025	560,777	736,802	16,528	15,900	32,428	192,553	576,677	769,230
1998	99,760	201,480	301,240	5,937	8,168	14,105	105,697	209,648	315,345
1999	125,427	250,198	375,625	12,468	19,736	32,204	137,895	269,934	407,829
2000	45,867	120,424	166,291	4,879	9,283	14,162	50,746	129,707	180,453
2001	56,620	131,500	188,120	10,144	9,872	20,016	66,764	141,372	208,136
2002	69,240	137,688	206,928	9,258	8,567	17,825	78,498	146,255	224,753
2003	101,000	214,323	315,323	9,619	11,435	21,054	110,619	225,758	336,377
2004	114,370	214,744	329,114	11,238	9,930	21,168	125,608	224,674	350,282
2005	86,369	493,542	579,911	11,371	18,583	29,954	97,740	512,125	609,865

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Year	Alaska/U.S. [a,b]			Yukon Territory/Canada [c]			Total		
	Chinook	Other salmon	Total	Chinook	Other salmon [d]	Total	Chinook	Other salmon	Total
2006	96,067	553,299	649,366	9,072	11,908	20,980	105,139	565,207	670,346
2007	90,753	548,568	639,321	5,094	14,332	19,426	95,847	562,900	658,747
2008	50,362	500,029	550,391	3,713	9,566	13,279	54,075	509,595	563,670
2009	35,111	368,717	403,828	4,758	2,011	6,769	39,869	370,728	410,597
2010	55,092	415,968	471,060	2,706	5,891	8,597	57,798	421,859	479,657
2011	41,625	780,784	822,409	4,884	8,226	13,110	46,509	789,010	835,519
2012	30,831	935,740	966,571	2,200	7,033	9,233	33,031	942,773	975,804
2013	12,741	1,037,537	1,050,278	2,146	6,170	8,316	14,887	1,043,707	1,058,594
2014	3,287	950,408	953,695	103	5,166	5,269	3,390	955,574	958,964
2015	7,595	872,084	879,679	1,204	4,453	5,657	8,799	876,537	885,336
2016 [e]	21,704	1,376,984	1,398,688	2,946	5,750	8,696	24,650	1,382,734	1,407,384
2017 [e]	38,411	1,369,593	1,408,004	3,631	5,716	9,347	42,042	1,375,309	1,417,351
2018 [e]	32,013	1,225,123	1,257,136	3,098	4,831	7,929	35,111	1,229,954	1,265,065
Average									
1961–2017	113,522	884,443	997,966	10,344	16,364	26,708	123,867	900,807	1,024,674
2008–2017	29,676	860,784	890,460	2,829	5,998	8,827	32,505	866,783	899,288
2013–2017	16,748	1,121,321	1,138,069	2,006	5,451	7,457	18,754	1,126,772	1,145,526
Minimum-17	3,287	120,424	166,291	103	2,011	5,269	3,390	129,707	180,453
Maximum-17	198,436	2,360,718	2,510,727	22,846	46,109	66,993	220,511	2,394,633	2,566,069

Note: Minimum and maximum indicate year with the lowest and highest values through 2017.

[a] Catch in number of salmon. Includes estimated number of salmon harvested for the commercial production of salmon roe.

[b] Commercial, subsistence, personal use, test fish retained for subsistence, and sport catches combined. Beginning 2017 includes harvest from the Coastal District communities of Scammon Bay and Hooper Bay even though not all stocks are bound for the Yukon River. Coastal District harvest information is included in the following years: 1978, 1987–1989 and 1992 to present.

[c] Catch in number of salmon. Commercial, Aboriginal, domestic, and sport catches combined.

[d] Includes coho salmon harvests in First Nations public angling and commercial fisheries, most of which was harvested in the Old Crow Aboriginal fishery (99.8%).

[e] Data are preliminary; particularly not yet published Alaska subsistence harvest data from 2016 and 2018.

Appendix B2.–Alaska harvest of Yukon River Chinook salmon, 1961–2018.

Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales	Sport fish	Yukon Area total
1961	21,488	119,664					141,152
1962	11,110	94,734					105,844
1963	24,862	117,048					141,910
1964	16,231	93,587					109,818
1965	16,608	118,098					134,706
1966	11,572	93,315					104,887
1967	16,448	129,656					146,104
1968	12,106	106,526					118,632
1969	14,000	91,027					105,027
1970	13,874	79,145					93,019
1971	25,684	110,507					136,191
1972	20,258	92,840					113,098
1973	24,317	75,353					99,670
1974	19,964	98,089					118,053
1975	12,867	63,838					76,705
1976	17,806	87,776					105,582
1977	17,581	96,757				156	114,494
1978	30,785	99,168				523	130,476
1979	31,005	127,673				554	159,232
1980	42,724	153,985				956	197,665
1981	29,690	158,018				769	188,477
1982	28,158	123,644				1,006	152,808
1983	49,478	147,910				1,048	198,436
1984	42,428	119,904				351	162,683
1985	39,771	146,188				1,368	187,327
1986	45,238	99,970				796	146,004
1987	51,418	134,760 [e]		1,706		502	188,386

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Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales	Sport fish	Yukon Area total
1988	45,495	100,364		2,125	1,081	944	150,009
1989	48,462	104,198		2,616	1,293	1,063	157,632
1990	48,587	95,247 [e]	413	2,594	2,048	544	149,433
1991	46,773	104,878 [e]	1,538		689	773	154,651
1992	47,077	120,245 [e]	927		962	431	169,642
1993	63,915	93,550	560	426	1,572	1,695	161,718
1994	53,902	113,137	703		1,631	2,281	171,654
1995	50,620	122,728	1,324	399	2,152	2,525	179,748
1996	45,671	89,671	521	215	1,698	3,873	141,649
1997	57,117	112,841	769	313	2,811	2,174	176,025
1998	54,124	43,618	81	357	926	654	99,760
1999	53,305	69,275	288	331	1,205	1,023	125,427
2000	36,404	8,515	-	75	597	276	45,867
2001	55,819	-	-	122	-	679	56,620
2002	43,742	24,128	230	126	528	486	69,240
2003	56,959	40,438	-	204	680	2,719	101,000
2004	55,713	56,151	-	201	792	1,513	114,370
2005	53,409	32,029	-	138	310	483	86,369
2006	48,593	45,829	-	89	817	739	96,067
2007	55,174	33,634	-	136	849	960	90,753
2008	45,186	4,641	-	126	-	409	50,362
2009	33,805	316	-	127	-	863	35,111
2010	44,559	9,897	-	162	-	474	55,092
2011	40,980	82 [f]	-	89	-	474	41,625
2012	30,415	-	-	71	-	345	30,831
2013	12,533	-	-	42	-	166	12,741
2014	3,286	-	-	1	-	0	3,287
2015	7,577	-	-	5	-	13	7,595
2016	21,627 [g]	-	-	57 [g]	-	20	21,684

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Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales	Sport fish	Yukon Area total
2017	38,100 [g]	168 [f]	-	125 [g]	-	18	38,411
2018	31,812 [g]	-	-	201 [g]	-	- [h]	32,013
Averages							
1961–2017	34,849	86,368	669	464	1,192	894	113,522
2008–2017	27,807	3,021	-	81	-	278	29,676
2013–2017	16,625	-	-	46	-	43	16,748
Minimum-17	3,286	82	81	1	310	0	3,287
Maximum-17	63,915	158,018	1,538	2,616	2,811	3,873	198,436

Note: Minimum and maximum indicate lowest and highest values through 2017.

[a] Includes test fish harvest and commercial retained fish (not sold) that were utilized for subsistence. Does not include harvest from the Coastal District communities of Scammon Bay and Hooper Bay.

[b] Includes ADF&G test fish sales prior to 1988.

[c] Includes an estimate of the number of salmon harvested for the commercial production of salmon roe; including carcasses from subsistence caught fish. These data are only available since 1990.

[d] Prior to 1987, and in 1990, 1991, and 1994 personal use was considered part of subsistence.

[e] Includes Chinook salmon sold illegally.

[f] No Chinook salmon were sold in the summer season. A total of 82 and 168 Chinook salmon were sold in District 1 and 2 in the fall season in 2011 and 2017 respectively.

[g] Data are preliminary; particularly not yet published Alaska subsistence harvest data from 2016 and 2018.

[h] Data are unavailable at this time.

Appendix B3.–Alaska harvest of Yukon River summer chum salmon, 1970–2018.

Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales	Sport fish	Yukon Area total
1970	166,504	137,006					303,510
1971	171,487	100,090					271,577
1972	108,006	135,668					243,674
1973	161,012	285,509					446,521
1974	227,811	589,892					817,703
1975	211,888	710,295					922,183
1976	186,872	600,894					787,766
1977	159,502	534,875				316	694,693
1978	171,383	1,052,226	25,761			451	1,249,821
1979	155,970	779,316	40,217			328	975,831
1980	167,705	928,609	139,106			483	1,235,903
1981	117,629	1,006,938	272,763			612	1,397,942
1982	117,413	461,403	255,610			780	835,206
1983	149,180	744,879	250,590			998	1,145,647
1984	166,630	588,597	277,443			585	1,033,255
1985	157,744	516,997	417,016			1,267	1,093,024
1986	182,337	721,469	467,381			895	1,372,082
1987	200,346	442,238	180,303	4,262		846	827,995
1988	227,829	1,148,650	468,032	2,225	3,587	1,037	1,851,360
1989	169,496	955,806 [e]	496,934	1,891	10,605	2,132	1,636,864
1990	115,609	302,625	214,552	1,827	8,263	472	643,348
1991	118,540	349,113 [e]	308,989		3,934	1,037	781,613
1992	142,192	332,313 [e]	211,264		1,967	1,308	689,044
1993	125,574	96,522	43,594	674	1,869	564	268,797
1994	124,807	80,284	178,457		3,212	350	387,110
1995	136,083	259,774	558,640	780	6,073	1,174	962,524
1996	124,738	147,127	535,106	905	7,309	1,946	817,131

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Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales	Sport fish	Yukon Area total
1997	112,820	95,242	133,010	391	2,590	662	344,715
1998	87,366	28,611	187	84	3,019	421	119,688
1999	83,784	29,389	24	382	836	555	114,970
2000	78,072	6,624	0	30	648	161	85,535
2001	72,155	[f]	0	146	0	82	72,383
2002	87,056	13,558	19	175	218	384	101,410
2003	82,272	10,685	0	148	119	1,638	94,862
2004	77,934	26,410	0	231	217	203	104,995
2005	93,259	41,264	0	152	134	435	135,244
2006	115,078	92,116	0	262	456	583	208,495
2007	92,926	198,201	0	184	10	245	291,566
2008	86,514	151,186	0	138	80	371	238,289
2009	80,539	170,272	0	308	0	174	251,293
2010	88,373	232,888	0	319	0	1,183	322,763
2011	96,020	275,161	0	439	0	294	371,914
2012	126,992	319,575	0	321	2,412	271	449,571
2013	115,114	485,587	0	138	2,304	1,423	604,566
2014	86,900	530,644	0	235	0	374	618,153
2015	83,567	358,856	0	220	2,494 [g]	194	445,331
2016	87,992 [h]	525,809	0	176 [h]	380	264	614,621
2017	87,437 [h]	555,296	0	438 [h]	1,819	186	645,176
2018	76,926 [h]	576,700	0	509 [h]	1,028	- [i]	655,163
Averages							
1970–2017	128,886	386,308	136,875	624	2,152	675	623,495
2008–2017	93,954	360,527	0	273	949	473	456,177
2013–2017	92,220	491,238	0	241	1,399	488	585,587
Minimum-17	72,155	6,624	0	30	0	82	72,383
Maximum-17	227,829	1,148,650	558,640	4,262	10,605	2,132	1,851,360

-continued-

Note: Minimum and maximum indicate lowest and highest values through 2017.

[a] Includes test fish giveaways and commercial retained fish (not sold) that were utilized for subsistence. Beginning 2017, includes harvest from the Coastal District communities of Scammon Bay and Hooper Bay even though not all stocks are bound for the Yukon River. Coastal District harvest information is included in the following years: 1987–1989 and 1992–present.

[b] Includes ADF&G test fish sales prior to 1988.

[c] Includes an estimate of the number of salmon harvested for the commercial production of salmon roe; including carcasses from subsistence caught fish.

[d] Prior to 1987, and in 1990, 1991, and 1994 personal use was considered part of subsistence.

[e] Includes illegal sales of summer chum salmon.

[f] Summer season commercial fishery was not conducted.

[g] Test fish sales includes Lower Yukon Test Fishery and Purse Seine Test Fishery sales.

[h] Data are preliminary; particularly not yet published Alaska subsistence harvest data from 2016 and 2018.

[i] Data are unavailable.

Appendix B4.–Alaska harvest of Yukon River fall chum salmon, 1961–2018.

Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales [e]	Yukon Area total
1961	101,772 [f, g]	42,461	0			144,233
1962	87,285 [f, g]	53,116	0			140,401
1963	99,031 [f, g]		0			99,031
1964	120,360 [f, g]	8,347	0			128,707
1965	112,283 [f, g]	23,317	0			135,600
1966	51,503 [f, g]	71,045	0			122,548
1967	68,744 [f, g]	38,274	0			107,018
1968	44,627 [f, g]	52,925	0			97,552
1969	52,063 [f, g]	131,310	0			183,373
1970	55,501 [f, g]	209,595	0			265,096
1971	57,162 [f, g]	189,594	0			246,756
1972	36,002 [f, g]	152,176	0			188,178
1973	53,670 [f, g]	232,090	0			285,760
1974	93,776 [f, g]	289,776	0			383,552
1975	86,591 [f, g]	275,009	0			361,600
1976	72,327 [f, g]	156,390	0			228,717
1977	82,771 [g]	257,986	0			340,757
1978	84,239 [g]	236,383	10,628			331,250
1979	214,881	359,946	18,466			593,293
1980	167,637	293,430	5,020			466,087
1981	177,240	466,451	11,285			654,976
1982	132,092	224,187	805			357,084
1983	187,864	302,598	5,064			495,526
1984	172,495	208,232	2,328			383,055
1985	203,947	267,744	2,525			474,216
1986	163,466	139,442	577			303,485
1987	342,819 [h]	[i]		19,066		361,885

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Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales [e]	Yukon Area total
1988	153,848	133,763	3,227	3,881	27,663	322,382
1989	211,303	270,195	14,749	5,082	20,973	522,302
1990	167,900	124,174	12,168	5,176	9,224	318,642
1991	145,524	230,852	23,366	0	3,936	403,678
1992	107,808	15,721 [j]	3,301	0	1,407	128,237
1993	76,882	[i]		163	0	77,045
1994	123,565	3,631	4,368	0	0	131,564
1995	130,860	250,766	32,324	863	1,121	415,934
1996	129,258	88,342	17,288	356	1,717	236,961
1997	95,141	56,713	1,474	284	867	154,479
1998	62,901	[i]		2	0	62,903
1999	89,940	20,371	0	262	1,171	111,744
2000	19,395	[i]		1	0	19,396
2001	35,703	[i]		10	0	35,713
2002	19,674	[i]		3	0	19,677
2003	56,930	10,996	0	394	0	68,320
2004	62,526	4,110	0	230	0	66,866
2005	91,534	180,249	0	133	87	272,003
2006	84,002	174,542	0	333	0	258,877
2007	101,221	90,677	0	173	0	192,071
2008	89,357	119,265	0	181	0	208,803
2009	66,119	25,876	0	78	0	92,073
2010	68,645	2,550	0	3,209	0	74,404
2011	80,202	238,979	0	347	0	319,528
2012	99,309	289,692	0	410	166	389,577
2013	113,384	238,051	0	383	121	351,939
2014	92,529	115,599	0	278	30	208,436

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Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales [e]	Yukon Area total
2015	86,600	191,470	0	80	50	278,200
2016	84,650 [k]	465,511	0	283 [k]	668	550,997
2017	85,093 [k]	489,702	0	626 [k]	1,246	576,667
2018	64,494 [k]	387,788	0	514 [k]	874	453,670
Averages						
1961–2017	104,455	170,272	3,313	1,364	2,348	258,757
2008–2017	86,589	217,670	0	588	228	305,062
2013–2017	92,451	300,067	0	330	423	393,248
Minimum-17	19,395	2,550	0	0	0	19,396
Maximum-17	342,819	489,702	32,324	19,066	27,663	654,976

Note: Minimum and maximum indicate year with the lowest and highest values through 2017.

[a] Includes test fish harvest and commercial retained fish (not sold) that were utilized for subsistence. Beginning 2017, this report includes harvest from the Coastal District communities of Scammon Bay and Hooper Bay even though not all stocks are bound for the Yukon River. Coastal District harvest information is included in the following years: 1978, 1987–1989 and 1992–present.

[b] Includes fish sold in the round and estimated numbers of female salmon commercially harvested for production of salmon roe (see Bergstrom et al. 1992). Includes ADF&G test fish prior to 1988. Beginning in 1999, commercial harvest may include some commercial related harvest.

[c] Includes an estimate of number of salmon harvested for the commercial production of salmon roe and the carcasses used for subsistence. In prior JTC reports, subsistence plus commercial related harvests are noted as subsistence "use".

[d] Prior to 1987, and in 1991, 1992 and 1994 personal use was considered part of subsistence.

[e] Test fish sales is the number of salmon sold by ADF&G test fisheries.

[f] Catches estimated because harvests of species other than Chinook salmon were not differentiated.

[g] Minimum estimates from 1961–1978 because subsistence surveys were conducted prior to the end of the fishing season.

[h] Includes an estimated 95,768 and 119,168 fall chum salmon illegally sold in Districts 5 (Yukon River) and 6 (Tanana River), respectively.

[i] Commercial fishery was not conducted.

[j] Commercial fishery operated only in District 6, the Tanana River.

[k] Data are preliminary; particularly not yet published Alaska subsistence harvest data from 2016 and 2018.

Appendix B5.–Alaska harvest of Yukon River coho salmon, 1961–2018.

Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales [e]	Sport fish [f]	Yukon Area total
1961	9,192 [g, h]	2,855	0				12,047
1962	9,480 [g, h]	22,926	0				32,406
1963	27,699 [g, h]	5,572	0				33,271
1964	12,187 [g, h]	2,446	0				14,633
1965	11,789 [g, h]	350	0				12,139
1966	13,192 [g, h]	19,254	0				32,446
1967	17,164 [g, h]	11,047	0				28,211
1968	11,613 [g, h]	13,303	0				24,916
1969	7,776 [g, h]	15,093	0				22,869
1970	3,966 [g, h]	13,188	0				17,154
1971	16,912 [g, h]	12,203	0				29,115
1972	7,532 [g, h]	22,233	0				29,765
1973	10,236 [g, h]	36,641	0				46,877
1974	11,646 [g, h]	16,777	0				28,423
1975	20,708 [g, h]	2,546	0				23,254
1976	5,241 [g, h]	5,184	0				10,425
1977	16,333 [h]	38,863	0			112	55,308
1978	7,787 [h]	26,152	0			302	34,241
1979	9,794	17,165	0			50	27,009
1980	20,158	8,745	0			67	28,970
1981	21,228	23,680	0			45	44,953
1982	35,894	37,176	0			97	73,167
1983	23,905	13,320	0			199	37,424
1984	49,020	81,940	0			831	131,791
1985	32,264	57,672	0			808	90,744
1986	34,468	47,255	0			1,535	83,258
1987	82,371 [i]	[j]		2,523		1,292	86,186

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Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales [e]	Sport fish [f]	Yukon Area total
1988	69,679	99,907	0	1,250	13,720	2,420	186,976
1989	40,924	85,493	0	872	3,945	1,811	133,045
1990	43,460	41,032	3,255	1,181	2,650	1,947	93,525
1991	37,388	103,180	3,506	0	2,971	2,775	149,820
1992	51,980	6,556 [k]	1,423	0	1,629	1,666	63,254
1993	15,812	[j]		0	0	897	16,709
1994	41,775	120	4,331	0	0	2,174	48,400
1995	28,377	45,939	1,074	417	193	1,278	77,278
1996	30,404	52,643	3,339	198	1,728	1,588	89,900
1997	23,945	35,320	0	350	498	1,470	61,583
1998	18,121	1	0	9	0	758	18,889
1999	20,891	1,601	0	147	236	609	23,484
2000	14,939	[j]		0	0	554	15,493
2001	22,122	[j]		34	0	1,248	23,404
2002	15,489	[j]		20	0	1,092	16,601
2003	23,872	25,243	0	549	0	1,477	51,141
2004	20,795	20,232	0	233	0	1,623	42,883
2005	27,250	58,311	0	107	0	627	86,295
2006	19,706	64,942	0	279	0	1,000	85,927
2007	19,624	44,575	0	135	0	597	64,931
2008	16,855	35,691	0	50	0	341	52,937
2009	16,006	8,311	0	70	0	964	25,351
2010	13,045	3,750	0	1,062	0	944	18,801
2011	12,344	76,303	0	232	0	463	89,342
2012	21,533	74,789	0	100	39	131	96,592
2013	14,457	66,199	0	109	1	266	81,032
2014	17,098	104,692	0	174	0	1,855	123,819

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Year	Subsistence [a]	Commercial [b]	Commercial related [c]	Personal use [d]	Test fish sales [e]	Sport fish [f]	Yukon Area total
2015	18,107	129,700	0	145	8	593	148,553
2016	8,822 [l]	201,482	0	266 [l]	11	670	211,251
2017	7,313 [l]	139,915	0	200 [l]	63	291	147,782
2018	5,527 [l]	110,587	0	131 [l]	48	- [m]	116,293
Averages							
1961–2017	22,135	39,991	326	346	923	963	60,281
2008–2017	14,558	84,083	0	241	12	652	99,546
2013–2017	13,159	128,398	0	179	17	735	142,487
Minimum-17	3,966	1	0	0	0	45	10,425
Maximum-17	82,371	201,482	4,331	2,523	13,720	2,775	211,251

Note: Minimum and maximum indicate year with the lowest and highest values through 2017.

[a] Includes test fish harvest and commercial retained fish (not sold) that were utilized for subsistence. Beginning 2017, this report includes harvest from the Coastal District communities of Scammon Bay and Hooper Bay even though not all stocks are bound for the Yukon River. Coastal District harvest information is included in the following years: 1978, 1987–1989 and 1992–present.

[b] Includes fish sold in the round and estimated numbers of female salmon commercially harvested for production of salmon roe (see Bergstrom et al. 1992: 1990 Yukon Area Annual Management Report). Includes ADF&G test fish prior to 1988. Beginning in 1999, commercial harvest may include some commercial related harvest.

[c] Includes an estimate of number of salmon harvested for the commercial production of salmon roe and the carcasses used for subsistence.

[d] Prior to 1987, and in 1991, 1992 and 1994 personal use was considered part of subsistence.

[e] Test fish sales is the number of salmon sold by ADF&G test fisheries.

[f] The majority of the sport fish harvest is taken in the Tanana River drainage.

[g] Catches estimated because harvests of species other than Chinook salmon were not differentiated.

[h] Minimum estimates from 1961–1978 because subsistence surveys were conducted prior to the end of the fishing season.

[i] Includes an estimated 5,015 and 31,276 coho salmon illegally sold in Districts 5 (Yukon River) and 6 (Tanana River), respectively.

[j] Commercial fishery was not conducted.

[k] Commercial fishery operated only in District 6, the Tanana River.

[l] Data are preliminary; particularly not yet published Alaska subsistence harvest data from 2016 and 2018.

[m] Data are unavailable at this time.

Appendix B6.–Alaska and Canadian total utilization of Yukon River Chinook and fall chum salmon, 1961–2018.

	Chinook salmon			Fall chum salmon		
Year	Canada [a]	Alaska [b, c]	Total	Canada [a]	Alaska [b, c]	Total
1961	13,246	141,152	154,398	9,076	144,233	153,309
1962	13,937	105,844	119,781	9,436	140,401	149,837
1963	10,077	141,910	151,987	27,696	99,031 [d]	126,727
1964	7,408	109,818	117,226	12,187	128,707	140,894
1965	5,380	134,706	140,086	11,789	135,600	147,389
1966	4,452	104,887	109,339	13,192	122,548	135,740
1967	5,150	146,104	151,254	16,961	107,018	123,979
1968	5,042	118,632	123,674	11,633	97,552	109,185
1969	2,624	105,027	107,651	7,776	183,373	191,149
1970	4,663	93,019	97,682	3,711	265,096	268,807
1971	6,447	136,191	142,638	16,911	246,756	263,667
1972	5,729	113,098	118,827	7,532	188,178	195,710
1973	4,522	99,670	104,192	10,135	285,760	295,895
1974	5,631	118,053	123,684	11,646	383,552	395,198
1975	6,000	76,705	82,705	20,600	361,600	382,200
1976	5,025	105,582	110,607	5,200	228,717	233,917
1977	7,527	114,494	122,021	12,479	340,757	353,236
1978	5,881	130,476	136,357	9,566	331,250	340,816
1979	10,375	159,232	169,607	22,084	593,293	615,377
1980	22,846	197,665	220,511	22,218	466,087	488,305
1981	18,109	188,477	206,586	22,281	654,976	677,257
1982	17,208	152,808	170,016	16,091	357,084	373,175
1983	18,952	198,436	217,388	29,490	495,526	525,016
1984	16,795	162,683	179,478	29,267	383,055	412,322
1985	19,301	187,327	206,628	41,265	474,216	515,481
1986	20,364	146,004	166,368	14,543	303,485	318,028
1987	17,614	188,386	206,000	44,480	361,885 [d]	406,365
1988	21,427	150,009	171,436	33,565	322,382	355,947
1989	17,944	157,632	175,576	23,020	522,302	545,322
1990	19,227	149,433	168,660	33,622	318,642	352,264
1991	20,607	154,651	175,258	35,418	403,678	439,096
1992	17,903	169,642	187,545	20,815	128,237 [e]	149,052
1993	16,611	161,718	178,329	14,090	77,045 [d]	91,135
1994	21,198	171,654	192,852	38,008	131,564	169,572
1995	20,884	179,748	200,632	45,600	415,934	461,534
1996	19,612	141,649	161,261	24,354	236,961	261,315
1997	16,528	176,025	192,553	15,600	154,479	170,079
1998	5,937	99,760	105,697	7,954	62,903	70,857
1999	12,468	125,427	137,895	19,636	111,744	131,380

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	Chinook salmon			Fall chum salmon		
Year	Canada [a]	Alaska [b, c]	Total	Canada [a]	Alaska [b, c]	Total
2000	4,879	45,867	50,746	9,246	19,396 [d]	28,642
2001	10,144	56,620 [f]	66,764	9,872	35,713 [d]	45,585
2002	9,258	69,240	78,498	8,092	19,677 [d]	27,769
2003	9,619	101,000	110,619	10,905	68,320	79,225
2004	11,238	114,370	125,608	9,750	66,866	76,616
2005	11,371	86,369	97,740	18,572	272,003	290,575
2006	9,072	96,067	105,139	11,796	258,877	270,673
2007	5,094	90,753	95,847	13,830	192,071	205,901
2008	3,713	50,362	54,075	9,566	208,803	218,369
2009	4,758	35,111	39,869	2,011	92,073	94,084
2010	2,706	55,092	57,798	5,787	74,404	80,191
2011	4,884	41,625	46,509	8,163	319,528	327,691
2012	2,200	30,831	33,031	7,023	389,577	396,600
2013	2,146	12,741	14,887	6,170	351,939	358,109
2014	103	3,287	3,390	5,033	208,436	213,469
2015	1,204	7,595	8,799	4,453	278,200	282,653
2016	2,946	21,704	24,650	5,750	550,997	556,747
2017 [g]	3,631	38,411	42,042	5,716	576,667	582,383
2018 [g]	3,098	32,013	35,111	4,831	453,670	458,501
Averages						
1961–2017	10,344	113,522	123,867	16,187	258,757	274,944
2008–2017	2,829	29,676	32,505	5,967	305,062	311,030
2013–2017	2,006	16,748	18,754	5,424	393,248	398,672
Minimum-17	103	3,287	3,390	2,011	19,396	27,769
Maximum-17	22,846	198,436	220,511	45,600	654,976	677,257

Note: Minimum and maximum indicate year with the lowest and highest values through 2017. Canadian managers sometimes do not refer to chum as fall chum salmon because they only have 1 chum salmon run.

[a] Catches in number of salmon. Includes commercial, Aboriginal, domestic, and sport catches combined.

[b] Catch in number of salmon. Includes estimated number of salmon harvested for the commercial production of salmon roe (see Bergstrom et al. 1992: 1990 Yukon Area Annual Management Report).

[c] Commercial, subsistence, personal-use, test fish, and sport catches combined. Beginning 2017, includes harvest from the Coastal District communities of Scammon Bay and Hooper Bay even though not all stocks are bound for the Yukon River. Coastal District harvest information is included in the following years: 1978, 1987–1989 and 1992–present.

[d] Commercial fishery did not operate within the Alaska portion of the drainage.

[e] Commercial fishery operated only in District 6, the Tanana River.

[f] No commercial fishery was conducted during the summer season.

[g] Data are preliminary.

Appendix B7.–Canadian harvest of Yukon River Chinook salmon, 1961–2018.

	Mainstem Yukon River harvest							Porcupine River	
Year	Commercial	Domestic	Aboriginal fishery	Recreational [a]	Test fishery	Combined non-commercial	Total	Aboriginal fishery harvest	Total Canadian harvest
1961	3,446		9,300			9,300	12,746	500	13,246
1962	4,037		9,300			9,300	13,337	600	13,937
1963	2,283		7,750			7,750	10,033	44	10,077
1964	3,208		4,124			4,124	7,332	76	7,408
1965	2,265		3,021			3,021	5,286	94	5,380
1966	1,942		2,445			2,445	4,387	65	4,452
1967	2,187		2,920			2,920	5,107	43	5,150
1968	2,212		2,800			2,800	5,012	30	5,042
1969	1,640		957			957	2,597	27	2,624
1970	2,611		2,044			2,044	4,655	8	4,663
1971	3,178		3,260			3,260	6,438	9	6,447
1972	1,769		3,960			3,960	5,729		5,729
1973	2,199		2,319			2,319	4,518	4	4,522
1974	1,808	406	3,342			3,748	5,556	75	5,631
1975	3,000	400	2,500			2,900	5,900	100	6,000
1976	3,500	500	1,000			1,500	5,000	25	5,025
1977	4,720	531	2,247			2,778	7,498	29	7,527
1978	2,975	421	2,485			2,906	5,881		5,881
1979	6,175	1,200	3,000			4,200	10,375		10,375
1980	9,500	3,500	7,546	300		11,346	20,846	2,000	22,846
1981	8,593	237	8,879	300		9,416	18,009	100	18,109
1982	8,640	435	7,433	300		8,168	16,808	400	17,208
1983	13,027	400	5,025	300		5,725	18,752	200	18,952
1984	9,885	260	5,850	300		6,410	16,295	500	16,795
1985	12,573	478	5,800	300		6,578	19,151	150	19,301
1986	10,797	342	8,625	300		9,267	20,064	300	20,364
1987	10,864	330	6,069	300		6,699	17,563	51	17,614
1988	13,217	282	7,178	650		8,110	21,327	100	21,427
1989	9,789	400	6,930	300		7,630	17,419	525	17,944
1990	11,324	247	7,109	300		7,656	18,980	247	19,227
1991	10,906	227	9,011	300		9,538	20,444	163	20,607
1992	10,877	277	6,349	300		6,926	17,803	100	17,903

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Year	Mainstem Yukon River harvest							Porcupine River Aboriginal fishery harvest	Total Canadian harvest
	Commercial	Domestic	Aboriginal fishery	Recreational [a]	Test fishery	Combined non-commercial	Total		
1993	10,350	243	5,576	300		6,119	16,469	142	16,611
1994	12,028	373	8,069	300		8,742	20,770	428	21,198
1995	11,146	300	7,942	700		8,942	20,088	796	20,884
1996	10,164	141	8,451	790		9,382	19,546	66	19,612
1997	5,311	288	8,888	1,230		10,406	15,717	811	16,528
1998	390	24	4,687	-	737	5,448	5,838	99	5,937
1999	3,160	213	8,804	177		9,194	12,354	114	12,468
2000	-	-	4,068	-	761	4,829	4,829	50	4,879
2001	1,351	89	7,421	146	767	8,423	9,774	370	10,144
2002	708	59	7,139	128	1,036	8,362	9,070	188	9,258
2003	2,672	115	6,121	275	263	6,774	9,446	173	9,619
2004	3,785	88	6,483	423	167	7,161	10,946	292	11,238
2005	4,066	99	6,376	436		6,911	10,977	394	11,371
2006	2,332	63	5,757	606		6,426	8,758	314	9,072
2007	-	-	4,175	2 [b]	617	4,794	4,794	300	5,094
2008	1 [c]	-	2,885	-	513	3,398	3,399	314	3,713
2009	364	17	3,791	125	-	3,933	4,297	461	4,758
2010	-	-	2,455 [d]	1 [e]	-	2,456	2,456	250	2,706
2011	4 [c]	-	4,550 [d]	40	-	4,590	4,594	290	4,884
2012	-	-	2,000 [d]	-	-	2,000	2,000	200	2,200
2013	2 [c]	-	1,902 [d]	-	-	1,902	1,904	242	2,146
2014	-	-	100	-	-	100	100	3	103
2015	-	-	1,000	-	-	1,000	1,000	204	1,204
2016	1 [c]	-	2,768	-	-	2,768	2,769	177	2,946
2017	-	-	3,500	-	-	3,500	3,500	131	3,631
2018	1 [c]	-	2,789	-	-	2,789	2,790	308	3,098
Averages									
1961–2017	5,717 [f]	393	5,009	342 [f]	608	5,496	10,110	249	10,219
2008–2017	364 [f]	17	2,495	55	565	2,694	2,731	244	2,975
2013–2017	-	-	1,854	-	-	1,854	1,855	151	2,006
Minimum-17	1	17	100	1	167	100	100	3	103
Maximum-17	13,217	3,500	9,300	1,230	1,036	11,346	21,327	2,000	22,846

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Note: Minimum and maximum indicate year with the lowest and highest values through 2017. Dash indicates fishery did not occur.

[a] Recreational harvest unknown before 1980.

[b] Recreational fishery involved non-retention of Chinook salmon for most of the season thus effectively closed.

[c] Closed during Chinook salmon season, harvested in chum salmon fishery.

[d] Adjusted to account for underreporting.

[e] Fishery was closed, 1 fish mistakenly caught and retained.

[f] Excluding years when no directed fishery occurred.

Appendix B8.–Canadian harvest of Yukon River fall chum salmon, 1961–2018.

	Mainstem Yukon River harvest						Porcupine River	
Year	Commercial	Domestic	Aboriginal fishery	Test fishery	Combined non-commercial [a]	Total [a]	Aboriginal fishery harvest	Total Canadian harvest
1961	3,276		3,800		3,800	7,076	2,000	9,076
1962	936		6,500		6,500	7,436	2,000	9,436
1963	2,196		5,500		5,500	7,696	20,000	27,696
1964	1,929		4,200		4,200	6,129	6,058	12,187
1965	2,071		2,183		2,183	4,254	7,535	11,789
1966	3,157		1,430		1,430	4,587	8,605	13,192
1967	3,343		1,850		1,850	5,193	11,768	16,961
1968	453		1,180		1,180	1,633	10,000	11,633
1969	2,279		2,120		2,120	4,399	3,377	7,776
1970	2,479		612		612	3,091	620	3,711
1971	1,761		150		150	1,911	15,000	16,911
1972	2,532				0	2,532	5,000	7,532
1973	2,806		1,129		1,129	3,935	6,200	10,135
1974	2,544	466	1,636		2,102	4,646	7,000	11,646
1975	2,500	4,600	2,500		7,100	9,600	11,000	20,600
1976	1,000	1,000	100		1,100	2,100	3,100	5,200
1977	3,990	1,499	1,430		2,929	6,919	5,560	12,479
1978	3,356	728	482		1,210	4,566	5,000	9,566
1979	9,084	2,000	11,000		13,000	22,084		22,084
1980	9,000	4,000	3,218		7,218	16,218	6,000	22,218
1981	15,260	1,611	2,410		4,021	19,281	3,000	22,281
1982	11,312	683	3,096		3,779	15,091	1,000	16,091
1983	25,990	300	1,200		1,500	27,490	2,000	29,490
1984	22,932	535	1,800		2,335	25,267	4,000	29,267
1985	35,746	279	1,740		2,019	37,765	3,500	41,265
1986	11,464	222	2,200		2,422	13,886	657	14,543
1987	40,591	132	3,622		3,754	44,345	135	44,480
1988	30,263	349	1,882		2,231	32,494	1,071	33,565
1989	17,549	100	2,462		2,562	20,111	2,909	23,020
1990	27,537	0	3,675		3,675	31,212	2,410	33,622
1991	31,404	0	2,438		2,438	33,842	1,576	35,418
1992	18,576	0	304		304	18,880	1,935	20,815
1993	7,762	0	4,660		4,660	12,422	1,668	14,090

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	Mainstem Yukon River harvest						Porcupine River Aboriginal fishery harvest	Total Canadian harvest
Year	Commercial	Domestic	Aboriginal fishery	Test fishery	Combined non-commercial [a]	Total [a]		
1994	30,035	0	5,319		5,319	35,354	2,654	38,008
1995	39,012	0	1,099		1,099	40,111	5,489	45,600
1996	20,069	0	1,260		1,260	21,329	3,025	24,354
1997	8,068	0	1,238		1,238	9,306	6,294	15,600
1998 [b]	-		1,795		1,795	1,795	6,159	7,954
1999	10,402	0	3,234		3,234	13,636	6,000	19,636
2000	1,319	0	2,927		2,927	4,246	5,000	9,246
2001	2,198	3	3,077	1 [b]	3,080	5,278	4,594	9,872
2002	3,065	0	3,167	2,756 [b]	3,167	6,232	1,860	8,092
2003	9,030	0	1,493	990 [b]	1,493	10,523	382	10,905
2004	7,365	0	2,180	995 [b]	2,180	9,545	205	9,750
2005	11,931	13	2,035		2,048	13,979	4,593	18,572
2006	4,096	0	2,521		2,521	6,617	5,179	11,796
2007	7,109	0	2,221	3,765 [b]	2,221	9,330	4,500	13,830
2008	4,062	0	2,068		2,068	6,130	3,436	9,566
2009	293	0	820		820	1,113	898	2,011
2010	2,186	0	1,523 [c]		1,523	3,709	2,078	5,787
2011	5,312	0	1,000 [c]		1,000	6,312	1,851	8,163
2012	3,205	0	700 [c]		700	3,905	3,118	7,023
2013	3,369	18	500 [c]		518	3,887	2,283	6,170
2014	2,485	19	546		565	3,050	1,983	5,033
2015	2,862	35	1,000 [c]		1,035	3,897	556	4,453
2016	1,745	0	1,000 [c]		1,000	2,745	3,005	5,750
2017	2,404	0	1,000 [c]		1,000	3,404	2,312	5,716
2018	1,957	0	1,000 [c]		1,000	2,957	1,874	4,831
Averages								
1961–2017	9,620	423	2,254	1,468	2,541	11,992	4,270	16,187
2008–2017	2,792	7	1,016	3,765	1,023	3,815	2,152	5,967
2013–2017	2,573	14	809	-	824	3,397	2,028	5,424
Minimum-17	293	0	100	1	0	1,113	135	2,011
Maximum-17	40,591	4,600	11,000	3,765	13,000	44,345	20,000	45,600

Note: Minimum and maximum indicate year with the lowest and highest values through 2017. Dash "-" indicates fishery did not occur. NA indicates a value cannot be calculated.

[a] Test fishery was not included in totals as it was live release.

[b] The chum salmon test fishery practiced live-release. Not included in the annual totals.

[c] Adjusted to account for underreporting.

Appendix B9.–Chinook salmon aerial survey indices for selected spawning areas in the U.S. (Alaska) portion of the Yukon River drainage, 1961–2018.

	Andreafsky River		Anvik River		Nulato River			Gisasa River
Year	East Fork	West Fork	Drainagewide total	Index area [a]	North Fork [b]	South Fork	Both forks	
1961	1,003		1,226		376 [c]	167	543	266 [c]
1962	675 [c]	762 [c]						
1963								
1964	867	705						
1965		355 [c]	650 [c]					
1966	361	303	638					
1967		276 [c]	336 [c]					
1968	380	383	310 [c]					
1969	231 [c]	231 [c]	296 [c]					
1970	665	574 [c]	368					
1971	1,904	1,682						
1972	798	582 [c]	1,198					
1973	825	788	613					
1974		285	471 [c]		55 [c]	23 [c]	78 [c]	161
1975	993	301	730		123	81	204	385
1976	818	643	1,053		471	177	648	332
1977	2,008	1,499	1,371		286	201	487	255
1978	2,487	1,062	1,324		498	422	920	45 [c]
1979	1,180	1,134	1,484		1,093	414	1,507	484
1980	958 [c]	1,500	1,330	1,192	954 [c]	369 [c]	1,323 [c]	951
1981	2,146 [c]	231 [c]	807 [c]	577 [c]		791	791	
1982	1,274	851						421
1983			653 [c]	376 [c]	526	480	1,006	572
1984	1,573 [c]	1,993	641 [c]	574 [c]				
1985	1,617	2,248	1,051	720	1,600	1,180	2,780	735
1986	1,954	3,158	1,118	918	1,452	1,522	2,974	1,346
1987	1,608	3,281	1,174	879	1,145	493	1,638	731
1988	1,020	1,448	1,805	1,449	1,061	714	1,775	797
1989	1,399	1,089	442 [c]	212 [c]				
1990	2,503	1,545	2,347	1,595	568 [c]	430 [c]	998 [c]	884 [c]
1991	1,938	2,544	875 [c]	625 [c]	767	1,253	2,020	1,690
1992	1,030 [c]	2,002 [c]	1,536	931	348	231	579	910
1993	5,855	2,765	1,720	1,526	1,844	1,181	3,025	1,573
1994	300 [c]	213 [c]		913 [c]	843	952	1,795	2,775
1995	1,635	1,108	1,996	1,147	968	681	1,649	410
1996		624	839	709		100	100	
1997	1,140	1,510	3,979	2,690				144 [c]
1998	1,027	1,249 [c]	709 [c]	648 [c]	507	546	1,053	889 [c]

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Year	Andreafsky River East Fork	Andreafsky River West Fork	Anvik River Drainagewide total	Anvik River Index area [a]	Nulato River North Fork [b]	Nulato River South Fork	Nulato River Both forks	Gisasa River
1999		870 [c]	950 [c]	950 [c]	[c]	[c]		[c]
2000	1,018		1,721	1,394	[c]	[c]		[c]
2001	1,059	565	1,420	1,177	1,116	768	1,884 [d]	1,298 [c]
2002	1,447	917	1,713	1,329	687	897	1,584	506
2003	1,116 [c]	1,578	973 [c]	973 [c]	[c]	[c]		
2004	2,879	1,317	3,679	3,304	856	465	1,321	731
2005	1,715	1,492	2,421	1,922	323	230	553	958
2006	591 [c]	824	1,886	1,776 [e]	620	672	1,292	843
2007	1,758	976	1,529	1,497	1,928	1078	2,583	593
2008	278 [c]	262 [c]	992 [c]	827 [c]	463	543	922	487
2009	84 [c]	1,678	832	590	1,418	842	2,260	515
2010	537 [c]	858	974	721	356	355	711	264
2011	620	1,173	642	501	788	613	1,401	906
2012		227 [c]	722	451	682	692	1,374	[c]
2013	1,441	1,094	940	656	586	532	1,118	201 [c]
2014		1,695	1,584	800	[c]	[c]	[c]	[c]
2015	2,167	1,356	2,616	1,726	999	565	1,564	558
2016	[f]	[f]	[f]	[f]	[f]	[f]	[f]	[f]
2017	[f]	942	1,101	894	500	443	943	[f]
2018	3,972	455	[f]	1,109 [c]			870	[f]
SEG [g]	[h]	640-1,600	1,100-1,700				940-1,900	[i]
Averages								
1961–2017	1,324	1,134	1,208	1,094	788	574	1,327	718
2008–2017	984	1,035	1,203	863	872	630	1,492	503
2013–2017	1,804	1,092	1,466	908	756	596	1,352	380
Minimum-17	84	213	222	212	55	23	78	45
Maximum-17	5,855	3,281	3,979	3,304	1,844	1,522	3,025	2,775

Note: Aerial survey counts are peak counts only. Survey rating was fair or good unless otherwise noted. Minimum and maximum indicate year with the lowest and highest values through 2017.

[a] Anvik River Index Area includes mainstem counts between Beaver Creek and McDonald Creek.

[b] Nulato River mainstem aerial survey counts below the forks are included with the North Fork.

[c] Incomplete, poor timing and/or poor survey conditions resulting in minimal, inaccurate, or no counts.

[d] In 2001, the Nulato River escapement goal was established for both forks combined.

[e] The count represents the index area and an additional 8 river miles downstream of Yellow River confluence.

[f] No surveys conducted.

[g] Sustainable escapement goal.

[h] Aerial escapement goal for Andreafsky River was discontinued in 2010. Note: weir-based goal replaced East Fork Andreafsky River aerial survey goal.

[i] Gisasa River aerial escapement goal was discontinued in 2010.

Appendix B10.–Chinook salmon escapement counts and percentage females counted for selected spawning areas in the U.S. (Alaska) portion of the Yukon River drainage, 1986–2018.

	East Fork Andreafsky River weir		Nulato River tower	Henshaw Creek weir		Gisasa River weir		Chena River tower		Salcha River tower	
Year	No. fish	% Fem.	No. fish	No. fish	% Fem.	No. fish	% Fem.	No. fish	% Fem. [a]	No. fish	% Fem. [a]
1986	1,530	28.8 [b]	-	-	-	-	-	9,065 [c]	25.4	-	35.0
1987	2,011	52.6 [b]	-	-	-	-	-	6,404 [c]	58.0	4,771 [c]	62.8
1988	1,341	42.3 [b]	-	-	-	-	-	3,346 [c]	61.2	4,322 [c]	39.6
1989	-	4.8	-	-	-	-	-	2,730 [c]	64.9	3,294 [c]	61.9
1990	-	38.5	-	-	-	-	-	5,603 [c]	46.9	10,728 [c]	46.7
1991	-	27.6	-	-	-	-	-	3,172 [c]	31.7	5,608 [c]	47.3
1992	-	26.1	-	-	-	-	-	5,580 [c]	37.8	7,862 [c]	34.3
1993	-	29.4	-	-	-	-	-	12,241	16.7	10,008	27.7
1994	7,801	35.5	1,795	-	-	2,888	-	11,877	45.1	18,404	44.7
1995	5,841	42.2	1,412	-	-	4,023	46.0	11,394 [c]	65.9	13,643	55.9
1996	2,955	42.1	756	-	-	1,991	19.5	7,153 [c]	43.9	7,570 [c]	50.7
1997	3,186	36.8	4,766	-	-	3,764	26.0	13,390	39.6	18,514	50.0
1998	4,034	28.8	1,536	-	-	2,414	16.2	4,745	41.2	5,027	30.1
1999	3,444	28.6	1,932	-	-	2,644	26.3	6,485	65.5	9,198	54.7
2000	1,609	32.3	908	193	29.7	2,089	33.8	4,694 [c]	25.9	4,595	43.9
2001	1,148	63.7	-	1,091	36.3	3,052	49.2	9,696	42.5	13,328	37.5
2002	4,123	21.1 [d]	2,696	649	30.8	2,025	20.7	6,967 [c]	31.9	9,000 [e]	34.8
2003	4,336	47.7	1,716 [f]	748	39.1	1,901	38.1	11,100	44.9	15,500 [e]	42.4
2004	8,045	34.8	-	1,248	23.2	1,774	33.5	9,645	63.2	15,761	63.2
2005	2,239	49.9	-	1,059	41.7	3,111	36.2	- [d]	42.3	5,988	54.3

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Year	Andreafsky River weir		Nulato River tower	Henshaw Creek weir		Gisasa River weir		Chena River tower		Salcha River tower	
	No. fish	% Fem.	No. fish	No. fish	% Fem.	No. fish	% Fem.	No. fish	% Fem.	No. fish	% Fem.
2006	6,463	43.6	-	-	- [d]	3,031	29.4	2,936	46.0	10,679	43.4
2007	4,504	44.5	-	740	42.6	1,427	41.1	3,806	40.0	6,425	35.7
2008	4,242	38.9	-	766	26.9	1,738	15.2	3,208	44.4	5,415 [e]	39.3
2009	3,004	47.2	-	1,637	53.7	1,955	28.0	5,253	55.0	12,774	39.1
2010	2,413	48.7	-	857	48.8	1,516	29.9	2,382	30.9	6,135	32.6
2011	5,213	19.9	-	1,796	33.6	2,692	18.8	- [d]	31.8	7,200 [e]	42.1
2012	2,517	27.4	-	922	42.9	1,323	38.7	2,220 [g]	55.8	7,165	59.8
2013	1,998	39.4	-	772	46.7	1,126	34.3	1,859 [d]	40.3	5,465	50.3
2014	5,949	47.9	-	-	- [d]	1,589	19.2	7,192 [h]	32.9	- [d]	32.0
2015	5,474	39.7	-	2,391	41.4	1,319	29.6	6,294	55.3	6,288 [i]	42.9
2016	2,676	49.4	-	1,354	47.5	1,395	27.2	6,665 [i]	22.8	2,675 [i]	38.9
2017	2,970	25.9	-	677	41.8	1,083	27.8	4,201 [i]	45.2	4,195 [i]	41.2
2018 [j]	4,114	24.9	-	-	- [d]	-	-	4,227	54.8	4,053	56.0
SEG [k]	2,100–4,900										
BEG [l]								2,800–5,700		3,300–6,500	
Averages											
1986–2017	3,743	37.1	1,946	1,056	39.2	2,161	29.8	6,377	43.6	8,585	44.2
2008–2017	3,646	38.5	-	1,241	42.6	1,574	26.9	4,364	41.4	6,368	41.8
2013–2017	3,813	40.5	-	1,299	44.4	1,302	27.6	5,242	39.3	4,656	41.1
Minimum-17	1,148	4.8	756	193	23.2	1,083	15.2	1,859	16.7	2,675	27.7
Maximum-17	8,045	63.7	4,766	2,391	53.7	4,023	49.2	13,390	65.9	18,514	63.2

Note: Minimum and maximum indicate year with the lowest and highest values through 2017. No. = number; Fem. = female. Dashes indicate a value cannot be calculated.

[a] Adjustment factor was applied.

[b] Tower counts.

[c] Mark–recapture population estimate.

[d] Project operations were hindered by high water most of the season.

[e] Estimate includes an expansion for missed counting days based on average run timing.

[f] Weir count.

[g] Estimated includes an expansion for missed counting days based on using 2 DIDSON sonars to assess Chinook salmon passage.

[h] Due to high water, DIDSON sonar was used and preliminary species apportionment was estimated using average run timing.

[i] Final estimate uses a binomial mixed-effects model to create passage estimates for periods of missed counts.

[j] Preliminary.

[k] Sustainable escapement goal (SEG).

[l] Biological escapement goal (BEG).

Appendix B11.–Estimated spawning escapement of Canadian-origin Yukon River mainstem Chinook salmon, 1982–2018.

Year	Historic mark-recapture border passage estimate [a]	Eagle sonar estimate	U.S. harvest above Eagle sonar [b]	Canadian mainstem border passage estimate		Canadian mainstem harvest	Spawning escapement estimate [c]
1982	36,598			60,346	[d]	16,808	43,538
1983	47,741			63,227	[d]	18,752	44,475
1984	43,911			66,300	[d]	16,295	50,005
1985	29,881			59,586	[d]	19,151	40,435
1986	36,479			61,489	[d]	20,064	41,425
1987	30,823			58,870	[d]	17,563	41,307
1988	44,445			61,026	[d]	21,327	39,699
1989	42,620			77,718	[d]	17,419	60,299
1990	56,679			78,192	[d]	18,980	59,212
1991	41,187			63,172	[d]	20,444	42,728
1992	43,185			56,958	[d]	17,803	39,155
1993	45,027			52,713	[d]	16,469	36,244
1994	46,680			77,219	[d]	20,770	56,449
1995	52,353			70,761	[d]	20,088	50,673
1996	47,955			93,606	[d]	19,546	74,060
1997	53,400			69,538	[d]	15,717	53,821
1998	22,588			41,335	[d]	5,838	35,497
1999	23,716			49,538	[d]	12,354	37,184
2000	16,173			30,699	[d]	4,829	25,870
2001	52,207			62,333	[d]	9,774	52,559
2002	49,214			51,428	[e]	9,070	42,358
2003	56,929			90,037	[e]	9,446	80,591
2004	48,111			59,415	[e]	10,946	48,469
2005	42,245	81,528	2,566	78,962	[f]	10,977	67,985
2006	36,748	73,691	2,303	71,388	[f]	8,758	62,630
2007	22,120	41,697	1,999	39,698	[f]	4,794	34,904
2008	14,666	38,097	815	37,282	[f]	3,399	33,883

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Year	Historic mark-recapture border passage estimate [a]	Eagle sonar estimate	U.S. harvest above Eagle sonar [b]	Canadian mainstem border passage estimate	Canadian mainstem harvest	Spawning escapement estimate [c]
2009	-	69,957	382	69,575 [f]	4,297	65,278
2010	-	35,074	604	34,470 [f]	2,456	32,014
2011	-	51,271	370	50,901 [f]	4,594	46,307
2012	-	34,747	91	34,656 [f]	2,000	32,656
2013	-	30,725	152	30,573 [f]	1,904	28,669
2014	-	63,482	51	63,431 [f]	100	63,331
2015	-	84,015	341	83,674 [f]	1,000	82,674
2016	-	72,329	762	71,567 [f]	2,769	68,798
2017	-	73,313	1,498	71,815 [f]	3,500	68,315
2018	-	57,893	629	57,264 [f]	2,790	54,474
Averages						
1971–2017	40,136	57,687	918	60,931	11,389	49,542
2008–2017	-	55,301	507	54,794	2,602	52,193
2013–2017	-	64,773	561	64,212	1,855	62,357
Minimum-17	14,666	30,725	51	30,573	100	25,870
Maximum-17	56,929	84,015	2,566	93,606	21,327	82,674

Note: Minimums and maximum indicate the lowest and highest values for each year presented through 2017.

[a] From 1982–2008, a mark–recapture program was used to determine border passage; fish were sampled and tagged near the border using fish wheels and sampled for marks/tags in upstream fisheries. The Eagle sonar project replaced the mark–recapture program in 2005.

[b] U.S. harvests between the sonar site and border prior to 2008 is unknown because subsistence harvest in the Eagle area extended above and below the sonar site but were most likely in the hundreds for Chinook salmon. Starting in 2008, subsistence harvests between the sonar site and the U.S./Canada border were recorded specifically for the purpose of estimating border passage.

[c] Canadian spawning escapement estimated as border passage minus Canadian harvest.

[d] Chinook salmon passage for Yukon mainstem at U.S./Canada border from 1982–2001 was reconstructed using a linear relationship with 3-area index (aerial surveys of Little Salmon, Big Salmon, and Nisutlin rivers in 2002–2007) plus Canadian harvests.

[e] Border passage estimated in 2002–2004 using escapement estimate from a radio tagging proportion study, plus Canadian harvest.

[f] Since 2005, border passage was estimated as fish counted by the Eagle sonar minus the U.S. harvest upriver from the sonar project.

Appendix B12.–Chinook salmon escapement counts for selected spawning areas in the Canadian (Yukon Territory) portion of the Yukon River drainage, 1961–2018.

Year	Tatchun Creek [a]	Blind Creek weir	Chandindu River weir	Big Salmon sonar	Klondike River sonar	Teslin River sonar	Pelly River sonar	Porcupine River sonar	Takhini River sonar	Whitehorse Fishway	
										Count	Percent hatchery contribution
1961										1,068	0
1962										1,500	0
1963										483	0
1964										595	0
1965										903	0
1966	7 [b]									563	0
1967										533	0
1968										414	0
1969										334	0
1970	100									625	0
1971	130									856	0
1972	80									391	0
1973	99									224	0
1974	192									273	0
1975	175									313	0
1976	52									121	0
1977	150									277	0
1978	200									725	0
1979	150									1,184	0
1980	222									1,383	0
1981	133									1,555	0
1982	73									473	0
1983	264									905	0
1984	153									1,042	0
1985	190									508	0
1986	155									557	0
1987	159									327	0
1988	152									405	16
1989	100									549	19
1990	643									1,407	24

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Year	Tatchun Creek [a]	Blind Creek weir	Chandindu River weir	Big Salmon sonar	Klondike River sonar	Teslin River sonar	Pelly River sonar	Porcupine River sonar	Takhini River sonar	Whitehorse Fishway Count	Whitehorse Fishway Percent Hatchery Contribution
1991										1,266 [c]	51 [c]
1992	106									758 [c]	84 [c]
1993	183									668 [c]	73 [c]
1994	477									1,577 [c]	54 [c]
1995	397									2,103	57
1996	423									2,958	35
1997	1,198	957								2,084	24
1998	405	373	132							777	95
1999	252	892	239							1,118	74
2000	276 [d]		4 [e]							677	69
2001			129 [f]							988	36
2002			[g]							605	39
2003		1,115	185 [h]							1,443	70
2004		792								1,989	76
2005		525		5.618						2.632	57
2006		677		7,308						1,720	47
2007		304		4,506						427	56
2008		276		1,329						399	54
2009		716		9,261	5,147					828	47
2010		270		3,817	803					672	49
2011		360		5,156	1,181					1,534	48
2012		157		2,584		3,396				1,030	59
2013		312		3,242		9,916				1,139	67
2014		602		6,321		17,507		2,951 [i]		1,601	78
2015		964		10,078		20,410		4,623		1,465	60
2016		664		6,761			5,807 [i]	6,457		1,556	42
2017		[j]		5,672			9,081	1,191	1,872 [i]	1,226	39
2018 [k]		612		5,159			9,491 [k]	3,414 [k]	1,554 [k]	691	27
Averages											
1971–2017	235	586	138	5,512	2,377	12,807	7,444	3,806	-	978	28
2008–2017	-	480	-	5,422	2,377	12,807	7,444	-	-	1,145	54
2013–2017	-	636	-	5,776	-	-	-	-	1,872	1,397	57
Minimum-17	7	157	4	1,329	803	3,396	5,807	1,191	1,872	121	16
Maximum-17	1,198	1,115	239	10,078	5,147	20,410	9,081	6,457	1,872	2,958	95

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Note: Minimum and maximum indicate year with the lowest and highest values through 2017.

[a] All foot surveys prior to 1997, except 1978 (boat survey) and 1986 (aerial survey) and weir counts from 1997–2000.

[b] Incomplete and/or poor survey conditions resulting in minimal or inaccurate counts.

[c] Counts and estimated percentages may be slightly exaggerated. In some or all of these years, a number of adipose-clipped fish ascended the Fishway and were counted more than once. These fish would have been released into the Fishway as fry between 1989 and 1994, inclusive.

[d] Flood conditions caused early termination of this program.

[e] High water delayed project installation, therefore counts are incomplete.

[f] Weir was breached from July 31–August 7 due to high water.

[g] Resistance board weir (RBW) tested for 3 weeks.

[h] Combination RBW and conduit weir tested and operational from July 10-30.

[i] Sonar feasibility year.

[j] High water conditions prevented weir operation.

[k] Data are preliminary.

Appendix B13.–Summer chum salmon escapement counts for selected spawning areas in the U.S. (Alaska) portion of the Yukon River drainage, 1973–2018.

	Andreafsky River			Anvik River		Rodo River	Kaltag River	Nulato River		
	East Fork		West Fork					South Fork	North Fork [a]	Mainstem
Year	Aerial [b]	Sonar, tower, or weir [c] counts	Aerial [b]	Tower and aerial [d]	Sonar	Aerial [b]	Tower	Aerial [b]	Aerial [b]	Tower
1973	10,149 [e]		51,835	249,015						
1974	3,215 [e]		33,578	411,133		16,137		29,016	29,334	
1975	223,485		235,954	900,967		25,335		51,215	87,280	
1976	105,347		118,420	511,475		38,258		9,230 [e]	30,771	
1977	112,722		63,120	358,771		16,118		11,385	58,275	
1978	127,050		57,321	307,270		17,845		12,821	41,659	
1979	66,471		43,391	-	277,712	-		1,506	35,598	
1980	36,823 [e]		114,759	-	482,181	-		3,702 [e]	11,244 [e]	
1981	81,555	152,665	-	-	1,479,582	-		14,348	-	
1982	7,501 [e]	181,352	7,267 [e]	-	444,581	-		-	-	
1983	-	113,328	-	-	362,912	-		1,263 [e]	19,749	
1984	95,200 [e]	72,598	238,565	-	891,028	-		-	-	
1985	66,146	-	52,750	-	1,080,243	24,576		10,494	19,344	
1986	83,931	152,730	99,373	-	1,085,750	-		16,848	47,417	
1987	6,687 [e]	45,221 [f]	35,535	-	455,876	-		4,094	7,163	
1988	43,056	68,937 [f]	45,432	-	1,125,449	13,872		15,132	26,951	
1989	21,460 [e]	-	-	-	636,906	-		-	-	
1990	11,519 [e]	-	20,426 [e]	-	403,627	1,941 [e]		3,196 [e, g]	1,419 [e]	
1991	31,886	-	46,657	-	847,772	3,977		13,150	12,491	
1992	11,308 [e]	-	37,808 [e]	-	775,626	4,465		5,322	12,358	
1993	10,935 [e]	-	9,111 [e]	-	517,409	7,867		5,486	7,698	
1994	-	200,981 [g]	-	-	1,124,689	-	47,295	-	-	148,762 [g]
1995	-	172,148	-	-	1,339,418	12,849	77,193	10,875	29,949	236,890
1996	-	108,450	-	-	933,240	4,380	51,269	8,490 [e]	-	129,694

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	Andreafsky River			Anvik River		Rodo River	Kaltag River	Nulato River		
	East Fork		West Fork					South Fork	North Fork [a]	Mainstem
Year	Aerial [b]	Sonar, tower, or weir counts	Aerial [b]	Tower and aerial [d]	Sonar	Aerial [b]	Tower	Aerial [b]	Aerial [b]	Tower
1997	-	51,139	-	-	605,751	2,775 [e]	48,018	-	-	157,975
1998	-	67,720	-	-	487,300	-	8,113	-	-	49,140
1999	-	32,587	-	-	437,355	-	5,339	-	-	30,076
2000	2,094 [e]	24,785	18,989 [e]	-	196,350	-	6,727	-	-	24,308
2001	-	2,134 [g]	-	-	224,059	-	-	-	-	-
2002	-	44,194	-	-	459,058	-	13,583	-	-	72,232
2003	-	22,461	-	-	256,920	-	3,056	-	-	19,590 [g]
2004	-	64,883	-	-	365,354	-	5,247	-	-	-
2005	-	20,127	-	-	525,392	-	22,093	-	-	-
2006	3,100 [e]	102,260	617	-	605,487	-	-	7,772	11,658	-
2007	-	69,642	-	-	459,038	-	-	21,825	15,277	-
2008	9,300	57,259	25,850	-	374,933	-	-	12,070	10,715	-
2009	736	8,770	3,877	-	193,098	621	-	2,120	567	-
2010	1,982	72,893	24,380	-	396,174	-	-	1,891	1,038	-
2011	12,889	100,473	10,020	-	642,529	6,011	-	9,454	8,493	-
2012	-	56,680	-	-	484,091	15,606	-	20,600	14,948	-
2013	10,965	61,234	9,685	-	577,876	-	-	13,695	13,230	-
2014	-	37,793	-	-	399,796	-	-	-	-	-
2015	6,004	48,809	2,836	36,871	374,968	3,685	-	4,102	9,525	-
2016	-	50,362	-	-	337,821	-	-	-	-	-
2017	-	55,532	11,655	38,191	415,139	-	-	4,890	7,882	-
2018	-	36,330	-	-	305,098	-	-	-	-	-
GOAL [h]		>40,000			350,000-700,000					
Average										
1973–2017	42,983	74,843	52,563	351,712	591,859	12,018	26,176	11,241	21,186	96,519
2008–2017	6,979	54,981	12,615	37,531	419,643	6,481	-	8,603	8,300	-
2013–2017	8,485	50,746	8,059	37,531	421,120	3,685	-	7,562	10,212	-
Minimum–17	736	2,134	617	36,871	193,098	621	3,056	1,263	567	19,590
Maximum–17	223,485	200,981	238,565	900,967	1,479,582	38,258	77,193	51,215	87,280	236,890

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	Henshaw Creek	Gisasa River		Hogatza River		Tozitna River	Chena River		Salcha River	
				Clear & Caribou Cr.	Clear Creek					
Year	Weir	Aerial [b]	Weir	Aerial [b]	Tower	Weir and aerial [b]	Aerial [b]	Tower	Aerial [b]	Tower
1973							79 [e]		290	
1974		22,022				1,823	4,349		3,510	
1975		56,904		22,355		3,512	1,670		7,573	
1976		21,342		20,744		725 [e]	685		6,484	
1977		2,204 [e]		10,734		761 [e]	610		677 [e]	
1978		9,280 [e]		5,102		2,262	1,609		5,405	
1979		10,962		14,221		-	1,025 [e]		3,060	
1980		10,388		19,786		580	338		4,140	
1981		-		-		-	3,500		8,500	
1982		334 [e]		4,984 [e]		874	1,509		3,756	
1983		2,356 [e]		28,141		1,604	1,097		716 [e]	
1984		-		184 [e]		-	1,861		9,810	
1985		13,232		22,566		1,030	1,005		3,178	
1986		12,114		-		1,778	1,509		8,028	
1987		2,123		5,669 [e]		-	333		3,657	
1988		9,284		6,890		2,983	432		2,889 [e]	
1989		-		-		-	714 [e]		1,574 [e]	
1990		450 [e]		2,177 [e]		36	245 [e]		450 [e]	
1991		7,003		9,947		93	115 [e]		154 [e]	
1992		9,300		2,986		794	848 [e]		3,222	
1993		1,581		-		970	168	5,483	212	5,809
1994		6,827	51,116 [g]	8,247 [i]		-	1,137	9,984	4,916	39,450
1995		6,458	136,886	-	116,735	4,985	185 [e]	3,519 [g]	934 [e]	30,784
1996		-	158,752	27,090 [i]	100,912	2,310	2,061	12,810 [g]	9,722	74,827
1997		686 [e]	31,800	1,821 [e]	76,454	428 [e]	594 [e]	9,439 [g]	3,968 [e]	35,741
1998		-	21,142	120 [e]	212 [g]	7 [e]	24 [e]	5,901	370 [e]	17,289
1999		-	10,155	-	11,283	-	520	9,165	150	23,221
2000	24,457	-	11,410	-	19,376	480	105	3,515	228	20,516
2001	34,777	-	17,946	-	3,674	12,527	2	4,773	-	14,900

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Year	Henshaw Creek	Gisasa River		Hogatza River			Tozitna River	Chena River		Salcha River	
				Clear & Caribou Cr.	Clear Creek						
	Weir	Aerial [b]	Weir	Aerial [b]	Tower		Weir and aerial [b]	Aerial [b]	Tower	Aerial [b]	Tower
2002	25,249	-	33,481	-	13,150		18,789	-	1,021 [g]	78	27,012 [j]
2003	21,400	-	25,999	-	6,159		8,487	-	573 [g]	-	-
2004	86,474	-	37,851	-	15,661		25,003	-	15,163 [g]	-	47,861
2005	237,481	-	172,259	-	26,420		39,700	219	16,873 [g]	4,320	194,933
2006	-	1,000	261,306	-	29,166 [j]		22,629	469	35,109 [g]	152	113,960
2007	44,425	-	46,257	-	6,029 [j]		8,470	-	4,999	4 [e]	13,069
2008	96,731	20,470	36,938	-	-		9,133	37	1,300 [g]	0 [e]	2,213 [g]
2009	156,933	1,060	25,904	3,981	-		8,434	-	16,516	-	31,035
2010	105,398	1,096	47,669	840	-		-	-	7,561	-	22,185
2011	248,247	13,228	95,796	3,665	-		11,351	-	-	-	66,564 [k]
2012	292,082	- [e]	83,423	23,022	-		11,045	-	6,882	-	46,252
2013	285,008	9,300 [e]	80,055	-	-		-	-	21,372	-	60,981
2014	- [e]	-	32,523	-	-		-	-	13,303 [e]	-	- [e]
2015	238,529	5,601	42,747	6,080	-		-	-	8,620	0 [e]	12,812
2017	360,687	-	73,584	-	-		-	-	21,156 [g]	-	29,093 [g]
2018 [l]	- [g]	-	-	-	-		-	-	9,088 [g]	-	22,782 [g]
GOAL											
Average											
1973–2017	177,530	9,843	79,432	11,337	39,279		7,043	1,030	10,986	3,247	45,652
2008–2017	230,044	8,459	58,531	7,518	-		9,991	37	11,467	0	30,448
2013–2017	292,751	7,451	59,116	6,080	-		-	-	14,189	0	26,446
Minimum–17	21,400	334	25,904	184	6,029		36	37	573	0	2,213
Maximum–17	360,687	56,904	261,306	28,141	116,735		39,700	4,349	35,109	9,810	194,933

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Note: Unless otherwise noted blank cells indicate years prior to the project being operational. Dashes indicate years in which no information was collected. Minimum and maximum indicate year with the lowest and highest values through 2017.

[a] Includes mainstem counts below the confluence of the North and South Forks, unless otherwise noted.

[b] Aerial survey counts are peak counts only, survey rating is fair or good unless otherwise noted.

[c] East Fork Andreafsky passage estimated with sonar 1981–1984, tower counts 1986–1988; weir counts from 1994–present. The project did not operate in 1985 and 1989–1993.

[d] From 1972–1979, counting tower operated; escapement estimate listed is the tower counts plus expanded aerial survey counts below the tower.

[e] Incomplete survey and/or poor survey timing or conditions resulted in minimal or inaccurate count.

[f] Mainstem counts below the confluence of the North and South Forks of the Nulato River included in the South Fork counts.

[g] Incomplete count due to late installation and/or early removal of project or high water events.

[h] Biological escapement goal (Andreafsky) or sustainable escapement goal (Anvik)

[i] Bureau of Land Management helicopter survey.

[j] Project operated as a video monitoring system.

[k] Estimate includes an expansion for missed counting days based on average run timing. Minimum documented abundance from successful counting days was 30,411 (SE not reported).

Appendix B14.–Fall chum salmon abundance estimates or escapement estimates for selected spawning areas in the U.S. (Alaska) portions of the Yukon River drainage, 1971–2018.

		Tanana River drainage					Upper Yukon River drainage	
Year	Yukon River mainstem sonar estimate [a]	Toklat River [b]	Kantishna River abundance estimate [c]	Delta River [d]	Bluff Cabin Slough [e]	Upper Tanana River abundance estimate [f]	Chandalar River [g]	Sheenjek River [h]
1971								
1972				5,384 [i]				
1973				10,469 [i]				
1974		41,798		5,915 [i]				117,921 [j]
1975		92,265		3,734				227,935 [j]
1976		52,891		6,312				34,649 [j]
1977		34,887		16,876				59,878 [j]
1978		37,001		11,136 [i]				42,661 [j]
1979		158,336		8,355 [i]				120,129 [j]
1980		26,346 [k]		5,137 [i]	3,190 [l]			38,093 [j]
1981		15,623		23,508 [i]	6,120 [l]			102,137 [m]
1982		3,624		4,235 [i]	1,156			43,042 [m]
1983		21,869		7,705 [i]	12,715			64,989 [m]
1984		16,758		12,411 [i]	4,017			36,173 [m]
1985		22,750		17,276	2,655 [l]			179,727 [m, n]
1986		17,976		6,703	3,458		59,313	84,207 [n, o]
1987		22,117		21,180 [i]	9,395		52,416	153,267 [n, o]
1988		13,436		18,024 [i]	4,481 [l]		33,619	45,206 [o]
1989		30,421		21,342	5,386 [l]		69,161	99,116 [o]
1990		34,739		8,992	1,632		78,631	77,750 [o]
1991		13,347		32,905	7,198			86,496 [p]
1992		14,070		8,893	3,615 [l]			78,808
1993		27,838		19,857 [i]	5,550 [l]			42,922
1994		76,057		23,777	2,277 [l]			150,565
1995	1,156,278	54,513 [k]		20,587 [i]	19,460	268,173	323,586	241,855

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Year	Yukon River mainstem sonar estimate [a]	Tanana River drainage: Toklat River [b]	Tanana River drainage: Kantishna River abundance estimate [c]	Tanana River drainage: Delta River [d]	Tanana River drainage: Bluff Cabin Slough [e]	Tanana River drainage: Upper Tanana River abundance estimate [f]	Upper Yukon River drainage: Chandalar River [g]	Upper Yukon River drainage: Sheenjek River [h]
1996	[q]	18,264		19,758	7,074 [d]	134,563	230,450	246,889
1997	579,767	14,511		7,705	5,707 [d]	71,661	211,914	80,423 [r]
1998	375,222	15,605		7,804	3,549 [d]	62,014	83,899	33,058
1999	451,505	4,551	27,199	16,534	7,559 [d]	97,843	92,685	14,229
2000	273,206	8,911	21,450	3,001	1,595	34,844	71,048	30,084 [s]
2001	408,961	6,007 [t]	22,992	8,103	1,808 [l]	96,556 [u]	112,664	53,932
2002	367,886	28,519	56,665	11,992	3,116	109,961	94,472	31,642
2003	923,540	21,492	87,359	22,582	10,600 [l]	193,418	221,343	44,047 [v]
2004	633,368	35,480	76,163	25,073	10,270 [l]	123,879	169,848	37,878
2005	1,894,078	17,779 [j]	107,719	28,132	11,964 [l]	337,755	526,838	561,863 [n]
2006	964,238		71,135	14,055		202,669	254,778	160,178 [n]
2007	740,195		81,843	18,610		320,811	243,805	65,435 [n]
2008	636,525			23,055	1,198 [l]		178,278	50,353 [n]
2009	[q]			13,492	2,900 [l]		[p]	54,126 [n]
2010	458,103			17,993	1,610 [l]		167,532	22,053
2011	873,877			23,639	2,655 [l]		298,223	97,976 [n]
2012	778,158			9,377 [e]			205,791	104,701 [n]
2013	865,295	9,161 [l]		31,955	5,554 [l]		252,710	
2014	706,630			32,480 [e]	4,095 [l]		226,489	
2015	669,483	8,422 [l]		33,401 [e]	6,020 [l]		164,486	
2016	994,760	16,885 [l]		21,913 [e]	4,936 [l]		295,023	
2017	1,829,931			48,783 [e]			509,115	
2018 [w]	928,664	19,141 [l]		39,641 [e]	5,554 [l]		170,356	
Escapement [x]	300,000 [y]	15,000 [z]		6,000		46,000 [aa]	74,000	50,000 [ab]
objective	600,000	33,000		13,000		103,000	152,000	104,000

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Year	Yukon River mainstem sonar estimate [a]	Tanana River drainage: Toklat River [b]	Tanana River drainage: Kantishna River abundance estimate [c]	Tanana River drainage: Delta River [d]	Tanana River drainage: Bluff Cabin Slough [e]	Tanana River drainage: Upper Tanana River abundance estimate [f]	Upper Yukon River drainage: Chandalar River [g]	Upper Yukon River drainage: Sheenjek River [h]
Averages								
1971–2017	789,572	18,579	61,392	20,001	5,877	158,011	224,317	107,262
2008–2017	868,085	11,489	-	25,609	3,621	-	255,294	65,842
2013–2017	1,013,220	11,489	-	33,706	5,151	-	289,565	-
Minimum-17	273,206	4,551	21,450	3,001	1,198	34,844	71,048	14,229
Maximum-17	1,894,078	54,513	107,719	48,783	19,460	337,755	526,838	561,863

Note: Minimum and maximum indicate the lowest and highest values for each year presented through 2017.

[a] New model estimates generated in 2015 and applied to dataset back to 1995 and used since.

[b] Expanded total abundance estimates for upper Toklat River index area using stream life curve (SLC) developed with 1987-1993 data. Index area includes Geiger Creek, Sushana River, and mainstem floodplain sloughs from approximately 0.25 mile upstream of roadhouse.

[c] Fall chum salmon abundance estimate for the Kantishna and Toklat River drainages is based on a mark–recapture program. Number of tagging and recovery wheels changed over the years.

[d] Population estimate generated from replicate foot surveys and stream life data (area under the curve method), unless otherwise indicated.

[e] Peak foot survey, unless otherwise indicated.

[f] Fall chum salmon abundance estimate for the upper Tanana River drainage is based on a mark–recapture program. Upper Tanana River consists of that portion upstream of the confluence with the Kantishna River. Number of tagging and recovery wheels changed over the years.

[g] Single-beam sonar estimate for 1986–1990 (not used in run reconstruction), split-beam sonar estimate 1995–2006, DIDSON in use since 2007, project was aborted in 2009. Sonar counts on the Chandalar River are extrapolated after conclusion of the project through October 9 from 1995–present with 2018 expanded to October 14 due to late run timing.

[h] Single-beam sonar estimate beginning in 1981, split-beam sonar estimate 2003–2004, and DIDSON 2005–2012. Sonar counts on the Sheenjek River are extrapolated after conclusion of the project through October 9 from 2005–2012.

[i] Estimates are a total spawner abundance, using migratory time density curves and stream life data.

[j] Total escapement estimate using sonar to aerial survey expansion factor of 2.22.

[k] Minimal estimate because of late timing of ground surveys with respect to peak of spawning.

[l] Aerial survey count, unless otherwise indicated.

[m] Project started late, estimated escapements expanded for portion missed using average run timing curves based on Teedriinjik (Chandalar; 1986-1990) and Sheenjek (1991-1993) rivers.

[n] Sonar counts include both banks in 1985–1987, 2005–2009, and 2011–2012.

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[o] Expanded estimates for period approximating second week of August through fourth week of September, using annual Chandalar River run timing data (1986–1990).

[p] Total abundance estimates are for the period approximating second week of August through fourth week of September (1991–present). Comparative escapement estimates before 1986 are considered more conservative; approximating the period end of August through September.

[q] Project operated all or partial season, estimate was not useable.

[r] Data interpolated due to high water from August 29–September 3, 1997 during buildup to peak passage on the Sheenjek River.

[s] Sheenjek sonar project ended early (September 12) because of low water therefore estimate was expanded based on average run timing (62%).

[t] Minimal estimate because Sushana River was breached by the main channel and uncountable.

[u] Low numbers of tags deployed and recovered resulted in an estimate with an extremely large confidence interval (95% CI +/- 41,072).

[v] Sheenjek sonar project ended on peak daily passages due to late run timing, estimate was expanded based on run timing (87%) at Rampart.

[w] Data are preliminary.

[x] Escapement goal (EG) includes individual tributary BEGs (biological) and drainagewide SEG (sustainable).

[y] Drainagewide escapement goal is related to mainstem passage estimate based on the sonar near Pilot Station minus upriver harvests.

[z] EG discontinued in 2010.

[aa] The BEG for the Tanana River as a whole is 61,000–136,000. However, it includes the Toklat River plus the Upper Tanana River which was broken out here for comparison to the upper Tanana River abundance estimates.

[ab] The BEG is based on estimates of Sheenjek escapements from 1974–1999 (Eggers 2001) which were primarily right bank only estimates. BEG discontinued in 2016.

Appendix B15.–Fall chum salmon escapement estimates for selected spawning areas in Canadian (Yukon Territory) portions of the Yukon River drainage, 1971–2018.

	Porcupine drainage		Mainstem					
	Fishing Branch	Porcupine River	Yukon River	Koidern	Kluane		Teslin	
Year	River [a]	sonar	index [b,c]	River	River [b, d]		River [b, e]	
1971	312,800 [f]							
1972	35,230 [g]				198	[h,i]		
1973	15,991		383		2,500			
1974	31,841				400			
1975	353,282		7,671		362	[h]		
1976	36,584 [f]				20			
1977	88,400 [f]				3,555			
1978	40,800 [f]				0	[h]		
1979	119,898 [f]				4,640	[h]		
1980	55,268 [f]				3,150			
1981	57,386 [i]				25,806			
1982	15,901 [f]		1,020 [j]		5,378			
1983	27,200 [f]		7,560		8,578	[h]		
1984	15,150 [f]		2,800 [k]	1,300	7,200		200	
1985	56,223		10,760	1,195	7,538		356	
1986	31,811		825	14	16,686		213	
1987	49,038		6,115	50	12,000			
1988	23,645		1,550	0	6,950		140	
1989	44,042		5,320	40	3,050		210 [l]	
1990	35,000 [m]		3,651	1	4,683		739	
1991	37,870		2,426	53	11,675		468	
1992	22,539		4,438	4	3,339		450	
1993	28,707		2,620	0	4,610		555	
1994	65,247		1,429 [j]	20 [j]	10,734		209 [l]	
1995	51,971 [n]		4,701	0	16,456		633	
1996	77,302		4,977		14,431		315	
1997	27,031		2,189		3,350		207	
1998	13,687		7,292		7,337		235	
1999	12,958				5,136		19 [i]	
2000	5,057		933 [l]		1,442		204	
2001	21,737		2,453		4,884		5	
2002	13,636		973		7,147		64	
2003	29,713		7,982		39,347		390	
2004	20,417		3,440		18,982		167	
2005	119,058		16,425		34,600		585	
2006	30,954		6,553		18,208		620	
2007	32,150							
2008	19,086 [n]							
2009	25,828 [o]							
2010	15,413 [o]							
2011	13,085 [n,o]							

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Year	Porcupine drainage: Fishing Branch River [a]	Porcupine drainage: Porcupine River sonar	Mainstem Yukon River index [b,c]	Koidern River	Kluane River [b, d]	Teslin River [b, e]
2012	22,399 [o]					
2013	25,376 [q]	35,615				
2014	7,304 [q]	17,756				
2015	8,351 [r]	21,397				
2016	29,397	54,395				
2017	48,524	67,818			16,265 [u]	
2018 [p]	10,151	[v]			1,734	
Goal [s]	50,000-120,000					
IMEG [t]	22,000-49,000					
Averages						
1971-2017	48,304	39,396	4,480	223	9,184	317
2008-2017	21,476	39,396	-	-	-	-
2013-2017	23,790	39,396	-	-	-	-
Minimum-17	5,057	17,756	383	0	0	5
Maximum-17	353,282	67,818	16,425	1,300	39,347	739

Note: Minimum and maximum indicate year with the lowest and highest values through 2017.

[a] Weir count, unless otherwise indicated. Weir counts from 1972–1975, 1985–1989, 1991–1992, 1996–2012 were expanded to represent the remainder of the run after the project was terminated for the season through October 25.

[b] Aerial survey, unless otherwise indicated.

[c] Index area includes Tatchun Creek to Fort Selkirk.

[d] Index area includes Duke River to end of spawning sloughs below Swede Johnston Creek.

[e] Index area includes Boswell Creek area (5 km below to 5 km above confluence).

[f] Total escapement estimated using weir to aerial survey expansion factor of 2.72, unless otherwise indicated.

[g] Weir installed September 22. Estimate consists of weir count of 17,190 after September 22, and tagging passage estimate of 17,935 before weir installation.

[h] Foot survey, unless otherwise indicated.

[i] Initial aerial survey count doubled before applying the weir/aerial expansion factor of 2.72 because only half of the spawning area was surveyed.

[j] Boat survey.

[k] Total index not surveyed. Survey included the mainstem Yukon River between Yukon Crossing to 30 km below Fort Selkirk.

[l] Incomplete and/or poor survey conditions resulting in minimal or inaccurate counts.

[m] Weir not operated. Although only 7,541 chum salmon were counted on a single survey flown October 26, a population estimate of approximately 27,000 fish was made through date of survey, based upon historic average aerial-to-weir expansion of 28%. Actual population of spawners was reported by DFO as between 30,000-40,000 fish considering aerial survey timing.

[n] Incomplete count caused by late installation and/or early removal of project or high-water events.

[o] Run timing was late and counts were expanded to represent the remainder of the run after the project was terminated for the season.

[p] Data are preliminary.

[q] Fishing Branch River weir did not operate, and escapement was estimated from a sonar operated on the upper Porcupine River minus Old Crow harvest and the proportion of radio tags to Fishing Branch River.

[r] Escapement Objective (EO) based on U.S./Canada Treaty Obligations, some years stabilization or rebuilding goals are applied.

[s] Interim Management Escapement Goal (IMEG) established for 2008-2012 based on percentile method.

[t] Interim Management Escapement Goal (IMEG) established for 2010-2018 based on brood table of Canadian origin mainstem stocks (1982–2003).

[u] Aerial survey as part of CRE-145-17.

[v] High water in August and early ice up prevented a complete passage estimate for Porcupine River fall chum salmon.

Appendix B16.–Estimated spawning escapement of Canadian-origin Yukon River fall chum salmon 1980–2018.

Date	Sonar estimate	Expanded estimate [a]	Eagle area subsistence harvest	Mainstem border passage estimate [b]	Canadian mainstem harvest	Mainstem escapement estimate [c]
1980				39,130	16,218	22,912
1981				66,347	19,281	47,066 [d]
1982				47,049	15,091	31,958
1983				118,365	27,490	90,875
1984				81,900	25,267	56,633 [d]
1985				99,775	37,765	62,010
1986				101,826	13,886	87,940
1987				125,121	44,345	80,776
1988				69,280	32,494	36,786
1989				55,861	20,111	35,750
1990				82,947	31,212	51,735
1991				112,303	33,842	78,461
1992				67,962	18,880	49,082
1993				42,165	12,422	29,743
1994				133,712	35,354	98,358
1995				198,203	40,111	158,092
1996				143,758	21,329	122,429
1997				94,725	9,306	85,419
1998				48,047	1,795	46,252
1999				72,188 [e]	13,636	58,552
2000				57,978 [e]	4,246	53,732
2001				38,769 [e]	5,278	33,491
2002				104,853 [e]	6,232	98,621
2003				153,656 [e]	10,523	143,133
2004				163,625 [e]	9,545	154,080
2005				451,477	13,979	437,498
2006	236,386	245,290	17,775	227,515 [f, g]	6,617	220,898
2007	235,871	265,008	18,691	246,317 [f, g]	9,330	236,987
2008	171,347	185,409	11,381	174,028 [f, g]	6,130	167,898

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Date	Sonar estimate	Expanded estimate [a]	Eagle area subsistence harvest	Mainstem border passage estimate [b]	Canadian mainstem harvest	Mainstem escapement estimate [c]
2009	95,462	101,734	6,995	94,739 [f]	1,113	93,626
2010	125,547	132,930	11,432	121,498 [f]	3,709	117,789
2011	212,162	224,355	12,477	211,878 [f]	6,312	205,566
2012	147,710	153,248	11,681	141,567 [f]	3,905	137,662
2013	200,754	216,791	12,642	204,149 [f]	3,887	200,262
2014	167,715	172,887	13,041	159,846 [f]	3,050	156,796
2015	112,136	125,095	12,540	112,555 [f]	3,897	108,658
2016	144,035	161,027	13,015	148,012 [f]	2,745	145,267
2017	407,166	419,099	14,110	404,989 [f]	3,404	401,585
2018 [h]	136,732	168,798	11,715	157,083 [f]	2,957	154,126
Averages						
1980–2017	188,024	200,239	12,982	132,056	15,098	116,957
2008–2017	178,403	189,258	11,931	177,326	3,815	173,511
2013–2017	206,361	218,980	13,070	205,910	3,397	202,514
Minimum-17	95,462	101,734	6,995	94,739	1,113	93,626
Maximum-17	407,166	419,099	18,691	404,989	9,330	401,585

Note: Table includes information on U.S/Canada border passage estimates, Eagle area subsistence harvest between the sonar and the border (where applicable), and Canadian mainstem harvest. Estimates for subsistence caught salmon between the sonar site and border (Eagle area) prior to 2008 include an unknown portion caught below the sonar site. This number is most likely in the thousands for chum salmon. Starting in 2008, the estimates for subsistence-caught salmon only include salmon harvested between the sonar site and the U.S./Canada border. Minimums and maximum indicate the lowest and highest values for each year presented through 2017.

[a] Sonar estimates include an expansion for fish that may have passed after operations ceased through October 18. In 2018, expanded to October 23 due to late run timing.

[b] Border passage estimate is based on a mark–recapture estimate unless otherwise indicated.

[c] Estimated mainstem border passage minus Canadian mainstem harvest (excludes Fishing Branch River).

[d] Escapement estimate based on mark–recapture program unavailable. Estimate based on assumed average exploitation rate.

[e] From 1999–2004, border passage estimates were revised using a Stratified Population Analysis System (Arnason et. al 1995).

[f] From 2006–present, border passage estimate is based on sonar minus harvest from U.S. residents upstream of deployment.

[g] Mark–recapture border passage estimates include 217,810; 235,956; and 132,048 fish from 2006–2008 respectively, during transition to sonar.

[h] Data are preliminary.

Appendix B17.–Coho salmon passage estimates or escapement estimates for selected spawning areas in the U.S. (Alaska) portion of the Yukon River drainage, 1972–2018.

		Nenana River drainage				Upper Tanana River drainage		
Year	Yukon River mainstem sonar estimate [a]	Lost Slough	Nenana mainstem [b]	Wood Creek	Seventeen Mile Slough	Delta Clearwater River [c]	Clearwater Lake and outlet	Richardson Clearwater River
1972						632 (b)	417 (f)	454 (f) [d]
1973						3,322 (u)	551 (u)	375 (u)
1974		1,388 (f)			27 (f)	3,954 (h) [d]	560 (f)	652 (h)
1975		827 (f)			956 (f)	5,100 (b)	1,575 (b)	
1976		118 (f)			281 (f)	1,920 (b)	1,500 (b)	80 (f) [d]
1977		524 (f) [d]		310 (g)	1,167 (f)	4,793 (b)	730 (b)	327 (f)
1978		350 (f)		300 (g)	466 (f)	4,798 (b)	570 (b)	
1979		227 (f)			1,987 (f)	8,970 (b)	1,015 (b)	372 (f)
1980		499 (f) [d]		1,603 (g)	592 (f)	3,946 (b)	1,545 (b)	611 (f)
1981		274 (f)		849 (w) [e]	1,005 (f)	8,563 (u) [f]	459 (f)	550 (f)
1982				1,436 (w) [e]	(f)	8,365 (g) [f]		
1983		766 (f)		1,042 (w)	103 (f)	8,019 (b) [f]	253 (f)	88 (f)
1984		2,677 (f)		8,826 (w)	(f)	11,061 (b)	1,368 (f)	428 (f)
1985		1,584 (f)		4,470 (w)	2,081 (f)	5,358 (b)	750 (f)	
1986		794 (f)		1,664 (w)	218 (b)	10,857 (b)	3,577 (f)	146 (f) [d]
1987		2,511 (f)		2,387 (w)	3,802 (f)	22,300 (b)	4,225 (b)	
1988		348 (f)		2,046 (w)		21,600 (b)	825 (b)	
1989				412 (w)	824 (f) [d]	11,000 (b)	1,600 (b)	483 (f)
1990		688 (f)	1,308 (f)		(h) [d]	8,325 (b)	2,375 (b)	
1991		564 (f)	447 (f)		52 (f)	23,900 (b)	3,150 (b)	
1992		372 (f)			490 (f)	3,963 (b)	229 (b)	500 (f)

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Year	Yukon River mainstem sonar estimate [a]	Nenana River drainage				Upper Tanana River drainage		
		Lost Slough	Nenana mainstem [b]	Wood Creek	Seventeen Mile Slough	Delta Clearwater River [c]	Clearwater Lake and outlet	Richardson Clearwater River
1993		350 (f)	419 (f)	666 (w) [g]	581 (h)	10,875 (b)	3,525 (b)	
1994		944 (h)	1,648 (h)	1,317 (w) [h]	2,909 (h)	62,675 (b)	3,425 (b)	5,800 (f)
1995	119,893	4,169 (f)	2,218 (h)	500 (w)	1,512 (h)	20,100 (b)	3,625 (b)	
1996	[i]	2,040 (h)	2,171 (h)	201 (u) [d]	3,668 (g/b)	14,075 (b)	1,125 (b) [d]	
1997	118,065	1,524 (h)	1,446 (h)	[j]	1,996 (h)	11,525 (b)	2,775 (b)	
1998	146,365	1,360 (h) [d]	2,771 (h) [d]	[j]	1,413 (g/b)	11,100 (b)	2,775 (b)	
1999	76,174	1,002 (h) [d]	745 (h) [d]	370 (h)	662 (h) [d]	10,975 (b)		
2000	206,365	55 (h) [d]	68 (h) [d]	[j]	879 (h) [d]	9,225 (b)	1,025 (b)	2,175 (h)
2001	160,272	242 (h)	859 (h)	699 (h)	3,753 (h)	46,985 (b)	4,425 (b)	1,531 (f)
2002	137,077	0 (h)	328 (h)	935 (h)	1,910 (h)	38,625 (b)	5,900 (b)	874 (f)
2003	280,552	85 (h)	658 (h)	3,055 (h)	4,535 (h)	102,800 (b)	8,800 (b)	6,232 (h)
2004	207,844	220 (h)	450 (h)	840 (h)	3,370 (h)	37,550 (b)	2,925 (b)	8,626 (h)
2005	194,372	430 (h)	325 (h)	1,030 (h)	3,890 (h)	34,293 (b)	2,100 (b)	2,024 (h)
2006	163,889	194 (h)	160 (h)	634 (h)	1,916 (h)	16,748 (b)	4,375 (b)	271 (h)
2007	192,406	63 (h)	520 (h)	605 (h)	1,733 (h)	14,650 (b)	2,075 (b)	553 (h)
2008	145,378	1,342 (h)	1,539 (h)	578 (h)	1,652 (h)	7,500 (b)	1,275 (b)	265 (h)
2009	[i]	410 (h)		470 (h)	680 (h)	16,850 (b)	5,450 (b)	155 (h)
2010	177,724	1,110 (h)	280 (h)	340 (h)	720 (h)	5,867 (b)	813 (b)	1,002 (h)
2011	149,533	369 (h)		0 (h) [j]	912 (h)	6,180 (b)	2,092 (b)	575 (h)
2012	130,734		106 (h)	0 (h) [j]	405 (h)	5,230 (b)	396 (h)	515 (h)
2013	110,515	721 (h)		55 (h)	425 (h)	6,222 (b)	2,221 (h)	647 (h)

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Year	Yukon River mainstem sonar estimate [a]	Nenana River drainage				Upper Tanana River drainage		
		Lost Slough	Nenana Mainstem [b]	Wood Creek	Seventeen Mile Slough	Delta Clearwater River [c]	Clearwater Lake and outlet	Richardson Clearwater River
2014	283,421	333 (h)	378 (h)	649 (h)	886 (h)	4,285 (b)	434 (h)	1,941 (h)
2015	121,193	242 (h)	1,789 (h)	1,419 (h)	3,890 (h)	19,533 (b)	1,621 (h)	3,742 (h)
2016	168,297	334 (h)	1,680 (h)	1,327 (h)	2,746 (h)	6,767 (b)	1,421 (h)	1,350 (h)
2017	166,320	1,278 (h)	862 (h)	2,025 (h)	1,942 (h)	9,617 (b)		
2018	136,347 [k]	1,822 (h)	241 (h)	361 (h)	347 (h)	2,884 (b)	2,465 (h)	976 (h)
SEG [l]						5,200-17,000		
Averages								
1972–2017	164,602	813	966	1,266	1,576	15,456	2,137	1,398
2008–2017	161,457	682	948	686	1,426	8,805	1,747	1,132
2013–2017	169,058	582	1,177	1,095	1,978	9,285	1,424	1,920
Minimum-17	76,174	0	68	0	27	632	229	80
Maximum-17	283,421	4,169	2,771	8,826	4,535	102,800	8,800	8,626

Note: Only peak counts presented. Survey rating is fair to good, unless otherwise noted. Denotations of survey methods include: (b)=boat, (f)=fixed wing, (g)=ground/foot, (h)=helicopter, (u)=undocumented, and (w)=weir. Minimum and maximum indicate year with the lowest and highest values through 2017.

[a] Passage estimates for coho salmon are incomplete. The sonar project is terminated prior to the end of the coho salmon run. New model estimates generated in 2015 and applied to dataset back to 1995 and used since.

[b] Index area includes mainstem Nenana River between confluences of Lost Slough and Teklanika River.

[c] Index area is lower 17.5 miles of system.

[d] Poor survey, resulted in minimal count.

[e] Weir was operated at the mouth of Clear Creek (Shores Landing).

[f] Expanded estimate based on partial survey counts and historic distribution of spawners from 1977–1980.

[g] Weir project terminated on October 4, 1993. Weir normally operated until mid- to late October.

[h] Weir project terminated September 27, 1994. Weir normally operated until mid- to late October.

[i] Project operated all or partial season, estimate was not useable.

[j] No survey of Wood Creek due to obstructions in creek or surveyed with zero fish observed.

[k] Data are preliminary.

[l] Sustainable escapement goal (SEG) established January 2004 (replaces BEG of greater than 9,000 fish established March 1993), based on boat survey counts of coho salmon in the lower 17.5 river miles during the period October 21–27.

Appendix B18.– Estimated run size, escapement and harvest shares for Mainstem Canadian-origin Yukon River Chinook salmon, 2001–2018.

	Yukon River Panel goal or IMEG [a]				Total allowable catch (TAC)		U.S. share (%) of TAC			Canada share (%) of TAC			
Year	From	To	Border passage [b]	Total run size [c]	From	To	74%	80%	U.S. harvest [d]	20%	26%	Canada harvest	Spawning escapement [e]
2001	18,000	28,000	62,333	85,663	57,663	67,663	42,671	54,131	23,325	11,533	17,592	9,774	52,564
2002	28,000		51,428	81,487	53,487		39,580	42,790	30,058	10,697	13,907	9,070	42,359
2003	25,000	28,000	90,037	149,979	121,979	124,979	90,264	99,983	59,939	24,396	32,495	9,446	80,594
2004	28,000		59,415	117,247	89,247		66,043	71,398	57,832	17,849	23,204	10,946	48,469
2005	28,000		78,962	123,612	95,612		70,753	76,490	44,650	19,122	24,859	10,977	67,985
2006	28,000		71,388	119,485	91,485		67,699	73,188	48,097	18,297	23,786	8,758	62,630
2007	33,000	43,000	39,698	87,899	44,899	54,899	33,225	43,919	48,201	8,980	14,274	4,794	34,904
2008	45,000		37,282	62,637	17,637		13,051	14,110	25,328	3,527	4,586	3,399	33,883
2009	45,000		69,575	87,682	42,682		31,585	34,146	17,646	8,536	11,097	4,297	65,278
2010	42,500	55,000	34,470	59,741	4,741	17,241	3,508	13,793	25,271	948	4,483	2,456	32,014
2011	42,500	55,000	50,901	71,726	16,726	29,226	12,377	23,381	20,825	3,345	7,599	4,594	46,307
2012	42,500	55,000	34,656	48,494	0	5,994	4,435	4,795	13,840	1,199	1,558	2,000	32,656
2013	42,500	55,000	30,573	37,177	0	0	0	0	6,604	0	0	1,904	28,669
2014	42,500	55,000	63,431	64,886	9,886	22,386	7,315	17,909	1,455	1,977	5,820	100	63,331
2015	42,500	55,000	83,674	87,323	32,323	44,823	23,919	35,858	3,649	6,465	11,654	1,000	82,674
2016	42,500	55,000	71,567	83,306	28,306	40,806	20,946	32,645	11,739	5,661	10,610	2,769	68,798
2017	42,500	55,000	71,815	93,858	38,858	51,358	28,755	41,087	22,043	7,772	13,353	3,500	68,315
2018	42,500	55,000	57,264	76,530	21,530	34,030	15,932	27,224	19,266	4,306	8,848	2,790	54,474
Average 2013-2017			64,212	73,310	21,875	31,875	16,187	25,500	9,098	4,375	8,287	1,855	62,357

Note: TAC range is calculated by subtracting each end of the goal range from the total run. Meeting the IMEG and providing Canada's share of the TAC is part of the U.S. obligation to meet the harvest share objectives.

[a] Yukon River Panel goals were not always a range. The current interim management escapement goal (IMEG) began in 2010 and is not a biologically-based escapement goal.

[b] From 2005–2018, border passage estimates are the Chinook salmon estimate of abundance from the sonar at Eagle, minus any Alaskan harvest from the community of Eagle upstream of the sonar.

[c] Total Canadian-origin run size is border passage plus Alaskan harvest of Canadian-origin Chinook salmon. Beginning in 2014, this includes harvest from the Coastal District.

[d] U.S. Harvest estimates are estimated by applying the Canadian-origin genetic stock proportions collected from harvest sampling to number of fish harvested in Alaska.

[e] Spawning escapement is the border passage estimate minus the harvest in Canada.

Appendix B19.– Summary of management and conservation measures implemented in the U.S (Alaska) and Canada, 2001-2018.

Year	U.S. management actions (commercial)	U.S. management actions (subsistence)	Canadian management actions (commercial, domestic, recreational)	Canadian management actions (subsistence)
2001		Subsistence fishing schedule implemented (and continued in following years)	Test fishery implemented in early season; commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2002	Chinook commercial fishing shifted to midpoint of run and later		Test fishery implemented in early season; commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2003	Chinook commercial fishing shifted to midpoint of run and later		Test fishery implemented in early season; commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2004	Chinook commercial fishing shifted to midpoint of run and later		Test fishery implemented in early season; commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2005	Chinook commercial fishing shifted to midpoint of run and later		Commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2006			Commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2007			Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River	Unrestricted
2008	Chinook commercial fishing closed	Protection on 2nd and 3rd pulses	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River	Voluntary reduction in harvest
2009	Chinook commercial fishing closed and no sale of incidental catch; summer chum fishing delayed.	1st and 2nd pulse closure	Commercial/domestic openings determined by weekly estimates of abundance, recreational open	Voluntary reduction in harvest in early season

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Year	U.S. management actions (commercial)	U.S. management actions (subsistence)	Canadian management actions (commercial, domestic, recreational)	Canadian management actions (subsistence)
2010	Chinook commercial fishing closed; summer chum fishing delayed		Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery.	Voluntary reduction in harvest
2011	Chinook commercial fishing closed and no sale of incidental catch; summer chum fishing delayed; summer chum fishing restricted to certain areas of low Chinook abundance.	1st and 2nd pulse closure; additional fishing time reductions in upper districts; 7.5" mesh size restriction all season	Chinook commercial/domestic fishing closed; recreational fishing varied to non-retention in the recreational fishery, angling closure at Tatchun River, recreational restrictions lifted late in the season	Voluntary reduction in harvest in early season
2012	Chinook commercial fishing closed and no sale of incidental catch; summer chum fishing delayed and restricted to areas of low Chinook abundance; chum fish wheels attended at all times and Chinook released alive.	1st and 2nd pulse closure; additional fishing time reductions in upper districts; 6" mesh size restriction after closures	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River	Voluntary reduction in harvest
2013	Chinook commercial fishing closed and no sale of incidental catch. Summer chum fishing with beach seines and dip nets, all Chinook released alive. Gillnet summer chum fishing restricted to 5.5" and 30 meshes; delayed and restricted to areas of low Chinook abundance; chum fish wheels attended at all times and Chinook released alive.	1st, 2nd and 3rd pulse closures - limited opportunity in between pulses; additional fishing time reductions in upper districts; 6" mesh size restriction all season	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River and Teslin River	Voluntary reduction in harvest
2014	Chinook commercial fishing closed; liberal opportunity for summer chum fishing with beach seines and dip nets - all Chinook released immediately and alive; 6" or smaller gillnet summer chum fishing delayed until majority of Chinook run complete; no sale of incidental Chinook; chum fish wheels had to be attended at all times and all Chinook released immediately to the water; concurrent subsistence and commercial openings.	Entire mainstem river closed to Chinook-directed fishing; no gillnets allowed greater than 4" mesh size to harvest non-salmon species; opportunity to harvest summer chum salmon in Districts 1-4 using elective gear that allows immediate and live release of Chinook allowed (dip nets, beach seines, and fish wheels); short openings with 6" or smaller gillnets allowed in each districts after >90% of Chinook salmon run had passed through; >99% in District 5.	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River and Teslin River	Regulatory removal of TAC until 3rd quartile, voluntary reduction or closure maintained by majority of First Nations.

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Year	U.S. management actions (commercial)	U.S. management actions (subsistence)	Canadian management actions (commercial, domestic, recreational)	Canadian management actions (subsistence)
2015	Chinook commercial fishing closed; liberal opportunity for summer chum fishing with beach seines and dipnets - all Chinook released immediately and alive; 6" or smaller gillnet summer chum fishing delayed until majority of Chinook run complete; no sale of incidental Chinook; fish wheels had to be attended at all times and all Chinook released immediately to the water; concurrent subsistence and commercial openings.	Entire river closed to Chinook-directed fishing; no gillnets allowed greater than 4" mesh size to harvest non-salmon species; opportunity to harvest summer chum salmon in Districts 1–4 using selective gear that allows immediate and live release of Chinook (dipnets, beach seines, and fish wheels); short openings with 6" or smaller gillnets allowed in each district between pulses of Chinook salmon when summer chum abundance was high. Subsistence fishing was allowed in Subdistrict 5-D on the early trickle of Chinook salmon. Subsistence schedules liberalized in Districts 4 and 5 once Chinook salmon border escapement was surpassed.	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River.	Regulatory removal of TAC until 2nd quartile, voluntary reduction or closure maintained by majority of First Nations.
2016	Chinook commercial fishing closed; liberal opportunity for summer chum fishing with selective gear - all Chinook released immediately and alive; 6" or smaller gillnet summer chum fishing delayed until majority of Chinook run complete; no sale of incidental Chinook. No concurrent subsistence and commercial openings.	Early season only: Districts 1–5 using selective gear requiring live release of Chinook (dipnets, beach seines, and fish wheels); Subdistrict 5-D had open fishing on the early trickle with 6” gillnets. Reduced regulatory schedule fishing with gillnets restricted to 6” in most districts. Followed by surgical openings with 7.5” gillnets late in the run. Subsistence schedules liberalized in Districts 4 and 5 once Chinook salmon border escapement was surpassed.	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River.	Aboriginal Fishery open with recommendation for reduced harvest (30%), voluntary reduction or closure maintained by majority of First Nations.
2017	Chinook commercial fishing closed; liberal opportunity for summer chum fishing with selective gear - all Chinook released immediately and alive; 6" or smaller gillnet summer chum fishing delayed until majority of Chinook salmon run had entered the river. No sale of incidental Chinook salmon in summer season; 1 commercial period occurred in District 1 where Chinook salmon caught during fall chum directed commercial fishing were allowed to be sold. No concurrent commercial and subsistence openings in Districts 1 and 2.	Early season only: Districts 1–5 placed on regulatory schedule fishing with gillnets restricted to 6” prior to the first pulse. Fishing restricted to selective gear requiring live release of Chinook (dipnets, beach seines, and fish wheels), then reopened to regulatory schedule with 7.5-inch of smaller mesh. Coastal District, Koyukuk and Innoko Rivers, and Subdistrict 5-D remained open with 7.5-inch or smaller mesh all season.	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River.	Aboriginal Fishery open with recommendation for reduced harvest, voluntary reduction or closure maintained by majority of First Nations.

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Year	U.S. management actions (commercial)	U.S. management actions (subsistence)	Canadian management actions (commercial, domestic, recreational)	Canadian management actions (subsistence)
2018	Chinook commercial fishing closed; liberal opportunity for summer chum fishing with selective gear - all Chinook released immediately and alive; 6" or smaller gillnet summer chum fishing delayed until majority of Chinook salmon run had entered the river. No sale of incidental Chinook salmon. No concurrent commercial and subsistence openings in Districts 1 and 2.	Early season: Districts 1–5 placed on half regulatory schedule fishing with gillnets restricted to 6". Two subsistence periods (1 per week) were cancelled in Districts 1–4A. Later in the season, limited opportunity (1 reduced time opening per week) was provided with 7.5" mesh in Districts 1-4. District 5 remained restricted to 6" mesh through the third pulse of the Chinook salmon run. Coastal District, Koyukuk and Innoko Rivers remained open with 7.5-inch or smaller mesh all season.	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River.	Aboriginal Fishery open with recommendation for reduced harvest; voluntary reduction or closure maintained by majority of First Nations.