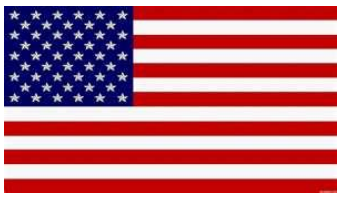
YUKON RIVER SALMON 2016 SEASON SUMMARY AND 2017 SEASON OUTLOOK

Prepared by

THE UNITED STATES AND CANADA
YUKON RIVER JOINT TECHNICAL COMMITTEE

March 2017
Regional Information Report 3A17-01
Alaska Department of Fish and Game
333 Raspberry Road
Anchorage, AK 99518, USA



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

REGIONAL INFORMATION REPORT 3A17-01

YUKON RIVER SALMON 2016 SEASON SUMMARY AND 2017 SEASON OUTLOOK

by
The United States and Canada
Yukon River Joint Technical Committee

Alaska Department of Fish and Game
Division of Commercial Fisheries
333 Raspberry Road
Anchorage, AK 99518, USA

March 2017

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/

This document should be cited as follows:

JTC (Joint Technical Committee of the Yukon River U.S./Canada Panel). 2017. Yukon River salmon 2016 season summary and 2017 season outlook. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A17-01, Anchorage.

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF APPENDICES (Continued)

LIST OF APPENDICES (Continued)

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 2016, presents a 2017 season outlook, and provides data on salmon harvests in commercial, subsistence, aboriginal, personal use, domestic, and sport or recreational fisheries. Summaries of Yukon River research projects and a list of 2016 Restoration and Enhancement Fund projects are also included. For 2016, the preliminary estimate of Chinook salmon spawning escapement in Canada was 69,000 fish, exceeding 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 83,000 fish. The preliminary estimate of fall chum salmon spawning escapement in the Canadian mainstem Yukon River was 145,267 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 counts combined with sonar estimates, was 29,396 fish. This estimate fell within 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 2017 remain the same as for 2016.

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 United States (U.S.) and Canada, Yukon River Joint Technical Committee (JTC) was established in 1985 and serves as a scientific advisory body to the Yukon River Panel (Panel). This annual report covers salmon fishery and management topics addressed by the JTC following the 2016 season and preceding the 2017 season, in accordance with the Yukon River Salmon Agreement.[1]

The JTC meets semi-annually to discuss harvest and escapement goals, management strategies, preseason outlooks and postseason reviews, and results of cooperative research projects. The fall meeting was held November 15–17, 2016 in Vancouver, British Columbia. The spring meeting was held March 6–8, 2017 by video conference between sites in Whitehorse, Yukon Territory, Kamloops, B.C., and Fairbanks, Alaska.

Preliminary postseason fishery reviews were presented and discussed during the fall meeting. These included presentations by U.S. and Canadian members on management, stock assessment, harvests, and escapement of Chinook *Oncorhynchus tshawytscha* and fall chum *O. keta* salmon; salmon bycatch in the Bering Sea and Gulf of Alaska trawl fisheries; and marine research surveys. Subcommittee work, including fall chum salmon assessments on the Porcupine and Fishing Branch rivers and sonar project guidelines, was discussed. The JTC also heard a report on Canadian agency salmon and habitat restoration planning.

In the spring meeting, the JTC reviewed preseason outlooks and management plans for the upcoming 2017 season. The JTC heard and discussed a final report on a Management Strategy Evaluation study addressing management needs and issues for Canadian-origin Chinook salmon, presented by Principal Investigator Mike Jones of Michigan State University.

Review of 2017 Yukon River Salmon Restoration and Enhancement (R&E) Fund detailed proposals was conducted prior to the fall JTC meeting and recommendations to the Panel were

[1] The Yukon River Salmon Agreement appears as Chapter 8 in the Pacific Salmon Treaty, http://www.psc.org/pubs/Treaty/Treaty.pdf.

finalized at the fall meeting and presented to the Panel during its December 2016 meeting. The Panel made requests for clarifications or modifications on some proposals, and the JTC reviewed the responses to those requests during the spring meeting.

JTC membership and meeting attendance (Fall 2016 and Spring 2017 meetings):

Bill Bechtol, Tanana Chiefs Conference (TCC)
Bonnie Borba, Alaska Department of Fish and Game (ADF&G)
Chuck Brazil, ADF&G
Caroline Brown, ADF&G
Randy Brown, U.S Fish and Wildlife Service (USFWS)
Holly Carroll, ADF&G
Jan Conitz (U.S. co-chair), ADF&G
Joel Harding, Department of Fisheries and Oceans Canada (DFO)
Jason Hwang, DFO
Mary Ellen Jarvis, DFO
Matt Keyse, USFWS
Nathan Millar (Canadian co-chair), DFO
Jim Murphy, US National Oceanic and Atmospheric Administration (NOAA)
Chris Stark, Bering Sea Fishermen's Association (BSFA)
Don Toews, Yukon Salmon Subcommittee (YSSC)
Fred West, ADF&G
Trix Tanner, DFO

JTC meeting guests (spring 2017)
Mike Jones, Michigan State University (guest workshop presenter)
John Syslo, Michigan State University (guest workshop presenter)
Michael Crowe, DFO
Elizabeth MacDonald, DFO
Jason Calvert, DFO
Vesta Mather, DFO
Jeff Estensen, ADF&G
Sean Larson, ADF&G

Throughout the years, U.S. and Canadian researchers have developed projects to monitor escapement and to determine genetic composition, relative abundance, run characteristics, run timing and other information to characterize the annual salmon migration in the Yukon River. Mainstem river sonars, tributary sonars, counting towers, aerial surveys and weirs are used to monitor escapement. Other information collected includes catch per unit of effort (CPUE), salmon sex and length composition, scales or vertebra for age determination, tissue samples for genetic stock identification, data on resident species, and information from recovery of tagged fish from various projects. Harvest is monitored through voluntary or required reporting, in Alaska, subsistence harvest is estimated from information collected in community surveys and fishing permits. Various government agencies, non-government organizations, and private contractors operate projects throughout the drainage (Appendices A7 and A8).

Summaries of many of these projects and information used to assess escapement and stock status and provide run outlooks are presented in this report. Although most data sets have been fully

compiled and most analyses completed prior to publication of this report, much of the information from the 2016 season was preliminary at the time of writing. Other published, peer reviewed sources should be consulted for definitive documentation of postseason information. The annual management report for the Yukon Area is published within the ADF&G Fishery Management Report series by year (e.g., Estensen et al. 2015, http://www.adfg.alaska.gov/sf/publications/). All Alaska subsistence and personal use harvest data are considered preliminary until the relevant ADF&G Fisheries Data Series reports (e.g., Jallen et al. 2015, http://www.adfg.alaska.gov/sf/publications/) are published.

This report is focused on Chinook and fall chum salmon stocks that occur on both sides of the international border, and more specifically on salmon originating in Canadian waters and addressed by the Yukon River Salmon Agreement. Two genetically distinct runs of chum salmon enter the Yukon River, an early summer component and a later fall component. Summer chum salmon are characterized by earlier run timing (early June to mid-July at the river mouth), rapid maturation in freshwater, and smaller body size (average 6–7 pounds). Summer chum salmon spawn primarily in run-off streams in the lower 700 miles of the Yukon River drainage and in the Tanana River drainage. Fall chum salmon are distinguished by later run timing (mid-July to early September at the mouth), robust body shape, and larger body size (average 7–8 pounds). Fall chum salmon primarily spawn in the upper portion of the drainage in streams that are spring fed or geologically have strong upwelling features. Major fall chum salmon spawning areas include the Tanana, Porcupine, and Chandalar river drainages in Alaska, as well as various streams in the Yukon Territory, Canada, including the Kluane, Fishing Branch and mainstem Yukon River. Like summer chum salmon, few coho salmon *O. kisutch* are bound for the upper reaches of the Yukon River in Canada, with the exception of a Porcupine River population. Most Yukon River coho salmon spawn in the lower 700 miles of the drainage, and within the Tanana River drainage.

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 management plan for Chinook salmon also stipulates a first pulse closure in the subsistence fishery intended to protect Canadian-origin Chinook salmon, regardless of preseason forecasted run size, to help ensure Yukon River Salmon Agreement escapement and harvest-sharing objectives will be met. The summer chum salmon management plan establishes run size thresholds needed to allow subsistence, commercial, sport, and personal-use fishing, prioritizing subsistence use. Because summer chum salmon and Chinook salmon migrate concurrently, regulations in the management plan allow for using selective gear types during times of Chinook salmon conservation that target summer chum salmon and allow immediate release of Chinook salmon back to the water alive. 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.

Preseason, ADF&G develops a management strategy in cooperation with federal managers, fishermen, tribal/traditional council representatives, and other stakeholders that outlines run and harvest outlooks along with management actions that may be implemented over the course of the summer season. Before the arrival of salmon, subsistence fishing is allowed 7 days per week to provide opportunity to harvest non-salmon species such as whitefish *Coregonus* spp., sheefish *Stenodus leucichthys*, northern pike *Esox lucius*, and burbot *Lota lota*. As the season progresses, ADF&G uses an adaptive management strategy for salmon that evaluates run strength to determine if a harvestable surplus exists above escapement requirements and subsistence uses.

Preseason Management Strategy Planning

The Canadian-origin run of Yukon River Chinook salmon in 2016 was projected to be 65,000-88,000 fish, and the total run size for the entire drainage (U.S. and Canada stocks) was expected to be approximately twice this size, 130,000–175,000 fish. For Canadian-origin Chinook salmon, the interim management escapement goal (IMEG) range recommended by the Yukon River Panel was 42,500–55,000 fish. As in recent years, initial management would be conservative until inseason assessment indicated the run size would be toward the upper end of the projected range. This run size was expected to be strong enough to meet escapement objectives and provide some harvestable surplus; however, conservation measures were still anticipated to be necessary to restrict harvests to below historical levels. Before the 2016 season, the Yukon River Drainage Fisheries Association (YRDFA) facilitated a meeting with U.S. management agencies (ADF&G and USFWS), 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: ensure adequate numbers of Chinook salmon reach their spawning grounds in Alaska and Canada, minimize the harvest of Chinook salmon, and provide ample opportunity to harvest abundant summer chum salmon and non-salmon species.

After break-up, but prior to Chinook salmon entering the river, opportunity for subsistence fishing for non-salmon species would be provided with 6-inch or smaller mesh gillnets. When subsistence reports and/or the Lower Yukon Test Fishery (LYTF) projects indicated Chinook salmon were present in the lower Yukon River, subsistence salmon fishing would be closed. These subsistence salmon fishing closures would be implemented chronologically in upriver districts and tributaries, including the Koyukuk, Innoko, and Tanana rivers, as Chinook salmon migrated upstream. This closure would be in place prior to the first pulse entering the river and would follow the first pulse (and the second pulse if warranted) until that pulse reached the Canadian border. Throughout salmon subsistence closures, subsistence fishing with 4-inch or smaller mesh gillnets not exceeding 60 feet in length would be allowed to harvest non-salmon species. Managers strongly encouraged fishermen to avoid fishing in areas where Chinook salmon were likely to be encountered. When summer chum salmon became abundant, subsistence fishing for summer chum salmon would be opened using selective fishing gear (e.g., dip nets, beach seines, and live-release fish wheels) to allow for the quick, live release of Chinook salmon. If inseason assessment projects indicated that escapement goals for Chinook salmon would be met, the use of 6-inch gillnets would be allowed for more efficient harvest of summer chum salmon on a reduced regulatory schedule. It was unlikely that districts and subdistricts would be returned to an unaltered regulatory subsistence schedule until the Chinook salmon run was almost complete in a given district or subdistrict and gillnet restrictions would likely not be relaxed until after the majority of the Chinook salmon run had passed through each

district. An informational flyer detailing these planned conservation strategies was mailed to Yukon River commercial permit holders and approximately 2,900 households identified from ADF&G's survey and permit databases.

The summer chum salmon outlook suggested a run size sufficient to meet escapement and subsistence needs and provide for a commercially harvestable surplus. However, the management of a summer chum-directed salmon commercial fishery would be affected by the need to conserve Chinook salmon and would depend on Chinook salmon run timing and abundance. The sale of incidentally-caught Chinook salmon would be prohibited for the entire season. Early in the season, selective fishing gear, including dip nets and beach seines, would be employed during commercial summer chum salmon fishing periods to reduce the harvest of Chinook salmon. Later in the season, 6-inch or smaller mesh gillnets were expected to be allowed when the harvest of Chinook salmon was anticipated to be low.

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 2016 season based on Chinook salmon run strength.

Inseason Run Assessment

The U.S. management agencies (ADF&G; USFWS) monitor a suite of assessment projects that provide critical data on salmon run timing, relative abundance, and stock composition of salmon. Information from multiple assessment projects are corroborated when available to provide the best possible assessment. Initial assessment in the lower Yukon River is critical to implementing an inseason management plan to operate an orderly fishery throughout the drainage. Three projects in the lower Yukon River provided inseason abundance and timing information. First, the Lower Yukon test fishery (LYTF) is a set gillnet project using 8.5-inch mesh primarily designed to assess Chinook salmon run timing and is operated in the Middle and South Mouths of the Yukon River. Second, a summer chum salmon-directed drift gillnet test fishery, which uses 5.5-inch mesh nets, is operated in the Middle and South Mouths of the Yukon River. Third, a mainstem Yukon River sonar project operated near the community of Pilot Station provides abundance estimates for Chinook and summer chum salmon. Additional drift test fishing was conducted throughout the 2016 season in the South Mouth at the Big Eddy sites with 8.25-inch mesh drift gillnets for Chinook salmon to provide supplemental run timing and relative abundance information. Given the anticipated below average run size, efforts were made by the department to reduce Chinook salmon mortality in test fisheries. Chinook salmon caught in drift and set gillnets that were deemed healthy were released alive immediately. Any Chinook salmon

mortalities were delivered to tribal/traditional councils in various villages for distribution to elders.

Ice break-up at the mouth of the Yukon River (near Alakanuk) occurred on May 3, which was more than 3 weeks earlier than the average break up date of May 25 (based on the years 1961–2015). The first summer chum salmon of the year was caught in the subsistence fishery on May 16 and in the 5.5-inch drift gillnet test fishery on May 19, over 2 weeks earlier than the average date of June 3 (based on the years 1967–2015). The first subsistence caught Chinook salmon was harvested on May 23, one week earlier than the average date of May 31 (based on the years 1961–2015). The department relied on subsistence harvest reports to guide initial management actions during the early portion of the salmon runs.

The LYTF (8.5 inch set gillnet project) was operational at the South Mouth site on May 24 and at the Middle Mouth site on June 3. The first Chinook salmon was caught in the test fishery on May 24. Unlike previous years, the Big Eddy set gillnet was operated for the entire summer season. However, only 1 set gillnet site operated at Middle Mouth in an effort to reduce Chinook salmon mortality. The LYTF concluded operations on July 15 with a cumulative CPUE of 38.19, which was above the historical average CPUE of 28.61 for years with early run timing. The first quarter point, midpoint, and third quarter point were June 11, June 19, and June 25, respectively. The 8.25-inch drift gillnet project for Chinook salmon operated in Big Eddy until July 15 and provided valuable supplemental run timing information for Chinook salmon entering the South Mouth of the Yukon River. In accordance with the goal of reducing Chinook salmon mortality, 790 Chinook salmon were released from the LYTF.

The preliminary cumulative passage estimate at the mainstem Yukon River sonar project near Pilot Station[2] was approximately 176,900 Chinook salmon, which was near the recent historical average of 178,300 fish (Appendix A2). Chinook salmon entered the river in 4 pulses consisting of approximately 22,500 fish; 33,000 fish; 47,000 fish; and 23,500 fish respectively. Inseason run assessment analysis was focused on making comparisons to years with similar early run timing. The first quarter point, midpoint, and third quarter point for the sonar project near Pilot Station were on June 17, June 23, and June 30, respectively, which were similar to passage dates from previous early runs. The 2016 Chinook salmon run appears to have been 2 days earlier than average run timing based on the midpoints at the LYTF and sonar assessment projects.

Tissue samples were taken from the majority of Chinook salmon caught in the test fishery at the sonar project near Pilot Station and were analyzed in 3 strata for genetic mixed stock analysis (MSA). The 3 strata periods were May 30–June 14 (number sampled (n) = 178), June 15-June 25 (n = 288), and June 26–July 6 (n = 111). Genetic MSA indicated the Canadian-origin stock proportion of each stratum to be 52%, 34%, and 54% for the first, second, and third stratum, respectively. The season-total Canadian-origin proportion of 43% (genetic proportion weighted by passage) suggested a stronger contribution of the Canadian-origin stock to the overall Chinook salmon run size in 2016 than was expected for an even year. Interestingly, the third stratum also had the highest Canadian stock proportion that has been measured since MSA began in 2005. For more background information on genetic MSA for Yukon River Chinook salmon, please refer to the ADF&G Gene Conservation Laboratory webpage[3].

[2] For more background information on ADF&G operated sonar projects including the Pilot Station site on the Yukon River, refer to the ADF&G sonar webpage, http://www.adfg.alaska.gov/index.cfm?adfg=sonar.site&site=12.

[3] http://www.adfg.alaska.gov/index.cfm?adfg=fishinggeneconservationlab.yukonchinook_baseline

Chinook Salmon Inseason Management

In previous years, gillnets were restricted from 7.5-inch to 6-inch or smaller mesh immediately following ice-out and then salmon fishing was closed once Chinook salmon were caught in the LYTF. However, in 2016, managers waited for increased Chinook salmon catches at the LYTF assessment project before closing the subsistence gillnet fishery. From ice-out up until the gillnet closure, fishermen could use 7.5-inch or smaller mesh gillnets to target sheefish and other species. In general, for most districts or subdistricts, once Chinook salmon were present, subsistence salmon fishing with gillnets and fish wheels was closed. These closures were implemented in upriver districts as Chinook salmon migrated upstream and then fishing was re-opened 24 hours later in each area with selective gear to allow for the harvest of summer chum salmon only and the live-release of Chinook salmon.

The first subsistence-caught Chinook salmon was on May 23 and the first Chinook salmon caught in the LYTF near Emmonak was May 24. Though these first catches of Chinook salmon were earlier than average, the LYTF did not detect increased numbers of Chinook salmon sufficient to warrant closing and restricting subsistence fishing until May 29. The Coastal District was divided into 2 areas and beginning May 29 the Southern Coastal District was restricted to 6-inch or smaller mesh gillnets (in effect until June 30), and the Northern Coastal District was closed until July 1. District 1 was closed to salmon fishing on May 29. District 2 closed on May 31; District 3 closed on June 3; Subdistrict 4-A Lower closed on June 6; Subdistrict 4-A Upper closed on June 10; Subdistricts 4-B and 4-C closed on June 12; and Subdistricts 5-A, 5-B, and 5-C closed on June 16. Because very few summer chum salmon migrate through District 5-D, and in order to allow some subsistence opportunity on early Chinook salmon that migrate prior to the first pulse, Subdistricts 5-D Lower, Middle, and Upper were allowed to fish with gillnets restricted to 6-inch or smaller mesh for 9 days prior to salmon fishing closures that occurred on June 28, July 1, and July 3 in Lower, Middle and Upper areas within the subdistrict, respectively. After subsistence salmon fishing closures, fishing in most districts and subdistricts was re-opened with selective gear (dip nets, beach seines and live release fish wheels) 24 hours a day, 7 days per week, to target summer chum salmon only. Beginning May 30, June 1, and June 4, fishing with selective gear was opened in Districts 1, 2, and 3, respectively. Beginning June 7 and June 11, fishing with selective gear was opened Subdistrict 4-A Lower and 4-A Upper, respectively. On June 13 fishing with selective gear opened in Subdsitricts 4-B and 4-C. In 2016, the use of dip nets and beach seines was allowed for the first time in District 5. On June 17 fishing with selective gear was opened in Subdistrict 5-A, 5-B and 5-C.

Four pulses of Chinook salmon passed the mainstem Yukon River sonar project near Pilot Station on June 11, 15, 20, and 27. Subsistence salmon closures were in place in Districts 1–5 during all of the first pulse and nearly all of the second pulse of the Chinook salmon run. Early assessment information from fishermen, the LYTF, and the Yukon River sonar project near Pilot Station indicated the run abundance was likely within the preseason projected range and maybe toward the upper end of the range. Genetic stock analysis of Chinook samples from the sonar project near Pilot Station indicated an above average proportion of the run was Canadian-origin. It was determined the run size was likely large enough to meet the spawning escapement objective and to support a small subsistence harvest of Chinook salmon in accordance with the total allowable catch provided for in the harvest sharing objectives of the Yukon River Salmon Agreement. The use of selective gear types was then discontinued and subsistence fishing

opportunity on a reduced regulatory schedule with gillnets restricted to 6-inch or smaller mesh was provided in Districts 1–5 to more efficiently harvest summer chum salmon and to minimize the harvest of Chinook salmon. These gillnet openings were intended to target large groups of summer chum salmon passing through the area and any Chinook salmon could be kept for subsistence purposes. The restriction to 6-inch mesh likely ` younger, male, Chinook salmon and this restriction was in place until late in the run when short openings with 7.5-inch or smaller gillnets were allowed in most districts from District 2 through District 5.

Once the majority of the Canadian-origin Chinook salmon run had passed through each district and confidence was gained that the border escapement objective would be achieved, subsistence salmon fishing restrictions were relaxed in each district. Conservative management actions were also taken in Yukon River tributaries in an effort to provide protection for U.S. Chinook salmon stocks. In the Tanana River (Subdistricts 6-A and 6-B), subsistence salmon fishing remained on its regulatory schedule of two 42-hour periods per week for the entirety of the Chinook salmon season. However, gear was restricted to 6-inch or smaller mesh gillnets and manned fish wheels were required from July 1 through July 11. In Subdistrict 6-C, personal use salmon fishing was restricted to 6-inch or smaller mesh gillnets from June 20 to July 15; during this time period, personal use fishermen could also use fish wheels and dip nets but had to release any Chinook salmon alive from these gear types. The Koyukuk and Innoko rivers were kept on their regulatory schedule of 24 hours per day, 7 days per week, but were restricted to 6-inch or smaller gillnets on June 20 and these restrictions were lifted on June 25 for the Innoko River and June 28 for the Koyukuk River.

Throughout the season, weekly teleconferences were facilitated by 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, ADF&G and USFWS staff provided inseason run assessment information and upcoming management strategies; subsistence fishermen provided reports on fishing effort and water conditions in their respective communities along the river.

2016 Summer Chum Salmon Outlook

The strength of the summer chum salmon run in 2016 was largely dependent on production from the 2012 (age-4 fish)[4] and 2011 (age-5 fish) escapements, as these age classes dominate the run. It was expected the 2016 total run would be slightly lower than the 2015 run of approximately 1.8 million fish. A run of this size was anticipated to provide for escapements, a normal subsistence harvest, and a potential commercial harvest of 450,000 to 950,000 summer chum salmon. Similar to previous years, the actual commercial harvest of summer chum salmon would likely be affected by a poor Chinook salmon run, in that incidental harvest of Chinook salmon in chum salmon-directed fisheries would need to be minimized.

Summer Chum Salmon Inseason Run Assessment and Management

The Yukon River summer chum salmon run was managed according to the guidelines described in the *Yukon River Summer Chum Salmon Management Plan* (Appendix A1). The management plan provides for escapement needs and subsistence use priority before other consumptive uses

[4] Ages of salmon in this report are presented as total age, from egg-in-gravel to return as spawner, rather than the commonly used decimal (European) notation indicating freshwater and saltwater years.

such as commercial, sport, and personal use fishing. The plan allows for varying levels of harvest opportunity depending on the run size projection. ADF&G uses the best available data to assess the run; including, preseason run outlooks; passage estimate at the mainstem Yukon River sonar project near Pilot Station; test fishing indices; age, sex, and length (ASL) composition; subsistence and commercial harvest reports; and information from escapement monitoring projects.

Liberal commercial fishing opportunity was provided to target the available surplus of summer chum salmon in Districts 1, 2, and 6. At the same time, a suite of strategies were used to conservatively manage these fisheries to minimize the incidental harvest of Chinook salmon. Utilizing regulations adopted by the Alaska Board of Fisheries (BOF) in 2013, ADF&G allowed for the commercial harvest of summer chum salmon using dip nets and beach seines beginning June 7 in District 1 and June 14 in District 2. The impact on the Chinook salmon run was expected to be minimal as fishermen were required to immediately release incidentally caught Chinook salmon back to the water alive. Unlike the 2015 season, in 2016 concurrent subsistence and commercial fishing periods were not offered because at the pre-season planning meeting many fishermen requested the openings be kept separate to avoid competition for optimal summer chum salmon fishing sites between commercial and subsistence fishermen.

In 2016, the use of gillnet gear was delayed until inseason assessment indicated the majority of the Chinook salmon run had migrated upriver in an effort to reduce the incidental harvest. In District 1 only, commercial opportunity with 5.5-inch or smaller mesh gillnets, not exceeding 30 meshes in depth, was provided for 8 periods in a further attempt to reduce the incidental harvest of Chinook salmon. Once managers were confident that the majority of the Chinook salmon run had migrated out of each district, commercial opportunity with 6-inch gillnet gear was provided for the remainder of the summer season beginning July 5 in District 1 and June 27 in District 2. No commercial fishery operated in District 4 in 2016 due to the lack of a buyer.

District 6 was managed using inseason assessment information collected at the mainstem Yukon River sonar project near Pilot Station and tributary escapement projects in the Tanana River drainage. A harvestable surplus of summer chum salmon was expected based upon sonar abundance estimates and genetic stock composition information. Given the available surplus and favorable market interest, ADF&G scheduled the first summer chum salmon directed commercial fishing period in District 6 on July 11. ADF&G scheduled a total of 9 commercial fishing periods for summer chum salmon in District 6; however, no commercial harvest of summer chum salmon occurred during the last 2 periods.

The sale of incidentally caught Chinook salmon was prohibited during the entire commercial fishing season. This action helped ensure fishermen would not target Chinook salmon during gillnet commercial fishing periods. In addition, fishermen could either release incidentally caught Chinook salmon alive or use them for subsistence purposes. Fishermen were required to report any Chinook salmon retained but not sold on commercial fish tickets.

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 threshold number of fall chum salmon needed to allow commercial fishing is

550,000 fish (Appendix A5) and commercial fishing is generally allowed only on the surplus above that level. The fall chum salmon plan incorporates Yukon River Salmon Agreement objectives for border passage of fall chum salmon and provides guidelines necessary for escapement and prioritized uses. 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 to 600,000 fall chum salmon (Fleischman and Borba 2009). 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 coho salmon plan allows a coho salmon directed commercial fishery in the absence of achieving the threshold number of fall chum salmon if a harvestable surplus of coho salmon exists and a commercial fishery will not have a significant impact on fall chum salmon escapement and allocation. Finally, under the Tanana River plan, 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

ADF&G monitored a suite of assessment projects that provided salmon run timing, relative abundance, and stock composition information. Projects operated in the lower Yukon River included 2 drift gillnet test fisheries, a mainstem Yukon River sonar providing abundance estimates, and subsistence and commercial harvest data collection. Genetic samples collected from chum salmon at the mainstem Yukon River sonar near Pilot Station provided stock composition information. Assessment projects operated in the upper Yukon River included sonars in the mainstem Yukon River near the U.S./Canada border as well as in 2 tributaries (Chandalar and Porcupine rivers) and a weir and sonar on the Fishing Branch River (upper Porcupine River). ASL information was collected at the lower Yukon River test fisheries and various upriver escapement projects.

By regulation, the fall season began in District 1 on July 16. Chum salmon caught in the LYTF beginning July 15 were considered fall chum salmon. Mountain Village drift gillnet test fishery began operation on July 18 and the mainstem Yukon River sonar near Pilot Station began counting chum salmon as fall chum salmon on July 19. Initial management was based on the preseason run projection of 800,000 to 900,000 fall chum salmon. All districts and subdistricts were placed on their full regulatory subsistence fishing schedules commensurate with switching over to fall management. By August 2, subsistence fishing in all mainstem districts (1–5) was open 7 days per week, 24 hours per day. In the mainstem Porcupine River, subsistence fishing for fall chum salmon was closed from August 31 until September 19, and then placed on a reduced fishing schedule of one 72-hour fishing period per week when projections were favorable based on passage at the upper Porcupine River border sonar and the Fishing Branch River weir and sonar projects in Canada. Finally, by September 30, fall chum salmon passage at the Fishing Branch River weir indicated that the lower end of the escapement objective would be met, and subsistence fishing was allowed 24 hours a day, 7 days a week.

The LYTF ceased operations on September 10 and had a cumulative CPUE for fall chum salmon of 1,893 fish, which is below the historical median of 2,099 fish[5]. The Mountain Village drift gillnet test fishery ceased operations on September 12 with a cumulative CPUE for fall chum salmon of 2,943 fish, which is above the historical median of 2,003 fish. Finally, the mainstem sonar near Pilot Station ceased operations on August 31, a week earlier than the date the project has normally ceased operation since 2008. The preliminary fall chum salmon passage estimate at the sonar near Pilot Station was 994,760 fish ± 39,094 (90% CI), which is above the historical median of 669,000 fish. Five pulses of fall chum salmon were detected, with the largest pulse, estimated to be 373,000 fish, having finished passing the sonar by August 20 (Figure 3). A potential sixth pulse was detected by an increase in cumulative fall chum salmon passage at LYTF and Mountain Village test fishery during the first week of September. Run timing for fall chum salmon was only slightly late, averaging 2 days late over all the assessment projects.

Coho Salmon Management Overview

The preliminary coho salmon passage estimate at the mainstem sonar project near Pilot Station was 168,297 fish ± 11,180 (90% CI), which is above the historical median of 132,929 fish. A portion of the coho salmon run was missed because the mainstem sonar operations ceased prior to the completion of the run. Based on daily catches in the LYTF, which operated until September 10, two additional pulses of coho salmon were observed during the extended operations. Run timing for coho salmon was average in the majority of the assessment projects. Coho salmon daily and cumulative passages at the mainstem Yukon River sonar remained above the median after the midpoint of the season (Figure 4). ADF&G identified a surplus of coho salmon in addition to what was harvested in the fall chum salmon commercial fishery and allowed a coho salmon directed fishery in Districts 1 and 2, from September 1 to September 10, and in Districts 5 and 6, from October 1 to October 5.

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 early October. Fishing opportunity in the Lower Yukon Area in May and the Upper Yukon Area 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 and are also dried, smoked, or frozen for later use. In the Upper Yukon Area, summer chum, fall chum, and coho salmon are all 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

[5] The project was operated by the Yukon Delta Fisheries Development Association after ADF&G ceased operations on August 29.

Commercial Fisheries. The survey is conducted in 33 communities (including the 2 coastal communities of Hooper and Scammon Bay) during the fall, after most households have completed fishing for salmon (Jallen et al. 2015). Additional information on harvest timing is obtained from harvest calendars that are sent to households and filled out voluntarily (Jallen et al. 2015).

All 2016 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 2016 preliminary subsistence salmon harvest in the Alaska portion of the Yukon River drainage was estimated to be 20,853 Chinook, 75,575 summer chum, 83,306 fall chum, and 8,460 coho salmon (Appendices B2–B5). For comparison, recent 5-year average (2011–2015) subsistence salmon harvest estimates are 17,768 Chinook, 80,828 summer chum; 94,186 fall chum; and 16,632 coho salmon (Appendices B2–B5) from communities in the Alaska portion of the Yukon River drainage.

Of the 20,853 Chinook salmon harvested in Alaska waters, 11,116 fish were considered to be of Canadian origin based on genetic samples taken from the subsistence harvest in 2016. Samples were collected from communities in each of the 5 mainstem 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. Subsistence fish harvested in the Koyukuk drainage and District 6 are not considered to be of Canadian-origin and not included in Canadian origin harvest total. All summer chum salmon are considered to be of U.S. origin. The estimated 2016 harvest of Chinook, fall chum, and coho salmon were below levels defined by the Alaska Board of Fisheries as Amounts Reasonably Necessary for Subsistence[6] (Brown and Jallen 2012).

In 2016, subsistence harvest surveys identified approximately 2,356 households in the Yukon Area in 31 communities. Of these, an estimated 1,123 households fished for salmon. Permits are not required for subsistence fishing throughout most of the Yukon Area, with the exception of the urban areas around Fairbanks and other areas accessible by road. Therefore, by far the largest share of subsistence harvest in the Yukon Area must be estimated from the detailed postseason survey results. In areas where permits are required, subsistence fishing permits were issued to 457 households and approximately 82% of the subsistence permits had been returned (at the time of this publication). Two hundred and fifty eight of the permitted households reported fishing for salmon and other non-salmon fish species. For the purposes of this report, results from the Coastal District communities of Hooper Bay and Scammon Bay are not included, as their harvest is considered part of the larger Yukon management area, but not specifically attributed to Yukon River origin stocks.

4.2 COMMERCIAL FISHERY

Summer Season Harvest

During the 2016 summer season there were a total of 49 commercial periods in the Lower Yukon Area and 7 commercial periods in the Upper Yukon Area. The total commercial harvest for the summer season in the Alaska portion of the Yukon River drainage was 525,809 summer chum

[6] 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.

salmon (Appendix A3), the second largest harvest since 1989 (Appendix B3). The commercial harvests of summer chum salmon in the Lower and Upper Yukon Areas were 521,789 and 4,020 fish, respectively. The total summer chum salmon commercial harvest for the entire Yukon Area was approximately 33% above the 2011–2015 average harvest of 393,965 fish (Appendix B3). Harvest with selective gear accounted for over a third of the total commercial summer chum salmon harvest in the Lower Yukon Area. In the Lower Yukon Area commercial fishery, approximately 8,261 Chinook salmon were reported as caught and released. A total of 5,508 Chinook salmon were reported retained for subsistence purposes during the summer season commercial fisheries. Approximately 115 Chinook salmon were reported retained for subsistence purposes during the fall season commercial fishery.

Fall Season Harvest

There were a total of 65 commercial periods during the fall season in 2016. The majority of the fall season commercial harvest occurred in the Lower Yukon Area. Commercial fishing periods were established in Districts 5 and 6, but limited markets resulted in low fishing effort and relatively small harvests. The total commercial harvest for the Yukon River fall season in the Alaska portion of the drainage was 465,396 fall chum and 201,482 coho salmon (Appendix A3). The fall chum salmon commercial harvest was the second largest on record falling just short of the record caught in 1981 (Appendix B4). The coho salmon harvest was a record harvest for the third consecutive year, eclipsing the previous high of 129,700 fish in 2015 (Appendix B5). The average weight of fall chum salmon caught commercially in Districts 1 and 2 was 7.0 lbs and the average weight of coho salmon was 6.3 lbs. All salmon were sold in the round and no salmon roe was sold separately.

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. Harvest estimates are not available until approximately 1 calendar year after the fishing season; therefore, 2016 estimates were not available for this report. Total sport harvest of salmon during 2015 in the Alaska portion of the Yukon River drainage (including the Tanana River) was estimated to be 0 Chinook, 194 chum, and 593 coho salmon (Appendices B2, B3, and B5). The recent 5-year (2011–2015) average Yukon River drainage sport salmon harvest was estimated to be 197 Chinook, 511 chum, and 662 coho salmon (Appendices B2, B3, and B5).

Most of sport fishing effort for the Yukon River occurs in the Tanana River drainage along the road system (Burr 2012; Brase and Baker 2015). From 2011 to 2015, harvests in the Tanana River represented, on average, 56%, 8%, and 30% of the total Yukon River drainage Chinook, summer chum, and coho salmon sport fish harvest[7], respectively. In the Tanana River, most

[7] Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited March 16, 2015). Available from: https://intra.sf.adfg.state.ak.us/swhs_est/

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 2011 to 2015, guided sport harvests in the Yukon River drainage (excluding the Tanana River drainage) averaged 66 Chinook and 241 coho salmon.

On April 29, 2016, an emergency order closed all waters to taking of Chinook salmon in the U.S. portion of the Yukon River drainage, but excluded the Tanana River drainage. Effective July 2, an emergency order prohibited the use of bait in all flowing waters of the tributaries of the Tanana River, which coincides with Chinook salmon arrival into the clearwater sport fisheries such as the Chena and Salcha rivers.

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, and it has been managed consistently under personal use regulations since then. 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 2016, the personal use salmon fishery followed the regulatory fishing times of two 42-hour periods per week and was restricted to live release fish wheels, dip nets, or 6” or smaller mesh gillnets from 6:00 pm Monday, June 20 until 6:00 p.m. Friday, July 15. Fishermen were required to release Chinook salmon alive from fish wheels and dip nets. A total of 57 personal use salmon and 21 personal use whitefish and sucker household permits were issued. The 2016 preliminary harvest results based on 97% of the personal use household permits returned in Subdistrict 6-C included 57 Chinook, 176 summer chum, 283 fall chum and 266 coho salmon. The recent 5-year (2011–2015) average personal use harvest are 42 Chinook, 271 summer chum, 300 fall chum and 152 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 5). The total run of Canadian-origin

mainstem Yukon River Chinook salmon in 2016 was expected to be below average, with a preseason outlook range of 65,000 to 88,000 Chinook salmon. As noted previously, the escapement goal (IMEG) range recommended by the Yukon River Panel was 42,500 to 55,000 Chinook salmon.

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.[8]

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 2016 decision matrix summarized the management reference points, general allocation plans, and anticipated management responses under different run size scenarios (Table 2).

The following decision thresholds were used to guide management actions to achieve an escapement goal range of 42,500 to 55,000 fish and a management target of 48,750 Canadian-origin Chinook salmon:

RED ZONE <42,500
No harvest – removal of all Chinook salmon harvest allocations. Run sizes this low represent a high conservation risk.

YELLOW ZONE (lower) 42,500 to 48,750
Base level harvest in the First Nation fishery only. Anticipated harvest of less than 10% of annual subsistence needs.

YELLOW ZONE (upper) 48,750 to 55,000
Run supports some First Nation subsistence fishing. The harvest target is 10% to 90% of annual subsistence needs and varies in accordance with projected run abundance. Harvest targets are met using voluntary harvest reductions in each First Nation.

GREEN ZONE >55,000
Opportunity for normal (full) First Nation subsistence harvest (i.e., no voluntary harvest reductions sought). Harvest opportunities (and allocation) for recreational, commercial, and domestic fisheries are provided in proportion to run abundance and are considered only when opportunities for First Nation harvests have not been restricted.

Prior to the season, meetings were held between the Yukon Salmon Sub-Committee (YSSC), DFO, Yukon First Nation Governments, Renewable Resources Councils (RRCs), and the general public to discuss the 2016 forecast and possible management scenarios. The poor preseason forecast, coupled with the failure to achieve minimum escapement targets in 5 of the past 9 years, resulted in continued concern over the long-term health of Canadian-origin Yukon River Chinook salmon stocks. At the recommendation of the YSSC, the inseason fishery management decision matrix for Yukon River Chinook salmon in Canada reflects the escapement goal range defined by the Yukon River Panel (YRP) pursuant to the Yukon River Salmon Agreement. In

[8] The IFMP is available online at http://www.dfo-mpo.gc.ca/Library/358169.pdf.

addition, to improve the likelihood of achieving conservation objectives, a midpoint management target of 48,750 was used to guide inseason management decisions.

As a result of recommendations brought forth by the YSSC, the TAC of Chinook salmon in commercial, domestic, and recreational fisheries was varied to zero at the beginning of the season. In addition, the YSSC recommended that First Nations take a conservative approach in the early season by reducing harvest, by deploying 6 inch or smaller mesh in the gillnet fishery and by releasing females where possible. The YSSC further recommended that DFO consider the quality of escapement in determining inseason management actions in 2016; i.e., if a below normal female to male ratio were observed, conservative approaches would be maintained. First Nations were cautioned to harvest 30% or less of what they would normally take in an unrestricted fishery until run strength of Canadian-origin Chinook salmon could be determined with reasonable confidence through inseason stock assessment programs, particularly the mainstem Yukon River sonar program located near Eagle.

Table 2.–Inseason fishery management decision matrix for mainstem Yukon River Chinook salmon in Canada, 2016.

Border Passage Projections	Fishery			
	First Nation	Recreational	Commercial	Domestic
<42,500 (Red Zone)	**Closed** Removal of allocation for conservation purposes.	**Closed** No retention permitted. Additional closures possible.	**Closed**	**Closed**
42,500 to 55,000 (Yellow Zone) Management Target: 48,750	**Varies** **42,500 to 48,750** Base level (incidental) harvest of less than 10% of annual subsistence needs. **48,750 to 55,000** Harvest target 10% to 90% of annual subsistence needs and varies with abundance	**Closed** No retention permitted	**Closed**	**Closed**
>55,000 (Green Zone)	**Open** Unrestricted	**Open** Retention permitted	**Open** Allocation varies with run size	**Open** Allocation varies with run size

Note: The Management Target of 48,750 is the minimum number of salmon intended to reach the spawning grounds. Allocations (harvest opportunities) are subject to run abundance and international harvest sharing provisions.

Inseason Management Yukon River Mainstem Chinook Salmon

Early in the 2016 season, information from the ADF&G LYTF project near Emmonak and the mainstem sonar project near Pilot Station in the Lower Yukon Area, suggested that the Canadian-origin Chinook salmon run would likely be within the preseason outlook range of 65,000 to 88,000 fish. Throughout the early to mid-portion of the run, the TAC available for commercial, domestic and recreational fisheries remained at zero and the conservative approach described above was maintained in the First Nation fishery. The DFO and YSSC held regular teleconferences with First Nation managers to update them on run projection scenarios.

Border passage projections at the midpoint of the season onward, as determined by mainstem Yukon River sonar project near Eagle, indicated that the escapement of Canadian–origin Chinook salmon was projected to meet or exceed the upper end of the escapement goal range of 42,500 to 55,000 fish. However, the sex ratio observed at Eagle sonar (33% female) was well below the long term average of 42%. Following discussions with the YSSC and First Nation Governments, the preseason approach for a conservative harvest, reduced mesh size and release of females was maintained. Some First Nation Governments developed and maintained community-based management plans that called for either a complete withdrawal from harvesting opportunities or for a very limited harvest to allow for cultural/ceremonial practices to continue.

In the recreational fishery, the daily catch and possession limits in the recreational fishery were reduced to zero, effective June 29. Given the limited opportunity provided to First Nation subsistence fisheries and conservative management actions undertaken in U.S. fisheries, Chinook salmon commercial and domestic fisheries in Canada remained closed throughout the 2016 season.

Inseason Management Porcupine River Chinook Salmon

In the absence of stock specific information on 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 2016, 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 30% or less of the recent subsistence harvest. This approach was intended to provide an opportunity for a modest level of subsistence harvest during the early part of the run until such time as 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, where 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, coupled with mainstem assessment information, indicated that the return of Chinook salmon was stronger than anticipated. While the inseason information seemed to suggest that additional harvesting opportunities could be available, there was concern over the lower number of females observed and a precautionary approach was maintained throughout the season. The Vuntut Gwitch'in Government reported a harvest of 177 Chinook salmon which was below the 2011–2015 average harvest of 188 fish (Appendix B7).

5.2 Fall Chum Salmon

Mainstem Yukon River

The 2016 preseason forecast for the Canadian-origin fall chum salmon run to the mainstem Yukon River was expected to be an average to above average run with a range of 137,500 to 195,000 fish. As noted previously, the escapement goal (IMEG) range recommended by the Yukon River Panel was 70,000 to 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 2016 decision matrix summarized the management reference points,

general allocation plans, and anticipated management responses under different run size scenarios (Table 3). The decision matrix is being reviewed to seek to realign it with the YRP's current IMEG. This work was not yet concluded at time of publication of this report.

The following decision thresholds were used to guide management actions to achieve an escapement goal range of 70,000 to 104,000 Canadian-origin chum salmon:

RED ZONE <40,000
No harvest – removal of all chum salmon harvest allocations. Run sizes this low represent a high conservation risk.

YELLOW ZONE 40,000 to 73,000
Run supports some First Nation subsistence fishing. The harvest target varies in accordance with projected run abundance. Harvest targets are met using voluntary harvest reductions in each First Nation.

GREEN ZONE >73,000
Opportunity for normal (full) First Nation subsistence harvest (i.e., no voluntary harvest reductions sought). Harvest opportunities (and allocation) for recreational, commercial, and domestic fisheries are provided in proportion to run abundance and are considered only when opportunities for First Nation harvests have not been restricted.

Table 3.–Inseason fishery management decision matrix for mainstem Yukon River fall chum salmon in Canada, 2016.

Border 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 on fishery openings and closures in Canada for fall chum salmon were made in a similar way to those for Chinook salmon. There is uncertainty associated with early inseason projections of fall chum salmon because of the unpredictable size, timing, and destination of the individual pulses. In 2016, 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 mainstem sonar project near Pilot Station and assessment information from the LYTF. As the fish 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. Since 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 2016 was to ensure that the IMEG range of 70,000–104,000 fall chum salmon was achieved. By late-August, it was evident that the fall chum salmon run was at or above the upper end of the preseason forecast based on projections from the mainstem sonar operated near Pilot Station and on LYTF data. The commercial and domestic fisheries opened on August 30 for 8 days to provide opportunities for the catch and sale of early run fall chum salmon, which are considered to be marketable as food for human consumption. In this initial opening, fishing was restricted to areas below the confluence of the Yukon River and Coffee Creek in order to protect migrating and spawning Chinook salmon in upstream areas. As mainstem Yukon River sonar estimates at Eagle provided further confidence in projections, the commercial and domestic fisheries opened in all areas defined in regulation on September 8 and remained open until October 21. The total 2016 commercial fall chum salmon harvest was 1,745 fish (Appendices A6 and B8).

Fishing Branch (Porcupine) River

The 2016 preseason forecast estimate for Porcupine River chum salmon (at Fishing Branch River) was 22,000 to 31,000 fish. The current IMEG for the Fishing Branch River established by the Yukon River Panel is 22,000–49,000 adult fall chum salmon. Considering that the minimum spawning escapement of fall chum salmon Fishing Branch River had not been achieved in 5 of the past 8 years, and only the very low end of the escapement goal range was achieved in 3 of the past 8 years, a very 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. Prior to the start of the season, the TAC of fall chum salmon allocated to Vuntut Gwitchin First Nation subsistence fisheries in 2016 was 1,000 or approximately 30% of the recent harvest average (Appendix B8).

Inseason Management Porcupine River Fall Chum Salmon

Canadian fishery management considered early season information from the sonar project near Pilot Station. Estimates of fall chum salmon passage in combination with genetic mixed stock analysis (MSA) could potentially be used to project the return of Fishing Branch chum salmon. However, the Fishing Branch River component at Pilot Station is such a small part of the total run that the uncertainty associated with these estimates is very high, and it is difficult to base management decisions on this information.

In 2016, the Old Crow-based Porcupine River sonar provided an estimated return of chum salmon to the Canadian portion of the Porcupine River. Escapement to the Fishing Branch River was monitored by a counting weir (reinstalled in 2015 and 2016 after a hiatus in 2013 and 2014). Note that only a portion of the fall chum salmon that return to the Canadian Porcupine River are destined for the Fishing Branch River (~60%).

As the season progressed, a more robust estimate became available at the Porcupine River sonar indicating that the lower end of the escapement goal would likely be achieved. Following discussions with Vuntut Gwitch'in First Nation, the TAC was adjusted to 2,000 fall chum salmon. The expanded sonar estimate of fall chum salmon passage at the Porcupine River sonar was 54,395 fish (Appendix B15). Of these, 2,955 fall chum salmon were harvested upstream of the sonar site resulting in a spawning escapement estimate of 51,440 fish. The total harvest of fall chum salmon on the Canadian portion of the Porcupine River in 2016 was 3,005 fish (Appendix B8). The Fishing Branch River weir count of 29,397 was within the IMEG range of 22,000–49,000 fish (Appendices A6 and B15).

6.0 CANADIAN HARVEST SUMMARIES

6.1 FIRST NATION FISHERIES

Catch estimates of salmon in the aboriginal 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 65,000–88,000 Canadian-origin Yukon Chinook salmon, YSSC recommended a conservative approach early in the 2016 fishing season. Although inseason border escapement projections indicated that the run strength was toward the upper end of the pre-season forecast, Yukon First Nation Governments continued to follow very conservative management plans resulting in a significantly reduced harvest in 2016. The Upper Yukon River aboriginal Chinook salmon catch was estimated to be 2,768 fish (Appendix A6). This compares to a recent (2011–2015) average of 1,910 fish and long term (1996–2015) average of 7,077 fish (Appendix B7).

Mainstem Yukon River Fall Chum Salmon

The preseason outlook for Canadian-origin fall chum salmon in 2016 indicated an average run of 137,500 to 195,000 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 2016 fall chum salmon harvest in the aboriginal fishery from the upper Yukon River was estimated to be 1,000 fish based on recent harvest information (Appendices A6 and B8).

Porcupine River Chinook, Fall Chum, and Coho Salmon

Vuntut Gwitchin First Nation (VGFN) reported a season total harvest of 177 Chinook salmon for 2016 (Appendices A6 and B8). The recent 10-year average (2006–2015) was 258 Chinook salmon (Appendix B7). A total of 3,005 fall chum salmon was harvested in the Old Crow-based VGFN fishery (Appendices A6 and B8), which was above the recent 10-year average harvest from 2006 to 2015 of 2,588 fall chum salmon (Appendix B8). No coho salmon were reported harvested on the Porcupine River in 2016; the 1961–2014 coho harvest averaged 150 fish, and none were harvested in 2015.

6.2 COMMERCIAL FISHERY

Mainstem Yukon River Chinook Salmon

The commercial Chinook salmon fishery remained closed throughout the 2016 Chinook salmon season. One Chinook salmon was caught incidentally in the directed fall chum fishery (Appendix A6).

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 1,745 fall chum salmon was harvested during commercial fishery openings (Appendix A6). This level of harvest was 50% below the 2006–2015 average of 3,498 fall chum salmon and 51% below the 2011–2015 average of 3,447 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 2016, 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 commercial fishery in 2016.

6.3 DOMESTIC 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 (1974–2015) average of 453 fish and a recent (2011–2015) average of 14 fish (Appendix B8).

6.4 RECREATIONAL 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 recreational 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 and no Chinook salmon were retained in the Yukon River or its tributaries in the 2016 recreational fishery. The average number of Chinook salmon catch retained annually within the 2006–2015 period was 155 fish (Appendix B7). For the 2016 season, the daily catch and possession limits of fall chum salmon in the recreational fishery remained at 2 and 4, respectively. There were no reports of fall chum salmon caught.

7.0 TOTAL RUN AND ESCAPEMENT ASSESSMENTS FOR 2016

7.1 CHINOOK SALMON

Total 2016 Chinook salmon passage at the mainstem Yukon River sonar project near Pilot Station was approximately 177,000 fish[9] (Appendix A2). This is considered an index of drainagewide Chinook salmon run, rather than a total run size estimate, since some salmon are harvested or enter spawning areas below this sonar site.

Total Chinook salmon passage at the mainstem Yukon River sonar near Eagle in 2016 was 72,329 fish (Appendix B11). After subtracting estimated U.S. subsistence harvest taken above the Eagle sonar site (762 fish) and the estimated Canadian harvest of Chinook salmon (2,769 fish), the estimated escapement in Canada was 68,798 Chinook salmon (Appendix B11). This escapement was above the upper end of the IMEG of 42,500–55,000 fish and within the preseason outlook range (65,000–88,000 fish; Table 18). Preliminary harvest estimates indicate that about 11,500 Canadian-origin Chinook salmon were harvested in U.S. fisheries (Appendix D3). Combining the spawning escapement estimate with the U.S. harvest of Canadian-origin Chinook salmon and Canadian harvest indicates the total Canadian-origin run size was approximately 83,000 Chinook salmon (Appendix D2).

Age, sex, and size composition was assessed at both mainstem sonar sites and in various escapement projects. Age composition of the run shifted slightly to higher proportions of older age classes in the upper river run near Eagle, compared with the lower mainstem run near Pilot Station, and the proportion of females declined as the run progressed upriver (Table 4; Appendix A10).

Table 4.–Yukon River Chinook salmon age and female percentages from selected mainstem Yukon River assessment projects, 2016.

	Chinook salmon age or sex composition (percentage of samples)			
	Lower mainstem near Pilot Station		Upper mainstem near Eagle	
Age/sex	Historical average (2005–2015)	2016	Historical average (2005–2015)	2016
Age-4	10.5	14.0	7.1	9.2
Age-5	48.8	69.4	41.9	65.1
Age-6	39.0	15.2	48.0	25.2
Female	35.8	44.9	42.0	32.4

Note: Sampling at Pilot station sonar uses a range of mesh sizes (2.75" – 8.5") while sampling at Eagle sonar uses just 2 mesh sizes (5.25" – 8.5"). 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, but 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 3 weirs, 2 counting towers, and 1 sonar project. No aerial surveys were conducted in 2016 because of high water and visibility issues (Table 5). Existing escapement goals for all U.S. tributary stocks were met or exceeded except for Salcha River (Table 5; Appendices B9, B10, B11 and C9). High water events on the Salcha River hindered estimating passage counts. Note that these stocks do not contribute to the border passage objective or Canadian escapement, but their performance relative to Canadian stock may provide a comparative indicator of production trends among different stock groups.

[9] Some estimates in this section are rounded.

Table 5.–Summary of 2016 Chinook salmon escapement estimates in Alaska tributaries, in comparison with existing escapement goals.

Location	Assessment method	Escapement goal (type)	2016 Escapement
E. Fork Andreafsky	Weir	2,100–4,900 (SEG)	2,676
W. Fork Andreafsky	Aerial survey	640–1,600 (SEG)	[a]
Anvik (Drainagewide)	Aerial survey	1,100–1,700 (SEG)	[a]
Nulato (Forks Combined)	Aerial survey	940–1,900 (SEG)	[a]
Gisasa	Weir	none	1,395
Henshaw	Weir	none	1,354
Chena	Tower/Sonar	2,800–5,700 (BEG)	6,665 [b]
Salcha	Tower/Sonar	3,300–6,500 (BEG)	2,675 [c]
Goodpaster	Tower	none	2,435

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

[a] No surveys conducted.

[b] Visual counts were conducted for only 1 day (June 26) due to high water and flooding on the Chena River. Sonars operated through the peak of the Chinook salmon run, but were pulled on July 19 because of flooding. Estimate is based on DIDSON sonar counts and a mixture model was used for species apportionment. A Bayesian Hierarchical Model was used to estimate missed counts.

[c] First year with sonar used as a secondary counting method. Tower and sonar pulled July 19 because of flooding. Visual counts were conducted for approximately 2 weeks between high water events. Estimate is based on DIDSON sonar counts and a mixture model was used for species apportionment. A Bayesian Hierarchical Model was used to estimate missed counts.

Escapement of Chinook salmon to tributaries in Canada was assessed at the Whitehorse Rapids Fishway, Blind Creek (Pelly River), Big Salmon, Wolf, Nisutlin, and Porcupine rivers. On the Big Salmon River, 6,691 Chinook salmon were counted (B. Mercer, personal communication), 25% above the average count of 5,359 fish (2006–2015, Appendix B12). At the Whitehorse Rapids Fishway, 1,556 Chinook salmon were counted, 44% above the 2006–2015 average count of 1,082 fish (Appendix B12). The overall sex ratio was 18% female, and hatchery-produced fish accounted for 42% of the return. On Blind Creek, 664 Chinook salmon were counted and this was 43% above the 2006–2015 average count of 464 fish (Appendix B12). Thirty-eight percent of the sampled fish were female (Jane Wilson, J. Wilson & Associates; personal communication). On August 16, 396 Chinook salmon were counted during an aerial survey of the Nisutlin River index area and 432 Chinook salmon were counted in a survey of the Wolf River index area (Appendix V10). On the Porcupine River 6,457 Chinook salmon were counted, 40% more than the estimated passage in 2015 Appendix B12).

7.2 SUMMER CHUM SALMON ALASKA

In 2016, an estimated 1.92 million summer chum salmon passed the sonar project near Pilot Station, which was slightly below the historical 10-year median of 1.95 million fish for the project (Appendix A2). The first quarter point, midpoint, and third quarter point were June 17, June 24, and July 5, respectively, which is consistent with historical early run timing. Five large pulses of summer chum salmon were detected at the sonar project with the largest group consisting of approximately 405,500 fish passing from July 2 to July 7. A new summer chum salmon drainagewide escapement goal with a BEG range of 500,000–1,200,000 fish was introduced in 2016 (Table 6), and the 2016 escapement exceeded this goal. The summer chum salmon escapement into the East Fork Andreafsky River met the SEG of greater than 40,000 fish (Table 6; Appendices B13 and C11). Escapement into the Anvik River was 337,800 summer chum salmon which was just below the lower bound of the SEG of 350,000 fish; however, over

5,000 summer chum salmon were counted on the first day of operations (June 17) and a portion of the run may have been missed in counting due to the earlier run timing. Summer chum salmon escapements were average or below average in all other tributaries monitoring summer chum salmon in 2016, with the exception of the Henshaw Creek, which was above average (Table 6; Appendices B13 and C11).

In addition to towers, sonars were used to supplement and corroborate tower counts for Chena and Salcha river salmon; 2016 was the first year for sonar on the Salcha River. Both assessment projects were hindered by high water and flooding events and passage estimates were below average. Sonars on both rivers were pulled on July 19. Mathematical models were used to generate estimates of missed fish passage and species apportionment from the available sonar and visual count data. Summer chum salmon estimates for both rivers are still considered incomplete counts (Table 6; Appendix B13).

Table 6.–Summary of 2016 summer chum salmon escapement counts, in comparison with existing escapement goals.

Location	Assessment method	Escapement goal (type)	2016 Summer chum salmon escapement
Drainagewide	Sonar	500,000-1,200,000 (BEG)	1,914,526 [a]
E. Fork Andreafsky	Weir	>40,000 (SEG)	50,362
Anvik	Sonar	350,000–700,000 (BEG)	337,821
Gisasa	Weir	none	66,670
Henshaw	Weir	none	286,780
Chena	Tower/sonar	none	6,493 [b]
Salcha	Tower/sonar	none	2,897 [c]

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

[a] Drainagewide escapement based on mainstem Yukon River sonar near Pilot Station minus harvest and escapement estimates below the sonar site.

[b] Sonar pulled on July 19 because of flooding.

[c] Due to high water events during the season this estimate is incomplete.

7.3 FALL CHUM SALMON

The initial method of determining total drainagewide (i.e., U.S.- and Canadian-origin) fall chum salmon run size is based on the lower Yukon River mainstem sonar passage estimate and the estimated inriver harvest of fall chum salmon downstream of the sonar site. Inseason the 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. Estimates of run size using this method resulted in a range of 1,383,000 to 1,473,000 fall chum salmon in 2016.

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 (Alaska and Canada) to the estimate of drainagewide escapement. In 2016 this method resulted in a total drainagewide run size estimate of 1,384,000 fall chum salmon, which was well above the 2016 forecast of 550,000 to 780,000 fish. The total run size was also higher than the inseason projection of 700,000 to 1,000,000 fish, based on the relationship of summer to fall chum salmon runs.

The drainagewide escapement estimate produced by the Bayesian state-space model was 829,000 fall chum salmon, which exceeded the upper end of the escapement goal range (Table 7). The model utilized historical escapement data from the Toklat, Delta, 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 (Table 7; Appendices B14, B16, and C14).

Table 7.–Summary of 2016 fall chum salmon escapement counts, in comparison with existing escapement goals in Alaska.

Location	Assessment method	Escapement goal (type)	2016 Fall chum salmon escapement
Drainagewide	Bayesian	300,000–600,000 (SEG)	829,000
Chandalar River	Sonar	74,000–152,000 (BEG)	295,000
Tanana River	none	61,000–136,000 (BEG)	–
Delta River	Ground Surveys	6,000–13,000 (BEG)	22,000

Note: Biological escapement goal (BEG) and sustainable escapement goal (SEG). Upper Yukon Tributary goal (Chandalar, Sheenjek and Fishing Branch rivers combined) and the Sheenjek River goal were discontinued in 2016.

Canadian-Origin Fall Chum Salmon Mainstem Yukon River

The estimate of U.S./Canada border passage for fall chum salmon included the Eagle sonar estimate (144,035 fish) plus an expansion for fish passing after the project near Eagle closed. In 2016 the expanded estimate of passage at the sonar site was 161,027 fall chum salmon (Appendix B16). After subtracting the preliminary U.S. subsistence harvest taken above the Eagle sonar site (13,015 fish), the estimated border passage was 148,012 fall chum salmon. After subtracting the preliminary Canadian harvest of 2,745 fish (Appendix A6) the estimated escapement in Canada was 145,267 fall chum salmon, which was well above the upper end of the IMEG of 70,000–104,000 fish (Table 8).

The preliminary reconstruction of the total 2016 mainstem run suggests a run size of approximately 298,000 Canadian-origin fall chum salmon. This estimate exceeds the preseason outlook range of 137,000 to 195,000 Canadian-origin mainstem Yukon River fall chum salmon. The preseason outlook range was based on the ADF&G drainagewide outlook range of 550,000 –780,000 fall chum salmon and an assumption that Canadian-origin mainstem Yukon River fall chum salmon would constitute at least 25% of the drainagewide return.

The 2016 fall chum salmon run was characterized as the largest even-numbered year return and the fifth largest run in 43 years. Based on the larger than average return of age-3 fall chum salmon the previous year, expectations were high that a large age-4 component could produce a larger run than forecasted. The age-4 fall chum salmon returning in 2016 in fact were the third largest return of this age class. In 2016, the proportions by age class for fall chum salmon caught in the LYTF, and used to represent the drainagewide run, included 2% age-3, 84.1% age-4, 13.2% age-5, and less than 1% age-6 fish. The age-4 component was well above average, the age-5 component was correspondingly well below average, and age-3 and age-6 components were near average when compared to LYTF weighted averages for years 1977–2015. Fall chum salmon ASL composition estimates from data collected in the Delta River included 3.1% age-3, 80.6% age-4, 15.6% age-5, and less than 1% age-6 fish (Appendix A25). Samples were also collected for the escapement into Canada in test fishing near the Eagle sonar site, and included 1.4% age-3, 75.6% age-4, 22.5% age-5, and less than 1% age-6 fall chum salmon (Appendix A25).

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

In 2016 the Porcupine River sonar fall chum salmon project was operated for the sixth year immediately downstream of Old Crow. An estimated 54,395 chum salmon passed by the sonar, and an estimated 3,005 fish were harvested in the Old Crow fishery, resulting in a preliminary spawning escapement estimate of 51,390 fish in the upper Porcupine River (Table 8; details are presented in Section 8.2).

DFO operated the Fishing Branch River weir in 2016 and installed a sonar feasibility project for use during high water. Weir installation was delayed by 12 days due to high water. The sonar supplemented the weir assessment throughout the majority of the season as the water remained high and counts were continued through the trap section of the weir. The weir/sonar count was expanded by 6,592 fish to include estimates for fish passage prior to weir operations, yielding a Fishing Branch River escapement estimate of 29,397 chum salmon.

Table 8.–Summary of 2016 preliminary fall chum salmon escapement counts to Canada, in comparison with existing international interim management escapement goals (IMEG).

Location	Assessment method	Escapement goal (type)	2016 Fall chum salmon escapement
Fishing Branch River	Weir/sonar count	22,000–49,000 (IMEG)	29,397
Yukon River Mainstem	Sonar and harvest	70,000–104,000 (IMEG)	145,267
Porcupine River (Canadian portion)	Sonar and harvest	none	51,390

8.0 PROJECT SUMMARIES

8.1 ALASKA

Mainstem Yukon River Sonar Project near Pilot Station

The goal of the mainstem Yukon River sonar project is to estimate daily upstream passage of Chinook, chum, and coho salmon. The project has been in operation since 1986. Both split-beam and Adaptive Resolution Imaging Sonar (ARIS) are used to estimate total fish passage while CPUE from the drift gillnet test fishing portion of the project is used to estimate species composition. A detailed history of refinements and enhancements to the project's sonar equipment and apportionment methodologies can be found in Lozori and McIntosh (2014).

Fish passage estimates at the mainstem Yukon River sonar project are based on a sampling design in which sonar equipment is operated daily in three 3-hour intervals and drift gillnets 25 fathoms long with mesh sizes ranging from 7.0 cm to 21.6 cm (2.75 in to 8.5 in) are fished twice each day between sonar periods to apportion the sonar counts to species. During the 2016 season, the right bank split-beam sonar was operational starting with period 3 on May 30. The left bank split-beam and ARIS were operational starting with period 1 on June 1. The project was fully operational on June 1 and continued operations through August 31. River breakup at Pilot Station occurred on April 29 based on National Weather Service data. Test fishing began on May 30, with the first Chinook and summer chum salmon both caught that first day of operation. The first coho salmon was caught on August 2.

An estimated 4,981,917 fish passed through the sonar sampling area between May 30 and August 31 (Table 9). The apportionment model was refined prior to the start of the 2016 field

season, and prior year's estimates were regenerated using the refined model (Carl Pfisterer, Commercial Fisheries Biologist, ADF&G, Fairbanks; personal communication). Regenerated historical passage estimates for 1995 and 1997-2015 are listed in Appendix A2 for comparison.

Drift gillnetting resulted in catches of 11,368 fish including 693 Chinook, 4,215 summer chum, 2,666 fall chum, and 653 coho salmon. A total of 3,141 fish of other species was also caught. Chinook salmon were sampled for ASL and 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 problems with detection due to silt or other environmental factors. During the summer season, water levels observed near Pilot Station were below average, and then rose to average and above average during the fall season, when compared to USGS 2001–2015 data[10].

In 2016, all project goals were met, with passage estimates given to fisheries managers daily during the season. Information generated at the sonar project near Pilot Station was also disseminated weekly through multi-agency international teleconferences and data-sharing with stakeholders in areas from the Lower Yukon River all the way to the spawning grounds in Canada.

Table 9.–Cumulative fish passage estimates by species with 90% confidence intervals (CI), at the mainstem Yukon River sonar project near Pilot Station in 2016.

		90% CI	
Species	Total passage	Lower	Upper
Large Chinook [a]	135,013	118,406	151,620
Small Chinook [b]	41,885	33,810	49,960
Summer chum	1,921,748	1,841,231	2,002,265
Fall chum	994,760	930,326	1,059,194
Coho	168,297	149,894	186,700
Pink	1,364,849	1,277,704	1,451,994
Other [c]	355,365	314,984	395,746
Total	4,981,917		

[a] Large Chinook salmon >655 mm.

[b] Small Chinook salmon ≤655 mm.

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

Mixed Stock Analysis of Yukon River Chinook Salmon Harvest in 2015

Reporting of harvest by stock is a year behind in this report due to insufficient funds to finalize harvest estimates and process genetic samples during or immediately after the season. Therefore 2015 results are reported here, and 2016 results will be presented the following year.

[10] http://waterdata.usgs.gov/ak/nwis/uv?cb_00060=on&cb_00065=on&format=gif_stats&period=21&site_no=15565447

Three region-of-origin groupings (also referred to as stock groups) have been identified for Chinook salmon 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 Canada. Scale pattern analysis, age composition estimates, and geographic distribution were used by ADF&G from 1981 through 2003 to estimate Chinook salmon stock composition in Yukon River harvests. From 2004 to present, genetic analysis has been the primary method for stock identification.

Tissue samples were collected from fish in mixed stock harvests in District 2 (mainstem sonar test fishery). Results from these analyses were combined with harvest age composition to provide stock composition for some harvest components. Because of limited sampling in 2015, stock and age composition of other harvest components were estimated from prior year samples.

U.S. and Canada combined harvest estimates for 2015 were 12.0% Lower stock group, 31.2% Middle stock group, and 56.8% Upper stock group (Appendix A12). U.S. only harvest estimates from the Lower, Middle, and Upper stock groups were 14.2%, 36.9%, and 48.9%, respectively (Appendix A13). U.S. and Canadian shares of the Upper stock group harvest were 72.9% and 27.1%, respectively (Appendix A14). U.S. and Canada combined harvest percentages for 2015 were compared with the 2010–2014 5-year average. Harvests were below average for the Lower stock group, near average for the Middle stock group, and slightly above average for the Upper stock group (Appendix A12). The U.S. proportion of harvest of the Upper stock group was below (2010-2014) average and correspondingly the Canadian proportion of the harvest was above average (Appendix A14).

Chinook and Chum Salmon Harvest Genetic Sampling 2016

Chinook Salmon

ADF&G field crews, along with other collaborators, collected 2,902 samples (axillary process tissue preserved in ethanol or silica beads) from adult Chinook salmon harvested by test and subsistence fisheries in 2016 in Alaska waters. These samples were from mixed stock fisheries in the mainstem Yukon River in Districts 1 through 5. Additionally, samples were collected from 700 Chinook salmon smolt in the Yukon River delta as part of a NMFS project. Samples collected from Yukon River mainstem test fisheries totaled 1,689 fish, and included 250 from the lower Yukon, 691 from the sonar project at Pilot Station, and 748 from the sonar project at Eagle. Samples collected from subsistence fisheries in Alaska totaled 1,212 fish from 12 locations: 113 from Kotlik and Emmonak (District 1); 135 from Mountain Village, St. Mary's, and Marshall (District 2); 135 from Russian Mission (District 3); 627 from Nulato, Kaltag, Galena, and Ruby (District 4); and 202 from Tanana (District 5). Subsistence harvest samples were collected by Spearfish Research (R&E URE-03-16), which contracted with individual fishermen to sample their own harvest.

Chum Salmon

In 2016, ADF&G, in cooperation with USFWS, collected genetic tissue samples from 4,213 summer chum salmon and 2,664 fall chum salmon during the test fishery associated with the sonar project near Pilot Station. Chum salmon genetic samples are stored in the Conservation Genetics Laboratory, USFWS, Anchorage, Alaska. Populations in the baseline are reported in aggregated stock groups (Table 10).

Table 10.–Microsatellite baseline is comprised of 37 stocks used to estimate stock composition from chum salmon sampled in the test drift gillnet program near Pilot Station in 2016.

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

Mixed Stock Analysis of Yukon River Chum Salmon Harvest in 2016

Analysis of chum salmon sampled from the test fishery near Pilot Station sonar provided stock composition estimates for most of the summer and fall chum salmon runs in 2016. Results 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 73% of the run and the middle river stock group comprised 27% of the run. The Tanana component of the middle river stock group comprised 8% of the total summer chum salmon run, and peaked in passage past the Pilot Station sonar during the sampling period of July 19 to July 25. The run transition from summer to fall chum salmon occurred on time with 52% of the mixture comprising fall chum salmon during the first period of fall season management (July 19-25). For fall chum salmon, 67% of the run was of U.S.-origin and 33% of Canadian-origin. The composition of the U.S. contribution was 29% Tanana and 38% U.S. border (Chandalar, Sheenjek, and Black rivers; Appendix 15). The composition of the Canadian contribution was 20% mainstem Yukon, 4% Porcupine, 8% White, and 1% Teslin rivers. Preparations are underway to continue the project for the 2017 season. Genetic MSA composition is used in fall season fishery management with consideration for all chum salmon stocks entering the river after July 19. Major components identified are summer, Tanana, Border U.S. (Chandalar, Sheenjek, Black River) and total Canadian-origin stocks; Canadian mainstem and Porcupine River stocks, however, are not separately identified (Appendix A15).

8.2 MAINSTEM YUKON RIVER SONAR NEAR EAGLE

Since 2006, Chinook and fall chum salmon passage has been estimated using split-beam and imaging sonar on the Yukon River near the community of Eagle, Alaska below the United States/Canada border (Lozori and McDougall 2016). 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 monitor 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.

In 2016, there were no operational problems and both sonars performed well with no major technical difficulties or failures. The 2016 Chinook salmon passage estimate at the sonar was 72,329 fish (71,686 lower 90% CI and 72,972 upper 90% CI) for the dates July 1 through August 17. The fall chum salmon passage estimate was 144,035 fish (142,892 lower 90% CI and 145,178 upper 90% CI) for the dates August 18 through October 6. Because of continued high passage at the termination of the project, the fall chum salmon estimate was subsequently adjusted to 161,027 fish. This expansion was calculated using a second order polynomial calculated for each day through October 18.

8.3 YUKON, CANADA

Yukon River (Mainstem) Adult Chinook Salmon Assessment

Blind Creek Weir

In 2016, the Blind Creek weir project enumerated Chinook salmon escapement and obtained biological information from the stock for the fourteenth consecutive year. The weir was situated at the same location used for the past 13 years, approximately 1 km upstream of the confluence with the Pelly River. Operation of the weir began on July 15 and continued through to August 15. The first Chinook salmon passed the weir on July 17. A total of 664 Chinook salmon were counted in 2016 (Appendix B12). This escapement was 43% above the 10-year average (464 fish), and the eighth ranking escapement in the 16 years of operation. The quarter point and midpoint of the run occurred on July 29 and July 31 respectively. This was 3 days earlier than the average quarter point, and 6 days earlier than the average midpoint. A subset of 500 Chinook salmon was sampled randomly for ASL data throughout the period of weir operation. Within this sample 188 (38%) were female and 312 (62%) were male. The mean mideye to fork length (MEFL) of females and males sampled was 785 mm and 659 mm, respectively (Jane Wilson, J. Wilson & Associates; personal communication). Of the 364 samples that were aged, 18.4% (29.8% of the males and no females) were age-4, 47.8% (55.6% of the males and 35.3% of the females) were age-5, 29.9% (13.3% of the males and 56.8% of the females) were age-6, and 3.8% (1.3% of the males and 7.9% of the females) were age-7.

Big Salmon Sonar

A long range dual frequency identification sonar (DIDSON) was used to enumerate the Chinook salmon escapement to the Big Salmon River in 2016 for the twelfth year. This operation was located at the same site used since 2005, approximately 1.5 km upstream of the confluence of the Yukon River. Sonar operation began on July 11 and continued without interruption through August 19 producing a total estimate of 6,691 Chinook salmon (Appendix B12). The peak daily count of 430 fish occurred on July 28, when 42% of the run had passed the sonar site. Approximately 50% of the run had passed the sonar by July 30 (6 days earlier than the 10-year average midpoint and 3 days later than the earliest midpoint in 2014). Approximately 90% of the run had passed the site by August 9, also 6 days earlier than average (Brian Mercer, Metla Environmental Inc.; personal communication). The 2016 Chinook salmon estimate from the Big Salmon was the fourth highest escapement recorded, and 25% above the (2006–2015) average estimate of 5,359 fish.

Genetic stock identification sampling at the mainstem Yukon River sonar operated near Eagle indicated that the Big Salmon River stock group comprised 7.0% (SD 1.9) of the Yukon River mainstem Chinook salmon escapement to Canada in 2016. This genetics estimate was lower than the 9.7% estimate derived by comparing the Big Salmon River sonar passage to the mainstem escapement estimate from Eagle and harvest data (68,798; Appendix B12).

Carcass samples were collected from August 15–24, over approximately 155 km of the Big Salmon River, yielding 136 Chinook salmon samples. Of the total, 84 (62%) fish were female and 52 (38%) fish were male. The mean MEFL of females and males sampled was 832 mm and 757 mm respectively (Brian Mercer, Metla Environmental Inc.; personal communication). Of the 102 samples which were successfully aged, 1.0% (2.9% of the males and none of the females) were age-4, 45.1% (74.3% of the males and 29.9% of the females) were age-5, and 53.9% (22.9% of the males and 70.1% of the females) were age-6.

Pelly River Sonar

Sonars were used to estimate 2016 Chinook salmon passage on the Pelly River between July 1 and August 3, 2016. Selkirk First Nation worked with Environmental Dynamics Incorporated (EDI) to conduct this pilot year of assessment. Two SIMRAD EK60 split-beam sonar systems (1 on each bank) were operated at a site approximately 20 km upstream of the confluence of the Pelly and Yukon rivers, at a site identified in the Selkirk First Nation's 2015 reconnaissance survey. A total of 4,740 Chinook salmon were estimated at this location during the 2016 period of operation. Counts ranged from 3 fish on the first day, to a peak count of 391 Chinook salmon on July 20. The total on August 2, the last full day of the project, was 140 Chinook (Jolene Lust, EDI; personal communication). 4,740 therefore represents a partial count of the 2016 Pelly River salmon run.

Whitehorse Rapids Fishway Chinook Salmon Enumeration

The Whitehorse Rapids Fishway is a fish ladder bypassing the Whitehorse dam that has a viewing window and trap gates on either side that are used for sampling fish without handling. Fishway staff enumerated 1,556 Chinook salmon at the Whitehorse Rapids Fishway between July 23 and September 3, 2016 (Appendix B12). Of the adult Chinook salmon counted at the Fishway, 651 were of hatchery origin, comprising 42% of the return. The hatchery component included 119 females and 532 males, comprising 42% of both the female and male escapement. The wild component included 164 females) and 741 males. Female Chinook salmon made up 18% of the total run.

The Whitehorse Rapids Fishway program is a joint initiative of the Yukon Fish and Game Association, Yukon Energy Corporation, and DFO. Students count all fish moving upstream through the Fishway, record the sex and size category (small, medium, or large) of each fish, and identify hatchery-origin fish based on the absence of the adipose fin; this information on run composition supports the Whitehorse Rapids Hatchery coded wire tagging program. Students also assist the Whitehorse Rapids Hatchery with brood stock collection at the Fishway.

Hatchery personnel collected biological samples from 72 male (46 wild and 26 hatchery origin) and 40 female (18 wild and 22 hatchery origin) Chinook salmon taken from the Whitehorse Rapids Fishway for broodstock.

Whitehorse Hatchery Operations

The Whitehorse Rapids Hatchery has a current annual release target of 150,000 2.0 gram Chinook salmon fry. 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 (2007–2016) is 138,251 fry (Appendix A16).

Chinook salmon fry reared at the Whitehorse Rapids Hatchery were adipose fin-clipped and injected with decimal coded wire tags in the early summer of 2016. The tagging procedure included the application of separate tag codes to each of 4 release groups.

The 2015 brood year tagging project noted some mortality upon completion of tagging on June 7. Approximately 50 juveniles in a portion of the stock died after a few days post tagging in the rearing containers and these losses were assumed to be a result of poor tag placement. Releases had been conducted prior to the discovery. Upon monitoring the juveniles for approximately 10 days without further mortalities the remaining fish were released to the last site. The low mortality in the tanks with signs of trauma, and the lack of signs of trauma in the fish from tanks released earlier indicated that the number of released fish likely to have died as a result of the tag mis-placement was not significant. The 2016 release was the nineteenth year in which all fit fish released from the Whitehorse Rapids Hatchery into the Yukon River were marked. With the exception of all fish released from the 1998 brood year, which were adipose-clipped but not tagged, all of the fry released from 1995–2015 brood years were coded wire tagged and adipose-clipped. The initiative to mark all of the fish released from the hatchery provides an opportunity to determine the hatchery contribution to the return as adult fish migrating upstream through the Whitehorse Rapids Fishway; it is also helpful during brood stock collection to identify origin. 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, Yukon River stock assessment operations, harvests and may have been captured in a recent smolt emigration study at the mouth of the Yukon River.

A total of 141,396 Chinook salmon fry reared and marked (clipped and/or tagged) at the Whitehorse Rapids Hatchery from the 2015 brood year were released between May 29 and June 7, 2016. The fry[11] were released to 4 locations upstream of the Whitehorse Rapids hydroelectric dam (Appendix A16). Average fry weight at time of release was 2.45 grams; average weights ranged from 2.21 grams (Wolf Creek release) to 2.82 grams (McClintock River release).

The estimated tag retention 2-3 days after tagging for the 2016 release (2015 BY) was 98%. The total 2016 release included an estimated 137,226 adipose-clipped fish with coded wire tags, and 5,802 fish that were clipped but not tagged, including the fish that were estimated to have lost their tags, and 1,898 small (or unfit) fish (Appendix A16).

Brood stock collection in 2016 began on August 7, after 195 Chinook salmon had migrated through the Whitehorse Rapids Fishway and ended on August 28. An attempt was made to collect 2 males for each female during brood stock collection to allow matrix spawning. Matrix spawning has been used for 25 years in an effort to maintain genetic diversity. A total of 73 males including 50 wild and 23 adipose-clipped (hatchery) Chinook salmon, were used for the brood stock program and were removed from the escapement. An additional 8 males were

[11] 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.

released back to the Fishway after milt collection. The hatchery removed 5.7% of the total 1,273 returning Chinook salmon males.

In total, 40 female Chinook salmon (14.1% of the total 283 female Chinook salmon that returned to the Fishway), including 2 partially spent fish, were spawned for the Whitehorse Rapids Hatchery program between August 27 and September 7. These included 18 wild and 22 adipose-clipped (hatchery) female Chinook salmon. One additional adipose-clipped female failed to ripen. The preliminary estimated total egg take was 211,113 green eggs. The fertilization rate was estimated to be 100%. Shocking and second inventory of the eggs began on October 6 and was completed by October 27. The estimated total egg take was then revised to 194,103, calculated from the eyed egg inventory and the 13,263 mortalities or samples that had been removed. The overall green egg to eyed egg survival was estimated to be 93%.

On October 26, 2016, an estimated 34,137 eyed eggs were transferred from the Whitehorse Rapids Hatchery to the McIntyre Creek Salmon Incubation Facility to be raised to the fry stage for the Ta'an Kwachan First Nation Fox Creek salmon restoration program. An additional 1,400 eyed eggs were provided to the Stream to Sea program for classroom incubation projects between October 25 and November 6. After these transfers and the removal of subsequent egg and alevin mortalities, Whitehorse Rapids inventory on January 31, 2017 was 138,140 Chinook salmon alevins.

Porcupine River Investigations

Porcupine River Chinook Salmon Sonar

In 2016, VGFN and DFO collaborated to enumerate Chinook salmon on the Porcupine River at Old Crow using multi-beam ARIS sonars on each bank at the same location used for chum salmon enumeration. Chinook salmon sonar operations occurred from June 23 to August 12. This was the third year of Porcupine Chinook salmon enumeration and the first season involving DFO on the project. The total upstream estimate for this period was 6,457 Chinook salmon, which was 40% higher than the 2015 estimate of 4,624 fish. Sonar operations were suspended from August 12 to August 22 due to high water. August 12 was the date of the last Chinook salmon and the first chum salmon capture in the test fisheries and was assumed to be the end of the Chinook salmon run and the beginning of the chum salmon run.

Porcupine River Chinook Salmon Telemetry

In 2016, VGFN and EDI conducted a radiotelemetry study of Chinook salmon spawning distribution in the upper Porcupine River. Chinook salmon were captured in 6.75 and 7.5 inch mesh set gillnets in the Porcupine River near Caribou Bar Creek, approximately 65 km downstream of Old Crow. Esophageal implant tags were applied to 80 salmon (40 female and 40 male) between July 12 and July 29. Three tags were recovered inseason and applied to additional Chinook salmon captured at the sonar site between July 25 and August 3. Fixed wing aerial survey flights were conducted to relocate the tags between August 13 and August 15, and again between September 9 and September 11. Salmon movement was also monitored with 2 stationary receivers, 1 at Rampart House 20 km downstream of the tagging site and the other 17.6 km upstream of the confluence of the Bell and Porcupine rivers (Ben Schonewille, EDI; personal communication). Of the 83 tags applied (including re-applications), 67 (81%) were subsequently re-located through a combination of fishery recaptures, stationary towers and fixed-wing telemetry. Of these tags, 15 (18%) were recorded as downstream dropouts at the Rampart

House tower below the sonar site, 8 (12%) were recovered in the fishery, 34 (51%) were located on the spawning grounds, and 10 (15%) were located in locations between the tagging site and spawning grounds. Of the 34 tags located on spawning grounds, 18 (53%) were located in the Crow River and associated tributaries, 7 (21%) in the Bell River watershed, 3 (9%) in the Miner River, 3 (9%) in the Whitestone River mainstem, 2 (6%) in the upper Porcupine River mainstem, and 1 (3%) was located in the Bluefish River (Ben Schonewille, B.Sc., R.P.Bio., EDI; personal communication).

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, while aerial surveys were used in some years (Appendix B15). In 2013 and 2014, spawning escapement to the Fishing Branch River was estimated based on passage of fall chum salmon by the Porcupine River sonar operation at Old Crow and the proportion of Porcupine River chum salmon radio tag recoveries upstream of the weir site. Spawning escapement estimates for the Fishing Branch River have ranged from approximately 5,100 fall chum salmon in 2000 to 353,300 fall chum salmon in 1975 (Appendix B15). In 2016, Fishing Branch River chum salmon enumeration was conducted using a combination of weir and sonar. An ARIS 1800 (short range) sonar was set up immediately upstream of the weir site to observe fish passage during the period prior to weir installation. Weir operations began on September 10, ten days later than planned due to installation delays caused by high water conditions. Fish passage was monitored with the weir from September 10 to 14, after which high water prohibited normal weir operations. Sonar counts, verified for a period each day with weir passage visual observations, were used to enumerate salmon passage until the start of weir removal on October 20. During much of the season due to continued high water the sonar counts were concentrated on the trap opening to provide daily estimates.

ASL data was collected from 906 chum salmon between September 9 and October 17. Of the 847 samples which were successfully aged, 2.8% (1.5% of the males and 4.4% of the females) were age-3, 81.2% (81.0% of the males and 81.5% of the females) were age-4, and 15.8% (17.5% of the males and 13.9% of the females) were age-5. An estimated 24,322 chum salmon migrated past the site during the period of weir/sonar operation. While sex composition was not available from the sonar data, sex ratios of daily visual counts applied to the daily sonar passage estimates indicated that the run was comprised of approximately 51% male and 49% female chum salmon.

Preseason and postseason expansion estimates of 5,132 and 32 fish, respectively, were added to the weir-sonar passage estimate to produce a total Fishing Branch River fall chum salmon escapement estimate of 29,397 fish (Appendix B15). Additionally, the estimates represent 56.5% of the fall chum salmon escapement upstream of Old Crow, as determined after subtracting the harvest (3,005 fish) from the Porcupine River sonar estimate. This estimate is within the Fishing Branch River interim escapement goal range of 22,000–49,000 fish.

Porcupine River Chum Salmon Sonar

In 2016, fall chum salmon were enumerated on the Porcupine River near Old Crow for the sixth year using multi-beam ARIS sonars located on each bank. Both sonars recorded inshore ranges (1-34.75 m and later, 1-25 m) for half of each hour, and offshore ranges (34.75-50 m and later, 25-50 m) for the other half hour. Ranges were modified to improve sonar imaging and fish

detection on September 10 and 11 (RB and LB respectively). Set and drift gillnets were deployed throughout the run to assess species composition and collect biometric samples.

The first chum salmon was caught in the test gillnets on August 12. Extreme high water compromised the sonar project from August 12 to 22. During this period passage was estimated by applying a second order polynomial equation (Crane and Dunbar 2011) to expand the counts from the first day of resumed sonar operation (August 21 on the right bank, and August 22 on the left bank) back to the assumed run start date of August 12. The same expansion formula was applied to the last full day of counts (October 7 on both banks) to expand the estimate through to a run end date of October 15. A total of 52,367 fish, including 49,848 on the left bank and 2,519 on the right bank, were estimated to have migrated upstream past the sonar site during the operational periods of the sonar project. The addition of expanded estimates for early season (1,016), post-sonar (1,454), and an interpolated estimate for a 3 day period of sonar malfunction on the right bank (177) produced a total season passage estimate of 55,015 Porcupine River fall chum salmon. The maximum daily passage estimate of 1,826 fall chum salmon occurred on August 28 with a subsequent lower peak of 1,699 fall chum salmon on September 29. The majority of fall chum salmon (an estimated 95%) migrated along the left bank. As in previous years, the majority of fall chum salmon migrated within the sonar transducer inshore range (94.1% on right bank and 99.4% on left bank).

Water levels were well above average throughout the season and river discharge volumes from a nearby survey station (09FD002) were the highest on record, from August 13–20, since 1987. River levels were over 2 m higher than the maximums previously experienced by the Porcupine River sonar project during this period.[12] This extreme high-water event prevented optimal sonar operations and may have limited upstream migration of fall chum salmon.

Genetic Baseline Sample Collection

In Canada, a total of 510 Chinook salmon baseline samples were collected from 12 locations: 34 from 100 Mile Creek, 3 from Fishing Branch River, 54 from Hoole River, 26 from McNeil River, 38 from Morley River, 66 from North Big Salmon River, 109 from Nisutlin River, 62 from Nordenskiold River, 34 from Porcupine River, 1 from Ross River, 30 from Swift River, and 53 from Wolf River. These samples were collected by collaborators in Canada and shared with the Gene Conservation Laboratory, ADF&G, Anchorage. These Chinook salmon data will be used to enhance the genetic baselines to improve future stock abundance estimates based on genetic mixed stock analysis.

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

Chinook Salmon

Genetic stock composition of the 2016 Chinook salmon migration bound for Canada was estimated using genetic samples collected from the drift gillnet test fishing program conducted in conjunction with Yukon River sonar operations near Eagle. Variation of 15 microsatellite loci was analyzed from 748 Chinook salmon sampled between July 2 and September 16. Chinook salmon sonar operations occurred from July 1 to August 17. Chinook salmon stock contribution

[12] Hydrological data `are located at https://wateroffice.ec.gc.ca/report/report_e.html?type=realTime&stn=09FD002.

estimates were based on 8 regional reporting groups (stock aggregates; Table 11) and estimated by period and for the entire season (Table 12).

Table 11.–Baseline comprised of 27 stocks used to estimate stock compositions of Chinook salmon collected in the test gillnet fishery at the Eagle sonar project in 2016.

Stock aggregate	Populations in baseline
North Yukon Tributaries	Chandindu and Klondike rivers
White River	Tincup Creek, Nisling River
Stewart River	Mayo, McQuesten, and Stewart rivers
Pelly River	Little and Big Kalzas, Earn, Glenlyon, Ross and Pelly rivers, Blind Creek
Mid-mainstem Tributaries	Mainstem Yukon and Nordenskiold rivers
Carmacks Area Tributaries	Little Salmon, Big Salmon, and North Big Salmon rivers, Tatchun Creek
Teslin River	Teslin Lake, Nisutlin, Morley, Jennings, and Teslin rivers
Upper Yukon Tributaries	Whitehorse Hatchery and Takhini River

Table 12.–Estimated stock composition of Chinook salmon in the test gillnet fishery at the Eagle sonar project in 2016.

Period	Jul 2–Jul 13	Jul 14–19	Jul 20–26	Jul 27–Sep 16	Season
Sample Size	*n*=165	*n*=223	*n*=164	*n*=176	*n*=728
Stock aggregate	Est. (SD)	Est. (SD)	Est. (SD)	Est. (SD)	Est. (SD)
Upper Yukon Tribs.	0.6 (0.6)	4.9 (1.6)	9.8 (2.5)	10.7 (2.6)	6.6 (1.0)
Teslin River	26.3 (4.3)	37.8 (5.0)	33.7 (6.3)	46.9 (6.2)	35.0 (2.9)
Carmacks Area Tribs.	18.6 (4.1)	13.9 (4.3)	19.0 (5.1)	11.3 (4.3)	16.4 (2.4)
Mid-Mainstem	2.6 (2.0)	5.8 (4.3)	17.9 (4.7)	20.2 (5.2)	11.8 (2.2)
Pelly River	24.3 (3.9)	16.7 (3.1)	10.8 (3.0)	8.5 (2.7)	15.3 (1.7)
Stewart River	6.1 (2.9)	15.5 (3.4)	8.4 (3.0)	0.1 (0.4)	8.0 (1.5)
North Yukon Tribs.	12.8 (2.7)	3.5 (1.4)	0.4 (0.7)	1.2 (0.9)	4.2 (0.8)
White River	8.5 (2.5)	1.9 (1.0)	0.0 (0.2)	1.1 (0.9)	2.7 (0.7)

Note: The mainstem Yukon River sonar operated near Eagle switched from enumerating Chinook to fall chum salmon on August 18, 2016.

Passage (i.e., abundance) estimates for each stock aggregate at Eagle were calculated by multiplying the total Chinook salmon passage estimate from sonar by the percent composition of each stock aggregate, as determined by the genetic analysis. This was done for 4 sample periods and for the season as a whole (Table 13; Figure 6).

Table 13.–Estimated abundance of Chinook salmon migrating past the Eagle sonar project in 2016.

Period Sample Size	Jul 2–Jul 13 *n*=165	Jul 14–19 *n*=223	Jul 20–26 *n*=164	Jul 27–Aug 17 *n*=176	Season estimate *n*=728
Stock aggregate	Estimate	Estimate	Estimate	Estimate	Estimate
Upper Yukon Tribs.	106	1,074	1,892	1,458	4,768
Teslin River	4,525	8,358	6,515	6,409	25,300
Carmacks Area Tribs.	3,206	3,088	3,664	1,537	11,867
Mid-Mainstem	455	1,291	3,467	2,761	8,565
Pelly River	4,181	3,700	2,086	1,165	11,045
Stewart River	1,057	3,432	1,629	9	5,762
North Yukon Tribs.	2,207	767	73	163	3,069
White River	1,470	429	1	153	1,953

Note: The Eagle sonar switched from enumerating Chinook to fall chum salmon on August 18, 2016. Includes 7 Chinook salmon tissue samples were collected after August 17, 2016.

Estimated stock percentages from samples obtained mainstem sonar project near Eagle for 2016 are within the ranges observed between 2008 and 2015. However the White River stock aggregate was the second lowest proportional contribution estimated within this period (Appendices B18 and C17). The derived abundance estimates for the Upper Yukon Tributaries and Teslin River were the highest within the 2008–2015 period. All other aggregate stock abundance estimates were within the range of estimates between 2008 and 2015. With the exception of the Mid-Mainstem aggregate and the White River aggregate, the abundance estimates were also above average for the period.

Fall Chum Salmon

Genetic stock identification of the 2016 fall chum salmon migration bound for Canada was estimated using genetic samples collected from the drift gillnet test fishing program conducted in conjunction with mainstem Yukon River sonar operations near Eagle. Variation of 14 microsatellite loci was analyzed for 736 of the 862 fall chum salmon sampled and stock contribution estimates were based on 4 regional reporting groups (stock aggregates; Table 14). The estimated proportions of stock composition are broken down by the various sampling periods from August 5 to September 30, 2016 (Table 15).

Table 14.–Baseline comprising 4 stock aggregates used to estimate stock compositions of fall chum salmon collected from the test gillnet fishery at Eagle sonar project in 2016.

Stock Aggregate	Population in Baseline
Yukon Early	Chandindu River
White River	Kluane River, Kluane Lake, Donjek River
Mainstem Yukon River	Mainstem Yukon River at Pelly River, Tatchun Creek, Big Creek, and Minto
Teslin River	Teslin River

An estimated 70.0% of the return that passed the sonar site up to September 30 originated from the Mainstem Yukon River reporting group (which includes a number of mainstem Yukon River spawning populations) and 29.3% were from the White River aggregate (Table 15). Less than 1% of the return was estimated to originate from the remaining 2 reporting groups: the Teslin River and the Yukon Early group.

Passage (i.e., abundance) estimates for each fall chum salmon stock aggregate were calculated by multiplying the total fall chum salmon passage estimate from the sonar project by the percent

composition of each stock aggregate, as determined by the genetic analysis. This was calculated for 4 separate sample periods and the total season (Table 16). Abundance estimates by stock aggregate are also presented in Figure 7 for the sampling period only.

Table 15.–Estimated stock composition of fall chum salmon in the test gillnet fishery at Eagle sonar project in 2016.

Period	Aug 5–Sep 3		Sep 4-16		Sep 17-24		Sep 25-30		Sampling Season	
Sample Size	*n*=152		*n*=137		*n*=225		*n*=222		*n*=736	
Region	Est.	SD	Est.	SD	Est.	SD	Est.	SD	Est.	SD
Mainstem	53.5	(4.5)	72.2	(4.6)	64.1	(3.7)	83.9	(2.8)	70.0	(1.9)
White	46.1	(4.4)	26.7	(4.5)	34.5	(3.6)	15.8	(2.8)	29.3	(1.8)
Teslin	0.2	(0.6)	1.1	(1.4)	1.3	(0.9)	0.3	(0.6)	0.6	(0.5)
Yukon Early	0.2	(0.7)	0.0	(0.3)	0.0	0.0	0.1	(0.3)	0.0	(0.1)

Table 16.–Estimated abundance of fall chum salmon migrating past the Eagle sonar project in 2016.

Period	Aug 18–Sep 3	Sep 4-16	Sep 17-24	Sep 25-Oct 18	Total Season
Sample Size	*n*=152	*n*=137	*n*=225	*n*=222	*n*=736
Region	Estimate	Estimate	Estimate	Estimate	Estimate
Mainstem	8,684	15,727	19,764	77,303	112,754
White	7,478	5,818	10,645	14,553	47,238
Teslin	36	244	413	236	1,029
Yukon Early	36	4	1	88	6

Note: The mainstem Yukon River sonar enumerated fall chum salmon from August 18 to October 6, 2016. An expansion formula was used to estimate passage October 7 to 18 and is included in these estimates. Fall chum salmon genetic samples were collected between August 5 and September 30, 2016. Stock proportions in the last sample were applied to estimate composition of the last period which includes expansion to October 18.

The mainstem fall chum salmon stock aggregate proportion of the total sonar passage was the highest estimated since the first year of sonar estimation of fall chum salmon passage (2006). The White River chum and Yukon early stock group proportions were the lowest estimated for the same period (Appendix B19). The estimated abundance for the mainstem stock group was above the average (2009–2015) passage, while the estimated abundance of the White River stock group was below average for this period. Abundance estimates for mainstem, White River and Teslin stock groups were within previously observed ranges (Appendix C18). The abundance of the Yukon early stock group was the lowest on record. However, the Teslin and Yukon Early groups comprise very small proportions of the total fall chum salmon sonar passage and of the genetic sample; thus, there is greater uncertainty associated with these estimates. Estimated chum salmon spawning escapement for regions represented in the genetic baseline is calculated by multiplying the genetic analysis estimate of stock aggregate proportions of the year's pooled samples by the spawning escapement estimate for the corresponding year (Figure C18). GSI analysis of samples, from the mainstem Yukon River test fish program associated with the sonar near Eagle, in recent years (R&E projects CRE-79-13, CRE-79-14, CRE-79-15) has indicated that the mainstem fall chum salmon component increases in the latter part of the run, while the White River proportion declines (reflecting differences in run timing). This suggests that applying the seasonal genetic proportion estimate to the whole run may overestimate the White

River contribution (and underestimate the mainstem contribution) in late run years. This was the case in 2016, when the postseason expansion indicated that over 30% of the run passed the sonar site after the last genetic sampling period.

Yukon Education Program

Fisheries and Oceans Canada Whitehorse and contractors have carried out Salmon in the Classroom, an educational program, since 1989. Activities include classroom lessons, presentations, salmon incubation in the classrooms, and fry releases with habitat field trips. An annual project begins prior to school starting with Chinook salmon egg collection and during school in the case of fall chum salmon egg collections. Egg incubation in a classroom aquarium with daily maintenance and record keeping and presentations are conducted over the course of the school year until spring when a release and interpretative habitat field trip is provided. The project involves the collection of salmon eggs from nearby salmon spawning streams, which links the students to the salmon of their local area. Students are able to release these fry back to their local stream, which enhances their understanding of the salmon life cycle, their local habitats, and helps them develop a local association of the salmon teachings they received over the course of the project. All efforts are made to collect a small number of eggs from mostly spawned salmon so as to limit disturbance to returning salmon. Chinook or chum salmon eggs are collected based on nearby populations and the linkage of the community to different salmon species. Classroom discussion and presentations include information on salmon, salmon habitat, challenges to salmon survival, and salmon anatomy through dissection in the classroom. Recently, fall chum salmon have been used for dissections due to low Chinook salmon returns. Specific annual project information can be found in R&E reports and the Salmon in the Classroom website http://www.pac.dfo-mpo.gc.ca/education/primary-primaire/index-eng.html.

Environmental Conditions Report

This summary of environmental conditions is in response to a request from the JTC to report annually on the 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 very 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 weather conditions and resulting influences on stream conditions of the past year. The purpose of this summary is to record annual environmental conditions that may influence Yukon River Chinook salmon spawning and rearing habitat. This record may be used to determine opportunities to improve management, research, or restoration strategies and to focus habitat considerations in the future.

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 observed unusual trends and/or events, and 3) consider implications for Chinook salmon. Conditions reported herein are informed through observations based on relevant activities, projects, or studies carried out by the public, fishers, consultants, and Fisheries and Oceans Canada staff. 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 2015 to April 2016

The 2015–2016 winter was warmer and drier than normal; air temperatures ranged from 3 degrees Celsius above normal in southern regions (below 62° N) to 6 degrees Celsius above normal in northern regions of the Canadian sub-basin of the Yukon River. Winter precipitation records ranged from well below normal in southern regions to normal in northern regions (Yukon Snow Survey Bulletin and Water Supply Forecast, May 1, 2016)[13]. Snowpack was not as variable as most years. Values ranged from well below normal in southeastern and southwestern Yukon to below normal in central regions and near normal in northern regions (Yukon Snow Survey Bulletin and Water Supply Forecast, May 1, 2016). Streamflow conditions throughout the territory were generally above normal with the exception of the upper Yukon River which remained normal. The Stewart and Porcupine Rivers were well above normal. Streamflow during the November to April period represents base flow and generally provides an indication of groundwater contributions. (Yukon Snow Survey Bulletin and Water Supply Forecast, May 1, 2016). These conditions represent the period incubation and alevin development period for Chinook salmon.

May 2016 to July 2016

The warm, early spring resulted in early snow melt. Given the reduced amount of water stored as snow, summer flow impacts were uncertain. Precipitation was variable earlier in the season. Widespread severe thunderstorm activity in the Whitehorse and Southern Lakes area in mid-July brought rainfall causing flooding throughout Whitehorse. Cooler air temperatures moved across the sub-basin in July, resulting in a drop in water temperatures that later recovered to a range within historic averages for the period. Temperatures in this period align with 1+ Chinook salmon outmigration, and 0+ emergence and movement downstream, followed by upstream migration into non-natal tributaries.

August 2016 to October 2016

Temperatures for late summer were close to normal with fall being generally warmer than in previous years. Elevated water temperatures during this time period likely did not pose a risk to adult upstream migration and spawning. Precipitation was near to slightly above normal for northern and central Yukon, and below normal in the southeast. Widespread rain in August caused several washouts along the Dempster Highway between Dawson City and Inuvik. The 51 mm recorded over a period of 16 hours was well in excess of previously recorded values at Rock River and caused most streams in the area to break their banks. Temperatures in this period align with adult upstream migration and spawning.

Summary

Migration, spawning, and rearing conditions in the Canadian sub-basin of the Yukon River were likely favorable for 2015-2016. With increased climate variability, on-going habitat monitoring and assessment in the Yukon River Canadian Sub-basin is encouraged to continue to inform management, research, restoration strategies, and habitat considerations going forward.

[13] http://www.env.gov.yk.ca/air-water-waste/snow_survey.php.

8.4 RESTORATION AND ENHANCEMENT FUND

The *Yukon River Salmon Agreement* between Canada and the United States was initialed in March 2001 and signed in December 2002. Under the terms of the Agreement, the 2 countries established the $1.2M U.S. per annum Yukon River Salmon Restoration and Enhancement (R&E) Fund.

The purpose of the R&E Fund is to financially support:

(a) programs, projects, and associated research and management activities on either side of the Alaska Yukon border directed at restoration, conservation and enhancement of Canadian origin salmon stocks; and

(b) programs and projects directed at developing stewardship of salmon habitat and resources and maintaining viable fisheries in the Yukon River in Canada.

Seven categories or areas of activity have been established as eligible for R&E funding, including:

1. Conservation,
2. Restoration,
3. Enhancement,
4. Stewardship,
5. Viable fisheries,
6. Communications, and
7. Administration. (Administrative activities are not eligible for funding by grants from the R&E Fund to third parties responding to the annual Call for Proposals).

In 2016 the Restoration and Enhancement Fund project proposal and submission process was changed. Completion of a Stage I Conceptual Proposal form was no longer required. Instead proponents were required to submit only a Detailed Proposal submission form and a Detailed Budget form in response to the Call for Proposals to be considered for funding in 2016. In developing the 2016 Call, the Yukon River Panel confirmed 2 key Near-Term Restoration priority interests as the focus for the year, namely:

1) Identify depleted stocks or limits to production and identify candidate stocks or systems for stock restoration;

2) Identify potential spawning and rearing habitat restoration sites.

In addition, priority consideration was provided for 2016 project proposals that demonstrated local community involvement or local partnerships (in particular with First Nations). The selection of these particular priorities was driven by the Panel's desire to improve the effectiveness of Restoration and Enhancement Fund resources in response to the decline of Yukon River Chinook salmon stocks experienced in recent years.

All the Detailed Proposals submitted were subject to an in-depth technical assessment by the JTC, through its R&E subcommittee, as well as being evaluated for their relevance and significance to the *Yukon River Salmon Agreement*; the priorities outlined in the 2007 Budget

Priorities Framework; and, the Call for Project Proposals by the members of the Yukon River Panel.

Yukon River Panel questions and recommendations pertaining to certain selected Detailed Proposals were provided to the project proponents concerned following the December 2015 Panel meeting. Specific feedback from the proponents involved was sought and later provided to the Panel. Using this additional information and, taking into consideration public comments received, the Yukon River Panel made final funding decisions at its spring meeting in March, 2016 in Anchorage, Alaska.

In 2016, a total of 31 projects were selected for R&E funding, of which, 21 were on-going multi-year projects and 10 were new (Table 17). Funds in the amount of $1,672,890 U.S. were allocated to projects. In U.S. dollar terms 69% of the funds were directed towards Conservation projects; 16% to Restoration; 10% towards Stewardship; and 5% towards Communications. To achieve this level of project spending in 2016 the Panel drew on unspent project funds from previous years to supplement the annual $1.2M US R&E Fund disbursement. These and all remaining additional unspent funds have been earmarked specifically to be expended on projects focusing on "restoration" priorities between 2016 and 2019.

Status of 2016 R&E Projects

Table 17.–Restoration and enhancement fund projects, cost and status for completion, listed by envelope/category type, 2016.

Project #	Project Title	Amount	Status & Due Date
CRE-78-16	Development of a genetic baseline for Canadian-origin Yukon River Chinook and Chum salmon	$55,000 CAD	31-Mar-17
URE-05-16	Genetic Stock Identification of Fall Chum Salmon in Subsistence Harvest from the Tanana Area, Yukon River, 2016	$33,539 U.S.	30-Jun-17
URE-03-16	Yukon River Chinook subsistence harvest genetic stock identification	$158,132 U.S.	30-Jun-17
URE-92-16N	Genetic stock identification of Pilot Station Chinook salmon	$47,266 U.S.	30-Jun-17
CRE-79-16	Genetic Stock Identification of Canadian-origin Yukon River Chinook and Chum salmon	$30,000 CAD	31-Mar-17
CRE-09-16	Porcupine River Chinook Salmon Sonar Program.	$220,624 CAD	31-Jan-17
CRE-37-16	Blind Creek Chinook Salmon Enumeration Weir	$48,062 CAD	15-Feb-17
CRE-41-16	Sonar Enumeration of Chinook Salmon on the Big Salmon River	$85,380 CAD	15-Feb-17
URE-16-16	Yukon River Border Sonar Operations	$109,830 U.S.	30-Jun-17
CRE-94-16N	Pelly River Chinook salmon sonar pilot project	$170,591 CAD	31-Jan-17
CRE-95-16N	Enhancing the information value of coded wire tags applied to Canadian-origin Chinook salmon	$9,900 CAD	31-Mar-17
CRE-26-16N	Yukon River Canadian-origin Juvenile Chinook out-migrant assessment.	$85,135 CAD	31-Mar-17
CRE-11-16	Porcupine River Chinook salmon telemetry	$160,951 CAD	
CRE-22-16	Fishing Branch River Chum Salmon Habitat Assessment	$114,439 CAD	15-Oct-17

-continued-

Table 17.–Page 2 of 2.

Project #	Project Title	Amount	Status & Due Date
CRE-51-16	2016 Michie Creek Salmon and Habitat Monitoring Project	$18,870 CAD	31-Dec-16
CRE-98-16N	Yukon River mid-mainstem salmon assessment program	$41,190 CAD	31-Oct-16
CRE-20-16	Temperature Monitoring of Yukon River Chinook Salmon Spawning and Migration Habitats in Canada	$6,000 CAD	31-Dec-16
CRE-99-16N	Assessing the limits to production of juvenile Canadian-origin Yukon River Chinook salmon	$29,000 CAD	31-Mar-17
	Conservation Total	**$1,165,875 U.S.**	
CRE-25-16	Fox Creek Salmon Restoration Project	$31,515 CAD	31-Mar-17
CRE-18-16	Deadman Creek Chinook restoration pilot project & in-stream egg incubation trial	$76,257 CAD	30-Jun-17
CRE-101-16N	Coded wire tagging of hatchery origin Canadian-origin Chinook salmon fry	$52,500 CAD	31-Dec-16
CRE-102-16N	Porcupine River Chum salmon restoration incubation and rearing pilot project	$55,250 CAD	31-Dec-17
CRE-103-16N	Rock River Chinook and Chum habitat assessment and restoration initiative	$88,601 CAD	
CRE-105-16N	Porcupine Drainage Engagement: Gathering, Mapping and Integrating Local and Traditional Knowledge	$42,000 CAD	31-Mar-17
	Restoration Total	**$263,053 U.S.**	
CRE-02-16	Salmon Stewardship Coordinators for Yukon Schools	$31,450 CAD	30-Jun-17
CRE-06-16	Yukon River North Mainstem Stewardship	$31,460 CAD	31-Dec-16
CRE-07-16	Tr'ondëk Hwëch'in First Fish Youth Culture Camp	$9,500 CAD	31-Dec-16
CRE-65-16	McIntyre Creek salmon incubation project	$57,863 CAD	31-Aug-17
CRE-19-16	Yukon River Chinook Salmon Stock Restoration Community Technical Team	$85,466 CAD	31-Mar-17
	Stewardship Total	**$163,962 U.S.**	
CC-01-16	Yukon River Inseason Management Teleconferences	$10,000 U.S.	31-Mar-17
CC-03-16	Yukon River Pre-season Preparation meeting	$70,000 U.S.	31-Oct-17
	Communication Total	**$80,000 U.S.**	
	Total U.S. dollars	**$1,672,890 U.S.**	

Note: CRE=Canadian Restoration and Enhancement Proposal, URE=U.S. Restoration and Enhancement Proposal, N=New Proposal, CC=Communications Committee Project, and CAD=Canadian.

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 on stock 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 (Whitehorse Rapids Hatchery Chinook salmon; Appendix A19). 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;). 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

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 Council (NPFMC), and are regulated by the National Marine Fisheries Service (NMFS) Alaska Regional Office. Annual summaries and inseason information on Pacific salmon bycatch in the Bering Sea and Gulf of Alaska groundfish fisheries are provided by the Alaska Regional Office as part of 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). Bycatch of Chinook salmon in the BSAI and GOA remained at relatively low levels in 2016 (Appendices A19, A20, and A21). Bycatch numbers of Chinook salmon in BSAI groundfish fisheries (n = 32,497) were higher than GOA groundfish fisheries (n = 22,081), with most of the bycatch occurring during the A-season (n = 25,720). Bycatch numbers of Chinook salmon are not equivalent to numbers of Chinook salmon returning to freshwater due to the natural mortality that occurs in marine habitats; the numbers 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 347,148 in 2016 and nearly all non-Chinook bycatch occurred during the B-season (n = 342,309).

Pollock directed fisheries have been the primary groundfish fishery of concern for salmon bycatch in the Bering Sea as they account for approximately 88% of the total Chinook salmon bycatch and 99% of the non-Chinook salmon bycatch in the BSAI groundfish fisheries (Appendix A22). 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 2 seasons, 40% to the winter roe season (January 20 to June 10; A-season) and 60% to 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 almost entirely during the summer/fall season (99%; Appendix A22).

A variety of regulatory measures 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), 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 inseason 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 used to limit the bycatch of Chinook salmon (NMFS 2009a, NMFS 2009b). Following these reviews, the NPFMC recommended amendment 91 (https://alaskafisheries.noaa.gov/rules-notices/search) be added to the *BSAI Groundfish Fisheries Management Plan* for the Bering Sea pollock fishery. 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 are allocated to each season and sector of the fishery based on the bycatch cap, historical Chinook salmon bycatch, and pollock harvest allocations. Sectors that exceed their proportion of the performance cap more than 2 times in any 7 year period while participating in an IPA will have their hard cap reduced to their proportion of the performance cap. Salmon still retain their classification of a prohibited species; however, amendment 91 establishes benchmark performance criteria for incentive plan agreements such as the voluntary rolling hotspot system that have been used or may be used in the future to avoid salmon bycatch in the Bering Sea pollock fishery. Amendment 110 was added in 2016 to provide additional Chinook salmon bycatch avoidance measures during periods of low abundance to protect western Alaska Chinook salmon subsistence fisheries. Amendment 110 lowers the 60,000 hard cap for Chinook salmon bycatch to 45,000 (with a similar proportional reduction in the performance cap) following years when the in-river run size of Unalakleet, Upper Yukon, and Kuskokwim River stock groups fall below 250,000 fish.

10.0 RUN OUTLOOKS 2017

10.1 YUKON RIVER CHINOOK SALMON

Canadian-Origin Yukon River Chinook Salmon

The preseason outlook range for Canadian-origin Chinook salmon run size in 2017 is 70,000 to 97,000 fish, which predicts a similar run size to that of 2016. Several sources of information were considered in developing the 2017 forecast.

The Chinook salmon run on the Yukon River is typically dominated by age-5 and age-6 fish. The brood years producing these age classes in 2016 were 2011 (age-6) and 2012 (age-5). The Canadian-origin Yukon River Chinook salmon spawning escapements in 2011 and 2012 were 46,107 and 32,656 fish, both of which were below average escapements (Appendix A9; Figure 8). In the past 15 years, odd-year runs (2001, 2003, 2005, 2007, 2009, and 2011) have generally tended to be larger than prior and subsequent even-year runs, due to a stronger age-6 component returning (Figure 9). However, the 2013 Chinook salmon run had a weaker age-5 component than anticipated and ended up being one of the lowest Chinook salmon runs on record. In 2014, the age-6 component was also subsequently weak, but a strong age-5 component returned, resulting in a larger run size than 2013. The run in 2015 was stronger than 2014, partially due to the high relative abundance of age-4 and age-6 fish. In 2015 the estimated return of age-4 fish was the highest since 1989 and subsequently the return of age-5 fish in 2016 was the highest

since 1991 (Appendix A9) indicating a strong return of age-6 fish for 2017. In 2016 the return of age-4 fish was again high pointing to the potential for a strong age-5 return in 2017 (Appendix A9).

Spawner-recruitment and sibling models predict the 2017 run size of Canadian-origin Chinook salmon will be as high as 94,000 and 135,000 fish, respectively (Table 18). The average of those 2 models indicates a return of about 114,000 Chinook salmon. However, these models do not account for uncertainty associated with lower productivity observed in recent years. Over the past 10 years, observed run sizes were approximately 33% lower than preseason outlooks developed with the spawner-recruitment model, 30% lower than preseason outlooks developed with the sibling model, and 32% lower than preseason outlooks developed by averaging the 2 models.

In 2017, the average of the 2 model predictions yielded an unadjusted estimate of 114,000 Chinook salmon. Model performance, estimated as the ratio of observed to predicted run size, was averaged for 2007–2013 to obtain a correction factor of 0.61, which was then applied to the unadjusted (model average) forecast. The adjusted outlook obtained by this method was 70,000 Chinook salmon. Years included in the correction factor calculation were chosen because they represent the years when the model forecasts most differed from each other or from the observed return, thus representing the most variability in performance. This outlook was used for the lower end of the outlook range.

Returns in 2014, 2015 and 2016 indicated an improvement in the forecasting performance of the models (i.e. the observed run size was only 15% lower than the uncorrected forecast for 2014, 13% lower 2015 and 19% lower in 2016). Furthermore, age composition of the 2016 run indicates that brood years returning in 2017 might be as productive as or more productive than brood years that returned in 2016. Thus the model performance from 2014 through 2016 was used for the correction factor (0.84) to obtain the upper end of the outlook range of 97,000 fish.

This suggests a run size in 2017 slightly larger to the run size observed 2016. The predicted run size is above the recent actual run size average (2012–2016) of 64,000 fish but below the historical average (1989–1999) run size of 146,000 fish.

Performance of Stock-Recruitment Models for the Years 2000–2015

A review of preseason outlook performance provides an opportunity to document the recent trend in the upper Yukon River Chinook salmon recruits per spawner values. The preseason outlook is derived using spawner-recruitment and sibling model projections compared to postseason estimates of run size (Table 18). As stated previously, the preseason estimates derived from each model are corrected based on average performance to create a range. Despite good brood year escapements, the observed run sizes were relatively low from 2000 to 2002 and from 2007 to 2014. The causes of low returns are unknown but likely involve a number of factors in the marine and freshwater environments. These factors probably relate to some of the variability seen in the performance of the projection models from year to year. For example, the 2008 outlook of 117,000 Chinook salmon overestimated the run size by a factor of 1.77 above the actual run, whereas the 2015 and 2016 outlooks overestimated the actual run sizes by smaller factors of 1.1 and 1.2 respectively. It will be important to determine if the low run sizes observed in the 2007 to 2014 period develop into a long-term trend, or whether the improved performance seen in 2015 and 2016 indicates the beginning of an increasing trend in productivity.

Table 18.–Preseason Canadian-origin Yukon River Chinook salmon outlooks for 2000–2017 and the observed run sizes for 2000–2016.

	Expected Run Size (Preseason)							Postseason estimate and model performance		
				Adjusted outlook range[a]		Juvenile-based model range		Model performance (observed/predicted run size)		
Year	Spawner-recruit	Sibling	Model average	Low end	High end	Low end	High end	Estimated run size[b]	Spawner-recruit	Sibling
2000	127,784	85,889	107,000					53,000	0.41	0.62
2001	126,641	51,082	89,000					86,000	0.68	1.68
2002	113,759	107,496	111,000					82,000	0.72	0.76
2003	116,948	109,577	113,000					150,000	1.28	1.37
2004	123,469	124,326	124,000					117,000	0.95	0.94
2005	121,764	117,860	120,000					124,000	1.02	1.05
2006	115,995	123,132	120,000					119,000	1.03	0.97
2007	118,557	139,934	129,000					88,000	0.74	0.63
2008	111,551	122,435	117,000					63,000	0.56	0.51
2009	98,172	103,541	101,000					88,000	0.89	0.85
2010	109,797	116,346	113,000					60,000	0.54	0.51
2011	102,831	113,323	108,000					72,000	0.7	0.63
2012	106,090	87,167	97,000	54,000	73,000			48,000	0.46	0.56
2013	109,984	79,160	95,000	49,000	72,000	43,000	61,000	37,000	0.34	0.47
2014	100,159	53,287	77,000	32,000	61,000	45,000	65,000	65,000	0.65	1.22
2015	96,083	103,701	100,000	59,000	70,000	55,000	79,000	87,000	0.91	0.84
2016	96,983	108,003	102,000	65,000[c]	88,000[c]	61,000	88,000	83,000	0.86	0.77
2017	93,724	135,105	114,000	70,000[c]	97,000[c]	93,000	134,000			

[a] From 2012 to 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 one thousand to create an "adjusted outlook range".

[b] 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.

[c] 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.

Revised Canadian-origin Chinook Salmon Database

The estimation of border passage was developed from a combination of radiotelemetry data (2002–2004) and mainstem sonar estimates (2005–2007). Total spawning escapements are calculated from border passage estimates by subtracting the Canadian catch, including U.S. harvest between the sonar project site and the Canadian border, which are all Canadian-origin fish. 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 was used to reconstruct historical Canadian spawning escapement estimates from 2001 back to 1982 (Appendix B11). These estimates replaced the earlier border and spawning escapement estimates, derived from the DFO Chinook salmon mark–recapture program. Information from a

number of sources, reviewed in 2008, indicated that the earlier mark–recapture derived border and spawning escapement estimates were likely biased low. Age-specific returns have been estimated from harvest and escapement data by age class in the return years (Appendix A9). The resulting database, or brood table, forms the basis for the current stock-recruitment model. The JTC is pursuing further statistical run reconstruction analyses to improve historic run size estimates.

Drainagewide Chinook Salmon

The outlook for the total Yukon River Chinook salmon run can be estimated by applying historical average proportions of Canadian-origin fish in the total run to the outlook estimated for the Canadian component of the run. The average proportion of Canadian-origin fish in the total run has been considered to be 50%. Since 2005, genetic MSA samples have been collected from the mainstem test fishery at the Pilot Station sonar project and the weighted season total Canadian proportion has ranged between 34% and 52%. The drainagewide run outlook range for 2017, based on the adjusted Canadian-origin model estimates and the assumed 50% Canadian component of the run, is 140,000–194,000 Chinook salmon. A run of this size could have the potential to provide for escapements and allow for some subsistence harvest.

The historical average drainagewide Chinook salmon run size from 1989 to 1999 was 300,000 fish. Since that time, there has been a marked reduction in productivity (despite cessation of targeted commercial fishing for Chinook salmon and drastic decreases in subsistence harvest). The recent 5-year average (2012–2016) drainagewide Chinook salmon run size is approximately 160,000 salmon, which is less than half the historical average. The projected 2017 Yukon River Chinook salmon run size therefore may be above the recent average but from a historical perspective, is still considered below average.

During the winter and spring, agency fisheries managers will attend meetings with stakeholders, including the Yukon River Panel meeting, to provide information about the 2017 outlook and other topics and discuss management options. The meetings provide a forum to discuss options and practical management strategies in 2017 that will assist in preparing for the possibility that the Chinook salmon run could be similar to the below average runs of 2007–2016.

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). BASIS 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 the data collected during these research surveys over time. Stations are typically sampled during September along a systematic latitude and longitude grid with stations separated by approximately 30 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 Chinook salmon are the primary stock group of Chinook salmon in the northern Bering Sea during the summer (Murphy et al.

2009) and trawl surveys have been used to provide stock-specific juvenile abundance estimates (Figure 10; Murphy et al. 2017). Juvenile Chinook salmon abundance estimates provide an early indicator of stock status for the Canadian-origin stock group due to the relatively stable marine survival after the stage at which juveniles are sampled in the northern Bering Sea (Figure 11).

Juvenile abundance-based projections have been provided to the JTC and Panel since 2013, and forecast ranges appeared to be good predictors of adult run abundance in 2014 and 2016 (Table 18). The 2013 run was 6,000 fish below the low end of the forecast and the 2015 run was 8,000 fish above the high end of the forecast. Underestimation of actual run abundance was expected in 2015 due to influence of the 2012 survey, which likely underestimated juvenile abundance (these would include 5-year-old fish returning in 2015). Juveniles in 2013 and 2014 would be the primary contributors to the 2017 run (returning as 6- and 5-year-olds, respectively) and both years had above average juvenile abundance. Juvenile abundance estimates in the northern Bering Sea contributed to a preliminary projected run size of 93,000 to 134,000 Canadian-origin Chinook salmon returning to the Yukon River in 2017 (Figure 12).

10.2 YUKON RIVER SUMMER CHUM SALMON

The strength of the summer chum salmon run in 2017 will be dependent on production from the 2013 (age-4 fish) and 2012 (age-5 fish) escapements, as these age classes generally dominate the run. The total runs during 2012 and 2013 were approximately 2.5 million and 3.1 million summer chum salmon, respectively. The escapement goal on the Anvik River (350,000–700,000 fish) was achieved in 2012 and 2013, and the escapement goal on the East Fork Andreafsky River (>40,000 fish) was also met in both years. It is expected that the 2017 run will be similar to the 2016 run of approximately 2.4 million fish.

The 2017 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 14 years (2003–2016). 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 1,200,000 to 1,500,000 summer chum salmon. Similar to the last 3 years, however, commercial harvest of summer chum salmon in 2017 could 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 2010 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 in these years resulted in subsequent returns that ranged in size from approximately 318,000 (1996 production) to 2,900,000 (2001 production) fish. Corresponding return per spawner rates ranged from 0.3 to 8.9, averaging 1.75 for all years combined (1974–2010; Appendix A23).

A considerable amount of uncertainty has been associated with these run forecasts, particularly in the last decade, because of unexpected run failures (1998 to 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) have been attributed to the marine environment. Forecasts have been presented as ranges since 1999 to allow for adjustments based on more recent trends in production. Historical ranges included the normal point projection as the upper and lower ends were determined by reducing the projection by the average ratio of observed to predicted returns from 1998 to each consecutive current year through 2004. In 2005, the average ratio of 2001 to 2004 was used to develop the point projection in an attempt to capture some of the observed improvement in the run. The point estimate for 2006 and 2007 odd/even maturity schedules used the years 1974–1983 to represent years of higher production, whereas point estimates for 2008–2012 used odd/even maturity schedules from 1984 to current year to represent years of lower production up through brood year 2005 (Appendix A23). With the dissipation of the odd/even cycles in the past 17 years the trend is not as clear in the dataset, therefore, the odd/even maturity schedule for all completed brood years 1974–2010 (Appendix A23) were used to determine the point estimates from 2013–2017.

Yukon River fall chum salmon return primarily as age-4 and age-5 fish, although age-3 and age-6 fish also contribute to the run (Appendix A23). The 2017 run will be composed of brood years 2011 to 2014 (Table 19). Estimates of returns per spawner (R/S) were used to estimate production for 2011 and 2012. An auto-regressive Ricker spawner-recruit model was used to predict returns from 2013 and 2014. The point projection estimates for 2017 used the 1974 to current complete brood year returns (2010) applied to the odd/even maturity schedule. The result is an estimate of 1,560,000 fall chum salmon returning in 2017. The forecast range is based on the upper and lower values of the 80% confidence bounds for the point projection. Confidence bounds were calculated using deviation of point estimates and observed returns from 1987 through 2016. Therefore, the 2017 forecasted run size is expressed as a range from 1,400,000 to 1,700,000 fall chum salmon (Table 19). This forecasted run size is above average for odd-numbered year runs (1974–2015; 1,100,000 fish).

Table 19.–Forecasted 2017 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, 2011–2014.

Brood Year	Escapement	Estimated Production (R/S)	Estimated Production	Age	Contribution Based on Age	Current Return
2011	888,100	0.78	692,718	6	0.4%	5,913
2012	680,400	2.64	1,796,256	5	34.7%	540,954
2013	824,000	1.67	1,375,977	4	62.9%	981,428
2014	723,000	1.54	1,114,067	3	2.1%	32,562
Total expected run (unadjusted)						1,560,000
Total 2017 run size expressed as a range based on the forecasted vs. observed returns from 1987 to 2016 (80% CI):						1,400,000 to 1,700,000

The dominant parent year escapements contributing to this outlook are 2012 and 2013, both of which exceeded the upper end of the drainagewide escapement goal range of 300,000 to 600,000 fall chum salmon (Appendix C16). The R/S in the parent year 2011 did not meet replacement; however, the age-4 component of the 2012 brood year appears to be exceptional (R/S of 2.64, ranking the fourth highest on record) and production is estimated to be well above replacement. The major contributor to the 2017 fall chum salmon run is anticipated to be age-4 fish returning from the 2013 parent year (Appendix A23). However, there is concern for possible decreased

productivity as escapements over 800,000 have been consistently observed to produce lower yields. If density dependence is a factor, the run size would be expected to be slightly below the forecast range.

For fall chum salmon, the sibling relationship is best between the age-5 to age-6 component (R^2=0.57). Typically, the sibling relationship between the age-3 to age-4 fish (R^2=0.50) is better than the age-4 to 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 to 2010 typically averaged 849,000 fall chum salmon, and in all years ranged from a low of 175,000 for brood year 1996 to a high of 2,049,000 for brood year 2001. Return of age-5 fish from the same time period for odd-numbered brood years typically averaged 277,000 fall chum salmon, and in all years ranged from a low of 59,000 fish for brood year 1998 to a high of 703,000 fish for brood year 2001. Considering the sibling relationship described, the contribution of age-5 fish should be well above average sustaining the run size to near average should the age-4 component come in below average.

As mentioned previously, a consideration for the decline in expected age-4 return observed in 2017 is based on how well returns from large escapements (>800,000) produce, since 8 out of 9 failed to yield replacement values. The most recent high production levels of 2.00 R/S (average R/S 1998 to 2003 completed brood years, excluding 2001) were well above those in the poor returns observed in 1994–1997 (average 0.44 R/S). Production in 2005 was a record low of 0.27 R/S, indicating poor survival; however, 2006 through 2009 increased each year, as predicted. Production began dropping with the 2010 brood year with the recent low occurring in 2011 brood year (0.78). 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 to 2016 period (Table 20).

During the 2017 fall fishing season, estimated strength of the projected run will be adjusted using the relationship to summer chum salmon run abundance and assessed based on various inseason monitoring project data. With a projected run size range of 1,400,000 to 1,700,000 fall chum salmon (midpoint 1,560,000 fish; Table 20), it is anticipated that escapement goals will be met while supporting normal subsistence fishing activities. The forecast suggests a commercial surplus between 850,000 and 1,150,000 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.

Table 20.–Preseason Yukon River drainagewide fall chum salmon outlooks 1998–2017 and observed run sizes for 1998–2016.

Year	Expected run size (preseason)	Estimated run size (postseason) [a]	Actual run size as proportion of expected run
1998	880,000	352,000	0.40
1999	1,197,000	418,000	0.35
2000	1,137,000	252,000	0.22
2001	962,000	374,000	0.39
2002	646,000	426,000	0.66
2003	647,000	791,000	1.22
2004	672,000	651,000	0.97
2005	776,000	2,170,000	2.80
2006	1,211,000	1,190,000	0.98
2007	1,106,000	1,130,000	1.02
2008	1,057,000	830,000	0.79
2009	791,000	603,000	0.76
2010	690,000	573,000	0.83
2011	740,000	1,210,000	1.64
2012	1,114,000	1,070,000	0.96
2013	1,029,000	1,180,000	1.15
2014	932,000	936,000	1.00
2015	1,060,000	817,000	0.77
2016	666,000	1,380,000	2.07
2017	1,560,000		

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.

Canadian-Origin Upper Yukon River Fall Chum Salmon

To develop an outlook for the 2017 Canadian-origin Yukon River fall chum salmon, the drainagewide outlook range of 1,400,000–1,700,000 fall chum salmon was multiplied by 25% (the estimated contribution of mainstem Yukon River Canadian-origin fall chum salmon), producing an outlook range of 350,000–425,000 fish (midpoint of 388,000 fish). Recent genetic stock identification analyses have indicated that this assumption (i.e., 25%) is reasonably close. The preliminary 2017 outlook is the highest since 1998 and above the 1998–2016 average run size of 219,000 fish (Table 21).

Table 21.–Preseason Canadian-origin mainstem Yukon River chum salmon outlooks for 1998–2017 and observed run sizes for 1998–2016.

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		

Note: The 2009 through 2017 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, most 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 4% of the drainagewide run, though estimates have ranged from 1.3% to 7%. Applying the 4% average estimate to the drainagewide outlook range of 1,400,000–1,700,000 fish yields a Fishing Branch River outlook of 56,000–68,000 fish, with a midpoint of 62,000 fish. This outlook is considered uncertain due to the high variation in contributions of Fishing Branch River fall chum salmon to drainagewide stocks.

A separate preliminary Fishing Branch River stock-recruit model suggests an outlook of 57,000 fall chum salmon which is within the lower range of this estimate. However, this model makes similar assumptions; including, that the proportion of Fishing Branch River fall chum salmon in the total U.S. harvest is equal to the proportion of the escapement of Fishing Branch River fall chum salmon in the drainagewide escapement. Due to limited data on stock composition of the U.S. fall chum salmon harvest this assumption cannot be verified so the outlook based on this model should be regarded as highly uncertain.

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, with the exception of 2003 to 2005 and 2016 (Table 22).

Table 22.–Preseason Fishing Branch River fall chum salmon outlooks for 1998 to 2017 and observed run sizes for 1998–2016.

Year	Expected run size (preseason)	Estimated run size (postseason)	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		

Note: Run sizes are rounded to nearest one thousand. The 2009 through 2016 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 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 2017 coho salmon run will be age-4 fish returning from the 2013 parent year. Based on the run reconstruction index (1995–2016, excluding 1996 and 2009), the 2013 escapement was estimated to be 81,000 coho salmon which was well below median (163,000). In 2013, a relatively large amount of coho salmon were harvested incidentally in the directed fall chum

salmon commercial fisheries. Subsistence harvest in 2013 was also below the 2003–2012 average of 19,000 coho salmon.

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 6,222 fish in 2013 was slightly above the lower end of the SEG range of 5,200 to 17,000 coho salmon. Four other locations in the Tanana River drainage were surveyed for coho salmon specifically; half of which were below average when compared to the (2011–2015) average escapements. Very informal coho salmon outlooks are made preseason based on average survival of the primary parent year escapement estimate, which in 2017 would indicate that the return would be average. However, the last 3 years of returns (2014–2016) have been high abundance years which may indicate good productivity which typically cycles for several years in succession; thus, it would not be unexpected if the 2017 return were above average.

11.0 STATUS OF ESCAPEMENT GOALS

11.1 SPAWNING ESCAPEMENT TARGET OPTIONS IN 2016

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 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. The JTC recommends retaining this IMEG range for 2017. The goal should be reviewed again by the JTC in the fall 2017 meeting.

Canadian-origin Mainstem Yukon River Fall Chum Salmon

In 2010, the 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 to 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. For 2017, the JTC recommends that the Canadian-origin mainstem Yukon IMEG remain as established in 2010.

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 A24). The most recent 3-year period, 2014-2016, just ended. The JTC recommendation is to extend this goal for the 3-year period, 2017–2019.

11.2 ESCAPEMENT GOALS FOR ALASKA STOCKS

Yukon salmon escapement goals for all species in Alaska were last reviewed in conjunction with the 2016 Alaska Board of Fisheries process for the Arctic, Yukon, and Kuskokwim (AYK) region (Conitz et al. 2015). Alaska salmon escapement goals are generally reviewed every 3 years coinciding with the Board of Fisheries cycle. Review for the next cycle will begin later in 2017.

12.0 REFERENCES CITED

Andersen, D. B. 1992. The use of dog teams and the use of subsistence-caught fish for feeding sled dogs in the Yukon River drainage. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 210, Juneau.

Arnason, A. N., C. W. Kirby, C. J. Schwarz, and J. R. Irvine. 1995. Computer analysis of data from stratified mark-recovery experiments for estimation of salmon escapements and other populations. Canadian Technical Report of Fisheries and Aquatic Sciences 2106:37 p.

Berger, J. D. 2010. Incidental catches of salmonids by U.S. groundfish fisheries in the Bering Sea/Aleutian Islands and the Gulf of Alaska, 1990-2010. NPAFC Doc. 1254. 10 pp. Fisheries Monitoring and Analysis Division, Alaska Fisheries Science Center, NMFS, NOAA, U.S. Department of Commerce, 7600 Sand Point Way NE, Seattle, WA 98115-0070.

Bergstrom, D. J., C. Blaney, K. Schultz, R. Holder, G. Sandone, D. Schneiderhan, L. H. Barton, and D. Mesiar. 1992. Annual management report Yukon Area, 1990. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A92-17, Anchorage.

Brase, A. L. J., and B. Baker. 2015. Fishery management report for recreational fisheries in the Tanana River management area, 2014. Alaska Department of Fish and Game, Fishery Management Report No. 15-49, Anchorage.

Brown, C., and D. Jallen. 2012. Options for amounts reasonably necessary for subsistence uses of salmon: Yukon Management Area; prepared for the January 2013 Anchorage Alaska Board of Fisheries meeting. Alaska Department of Fish and Game, Division of Subsistence Special Publications No. BOF 2012-08, Fairbanks.

Burr, J. 2012. Fishery management report for sport fisheries in the Yukon Management Area, 2011. Alaska Department of Fish and Game, Fishery Management Report No. 12-44, Anchorage.

Conitz, J. M., K. G. Howard, and M. J. Evenson. 2015. Escapement goal recommendations for select Arctic-Yukon-Kuskokwim Region salmon stocks, 2016. Alaska Department of Fish and Game, Fishery Manuscript No. 15-08, Anchorage.

Crane, A. B., and R. D. Dunbar. 2011. Sonar estimation of Chinook and fall chum salmon passage in the Yukon River near Eagle, Alaska, 2009. Alaska Department of Fish and Game, Fishery Data Series No.11-08, Anchorage.

Eggers, D. M. 2001. Biological escapement goals for Yukon River Fall chum salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report 3A01-10, Anchorage.

Estensen, J. L., S. N. Schmidt, S. Garcia, C. M Gleason, B. M. Borba, D. M. Jallen, A. J. Padilla, and K. M Hilton. 2015. Annual management report Yukon Area, 2014. Alaska Department of Fish and Game, Fishery Management Report No. 15-50, Anchorage.

Fleischman, S. J., and B. M. Borba. 2009. Escapement estimation, spawner-recruit analysis, and escapement goal recommendation for fall chum salmon in the Yukon River drainage. Alaska Department of Fish and Game, Fishery Manuscript Series No. 09-08, Anchorage.

Guthrie, C. M., H. T. Nguyen, and J. R. Guyon. 2016. Genetic stock composition analysis of the Chinook salmon bycatch from the 2014 Bering Sea walleye pollock (*Gadus chalcogrammus*) trawl fishery. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-AFSC-310. 25 p.

Healey, M. C. 1991. Life history of Chinook salmon (*Oncorhynchus tshawytscha*). [*In*]: Groot, C. and L. Margolis, editors, Pacific Salmon Life Histories. UBC Press, Vancouver, B.C., Canada, pp. 311-394.

Ianelli, J. N., and D. L. Stram. 2014. Estimating impacts of the pollock fishery bycatch on western Alaska Chinook salmon. ICES Journal of Marine Science 72:1159-1172.

Jallen, D. M., S. K. S. Decker, and T. Hamazaki. 2015. Subsistence and personal use salmon harvests in the Alaska portion of the Yukon River drainage, 2012. Alaska Department of Fish and Game, Fishery Data Series No. 15-28, Anchorage.

REFERENCES CITED (Continued)

Kondzela, C., M., J. A. Whittle, D. Yates, H. T. Vulstek, and J. R. Guyon. 2016. Genetic stock composition analysis of Chum salmon from the prohibited species catch of the 2014 Bering Sea Walleye Pollock trawl fishery and Gulf of Alaska groundfish fisheries. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-314, 49 p.

Larson, W. A., F. M. Utter, K. W. Myers, W. D. Templin, J. E. Seeb, C. M. Guthrie, A. V. Bugaev, and L. W. Seeb. 2013. Single-nucleotide polymorphisms reveal distribution and migration of Chinook salmon (*Oncorhynchus tshawytscha*) in the Bering Sea and North Pacific Ocean. Canadian Journal of Fisheries and Aquatic Sciences 70:128-141.

Lozori, J. D., and B. C. McIntosh. 2014. Sonar estimation of salmon passage in the Yukon River near Pilot Station, 2012. Alaska Department of Fish and Game, Fishery Data Series No. 14-22, Anchorage.

Lozori, J. D., and M. J. McDougall. 2016. Sonar estimation of Chinook and fall chum salmon passage in the Yukon River near Eagle, Alaska, 2015. Alaska Department of Fish and Game, Fishery Data Series No. 16-27, Anchorage.

Murphy, J. M., K. G. Howard, J. C. Gann, K. C. Cieciel, W. D. Templin, and C. M. Guthrie. 2017. Juvenile Chinook Salmon abundance in the northern Bering Sea: Implications for future returns and fisheries in the Yukon River. Deep Sea Research Part II: Topical Studies in Oceanography 135:156-167.

Murphy, J. M., W. D. Templin, E. V. Farley, Jr., and J. E. Seeb. 2009. Stock-structured distribution of western Alaska and Yukon juvenile Chinook salmon (*Oncorhynchus tshawytscha*) from United States BASIS surveys, 2002-2007. North Pacific Anadromous Fish Commission Bulletin 5:51-59.

NMFS (National Marine Fisheries Service). 2009a. Bering Sea salmon bycatch management volume I final environmental impact statement. National Marine Fisheries Service Alaska Regional Office, Juneau, AK, December 2009. Available at: http://www.fakr.noaa.gov/Sustainablefisheries/bycatch/salmon/chinook/feis/eis_1209.pdf

NMFS (National Marine Fisheries Service). 2009b. Bering Sea salmon bycatch management volume II final regulatory impact review. National Marine Fisheries Service Alaska Regional Office, Juneau, AK, December 2009. Available at: http://www.fakr.noaa.gov/Sustainablefisheries/bycatch/salmon/chinook/rir/rir1209.pdf

NPAFC (North Pacific Anadromous Fish Commission). 2001. Plan for NPAFC Bering-Aleutian Salmon International Survey (BASIS) 2002-2006. North Pacific Anadromous Fish Commission Doc. 579. 27 pp. Available at: www.npafc.org.

Salo, E. O. 1991 Life history of chum salmon, *Oncorhynchus keta*. [*In*]: Groot, C., and L. Margolis, editors. Pacific Salmon Life Histories. UBC Press, Vancouver, B.C., Canada, pp. 231-309.

FIGURES

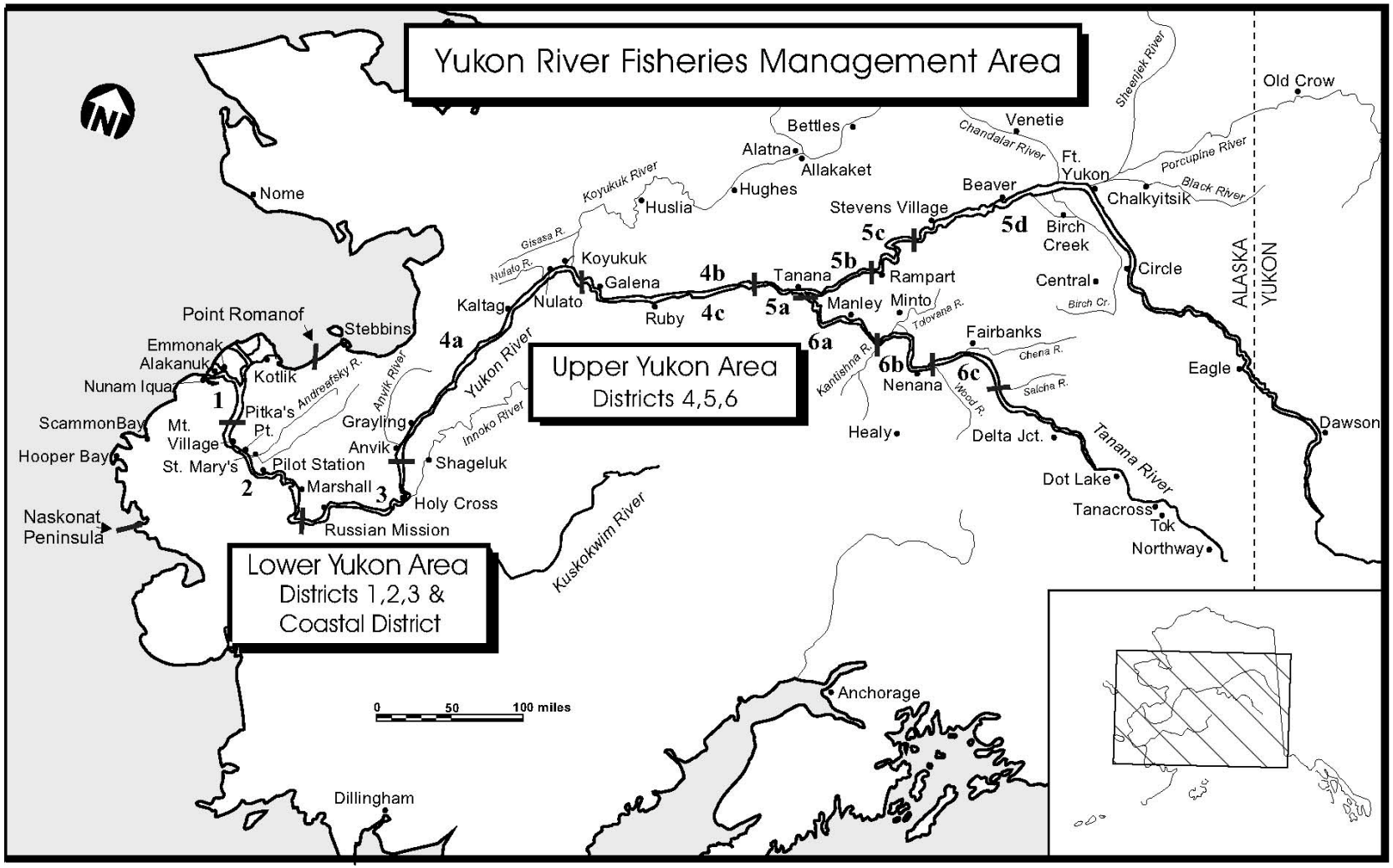
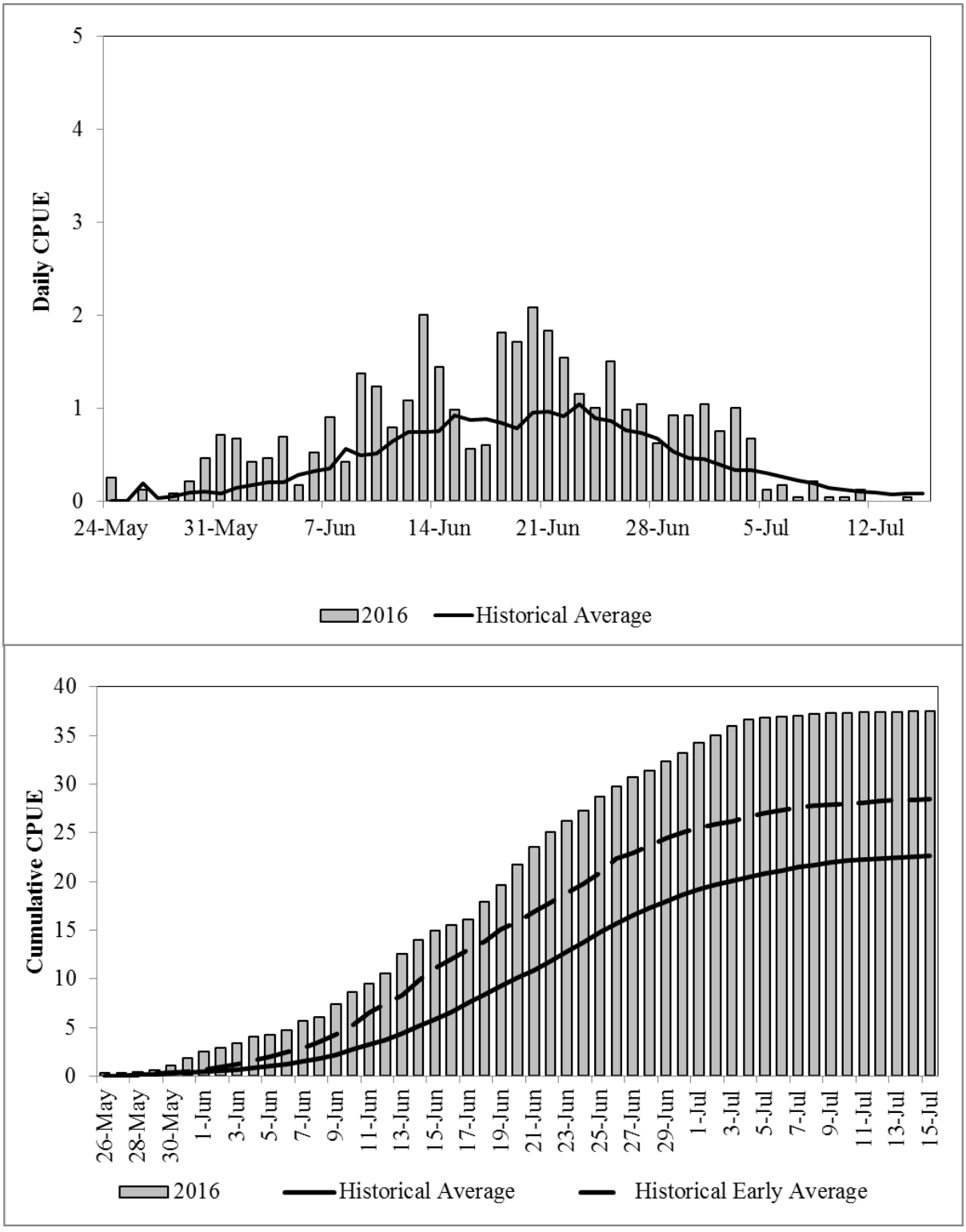
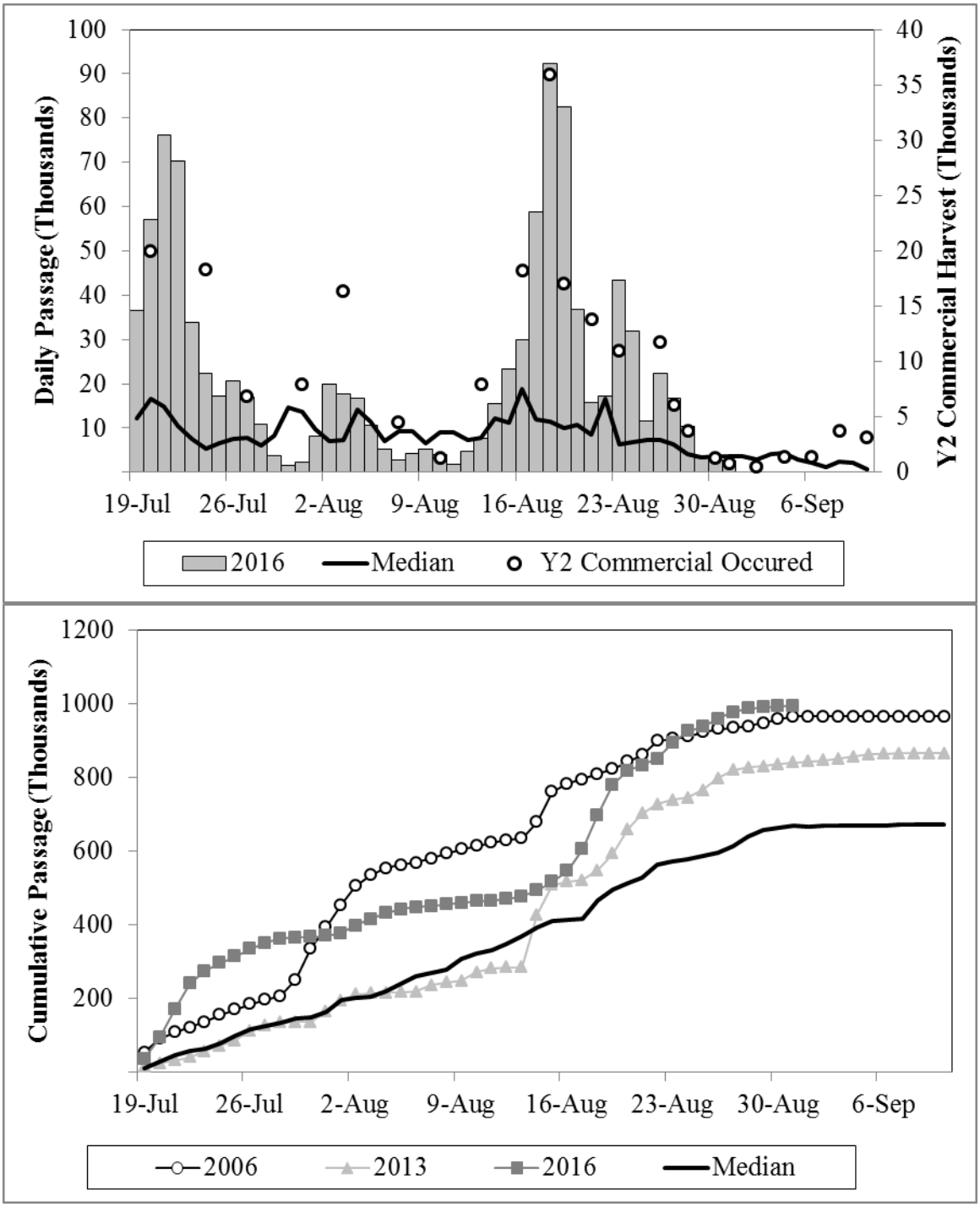


Figure 1.–Map of the Alaska portion of the Yukon River drainage showing communities and fishing districts.



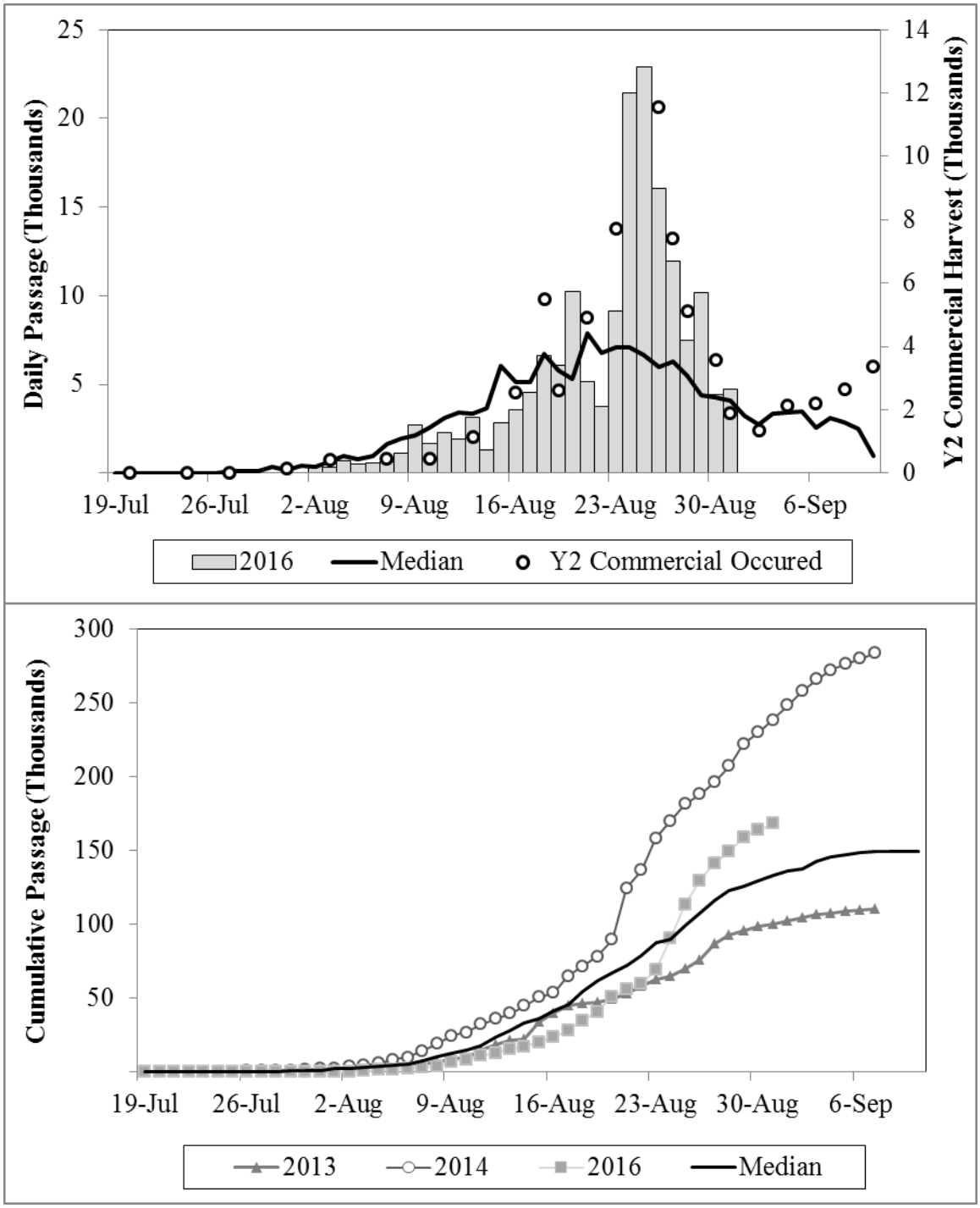
Note: Historical average includes 1989–2011, excluding 2009 and 2012–2015. Historical early average includes only 1993, 1995, 1996, 2003, 2004 and 2014.

Figure 2.–Daily (top) and cumulative (bottom) catch per unit effort (CPUE) for Chinook salmon in 8.5 inch set gillnet test fishery sites in 2016, compared to historic and early year average run timing, for select years between 1989–2015.



Note: Historical median includes 1995–2015, excluding 1996 and 2009. Y2 refers to District 2 Yukon Area.

Figure 3.–Daily passage estimates at the mainstem Yukon River sonar at Pilot Station attributed to fall chum salmon 2016 (top), compared to median and cumulative passage estimates (bottom), compared to other runs of similar size.



Note: Historical median includes 1995–2015, excluding 1996 and 2009. Y2 refers to District 2 Yukon Area.

Figure 4.–Daily passage estimates at the mainstem Yukon River sonar at Pilot Station attributed to coho salmon 2016 (top), compared to median and cumulative passage estimates (bottom), compared to median and other select years.

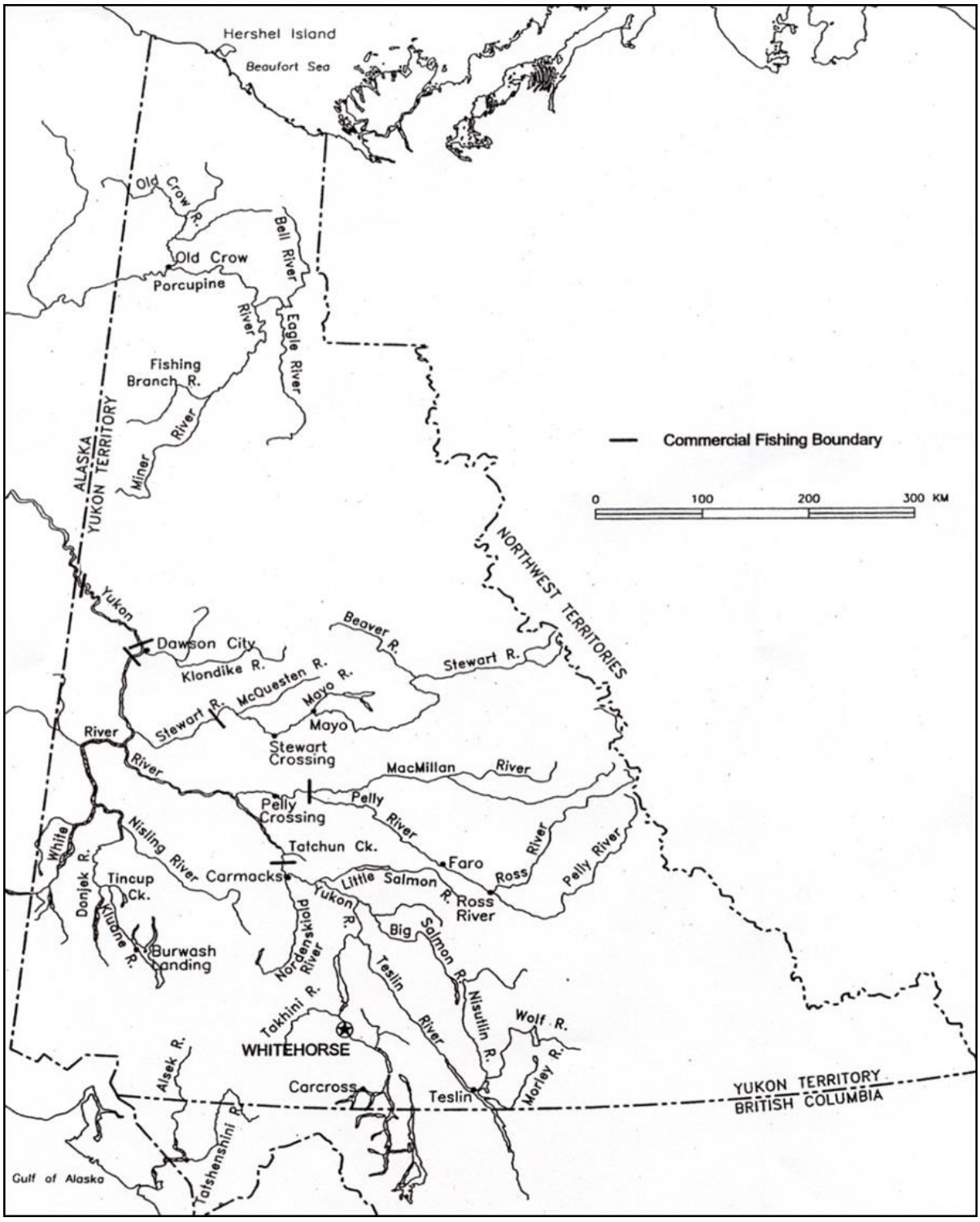
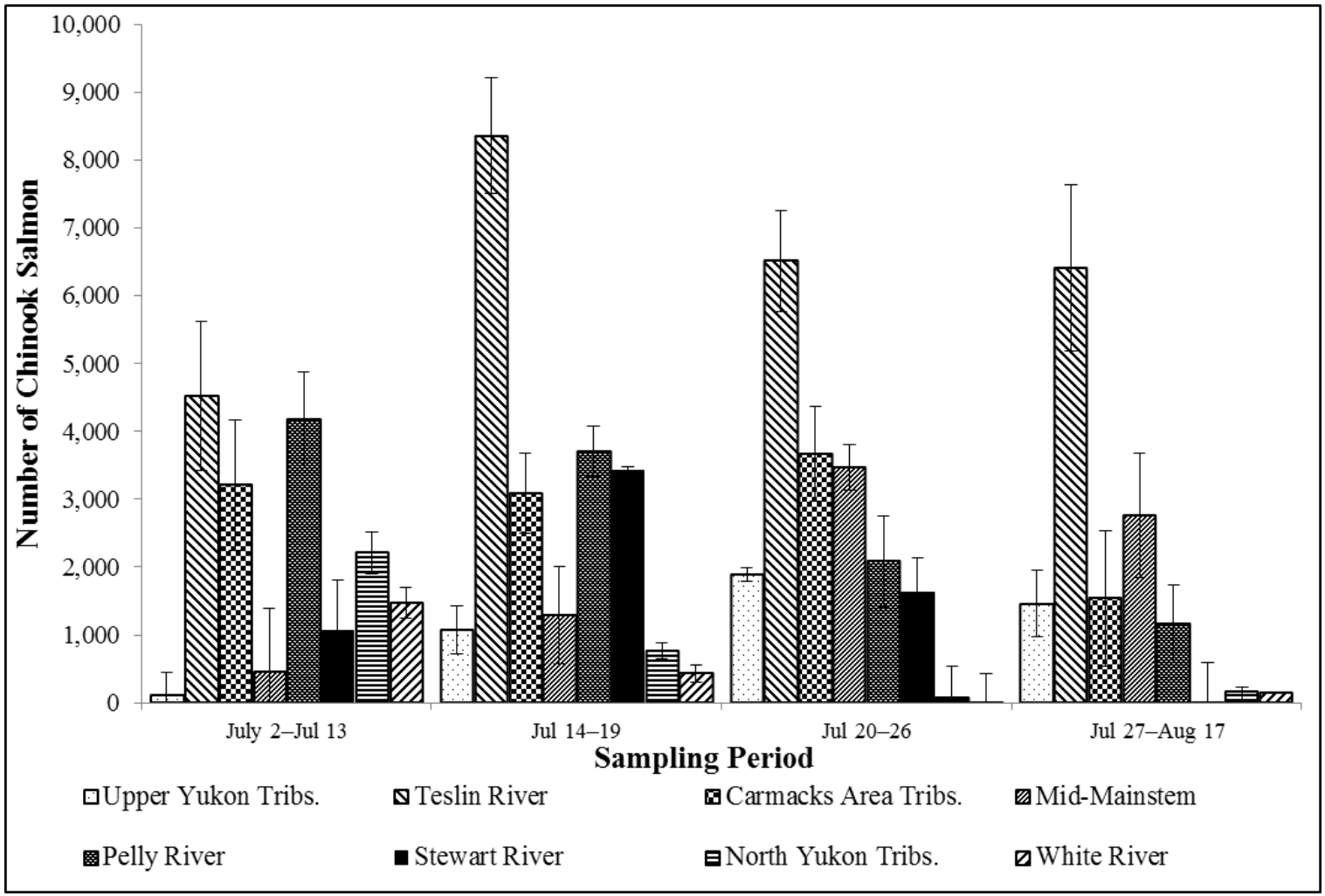
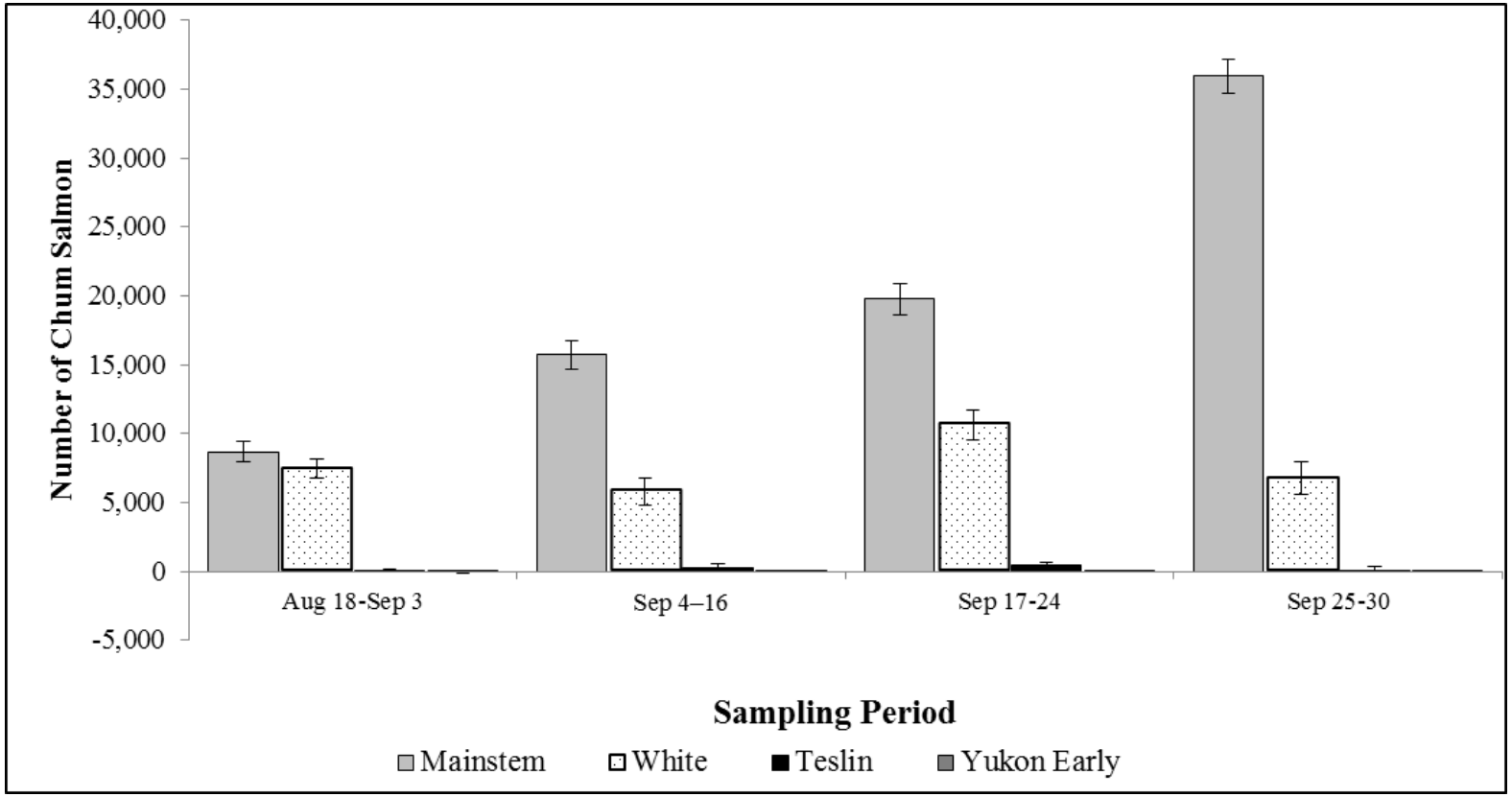


Figure 5.–Commercial fishing boundaries, tributaries, and major towns within the Yukon Territory, Canada.



Note: This figure shows total seasonal abundance for 8 regional stock aggregates. Stock composition, determined by genetic stock identification of samples collected at the Eagle sonar site, was applied to total abundance estimates from the Eagle sonar to derive these estimates.

Figure 6.–Relative abundance of Canadian-origin Yukon Chinook salmon stocks in the mainstem Yukon River sonar Eagle site in 2016 determined by genetic stock identification.



Note: This figure shows the seasonal abundance for 4 regional stock aggregates. Does not include postseason expansion estimates. Stock composition, determined by genetic stock identification of samples collected at the Eagle sonar site, was applied to total abundance estimates from the Eagle sonar to derive these estimates.

Figure 7.–Relative abundance of Canadian-origin Yukon fall chum salmon stocks at mainstem Yukon River sonar site near Eagle in 2016 determined by genetic stock identification.

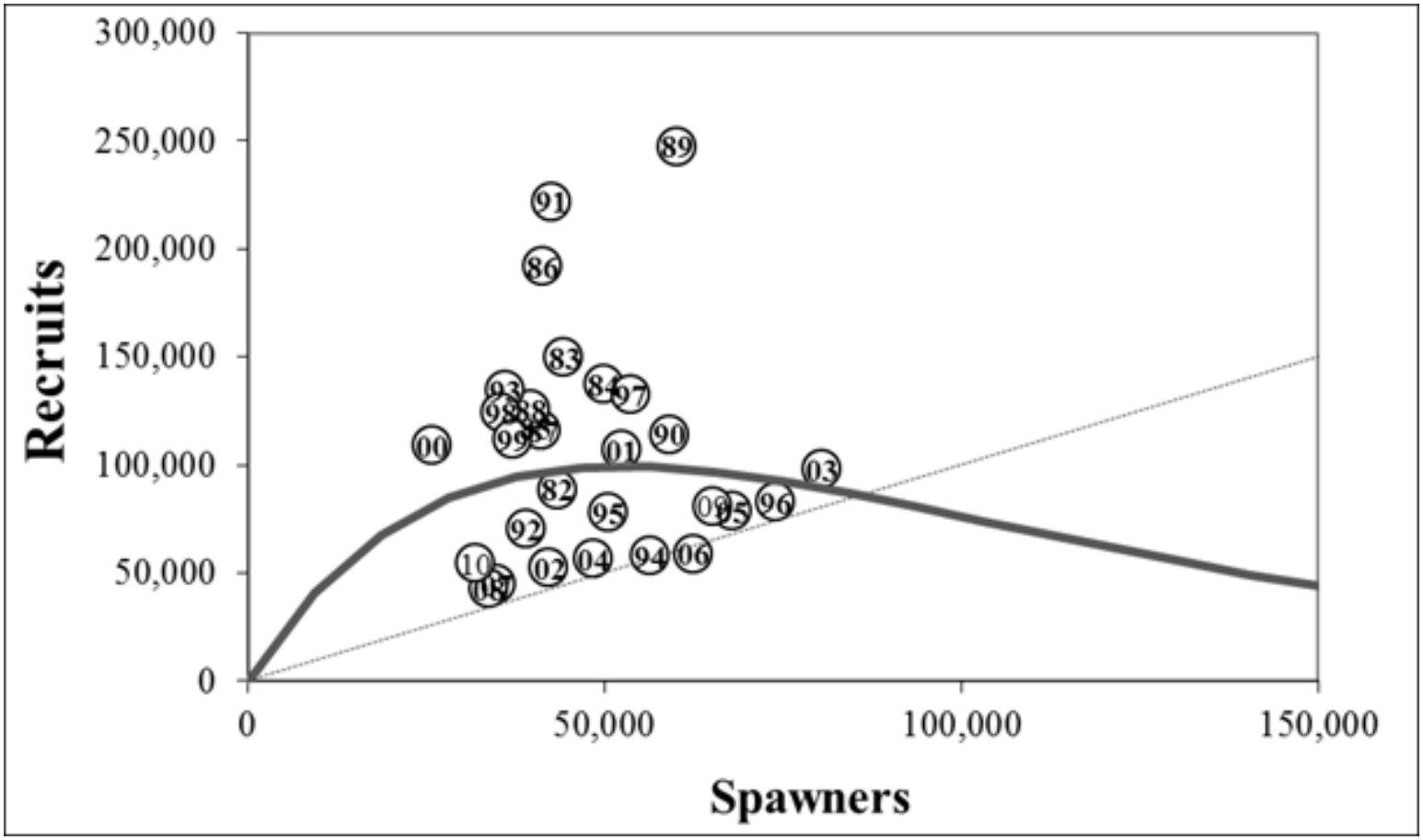
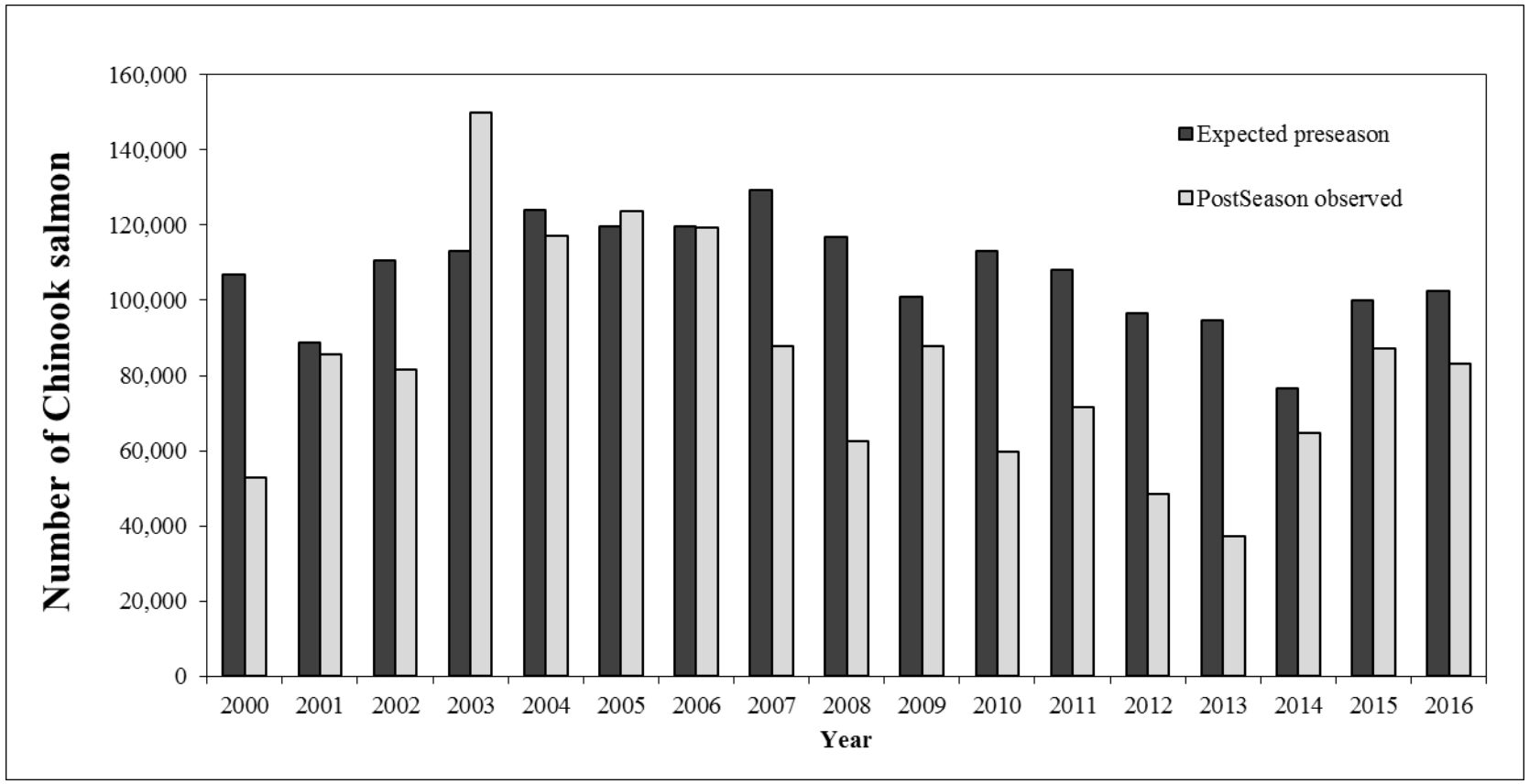
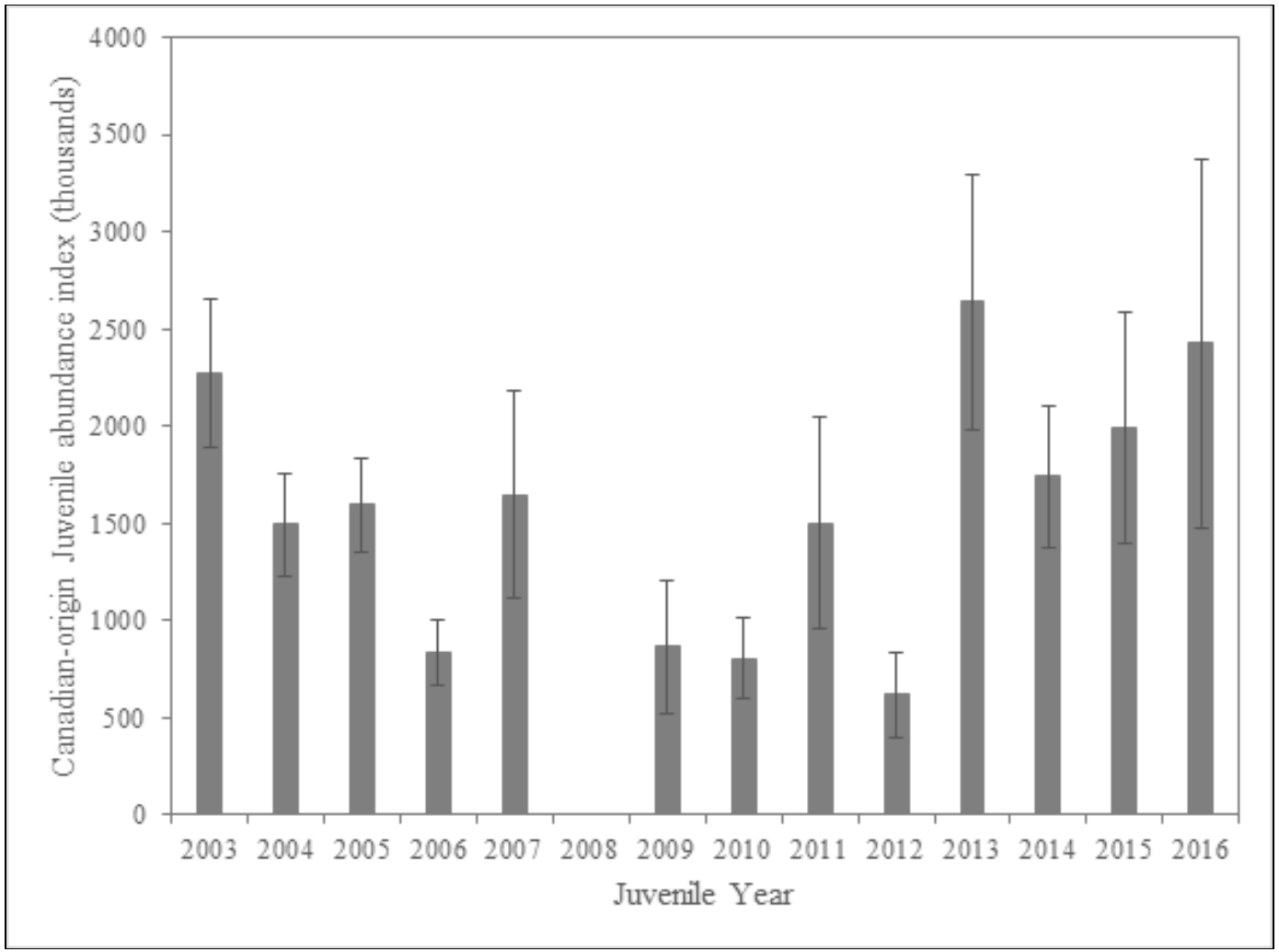


Figure 8.–Yukon River Canadian-origin Chinook salmon recruits versus spawners, Ricker curve, and 1:1 replacement line. Brood years 1982–2010 are included.



Note: The "expected" value is the average of the Spawner-Recruit and Sibling relationship-generated projections created preseason. Correction value based on model performance has not been applied to the "expected" values. 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 9.–Expected versus observed number of Canadian-origin Chinook salmon returning to spawn, 2000–2016.



Note: Error bars ranges are 2 standard deviation of the abundance estimates. The 2016 estimate is preliminary and subject to change.

Figure 10.–Juvenile abundance estimates of Canadian-origin Chinook salmon from the Yukon River based on pelagic trawl research surveys in the northern Bering Sea (2003–2016).

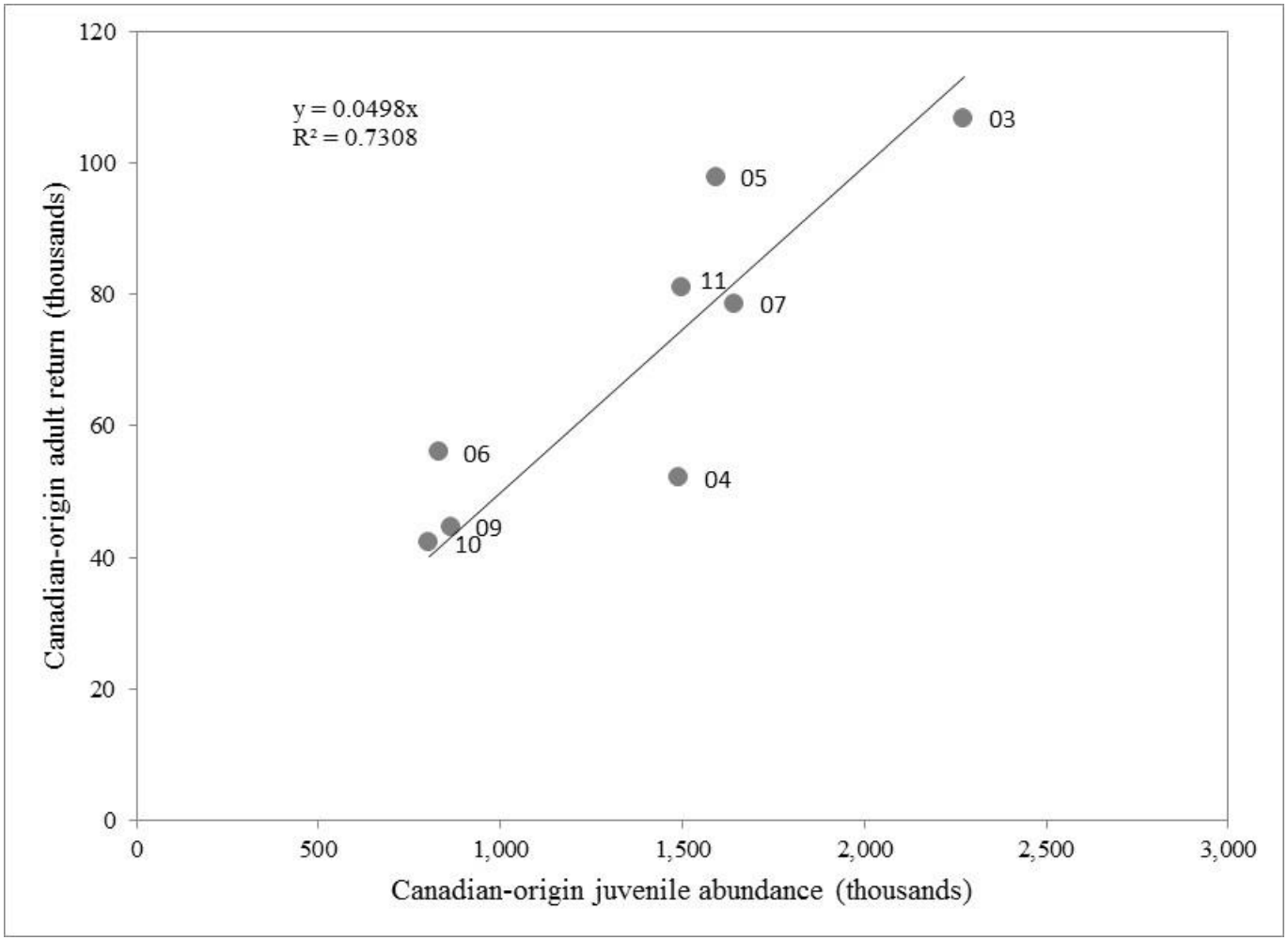
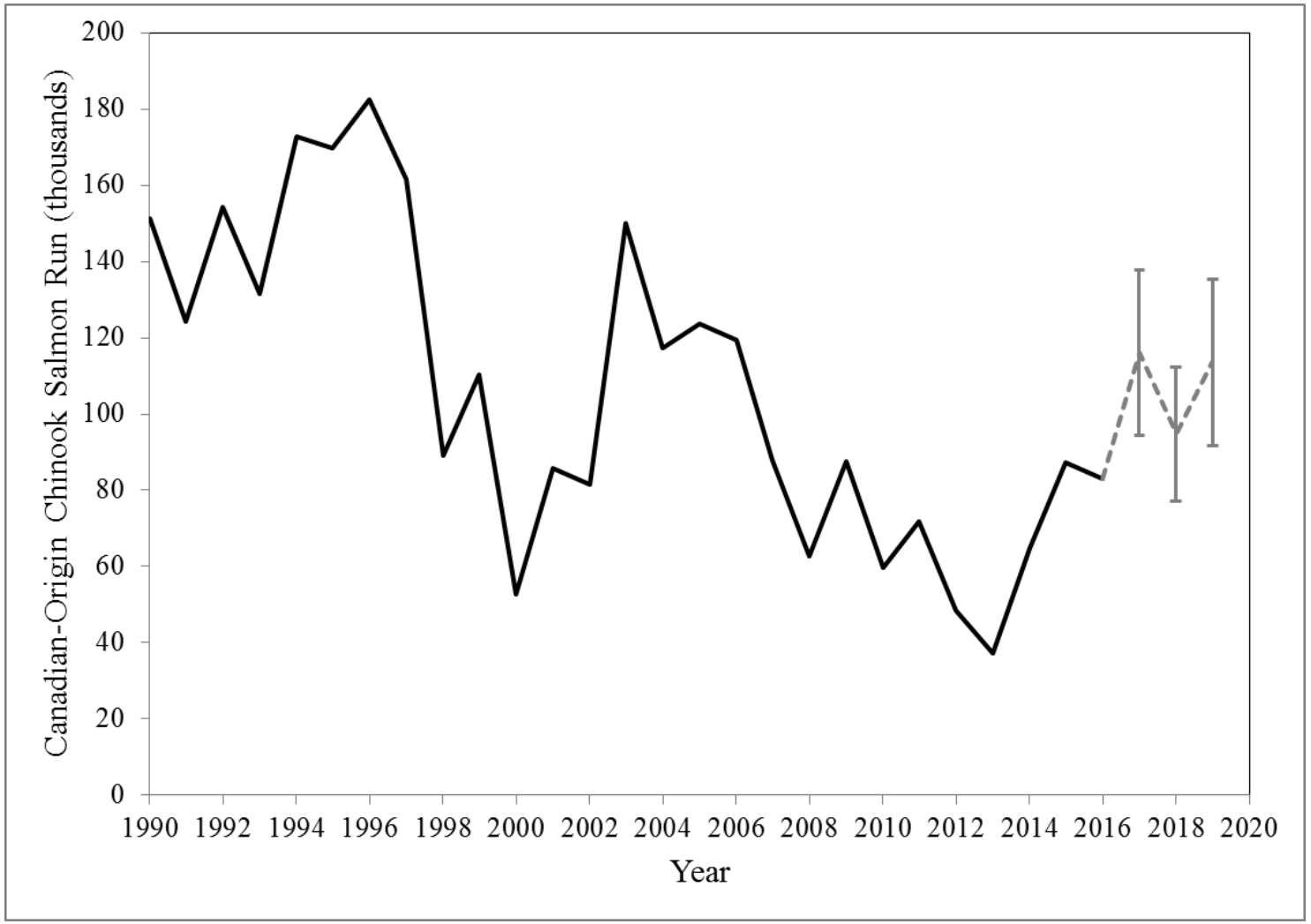


Figure 11.–The relationship between juvenile and adult abundance for Canadian-origin Chinook salmon from the Yukon River. Data labels indicate sampling years for juvenile abundance.



Note: Preliminary run projections exclude 2012 juvenile abundance due to incomplete survey coverage during 2012. Error bar ranges are 2 standard deviation of the abundance estimates.

Figure 12.–Historic run size estimates of Canadian-origin Chinook salmon in the Yukon River (solid line 1990–2016) and preliminary projected run sizes based on juvenile abundance (dashed line 2017–2019).

APPENDIX A: TABLES

Appendix A1.–Yukon River drainage summer chum salmon management plan overview.

	Recommended Management Actions by Fishery			
Projected Run Size [a]	Commercial	Personal Use	Sport	Subsistence
500,000 or Less	Closure	Closure	Closure	Restrictions [b]
500,001 to 650,000	Closure [c]	Closure [c]	Closure [c]	Possible Restrictions [d]
650,001 to 750,000	0 – 50,000 [e]	Restrictions [c]	Restrictions [c]	Normal Fishing Schedules
Greater than 750,000	500,000 – 1,200,000 [f]	Open	Open	Normal Fishing Schedules

[a] ADF&G will use best available data including preseason projections, test fishing indices, age and sex composition, subsistence and commercial harvest reports, and passage estimates from escapement monitoring projects to assess the run.

[b] A directed subsistence summer chum salmon fishery may be opened by emergency order in a district, subdistrict, or portion of a district or subdistrict if indicators show the individual escapement goal for that area will be met.

[c] If indicators show that individual escapement goals and subsistence needs within a district, subdistrict, or portion of a district or subdistrict will be met, ADF&G may open, by emergency order, a summer chum salmon fishery for commercial, sport, or personal use fishing in that district, subdistrict, or portion of a district or subdistrict.

[d] The department may restrict the subsistence directed summer chum salmon fishery to achieve drainagewide escapement of no less than 600,000 summer chum salmon, except that, if indicators show that individual escapement goals within a district, subdistrict, or portion of a district or subdistrict will be met, ADF&G may open, by emergency order, a less restrictive directed subsistence summer chum salmon fishery in that district, subdistrict, or portion of a district or subdistrict.

[e] ADF&G may open a drainagewide commercial fishery with the harvestable surplus distributed by district or subdistrict in proportion to the guideline harvest levels established in 5 AAC 05.362 (g) if buying capacity allows.

[f] When the projected run size of summer chum salmon is more than 750,000 fish, ADF&G may open, by emergency order, a drainagewide commercial fishery managed to achieve escapements within the established drainagewide escapement goal range of 500,000– l,200,000 summer chum salmon. The targeted harvest of the surplus will be distributed by district or subdistrict in proportion to the guideline harvest levels established in 5 AAC 05.362 (g).

Appendix A2.–Passage estimates based on the mainstem Yukon River sonar near Pilot Station, Yukon River drainage, 1995 and 1997–2016.

	Chinook			Chum						
Year [a]	Large [b]	Small	Total	Summer	Fall [c]	Total	Coho [c]	Pink	Other [d]	Total
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
2015	105,063	41,796	146,859	1,591,505	669,483	2,260,988	121,193	39,690	853,989	3,422,719
2014	120,060	43,835	163,895	2,020,309	706,630	2,726,939	283,421	679,126	584,831	4,438,212
2013	120,536	16,269	136,805	2,849,683	865,295	3,714,978	110,515	6,126	732,009	4,700,433
2012	106,529	21,026	127,555	2,136,476	778,158	2,914,634	130,734	420,344	464,058	4,057,325
2011	117,213	31,584	148,797	2,051,501	873,877	2,925,378	149,533	9,754	453,537	3,686,999
2010	118,335	26,753	145,088	1,415,027	458,103	1,873,130	177,724	917,731	569,905	3,683,578
2009 [e]	128,154	49,642	177,796	1,477,186	274,227	1,751,413	240,779	34,529	589,916	2,794,433
2008	138,220	36,826	175,046	1,849,553	636,525	2,486,078	145,378	580,127	306,225	3,692,854
2007	119,622	50,624	170,246	1,875,491	740,195	2,615,686	192,406	126,282	761,657	3,866,277
2006	192,296	36,467	228,763	3,780,760	964,238	4,744,998	163,889	183,006	531,047	5,851,703
2005 [f]	165,349	22,527	187,876	2,384,645	1,893,688	4,278,333	194,372	61,091	364,250	5,085,922
2004	138,317	62,444	200,761	1,344,213	633,368	1,977,581	207,844	399,339	391,939	3,177,464
2003	287,729	30,359	318,088	1,183,009	923,540	2,106,549	280,552	11,370	379,651	3,096,210
2002	111,290	40,423	151,713	1,097,769	367,886	1,465,655	137,077	123,698	405,534	2,283,677
2001 [g]	104,060	17,029	121,089	442,546	408,961	851,507	160,272	2,846	265,749	1,401,463
2000	48,321	6,239	54,560	448,665	273,206	721,871	206,365	61,389	262,627	1,306,812
1999	159,805	24,413	184,218	969,459	451,505	1,420,964	76,174	3,947	337,701	2,023,004
1998	88,129	19,909	108,038	824,901	375,222	1,200,123	146,365	103,416	210,677	1,768,619
1997 [h]	114,519	85,244	199,763	1,359,117	579,767	1,938,884	118,065	3,872	376,841	2,637,425
1995	164,867	45,874	210,741	3,632,179	1,156,278	4,788,457	119,893	53,277	708,747	5,881,115

Note: Historical passage estimates at the mainstem Yukon River sonar near Pilot Station 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 mideye to 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) and 2008–2014 (September 7).

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

[e] 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.

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

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

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

Appendix A3.–Alaska commercial salmon sales (in numbers) by district and subdistrict, 2016.

District/Subdistrict	Number of Fishermen [a]	Chinook	Summer Chum	Fall Chum	Coho	Pink
1	288	0	293,522	226,576	113,669	125,070
2	216	0	228,267	213,225	67,208	2,268
Subtotal Districts 1 and 2	483	0	521,789	439,801	180,877	127,338
3	–	–	–	–	–	–
Total Lower Yukon	483	0	521,789	439,801	180,877	127,338
Anvik River	–	–	–	–	–	–
4-A	–	–	–	–	–	–
4-BC	–	–	–	–	–	–
Subtotal District 4	–	–	–	–	–	–
5-ABC	4	–	–	7,542	54	–
5-D	–	–	–	–	–	–
Subtotal District 5	4	–	–	7,542	54	–
6-ABC	5	0	4,020	18,053	20,551	0
Total Upper Yukon	9	0	4,020	25,595	20,605	0
Total Alaska	492	0	525,809	465,396	201,482	127,338

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 A4.–Number of commercial salmon fishing gear permit holders making at least 1 delivery by district and season, Yukon Area, 1990–2016.

Chinook and Summer Chum Salmon Season									
	Lower Yukon Area				Upper Yukon Area				Yukon Area
Year	District 1	District 2	District 3	Subtotal	District 4	District 5	District 6	Subtotal	Total
1990	453	242	15	679	92	27	23	142	821
1991	489	253	27	678	85	32	22	139	817
1992	438	263	19	679	90	28	19	137	816
1993	448	238	6	682	75	30	18	123	805
1994	414	250	7	659	55	28	20	103	762
1995	439	233	0	661	87	28	21	136	797
1996	448	189	9	627	87	23	15	125	752
1997	457	188	0	639	39	29	15	83	722
1998	434	231	0	643	0	18	10	28	671
1999	412	217	5	631	5	26	6	37	668
2000	350	214	0	562	0	0	0	0	562
2001 [a]	-	-	-	-	-	-	-	-	-
2002	322	223	0	540	0	18	6	24	564
2003	351	217	0	556	3	16	7	26	582
2004	396	212	0	549	0	14	6	20	569
2005	370	228	0	578	0	12	5	17	595
2006	379	214	6	569	0	15	10	25	594
2007	359	220	3	564	5	12	10	27	591
2008	266	181	0	444	8	0	5	13	457
2009	213	166	0	376	6	0	5	11	387
2010	264	181	0	440	5	0	5	10	450
2011	228	182	0	403	0	0	5	5	408
2012	242	178	0	413	11	0	3	14	427
2013	220	174	0	384	9	0	2	11	395
2014	231	183	0	405	10	0	1	11	416
2015	270	177	0	435	0	0	2	2	437
2016	245	198	0	435	0	0	2	2	437
2006–2015 Average	267	186	1	443	5	3	5	13	456

-continued-

Fall Chum and Coho Salmon Season									
	Lower Yukon Area				Upper Yukon Area				Yukon Area
Year	District 1	District 2	District 3	Subtotal	District 4	District 5	District 6	Subtotal	Total
1990	301	227	19	529	11	11	27	49	578
1991	319	238	19	540	8	21	25	54	594
1992	0	0	0	0	0	0	22	22	22
1993 [a]	-	-	-	-	-	-	-	-	-
1994	0	0	0	0	0	1	11	12	12
1995	189	172	0	357	4	12	20	36	393
1996	158	109	0	263	1	17	17	35	298
1997	176	130	0	304	3	8	0	11	315
1998	0	0	0	0	0	0	0	0	0
1999	146	110	0	254	4	0	0	4	258
2000 [a]	-	-	-	-	-	-	-	-	-
2001 [a]	-	-	-	-	-	-	-	-	-
2002 [a]	-	-	-	-	-	-	-	-	-
2003	75	0	0	75	2	0	5	7	82
2004	26	0	0	26	0	0	6	6	32
2005	177	0	0	177	0	0	7	7	184
2006	219	71	0	286	0	4	11	15	301
2007	181	122	0	300	0	2	8	10	310
2008	251	177	0	428	0	3	8	11	439
2009	165	130	0	292	0	0	2	2	294
2010	72	18	0	90	0	0	4	4	93
2011	234	169	0	395	0	2	5	7	402
2012	266	201	0	457	4	3	5	12	469
2013	251	197	0	436	0	1	6	7	443
2014	256	199	0	441	0	2	2	4	445
2015	266	184	0	440	0	1	5	6	446
2016	275	197	0	459	0	4	4	8	467
2006–2015 Average	216	147	0	357	0	2	6	8	364

-continued-

COMBINED SEASON									
	Lower Yukon Area				Upper Yukon Area				Yukon Area
Year	District 1	District 2	District 3	Subtotal	District 4	District 5	District 6	Subtotal	Total
1990	459	258	22	679	92	31	30	153	832
1991	497	272	29	680	85	33	28	146	826
1992	438	263	19	679	90	28	25	143	822
1993	448	238	6	682	75	30	18	123	805
1994	414	250	7	659	55	28	20	103	762
1995	446	254	0	664	87	31	24	142	806
1996	455	217	9	628	87	29	19	135	763
1997	463	221	0	640	39	31	15	85	725
1998	434	231	0	643	0	18	10	28	671
1999	422	238	5	632	6	26	6	38	670
2000	349	214	0	561	0	0	0	0	561
2001 [a]	-	-	-	-	-	-	-	-	-
2002	322	223	0	540	0	18	6	24	564
2003	358	217	0	557	3	16	8	27	584
2004	399	212	0	551	0	14	9	23	574
2005	392	228	0	581	0	12	9	21	602
2006	396	224	6	574	0	20	16	36	610
2007	366	236	3	566	5	13	12	30	596
2008	297	208	0	474	8	3	11	22	496
2009	226	172	0	391	6	0	6	12	403
2010	274	183	0	444	5	0	6	11	455
2011	260	201	0	437	0	2	7	9	446
2012	284	210	0	475	11	3	5	19	494
2013	264	211	0	451	9	1	6	16	467
2014	277	216	0	468	10	2	2	14	482
2015	299	207	0	480	0	1	5	6	486
2016	288	216	0	483	0	4	5	9	492
2006–2015 Average	294	207	1	476	5	5	8	18	494

Note: Subtotals and combined season (summer and fall) totals are not additive since fishermen may have operated in more than 1 district during the year.

[a] No commercial salmon fishery was conducted the entire season in 2001.

Appendix A5.–Yukon River drainage fall chum salmon management plan overview, 5 AAC 01.249.

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 550,000	Closure	Closure [c]	Closure [c]	Possible Restrictions [c, d]	to
Greater Than 550,001	Open [e]	Open	Open	Regulatory Fishing Schedules	600,000

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

[b] ADF&G 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).

Appendix A6.–Canadian weekly commercial catches of Chinook, fall chum and coho salmon in the Yukon River in 2016.

Statistical Week	Week Ending	Start Date	Finish Date	Days Fished	Number of Fishermen	Boat Days	Chinook Salmon	Chum Salmon	Coho Salmon
29	16-Jul	10-Jul	16-Jul	closed					
30	23-Jul	17-Jul	23-Jul	closed					
31	30-Jul	24-Jul	30-Jul	closed					
32	6-Aug	31-Jul	6-Aug	closed					
33	13-Aug	7-Aug	13-Aug	closed					
34	20-Aug	14-Aug	20-Aug	closed					
35	27-Aug	21-Aug	27-Aug	closed					
36	3-Sep	28-Aug	3-Sep	5	0.4	2	0	45	
37	10-Sep	4-Sep	10-Sep	6	1.0	6	1	441	
38	17-Sep	11-Sep	17-Sep	7	0.7	5	0	537	
39	24-Sep	18-Sep	24-Sep	7	1.0	7	0	518	
40	1-Oct	25-Sep	1-Oct	7	0.7	5	0	129	
41	8-Oct	2-Oct	8-Oct	7	0.3	2	0	75	
42	15-Oct	9-Oct	15-Oct	7	0.0	0	0	0	
43	22-Oct	16-Oct	22-Oct	7	0.0	0	0	0	
44	29-Oct	23-Oct	29-Oct	0	0.0	0	0	0	
Dawson Area Commercial				53		27	1	1,745	0
Upriver Commercial							0	0	0
Total Commercial Harvest							1	1,745	0
Domestic							0	0	0
Recreational							0	0	0
Aboriginal Fishery							2,768	1,000 [a]	0
Total Upper Yukon Harvest							2,769	2,745	0
Old Crow Aboriginal Fishery							177	3,005	0
Total Canada Harvest							2,946	5,750	0

Note: Number of fishermen = Average number of fishermen over days open.

[a] Data are preliminary.

Appendix A7.–Salmon fishery projects conducted in the Alaska portion of the Yukon River drainage in 2016.

Project Name	Location, River Mile (RM)	Primary Objective(s)	Duration	Agency	Responsibility
Commercial Catch and Effort Assessment	Alaska portion of the Yukon River drainage	1) Document and estimate the catch and associated effort of the Alaska Yukon River and; 2) Commercial salmon fishery via receipts (fish tickets) of commercial sales of salmon.	Jun-Oct	ADF&G	All aspects
Commercial Catch Sampling and Monitoring	Alaska portion of the Yukon River drainage	1) Determine age, sex and size of Chinook, chum and coho salmon harvested in Alaska Yukon River commercial fisheries and; 2) Monitor Alaska commercial fishery openings and closures.	Jun-Oct	ADF&G, ADPS	All aspects Enforcement
Subsistence and Personal Use Catch and Effort Assessment	Alaska portion of the Yukon River drainage	Document and estimate the catch and associated effort of the Alaska Yukon River subsistence salmon fishery via interviews, catch calendars, mail-out questionnaires, telephone interviews, and subsistence fishing permits, and of the personal use fishery based on fishery permits.	Ongoing	ADF&G, YRDFA	All aspects Assistants in Communities
Sport Catch, Harvest and Effort Assessment	Alaska portion of the Yukon River drainage	Document and estimate the catch, harvest, and associated effort of the Alaska Yukon River sport fishery via postseason mail-out questionnaires.	Postseason	ADF&G	All aspects
Biological Sampling of Yukon River Salmon	Yukon, RM 17-1,002	Collect genetics samples and age, sex, and length information from subsistence caught Chinook salmon.	Jun-Aug	Spearfish Research	All aspects
Yukon River Chinook Microsatellite Baseline	Yukon River drainage	Survey standardized microsatellites and Yukon River Chinook salmon both U.S. and Canada populations.	Ongoing	ADF&G, USFWS, DFO	TI Funding R&E Funding
Yukon River Salmon Stock Identification	Yukon River drainage	Estimate Chinook salmon stock composition of the various Yukon River drainage harvests through genetic stock identification, age compositions, and geographical distribution of catches and escapements.	Ongoing	ADF&G	All aspects TI Funding
Yukon Delta Smolt	Yukon Delta (mouths and delta platform)	1) Determine the composition and spatio-temporal variation in prey species of juvenile Chinook salmon; 2) Determine the quality of dominate juvenile Chinook salmon prey;3) Assess the relationship between prey quality and juvenile Chinook salmon size and condition during summer; 4) Evaluate juvenile Chinook salmon spatial distribution and habitat use in relation to prey communities in Yukon River tributaries and delta habitats; and 5) evaluate spatio-temporal differences in juvenile Chinook salmon condition, size, and energy content.	May-Aug	ADF&G NOAA-AFSC & Spearfish Research	All aspects

-continued-

Appendix A7.–Page 2 of 5.

Project Name	Location, River Mile (RM)	Primary Objective(s)	Duration	Agency	Responsibility
Local and Traditional Knowledge (LTK) of Freshwater Aspects of Chinook Salmon Life Cycle, Yukon River	St. Marys, Anvik, Huslia, Allakaket, and Fort Yukon	1) Identify and map the specific fresh-water habitat areas where local residents have personal experience through fishing or other activities;2) Conduct in-depth ethnographic interviews to document LTK of these areas regarding such factors as spawning density and behavior, water quality, migratory access; 3) Compare ethnographic data to results of area enumeration projects for potential correlation; 4) Consult the Anadromous Waters Catalog regarding identified areas and compare with results of key respondent interviews/maps.	Dec 2013 – Jun 2016	ADF&G	All aspects
Patterns and Trends in Subsistence Salmon Fishing on the Yukon River	Alakanuk, Marshall, Nulato, Galena, Beaver, and Eagle.	1) Compare community and household harvest databases; conduct quality and control assessment; 2) Analyze the databases to identify harvest patterns and trends that influence harvest activities for three salmon species (Chinook, summer chum and fall chum salmon) in six communities.	Dec 2013 – Jan 2017	ADF&G, APU	All aspects. APU statistical analysis macro-level patterns
Yukon River Chum Salmon Mixed-Stock Analysis	Pilot Station, RM 123	Estimate the stock compositions of chum salmon using samples collected from Pilot Station sonar test fisheries.	May–Aug	USFWS	All aspects TI Funding summer, OSM Funding -fall
YRDFA Weekly Teleconferences	Yukon River drainage	Acts as a forum for fishermen along the Yukon River to interact with state and federal managers for the collection and dissemination of fisheries information.	May–Sept	YRDFA	All aspects R&E & OSM Funding
Lower Yukon River Set Gillnet Test Fishing	South, Middle, and North mouths of the Yukon River Delta, RM 20	1) Index Chinook salmon run timing and abundance using set gillnets and; 2) Sample captured salmon for age, sex, size composition information.	Jun–Aug	ADF&G, YDFDA	All aspects
Lower Yukon River Drift Test Fishing	South, Middle, and North mouths of the Yukon River Delta, RM 20	1) Index Chinook, summer and fall chum, and coho salmon run timing and abundance using drift gillnets and; 2) Sample captured salmon for age, sex, size composition information.	Jun–Aug	ADF&G, YDFDA	All aspects
Mountain Village Drift Gillnet Test Fishing	Mainstem Yukon River, RM 87	1) Index fall chum and coho salmon run timing and relative abundance using drift gillnets and; 2) Sample captured salmon for age, sex, size composition information.	Jul–Sep	Sandone Consulting LLC, ATC, ADF&G	All aspects R&M funding
East Fork Weir, Andreafsky River	RM 20 East Fork, Yukon RM 124	Estimate daily escapement, with age, sex and size composition, of Chinook and summer chum salmon into the East Fork of the Andreafsky River.	Jun–Aug	USFWS	All aspects OSM Funding

-continued-

Appendix A7.–Page 3 of 5.

Project Name	Location, River Mile (RM)	Primary Objective(s)	Duration	Agency	Responsibility
Anvik River Sonar	RM 40 Anvik River, Yukon RM 358	1) Estimate daily escapement of summer chum salmon to the Anvik River and; 2) Estimate age, sex, and size composition of the summer chum salmon escapement.	Jun–Jul	ADF&G	All aspects AKSSF Funding
Inseason Monitoring of Subsistence Salmon Harvests	Marshall, Yukon RM 161	Collected inseason data by conducting door-to-door salmon harvest surveys during the fishing season with reference to: 1) local research assistant capacity with staff oversight; 2) financial costs; 3) community response; provide regular updates to managers; and 4) currently producing report outlining results.	May–Jan	ADF&G	All aspects
Yukon River Sonar	Pilot Station, RM 123	Estimate Chinook and summer and fall chum salmon passage in the mainstem Yukon River. Apportionment of species including coho salmon and other finfish.	May–Sep	ADF&G	All aspects
Gisasa River Weir	RM 3 Gisasa River, Koyukuk River drainage, RM 567	1) Estimate daily escapement of Chinook and summer chum salmon into the Gisasa River and; 2) Estimate age, sex, and size composition of the Chinook and summer chum salmon escapements.	June–Aug	USFWS	All aspects OSM Funding
Henshaw Creek Weir	RM 1 Henshaw Creek, Koyukuk River drainage, RM 976	1) Estimate daily escapement of Chinook and summer chum salmon into Henshaw Creek and; 2) Estimate age, sex, and size composition of the Chinook and summer chum salmon escapements.	Jun–Aug	TCC, USFWS-OSM	All aspects oversight & funding report write-up
Koyukuk River Chum salmon Radio Telemetry	RM 18 Koyukuk River drainage, RM 527 Yukon River drainage	1) Estimate abundance and distribution of chum salmon in the Koyukuk River; project operated 2014–2016.	Jun–Aug	USFWS/TCC	All aspects/tag recovery OSM Funding
Chandalar River Sonar	RM 14 Chandalar River, Yukon RM 996	1) Estimate fall chum salmon passage using DIDSON sonars in the Chandalar River.	Aug–Sept	USFWS	All aspects TI Funding
Yukon River Sonar	Eagle, RM 1,213	1) Estimate daily passage of Chinook and chum salmon in the mainstem Yukon River using both split-beam and DIDSON and; 2) Estimate age, sex, and size composition of salmon captured in the test nets.	Jul–Oct	ADF&G, DFO	All aspects, technical support, TI Funding, R&E Funding
Nenana River Escapement Surveys	Nenana River drainage, RM 860	Aerial surveys for numbers and distribution of coho and chum salmon in 10 tributaries of the Nenana River below Healy Creek.	Sep–Oct	ADF&G	All aspects

-continued-

Appendix A7.–Page 4 of 5.

Project Name	Location, River Mile (RM)	Primary Objective(s)	Duration	Agency	Responsibility
Delta River Ground Surveys	Tanana River drainage RM 1,031	1) Estimate fall chum salmon spawning escapement in Delta River and; 2) Sample fall chum salmon carcasses for age, sex, and size composition information.	Oct–Dec	ADF&G	All aspects
Chena River Tower	RM 45 Chena River, Tanana River drainage, RM 921	Estimate daily escapement of Chinook and summer chum salmon into the Chena River.	Jul–Aug	ADF&G	All aspects AYKSSF Funding
Salcha River Tower	RM 4 Salcha River, Tanana River drainage, RM 967	Estimate daily escapement of Chinook and summer chum salmon into the Salcha River.	Jul–Aug	ADF&G	All aspects R&M Funding
Upper Tanana Escapement Surveys	Tanana River drainage, RM 991-1,053	Aerial and boat surveys for numbers and distribution of chum and coho salmon in the side sloughs and tributaries of the Tanana River drainage.	Nov	ADF&G	All aspects
Goodpaster River Tower	RM 45 Goodpaster River, Tanana River drainage, RM 1,049	Estimate daily escapement of Chinook and summer chum salmon into the Goodpaster River.	Jul–Aug	BSFA	All aspects Pogo Mine funding
Upper Yukon River Chum Salmon Genetic Stock Identification	Yukon River drainage	Establish the feasibility of using DNA markers for genetic stock identification of chum salmon in the Yukon River.	Jun–Oct	USFWS	All aspects
Yukon River Inseason Salmon Harvest Interviews	Alakanuk, Marshall, Russian Mission, Holy Cross, Kaltag, Huslia, Galena, Nenana, Ft. Yukon and Eagle	Collect qualitative inseason subsistence salmon harvest information through weekly interviews.	Jun–Sep	YRDFA, USFWS	All aspects OSM funding
Migratory Timing and Harvest Information of Chinook Salmon Stocks	Yukon River drainage	Enlarge existing allozyme and develop a DNA database to characterize the genetic diversity of Chinook salmon in the Yukon River within the U.S. and Canada. U.S. collections include microsatellites and allozyme. Canadian collections include microsatellites.	Jun–Aug	USFWS-OSM, ADF&G, DFO	All aspects
In-river coded-wire-tag (CWT) recovery (Whitehorse Hatchery tags)	Yukon River drainage	Collection of Chinook salmon heads from all operating project that are marked with no adipose fin and sent to lab to extract data tag (Appendix A17).	May-Sep	ADF&G	Decoding

-continued-

Acronyms:

ADF&G	= Alaska Department of Fish and Game
ADPS	= Alaska Department of Public Safety
AFSC	= Alaska Fisheries Science Center
APU	= Alaska Pacific University
ATC	= Asacarsarmiut Tribal Council
AVCP	= Association of Village Council Presidents, Inc.
AYKSSF	= Arctic-Yukon-Kuskokwim Sustainable Salmon Fund
BSFA	= Bering Sea Fishermen's Association
DFO	= Department of Fisheries and Oceans (Canada)
DNA	= Deoxyribonucleic acid
NOAA	= National Oceanic and Atmospheric Association
OSM	= Office of Subsistence Management
R&E	=Yukon River Panel Restoration and Enhancement Program
R&M	=Research and Management Fund
TCC	= Tanana Chiefs Conference, Inc.
USFWS	= United States Fish and Wildlife Service
USFWS-OSM	= United States Fish and Wildlife Service, Office of Subsistence Management
YDFDA	=Yukon Delta Fisheries Development Association
YRDFA	= Yukon River Drainage Fisheries Association

Appendix A8.–List of harvest/escapement monitoring and incubation/rearing projects involving salmon in the Canadian portion of the Yukon River drainage in 2016.

Project Name	Location, River Mile (RM)	Primary Objective(s)	Duration	Agency	Responsibility
Aboriginal Catch Monitoring	Yukon communities	1) To determine weekly catches and effort in the aboriginal fishery, and; 2) To implement components of the UFA and AFS.	Jul–Oct	YFN's DFO	Joint Project
Recreational Catch Monitoring	Yukon River mainstem and tributaries	1) To determine the recreational harvest by species including the date, sex, whether released or retained, and fishing location, and; 2) Salmon caught are reported through the YSCCC program.	Jul– Oct	DFO	All aspects
Commercial Catch Monitoring	Yukon River mainstem	1) To determine weekly catches and effort in the Canadian commercial fishery (Chinook and chum) and; 2) to collect other information as required.	Jul–Oct	DFO	All aspects
Escapement Surveys and Biological Sampling	Throughout upper Yukon River drainage	1) To conduct surveys of spawning fish by foot, boat, air etc.; 2) To collect ASL and genetic tissue samples from spawning populations, and; 3) To enumerate and recover tags in terminal areas.	Jul–Oct	DFO YFNs AFS	All aspects
Porcupine River Chinook Salmon Radio Tagging and Telemetry	Porcupine River and tributaries (Including Fishing Branch) upstream of Old Crow.	1) To apply radio tags to Chinook salmon in the Porcupine River and subsequently locate them to estimate the proportion of fish spawning in the mainstem and in each major tributary, and; 2) To collect genetic samples from radio tagged adult Chinook salmon for incorporation in the Yukon River Chinook genetic baseline	Jul–Sep	VGG & EDI	All aspects
Porcupine River Sonar - Chinook	Old Crow	1) Installation and operation of two ARIS sonars to 1) estimate Chinook salmon daily passage, and 2) to conduct biological sampling for species apportionment, age, sex and length.	Jul–Aug	VGG & EDI, DFO	All aspects
Porcupine River Sonar - Chum	Old Crow	1) Operation of two ARIS sonars to 1) estimate chum salmon daily passage, and 2) conduct biological sampling for species apportionment, age, sex and length.	Aug–Oct	DFO, VGG	All aspects
Whitehorse Rapids Fishway	Whitehorse	1) To enumerate wild and hatchery-reared Chinook salmon returns to the Whitehorse fishway area and; 2) obtain age, size,sex and tag data.	Jul–Aug	YF&GA	All aspects
Blind Creek Weir	Pelly River	1) To enumerate Chinook salmon escapement, recover tags and; 2)collect ASL data and DNA samples.	Jul–Aug	JW&A	All aspects
Big Salmon Sonar	Big Salmon River	1) Installation and operation of a DIDSON sonar program for Chinook salmon, and; 2) obtain carcass ASL samples.	Jul–Aug	Metla Env. Inc., JW&A	All aspects

-continued-

Appendix A8.–Page 2 of 2.

Project Name	Location, River Mile (RM)	Primary Objective(s)	Duration	Agency	Responsibility
Pelly River Sonar	Pelly River mainstem	1) Develop an accurate, inseason stock assessment tool to estimate the annual passage rates for Chinook salmon in the Pelly River; and 2) conduct test netting for species apportionment, and to collect ASL samples.	Jul–Aug	Selkirk First Nation & EDI	All aspects
Whitehorse Rapids Fish Hatchery and Coded-Wire Tagging Project	Whitehorse	1) To rear and release ~150K Chinook salmon fry produced from Whitehorse Rapids Fishway broodstock, and; 2) To mark fry with a CWT, adipose clip, and release upstream of the Whitehorse hydroelectric facility.	Ongoing	GY and YEC, YF&GA, DFO	All aspects Coded-wire tagging
McIntyre Incubation Facility and Coded-Wired Tagging Project	Whitehorse	1) To incubate up to 120K Chinook salmon eggs from brood stock collected in Yukon River spawning tributaries, and/or the Whitehorse Rapids Fishway, and; 2) To rear, mark with CWT, adipose clip, and release fry to natal streams and/or restoration sites.	Ongoing	YC, YEC, TKC, DFO	Field work, project monitoring, technical support
Big Salmon River Juvenile Chinook Assessment	Big Salmon River	1) Operation of Rotary Screw Trap, Gee minnow traps and seine nets to capture juvenile Chinook salmon and use CPUE and mark-recapture to initiate development of an abundance index 2) sample juvenile chinook salmon to monitor change in size through the season.	May–Aug	DFO & Metla Env. Inc.	All aspects

Acronyms:

ASL = Age Sex Length- term that refers to the collection of biological information.
AFS = Aboriginal Fisheries Strategy
BM&A = B. Mercer and Associates
CWT = Coded Wire Tag
DFO = Department of Fisheries and Oceans Canada
DNA = Deoxyribonucleic acid
EDI = Environmental Dynamics Incorporated
GY = Government of Yukon-Environment Yukon
JW&A = Jane Wilson & Associates
Metla Env. Inc = Metla Environmental Incorporated
TKC = Ta'an Kwa'chin Council
UFA = Umbrella Final Agreement
YC = Yukon College
YEC = Yukon Energy Corporation
YFN's = Yukon First Nations
YF&GA = Yukon Fish and Game Association
YSCCC = Yukon Salmon Conservation Catch Card

Appendix A9.–Yukon River Canadian-origin Chinook salmon total run by brood year and escapement by year.

Brood Year	Age 3	4	5	6	7	8	Return	Spawners	R/S
74						634			
75					33,080	175			
76				88,405	22,026	40			
77			19,491	111,771	19,734	801	151,797		
78		4,443	22,845	63,235	29,424	1,493	121,439		
79	1,534	3,388	21,422	100,503	48,253	1,175	176,274		
80	15	6,604	13,510	70,415	33,978	4,240	128,763		
81	0	1,122	33,220	114,180	54,845	1,841	205,208		
82	0	5,141	17,169	37,883	27,763	376	88,330	43,538	2.03
83	560	7,558	35,117	89,449	16,408	162	149,253	44,475	3.36
84	69	13,368	34,379	75,041	13,782	138	136,778	50,005	2.74
85	223	10,738	38,956	62,142	4,756	91	116,906	40,435	2.89
86	347	20,408	45,928	109,067	15,843	138	191,731	41,425	4.63
87	0	2,368	33,542	67,697	11,700	18	115,325	41,307	2.79
88	0	6,641	34,323	75,396	8,937	68	125,366	39,699	3.16
89	75	13,517	78,826	128,851	25,841	0	247,109	60,299	4.10
90	56	6,343	24,873	71,641	10,816	9	113,737	59,212	1.92
91	501	7,107	82,332	121,590	10,182	0	221,712	42,728	5.19
92	6	2,608	23,981	41,677	1,831	0	70,103	39,155	1.79
93	14	5,313	36,363	86,880	5,880	0	134,450	36,244	3.71
94	0	755	19,932	30,683	6,175	0	57,545	56,449	1.02
95	34	1,784	15,989	52,720	7,026	10	77,562	50,673	1.53
96	20	276	23,201	44,462	14,610	2	82,571	74,060	1.11
97	14	3,567	26,386	94,406	7,828	14	132,216	53,821	2.46
98	0	3,478	39,260	76,502	4,357	0	123,598	35,497	3.48
99	134	1,692	30,110	76,649	2,870	0	111,455	37,184	3.00
00	0	2,798	40,704	63,414	1,509	0	108,424	25,870	4.19
01	8	1,813	50,877	51,785	2,205	0	106,688	52,564	2.03
02	75	2,262	28,704	20,725	227	9	52,003	42,359	1.23
03	63	5,898	37,236	52,339	2,261	2	97,798	80,594	1.21
04	3	2,462	26,833	21,936	4,777	1	56,012	48,469	1.16
05	9	8,268	29,475	38,857	1,754	0	78,362	67,985	1.15
06	15	6,008	25,245	25,683	1,568	0	58,519	62,630	0.93
07	47	2,858	17,746	22,193	1,705	0	44,549	34,904	1.28
08	1	3,138	11,092	26,003	1,942	0	42,176	33,883	1.24
09	173	2,324	32,679	45,253	563		80,992	65,278	1.24
10	1	4,332	30,525	20,307			55,164	32,009	1.72
11	106	9,364	52,152					46,107	
12	252	10,105						32,656	
13	3							28,669	
14								63,327	
15								82,674	
16								68,798	
Average 1982–2009							107,892	48,598	2.22
							Contrast =	3.12	

Note: Spawner data are derived from the 3-Area Index (1982-2001), radiotelemetry (2002–2004), and the mainstem Yukon River sonar at Eagle (2005–2016). Current brood year data (shaded values) are preliminary. 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 the 2005.

Appendix A10.–Chinook salmon age and sex percentages from selected Yukon River escapement projects, 2016.

Location	Sample Size		Age 3	4	5	6	7	Total
East Fork	161	Male	1.9	24.8	23.6	0.0	0.0	50.3
Andreafsky River [a]		Female	0.0	1.2	41.7	6.8	0.0	49.7
		Total	1.9	26.0	65.3	6.8	0.0	100.0
Pilot Station	618	Male	0.3	12.1	36.9	5.4	0.3	55.0
test fishery [b]		Female	0.0	1.9	32.5	10.0	0.6	45.0
		Total	0.3	14.0	69.4	15.4	0.9	100.0
Gisasa River [a]	239	Male	0.4	33.1	36.0	3.3	0.0	72.8
		Female	0.0	1.3	8.8	16.7	0.4	27.2
		Total	0.4	34.4	44.8	20.0	0.4	100.0
Henshaw Creek [a]	381	Male	0.5	10.2	37.9	3.9	0.0	52.5
		Female	0.0	0.0	25.9	21.3	0.3	47.5
		Total	0.5	10.2	63.8	25.2	0.3	100.0
Chena River [c]	368	Male	0.0	43.2	31.8	2.2	0.0	77.2
		Female	0.0	0.5	14.2	7.6	0.5	22.8
		Total	0.0	43.7	46.0	9.8	0.5	100.0
Salcha River [c]	474	Male	0.0	36.5	23.4	1.3	0.0	61.2
		Female	0.0	5.9	17.3	15.4	0.2	38.8
		Total	0.0	42.4	40.7	16.7	0.2	100.0
Eagle test fishery [b]	666	Male	0.0	9.2	50.1	8.3	0.0	67.6
		Female	0.0	0.0	14.9	16.9	0.6	32.4
		Total	0.0	9.2	65.0	25.2	0.6	100.0

[a] Samples were collected from a weir trap.

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

[c] Samples were handpicked from carcasses.

Appendix A11.–Yukon River Chinook salmon age and female percentages and mean length from the mainstem Yukon River sonar project test fishery operated near Eagle, 2005–2016.

		Percent by Age Class						
		3 yr	4 yr	5 yr	6 yr	7 yr		
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	779.2
2006	256	0.0	16.8	60.2	22.7	0.4	38.6	736.1
2007	389	0.0	5.7	40.1	53.7	0.5	44.3	785.0
2008	375	0.0	2.7	56.3	36.5	4.5	37.0	779.4
2009	647	0.0	7.7	33.2	59.0	0.0	40.8	793.0
2010	336	0.0	7.4	46.4	42.0	4.2	41.0	774.8
2011	420	0.0	2.1	29.5	60.5	7.9	48.8	813.0
2012	249	0.4	6.4	30.1	58.6	4.4	46.8	782.2
2013	265	0.0	4.2	27.5	63.4	4.9	51.0	806.6
2014	606	0.2	6.6	50.5	40.1	2.6	35.0	764.0
2015	927	0.3	10.8	34.4	52.3	2.2	41.4	774.1
2016	666	0.0	9.2	65.1	25.2	0.6	32.4	759.0
Average								
2005-2015	422	0.1	7.1	41.7	47.9	3.2	41.6	780.7
2011-2015	493	0.2	6.0	34.4	55.0	4.4	44.6	788.0
Minimum-15	171	0.0	2.1	27.5	22.7	0.0	33.0	736.1
Maximum-15	927	0.4	16.8	60.2	63.4	7.9	51.0	813.0

Note: Length is measured mid-eye to the fork of tail to the nearest mm.

Appendix A12.–Total (U.S. and Canada) Yukon River Chinook salmon harvest percentage by stock group, 1981–2015.

	Stock Group		
Year	Lower	Middle	Upper
1981	5.4	54.5	40.1
1982	13.9	24.7	61.4
1983	12.9	33.7	53.3
1984	25.3	40.2	34.5
1985	27.6	22.3	50.1
1986	19.5	9.6	70.9
1987	15.9	19.6	64.5
1988	21.8	15.8	62.5
1989	24.4	15.9	59.7
1990	20.2	25.2	54.7
1991	28.0	25.3	46.7
1992	16.3	21.8	61.9
1993	21.5	25.4	53.1
1994	18.2	21.4	60.4
1995	17.9	22.4	59.7
1996	21.0	10.4	68.6
1997	26.4	16.8	56.9
1998	32.7	17.4	49.8
1999	40.1	6.3	53.6
2000	33.9	12.3	53.8
2001	31.6	16.0	52.4
2002	19.4	29.2	51.4
2003	6.8	28.9	64.3
2004	15.3	28.8	55.9
2005	20.7	21.4	57.9
2006	17.6	27.6	54.9
2007	13.0	30.6	56.4
2008	17.0	28.0	55.0
2009	11.1	31.4	57.5
2010	17.8	32.7	49.5
2011	13.9	29.8	56.3
2012	13.3	34.8	51.9
2013	13.4	21.0	65.6
2014	25.4	27.8	46.8
2015	12.0	31.2	56.8
2016 [a]			
Average			
1981-2014	20.0	24.4	55.6
2010-2014	16.8	29.2	54.0
Minimum-14	5.4	6.3	34.5
Maximum-14	40.1	54.5	70.9

[a] Data not available.

Appendix A13.–Yukon River Chinook salmon harvest percentage by stock group in Alaska, 1981–2015.

	Stock Group		
Year	Lower	Middle	Upper
1981	5.9	59.8	34.3
1982	15.4	27.5	57.1
1983	14.2	37.0	48.9
1984	28.0	44.3	27.7
1985	30.4	24.6	45.1
1986	22.3	10.9	66.8
1987	17.4	21.4	61.2
1988	24.9	18.1	57.0
1989	27.2	17.7	55.1
1990	22.8	28.4	48.8
1991	31.8	28.7	39.6
1992	18.0	24.1	57.8
1993	23.7	28.0	48.3
1994	20.4	24.1	55.5
1995	20.0	25.0	55.0
1996	24.0	11.8	64.2
1997	28.9	18.3	52.8
1998	34.7	18.5	46.8
1999	44.1	6.9	49.0
2000	37.5	13.6	48.9
2001	37.5	19.0	43.5
2002	22.1	33.3	44.6
2003	7.5	31.7	60.8
2004	16.9	31.6	51.5
2005	23.4	24.2	52.4
2006	19.2	30.2	50.5
2007	13.7	32.3	54.0
2008	18.2	30.0	51.8
2009	12.7	35.8	51.6
2010	18.7	34.3	47.0
2011	15.6	33.3	51.1
2012	14.4	37.5	48.2
2013	16.0	25.0	59.0
2014	26.3	28.8	44.8
2015	14.2	36.9	48.9
2016 [a]			
Average			
1981-2014	22.2	26.9	50.9
2010-2014	18.2	31.8	50.0
Minimum-14	5.9	6.9	27.7
Maximum-14	44.1	59.8	66.8

[a] Data not available.

Appendix A14.–Upper stock group percentage, by country, from the Yukon River Chinook salmon harvest, 1981–2015.

	Upper Stock Group	
Year	U.S.	Canada
1981	78.1	21.9
1982	83.5	16.5
1983	83.7	16.3
1984	72.7	27.3
1985	81.6	18.4
1986	82.7	17.3
1987	86.7	13.3
1988	79.8	20.2
1989	82.9	17.1
1990	79.2	20.8
1991	74.8	25.2
1992	84.5	15.5
1993	82.6	17.4
1994	81.8	18.2
1995	82.4	17.6
1996	81.9	18.1
1997	84.8	15.2
1998	88.8	11.2
1999	83.0	17.0
2000	81.9	18.1
2001	69.8	30.3
2002	76.3	23.5
2003	86.2	13.8
2004	83.7	16.3
2005	80.1	19.9
2006	84.1	15.9
2007	90.5	9.5
2008	88.1	11.9
2009	78.8	21.2
2010	90.5	9.5
2011	81.0	19.0
2012	86.3	13.7
2013	75.5	24.5
2014	92.2	7.8
2015	72.9	27.1
2016 [a]		
Average		
1981-2014	82.4	17.6
2010-2014	85.1	14.9
Minimum-14	69.8	7.8
Maximum-14	92.2	30.3

[a] Data not available.

Appendix A15.–Stock group percentage by major stock and by country, from chum salmon beginning July 19 at the mainstem Yukon River sonar operated near Pilot Station, 1999–2016.

	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%
Average						
2004–2015	17%	83%	24%	31%	54%	29%
2011–2015	15%	85%	25%	31%	56%	29%
Minimum-15	9%	75%	13%	20%	44%	22%
Maximum-15	25%	91%	34%	43%	63%	34%

Note: 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, Chandalar, Sheenjek and Black rivers.

Appendix A16.–Summary of releases for coded wire tagged Chinook salmon from Whitehorse Hatchery, 1985–2016.

Release Location		Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
Michie		25-May-85	02-32-48	26,670	518	0.019	27,188		0	27,188
Michie		25-May-85	02-32-26	28,269	518	0.018	28,787		0	28,787
Michie		25-May-85	02-32-47	43,325	518	0.012	43,843		0	43,843
Wolf		1985	no-clip	0	0		0		10,520	10,520
	SUM	1985		98,264	1,555		99,819		10,520	110,339
Michie		1986	02-37-31	77,170			77,170		1,000	78,170
Wolf		1986					0		5,720	5,720
	SUM	1986		77,170			77,170		6,720	83,890
Michie		5-Jun-87	02-48-12	47,644	1,361	0.028	49,005	2.50	9,598	58,603
Michie		5-Jun-87	02-48-13	49,344	808	0.016	50,152	2.50	9,141	59,293
Michie		5-Jun-87	02-48-14	51,888	559	0.011	52,447	2.50	9,422	61,869
Michie		5-Jun-87	02-48-15	43,367	2,066	0.045	45,433	2.50	7,868	53,301
Michie		5-Jun-87	02-42-58	25,945	245	0.009	26,190	2.50	4,171	30,361
Wolf		30-May-87	02-42-59	26,752	123	0.005	26,875	2.50	422	27,297
	SUM	1987		244,940	5,162		250,102		40,622	290,724
Michie		10-Jun-88	02-55-49	77,670	1,991	0.025	79,661	2.80	84,903	164,564
Michie		10-Jun-88	02-555-0	78,013	1,592	0.020	79,605	2.70	85,288	164,893
Wolf		5-Jun-88	no-clip	0	0		0		25,986	25,986
	SUM	1988		155,683	3,583		159,266		196,177	355,443
Wolf		1989	no-clip	0	0		0		22,388	22,388
Michie		6-Jun-89	02-60-04	26,161	326	0.012	26,487	2.30	0	26,487
Michie		6-Jun-89	02-60-05	24,951	128	0.005	25,079	2.30	0	25,079
Michie		6-Jun-89	02-60-06	25,098	291	0.011	25,389	2.40	0	25,389

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
Michie	6-Jun-89	02-60-07	25,233	156	0.006	25,389	2.20	95,724	121,113
Fishway	6-Jun-89	02-60-08	25,194	357	0.014	25,551	2.70	0	25,551
Fishway	6-Jun-89	02-60-09	25,190	351	0.014	25,541	2.70	0	25,541
SUM	1989		151,827	1,609		153,436		118,112	271,548
Wolf	6-Jun-90	no-clip	0	0		0		11,969	11,969
Michie	2-Jun-90	02-02-38	24,555	501	0.020	25,056	2.30	0	25,056
Michie	2-Jun-90	02-02-39	24,345	753	0.030	25,098	2.30	0	25,098
Fishway	2-Jun-90	02-02-60	24,508	501	0.020	25,009	2.20	0	25,009
Fishway	2-Jun-90	02-02-63	25,113	254	0.010	25,367	2.20	0	25,367
SUM	1990		98,521	2,009		100,530		11,969	112,499
Wolf	8-Jun-91	18-03-22	49,477	793	0.016	50,270	2.30	0	50,270
Fishway	6-Jun-91	18-03-23	52,948	193	0.004	53,141	2.30	0	53,141
Michie	6-Jun-91	18-03-24	50,020	176	0.004	50,196	2.30	87,348	137,544
SUM	1991		152,445	1,162		153,607		87,348	240,955
Wolf	4-Jun-92	18-08-29	48,239	0	0.000	48,239	2.40	0	48,239
Fishway	4-Jun-92	18-08-28	49,356	99	0.002	49,455	2.30	0	49,455
Michie	4-Jun-92	18-08-30	52,946	643	0.012	53,589	2.20	249,166	302,755
SUM	1992		150,541	742		151,283		249,166	400,449
Wolf	6-Jun-93	18-12-15	50,248	0	0.000	50,248	2.30	0	50,248
Fishway	6-Jun-93	18-12-16	49,957	434	0.009	50,391	2.30	0	50,391
Michie	6-Jun-93	18-12-17	50,169	0	0.000	50,169	2.30	290,647	340,816
SUM	1993		150,374	434		150,808		290,647	441,455

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
Wolf	2-Jun-94	18-14-27	50,155	270	0.005	50,425	2.30	0	50,425
Michie	2-Jun-94	18-14-28	50,210	127	0.003	50,337	2.30	158,780	209,117
Fishway	2-Jun-94	18-14-29	50,415	125	0.002	50,540	2.30	0	50,540
SUM	1994		150,780	522		151,302		158,780	310,082
Wolf	6-Jun-95	18-12-46	10,067	164	0.016	10,231	1.67	0	10,231
Wolf	6-Jun-95	18-12-47	9,122	0	0.000	9,122	1.53	0	9,122
Michie	6-Jun-95	18-18-26	25,231	337	0.013	25,568	2.47	4,552	30,120
Michie	6-Jun-95	18-18-27	25,187	141	0.006	25,328	2.33	0	25,328
SUM	1995		69,607	642		70,249		4,552	74,801
Wolf	26-May-96	18-07-48	10,131	102	0.010	10,233	2.30	0	10,233
Fox (Michie)	4-Jun-96	18-28-23	35,452	0	0.000	35,452	2.43	0	35,452
Byng	4-Jun-96	18-10-41	25,263	516	0.020	25,779	2.37	0	25,779
Michie	5-Jun-96	18-33-45	50,082	1,022	0.020	51,104	2.51	0	51,104
Michie	5-Jun-96	18-33-46	50,260	508	0.010	50,768	2.43	0	50,768
Michie	5-Jun-96	18-33-47	49,985	505	0.010	50,490	2.32	0	50,490
Judas	4-Jun-96	18-33-48	49,798	1,016	0.020	50,814	2.43	0	50,814
McClintock	4-Jun-96	18-33-49	49,991	302	0.006	50,293	2.27	0	50,293
SUM	1996		320,962	3,971		324,933		0	324,933
Wolf	1-Jun-97	18-23-25	14,850	150	0.010	15,000	2.30	0	15,000
Wolf	1-Jun-97	18-23-26	20,334	0	0.000	20,334		0	20,334
Wolf	8-Jun-97	18-29-06	10,158	0	0.000	10,158		0	10,158
Fox (Michie)	11-Jun-97	18-25-54	25,242	0	0.000	25,242	2.43	0	25,242

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
Fox (Michie)	11-Jun-97	18-25-55	24,995	253	0.010	25,248		0	25,248
Byng	11-Jun-97	18-29-07	10,029	0	0.000	10,029	2.37	0	10,029
Byng	11-Jun-97	18-29-05	10,155	0	0.000	10,155		0	10,155
Michie	11-Jun-97	18-28-59	49,657	502	0.010	50,159	2.51	0	50,159
Michie	11-Jun-97	18-28-60	50,130	0	0.000	50,130	2.43	0	50,130
Judas	7-Jun-97	18-23-27	19,951	202	0.010	20,153	2.43	0	20,153
Judas	11-Jun-97	18-25-53	25,146	0	0.000	25,146	2.43	0	25,146
McClintock	11-Jun-97	18-25-51	25,399	0	0.000	25,399	2.27	0	25,399
McClintock	11-Jun-97	18-25-52	24,792	251	0.010	25,043		0	25,043
SUM	1997		310,838	1,358		312,196		0	312,196
Michie	12-Jun-98	18-41-22	49,243	1,004	0.020	50,247	2.84	0	50,247
Michie	12-Jun-98	18-41-21	49,197	1,004	0.020	50,201	2.81	0	50,201
Byng	12-Jun-98	18-31-60	24,518	1,022	0.040	25,540	3.00	0	25,540
McClintock	12-Jun-98	18-40-43	49,810	503	0.010	50,313	2.76	0	50,313
Judas	13-Jun-98	02-54-17	19,018	1,432	0.070	20,450	2.55	0	20,450
Judas	12-Jun-98	18-31-59	25,331	256	0.010	25,587	2.60	0	25,587
Wolf	6-Jun-98	02-19-58	10,104	421	0.040	10,525	1.95	0	10,525
Wolf	4-Jun-98	02-46-06	34,813	710	0.020	35,523	2.63	0	35,523
SUM	1998		262,034	6,352		268,386		0	268,386
Michie	6-Jun-99			80,393		80,393	3.13	0	80,393
Byng	6-Jun-99			64,430		64,430	2.92	0	64,430
McClintock	6-Jun-99			64,169		64,169	2.95	0	64,169
Wolf	6-Jun-99			31,048		31,048	3.07	0	31,048

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
SUM	1999			240,040		240,040		0	240,040
Michie	8-Jun-00	18-31-28	25,114	254	0.010	25,368	2.80	0	25,368
Michie	8-Jun-00	18-31-29	25,037	253	0.010	25,290	2.80	0	25,290
Michie	8-Jun-00	18-43-03	10,907	110	0.010	11,017	2.84	0	11,017
McClintock	8-Jun-00	18-13-54	25,041	254	0.010	25,295	2.70	0	25,295
McClintock	8-Jun-00	18-13-55	25,016	253	0.010	25,269	2.68	0	25,269
Wolf	4-Jun-00	18-23-53	25,071	253	0.010	25,324	2.67	0	25,324
Wolf	4-Jun-00	18-23-54	25,012	254	0.010	25,266	2.40	0	25,266
SUM	2000		161,198	1,631		162,829		0	162,829
Michie	8-Jun-01	18-44-16	25,318	256	0.010	25,574	2.68	0	25,574
Michie	8-Jun-01	18-44-17	27,293	276	0.010	27,569	2.68	0	27,569
Michie	8-Jun-01	18-44-18	27,337	276	0.010	27,613	2.60	0	27,613
Michie	8-Jun-01	18-44-19	11,629	117	0.010	11,746	2.60	0	11,746
McClintock	8-Jun-01	18-44-12	24,526	248	0.010	24,774	3.13	0	24,774
McClintock	8-Jun-01	18-44-13	25,033	253	0.010	25,286	3.13	0	25,286
McClintock	8-Jun-01	18-36-50	10,840	110	0.010	10,950	3.13	0	10,950
Byng	8-Jun-01	18-44-14	25788	260	0.010	26,048	2.84	0	26,048
Byng	8-Jun-01	18-44-15	25,136	254	0.010	25,390	2.84	0	25,390
Wolf	28-May-01	18-44-10	26,205	265	0.010	26,470	3.34	0	26,470
Wolf	28-May-01	18-44-11	23,902	241	0.010	24,143	3.34	0	24,143
SUM	2001		253,007	2,556		255,563		0	255,563
Wolf	23-May-02	18-51-01	25,334	126	0.005	25,460	3.30	0	25,460

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
Wolf	2-Jun-02	18-51-02	25,079	177	0.007	25,256	3.10	0	25,256
McClintock	10-Jun-02	18-51-03	24,769	505	0.020	25,274	3.60	0	25,274
Byng	10-Jun-02	18-51-04	24,907	0	0.000	24,907	3.00	0	24,907
Byng	10-Jun-02	18-51-05	24,925	125	0.005	25,050	3.00	0	25,050
Michie	10-Jun-02	18-51-06	27,114	191	0.007	27,305	3.20	0	27,305
Michie	10-Jun-02	18-51-07	26,854	0	0.000	26,854	3.02	0	26,854
Michie	10-Jun-02	18-50-61	27,850	281	0.010	28,131	3.20	0	28,131
Michie	10-Jun-02	18-50-62	27,241	0	0.000	27,241	3.04	0	27,241
Michie	10-Jun-02	18-50-63	8,481	86	0.01	8567	3.2	0	8567
Yukon River								3,062	3062
SUM	2002		242,554	1,491		244,045		3,062	247,107
Wolf	25-May-03	18-47-48	27,489	83	0.0030	27,572	2.72	0	27,572
Wolf	25-May-03	18-47-49	26,704	161	0.0060	26,865	2.69	0	26,865
Byng	2-Jun-03	18-47-47	23,483	71	0.0030	23,554	3.01	0	23,554
Byng	2-Jun-03	18-47-46	27,058	54	0.0020	27,112	2.98	0	27,112
Michie	2-Jun-03	18-49-58	28,485	0	0.0000	28,485	3.05	0	28,485
Michie	2-Jun-03	18-49-59	27,519	0	0.0000	27,519	2.98	0	27,519
Michie	2-Jun-03	18-49-60	15,541	0	0.0000	15,541	3.07		15,541
Judas L. (not in totals)	6-Jun-03							2,500	
SUM	2003		176,279	369		176,648		0	176,648
Wolf	5/28-30/2004	01-01-70	28,946	292		29,238	2.90	0	29,238
Wolf	22-Jun-04							2,514	2,514

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
Mainstem	5/28-29/2004	02-01-69	24,920	431		25,351	3.10	0	25,351
Byng	8-Jun-04	02-01-68	24,401	626		25,027	3.36	0	25,027
McClintock	8-Jun-04	02-01-67	24,246	879		25,125	3.20	0	25,125
Michie	8-Jun-04	02-01-66	24,609	554		25,163	3.12	0	25,163
Michie	8-Jun-04	02-01-65	13,594	306		13,900	3.12	0	13,900
SUM	2004		140,716	3,088		143,804		2,514	146,318
Wolf	5/31-6/05	18-19-36	10,751	109	1.000	10,860	2.50	0	10,860
Wolf	5/31-6/05	18-56-17	5,835	59	1.000	5,894	2.50	0	5,894
Wolf	7-Jul-05			614		614			614
Byng	13-Jun-05	18-56-18	5,853	119	2.000	5,972	2.50	0	5,972
Byng	13-Jun-05	18-56-19	4,369	89	2.000	4,458	2.50	0	4,458
McClintock	13-Jun-05	18-44-19	10,632	0	0.000	10,632	2.50	0	10,632
Michie	13-Jun-05	02-01-64	4,870	0	0.000	4,870	2.50	0	4,870
Michie	13-Jun-05	02-01-65	5,983	0	0.000	5,983	2.50	0	5,983
Michie	13-Jun-05	08-01-65	28,082	284	1.000	28,366	2.50	0	28,366
Michie	13-Jun-05	18-56-20	5,906	0	0.000	5,906	2.50	0	5,906
Mainstem	6/02,6/14,07/7	08-01-68	28,991	293	1.000	29,284	2.50	0	29,284
SUM	2005		111,272	1,567		112,839			112,839
Wolf	6/4 - 6/11	08-01-66	26,412	0	0.000	26,412	2.66	0	26,412
Wolf	6/4 - 6/11	08-01-71	8,718	88	1.000	8,806	2.66	0	8,806
Mainstem	8-Jun-06	08-01-72	6,761	427	1.500	7,188	2.63	0	7,188
Mainstem	8-Jun-06	08-01-67	28,045	103	1.500	28,148	2.63	0	28,148

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
Michie	14-Jun-06	08-01-68	39,164	596	1.500	39,760		0	39,760
Michie	14-Jun-06	08-01-74	3,692	56	1.500	3,748	2.41	0	3,748
McClintock	14-Jun-06	08-01-70	29,282	296	1.000	29,578	2.58	0	29,578
McClintock	14-Jun-06	08-01-73	5,426	55	1.000	5,481	2.89	0	5,481
Wolf	11-Jun-06		0	7,658	0.000	7,658	3.02	0	7,658
SUM	2006		147,500	9,279		156,779			156,779
Wolf	5/24-6/3	Agency Tags 18	37,781	771	2.000	38,552		0	38,552
Wolf	3-Jun-07			2,632	0.000	2,632	2.33	0	2,632
Mainstem	29-May-07	Agency Tags 18	35,253	356	1.000	35,609	2.87	0	35,609
Michie	8-Jun-07	Agency Tags 18	50,084	506	1.000	50,590	3.22	0	50,590
McClintock	8-Jun-07	Agency Tags 18	38,383	388	1.000	38,771	3.22	0	38,771
SUM	2007		161,501	4,653		166,154			166,154
Wolf	6/01-6/26	Agency Tags 08	10,939	0	0.000	10,939	2.97		10,939
Wolf	26-Jun-08			2,618		2,618			2,618
Mainstem	5-Jun-08	Agency Tags 08	20,498	418	2.000	20,916	2.84		20,916
Michie	5-Jun-08	Agency Tags 08	24,615	502	2.000	25,117	2.71		25,117
McClintock	5-Jun-08	Agency Tags 08	24,687	1,029	4.000	25,716	2.89		25,716
SUM	2008		80,739	4,567		85,306		0	85,306
Wolf	31-May-09	Agency Tags 08	19,652	199	1.000	19,851	2.76		19,851
Wolf	11-Jun-09			2,672		2,672			2,672
Mainstem	6-Jun-09	Agency Tags 08	42,648	258	0.600	42,906	3.00		42,906
Michie	6-Jun-09	Agency Tags 08	77,048	778	0.100	77,826	2.87		77,826
McClintock	6-Jun-09	Agency Tags 08	26,338	53	0.020	26,391	2.52		26,391
SUM	2009		165,686	3,960		169,646		0	169,646

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
Wolf	30-May-10	Agency Tag 18	12,000	0	0.000	12,000	2.89	0	12,000
Michie	1-Jun-10	Agency Tag 18	66,848	2,067	3.000	68,915	3.00	0	68,915
McClintock	1-Jun-10	Agency Tag 18	19,714	0	0.000	19,714	3.00	0	19,714
McClintock	1-Jun-10			1,369		1,369		0	1,369
Mainstem	1-Jun-10	Agency Tag 18	23,985	242	1.000	24,227	2.98	0	24,227
SUM	2010		122,547	3,678		126,225		0	126,225
Wolf	10-Jun-11	Agency Tag 18	10,000	1,550	0.000	11,550	2.76	0	11,550
Michie	6-Jun-11	Agency Tag 18	65,640	1,000	1.500	66,640	2.94	0	66,640
McClintock	6-Jun-11	Agency Tag 18	32,811	0	0.000	32,811	2.65	0	32,811
Mainstem	6-Jun-11	Agency Tag 18	23,921	0	0.000	23,921	2.67	0	23,921
SUM	2011		132,372	2,550		134,922		0	134,922
Wolf	27-May-12	18-61-03	10,171	103	1.000	10,274	2.80	0	10,274
Michie	6-Jun-12	18-13-74	43,412	488	1.100	43,900	2.87	0	43,900
Michie	6-Jun-12	18-17-79	36,033	549	1.500	36,582	2.87	0	36,582
Mainstem	6-Jun-12	18-26-85	28,345	1,705	0.500	30,050	2.78	0	30,050
McClintock	6-Jun-12	18-26-86	27,264	418	1.500	27,682	2.83	0	27,682
SUM	2012		145,225	3,263		148,488		0	148,488
Wolf	27-May-13	18-60-25	10,377	3,473	1.003	13,850	2.24	0	13,850
Michie	4-Jun-13	18-25-79	46,625	952	2.000	47,577	2.7	0	47,577
Michie	4-Jun-13	18-17-82	32,358	660	2.000	33,018	2.46	0	33,018
Mainstem	4-Jun-13	18-36-08	9,192	93	1.000	9,285	2.44	0	9,285

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
Mainstem	4-Jun-13	18-36-09	6,857	140	2.000	6,997	2.44	0	6,997
McClintock	4-Jun-13	18-27-64	31,665	0	0.000	31,665	2.35	0	31,665
SUM	2013		137,074	5,318		142,392		0	142,392
Wolf	1-Jun-14	18-31-84	6,509	2,821	3.000	6,710	2.15	0	9,330
Michie	3-Jun-14	18-31-87	68,638	1,401	2.000	70,039	2.72	0	70,039
McClintock	3-Jun-14	18-28-74	29,618	604	2.000	30,222	2.46	0	30,222
Mainstem	3-Jun-14	18-31-85	14,883	150	1.000	15,033	2.22	0	15,033
SUM	2014		119,647	4,977		122,004		0	124,624
Wolf	31-May-15	18-39-96	9,991	4,032	2.000	14,227	2.08	0	14,023
Michie	3-Jun-15	18-40-65	78,594	1,604	2.000	80,198	2.35	0	80,198
McClintock	3-Jun-15	18-40-64	29,919	303	1.000	30,222	2.24	0	30,222
Mainstem	3-Jun-15	18-39-98	9,742	99	1.000	9,841	2.35	0	9,841
Mainstem	3-Jun-15	18-39-97	8,980	91	1.000	9,071	2.38	0	9,071
Fox Cr [b]	8-Jun-15	18-31-86	14,949	151	1.000	15,100	2.50	0	15,100
SUM	2015		137,226	6,129		143,559		0	143,355
Wolf	29-May-16	18-38-68	7,273	2,706	10.000	9,979	2.21	0	9,979
Wolf	29-May-16	18-38-69	3,949	439	10.000	4,388	2.34	0	4,388
Michie	7-Jun-16	18-45-90	43,820	1,355	3.000	45,175	2.43	0	45,175
Michie	7-Jun-16	18-45-91	35,896	733	2.000	36,629	2.39	0	36,629
McClintock	17-Jun-16	18-38-90	33,239	336	1.000	33,575	2.82	0	33,575
Mainstem	7-Jun-16	18-44-91	5,723	117	2.000	5,840	2.41	0	5,840
Mainstem	7-Jun-16	18-44-92	5,694	116	2.000	5,810	2.54	0	5,810
SUM	2016		135,594	5,802		141,396		0	141,396

-continued-

Release Location	Release Date	Code	# Tagged & Clipped [a]	Adipose Clipped Only	%Tag-Loss	Total Clipped	Weight (grams)	Total Unclipped	Total Released
AVERAGE	2007-2016		133,761	4,490		138,009	2.64	0	138,251
TOTAL	1985-2016		4,964,124	334,019		5,295,726		1,180,189	6,478,331

Note: Hatchery Chinook salmon fry released as 0+ sub yearling smolt.

[a] Usually corresponds to "tagged" category on Mark–Recapture Program (MRP) release forms. Coded Wire Tag (CWT) data recorded from CWT release sheets 1989-94 and; CWT data prior to 1987 not verified against Salmonid Enhancement Program (SEP) records.

[b] Tributary to Lake Laberge, Release numbers not included in long term average and totals.

Appendix A17.–Summary of releases of Chinook salmon from Yukon Territory instream incubation/rearing sites 1991–2016.

Project	Brood Year	Stock	Mark	Stage	Release Site	Start Date	End Date	Number Tagged	# Ad. Only	# Un-Marked	Total Rel.	WT. (gm)
Klondike R.	1990	Tatchun R.	02-01-01-02-12	Spring Fry	Tatchun R.	6/28/1991	6/28/1991	13593	21	650	14264	0.74
Klondike R.	1990	Tatchun R.	02-01-01-02-09	Spring Fry	Tatchun R.	6/28/1991	6/28/1991	15247	173	750	16170	0.74
Klondike R.	1991	Tatchun R.	18-06-45	Spring Fry	Tatchun R.	NA	8/31/1992	11734	0	817	12551	2.47
Klondike R.	1991	Tatchun R.	02-33-56	Spring Fry	Tatchun R.	NA	8/31/1992	6453	0	852	7305	2.47
Klondike R.	1991	Tatchun R.	18-06-44	Spring Fry	Tatchun R.	NA	8/31/1992	11585	0	320	11905	2.47
Klondike R.	1991	Yukon R	NOCN9148	Spring Fry	Pothole Lk.	6/1992	6/1992	0	0	1500	1500	0.00
Klondike R.	1992	Klondike R.	02-01-01-04-04	Spring Fry	Klondike R.	7/1/1993	7/1/1993	12832	240	144	13216	1.14
Klondike R.	1992	Klondike R.	02-01-01-04-05	Spring Fry	Klondike R.	7/1/1993	7/1/1993	7546	256	167	7969	1.14
Klondike R.	1992	Tatchun R.	02-01-01-04-02	Spring Fry	Tatchun R.	6/17/1993	6/17/1993	4654	633	335	5622	0.76
Klondike R.	1993	Klondike R.	02-01-01-05-03	Spring Fry	Klondike R.	6/30/1994	6/30/1994	6174	10	54	6238	0.88
Klondike R.	1993	Tatchun R.	02-01-01-04-07	Spring Fry	Tatchun R.	6/30/1994	6/30/1994	12077	246	71	12394	0.99
Klondike R.	1993	Tatchun R.	02-01-01-05-05	Spring Fry	Tatchun R.	6/30/1994	6/30/1994	9982	0	61	10043	0.99
Klondike R.	1994	Klondike R.	02-01-01-06-03	Spring Fry	Klondike R.	NA	7/4/1995	2159	11	190	2360	0.75
Klondike R.	1994	Klondike R.	02-01-01-06-02	Spring Fry	Klondike R.	NA	7/4/1995	1809	16	56	1881	0.75
Klondike R.	1994	Tatchun R.	02-01-01-05-11	Spring Fry	Tatchun R.	7/4/1995	7/4/1995	12431	100	686	13217	0.81

-continued-

Appendix A17.–Page 2 of 9.

Project	Brood Year	Stock	Mark	Stage	Release Site	Start Date	End Date	Number Tagged	# Ad. Only	# Un-Marked	Total Rel.	WT. (gm)
Mayo River	1991	Mayo R.	NOCN9147	Spring Fry	Mayo R.	6/1992	6/1992	0	0	13000	13000	0.00
Mayo River	1992	Mayo R.	NOCN9292	Spring Fry	Mayo R.	7/1993	7/1993	0	0	500	500	0.00
McIntyre Ck.	1990	Takhini R.	02-33-55	Fall Fry 5-8 gm	Takhini R.	9/13/1990	9/13/1990	7967	80	39	8086	3.20
McIntyre Ck.	1990	Takhini R.	02-33-54	Fall Fry 5-8 gm	Takhini R.	9/13/1990	9/13/1990	10789	109	101	10999	3.20
McIntyre Ck.	1991	Takhini R.	02-01-01-03-08	Spring Fry	Flat Ck.	NA	7/4/1992	12141	143	3425	15709	0.98
McIntyre Ck.	1991	Takhini R.	02-01-01-03-09	Spring Fry	Flat Ck.	NA	7/4/1992	13102	466	1398	14966	0.98
McIntyre Ck.	1991	Takhini R.	02-01-01-03-10	Spring Fry	Flat Ck.	NA	7/4/1992	4955	261	601	5817	0.98
McIntyre Ck.	1992	Klondike R.	02-01-01-04-04	Spring Fry	Klondike R.	7/1/1993	7/1/1993	12832	240	144	13216	1.14
McIntyre Ck.	1992	Klondike R.	02-01-01-04-05	Spring Fry	Klondike R.	7/1/1993	7/1/1993	7546	256	167	7969	1.14
McIntyre Ck.	1992	Takhini R.	02-34-24	Spring Fry	Flat Ck.	8/17/1993	8/17/1993	9532	823	95	10450	2.71
McIntyre Ck.	1992	Takhini R.	02-34-23	Spring Fry	Flat Ck.	8/17/1993	8/17/1993	9822	850	218	10890	2.71
McIntyre Ck.	1992	Takhini R.	18-14-54	Spring Fry	Flat Ck.	8/17/1993	8/17/1993	10925	567	227	11719	2.71
McIntyre Ck.	1992	Takhini R.	18-14-53	Spring Fry	Flat Ck.	8/17/1993	8/17/1993	10658	865	226	11749	2.71
McIntyre Ck.	1992	Takhini R.	02-02-17	Spring Fry	Flat Ck.	8/17/1993	8/17/1993	2291	114	37	2442	2.71
McIntyre Ck.	1992	Takhini R.	02-34-22	Spring Fry	Flat Ck.	8/17/1993	8/17/1993	10355	314	40	10709	2.71
McIntyre Ck.	1992	Tatchun Ck.	02-01-01-04-02	Spring Fry	Tatchun Ck.	6/17/1993	6/17/1993	4654	633	335	5622	0.76
McIntyre Ck.	1993	Takhini R	18-17-51	Spring Fry	Flat Ck.	8/26/1994	8/31/1994	7410	46	222	7678	2.60

-continued-

Appendix A17.–Page 3 of 9.

Project	Brood Year	Stock	Mark	Stage	Release Site	Start Date	End Date	Number Tagged	# Ad. Only	# Un-Marked	Total Rel.	WT. (gm)
McIntyre Ck.	1993	Takhini R.	18-17-50	Spring Fry	Flat Ck.	8/26/1994	8/31/1994	11227	40	87	11354	2.6
McIntyre Ck.	1993	Takhini R.	18-17-49	Spring Fry	Flat Ck.	8/26/1994	8/31/1994	11071	159	142	11372	2.6
McIntyre Ck.	1993	Takhini R.	18-17-48	Spring Fry	Flat Ck.	8/26/1994	8/31/1994	11375	0	104	11479	2.6
McIntyre Ck.	1993	Takhini R.	18-17-52	Spring Fry	Flat Ck.	8/26/1994	8/31/1994	10668	21	198	10887	2.6
McIntyre Ck.	1993	Takhini R.	02-02-16	Spring Fry	Takhini R.	8/30/1994	8/30/1994	9343	271	36	9650	2.8
McIntyre Ck.	1993	Takhini R.	02-01-63	Spring Fry	Takhini R.	8/30/1994	8/30/1994	10899	222	62	11183	2.8
McIntyre Ck.	1994	Takhini R.	02-01-01-04-15	Spring Fry	Takhini R.	8/14/1995	8/14/1995	9887	0	410	10297	2.2
McIntyre Ck.	1994	Takhini R.	02-01-01-04-13	Spring Fry	Takhini R.	8/14/1995	8/14/1995	14452	0	365	14817	2.2
McIntyre Ck.	1994	Takhini R.	02-01-01-04-12	Spring Fry	Flat Ck.	8/14/1995	8/14/1995	14193	59	281	14533	2.2
McIntyre Ck.	1994	Takhini R.	02-01-01-04-14	Spring Fry	Flat Ck.	8/14/1995	8/14/1995	13586	130	295	14011	2.2
McIntyre Ck.	1995	Takhini R.	02-01-01-05-08	Spring Fry	Takhini R.	8/12/1996	8/12/1996	15731	251	496	16478	2.1
McIntyre Ck.	1995	Takhini R.	02-01-01-05-09	Spring Fry	Takhini R.	8/12/1996	8/12/1996	8085	41	293	8419	2.1
McIntyre Ck.	1995	Takhini R.	02-01-01-05-10	Spring Fry	Flat Ck.	8/7/1996	8/7/1996	10727	65	170	10962	2.0
McIntyre Ck.	1995	Takhini R.	02-01-01-02-10	Spring Fry	Takhini R.	6/27/1996	6/27/1996	14530	49	62	14641	0.8
McIntyre Ck.	1995	Takhini R.	02-01-01-02-11	Spring Fry	Takhini R.	6/27/1996	6/27/1996	13526	91	294	13911	0.8
McIntyre Ck.	1996	Takhini R.	02-01-01-06-14	Spring Fry	Flat Ck.	7/2/1997	7/4/1997	15622	158	382	16162	0.8
McIntyre Ck.	1996	Takhini R.	02-01-01-04-06	Spring Fry	Flat Ck.	7/2/1997	7/4/1997	14845	37	280	15162	0.8
McIntyre Ck.	1996	Takhini R.	02-01-01-07-03	Spring Fry	Takhini R.	6/27/1997	6/27/1997	1521	15	148	1684	1.0

-continued-

Appendix A17.–Page 4 of 9.

Project	Brood Year	Stock	Mark	Stage	Release Site	Start Date	End Date	Number Tagged	# Ad. Only	# Un-Marked	Total Rel.	WT. (gm)
McIntyre Ck.	1997	Tatchun Ck.	02-01-01-06-08	Spring Fry	Tatchun Ck.	6/19/1998	6/19/1998	9284	150	74	9508	1.1
McIntyre Ck.	1997	Tatchun Ck.	02-01-01-06-09	Spring Fry	Tatchun Ck.	6/19/1998	6/19/1998	10318	211	188	10717	1.1
McIntyre Ck.	1997	Tatchun Ck.	02-01-01-07-02	Spring Fry	Tatchun Ck.	6/19/1998	6/19/1998	2536	52	0	2588	1.1
McIntyre Ck.	1997	Takhini R.	02-01-01-07-09	Spring Fry	Flat Ck.	6/22/1998	6/22/1998	11374	115	115	11604	1.1
McIntyre Ck.	1997	Takhini R.	02-01-01-06-11	Spring Fry	Takhini R.	6/23/1998	6/23/1998	12933	334	118	13385	1.1
McIntyre Ck.	1997	Takhini R.	02-01-01-06-10	Spring Fry	Takhini R.	6/23/1998	6/23/1998	12186	37	115	12338	1.1
McIntyre Ck.	1997	Takhini R.	02-01-01-07-08	Spring Fry	Takhini R.	6/23/1998	6/23/1998	12341	253	148	12742	1.1
McIntyre Ck.	1998	Tatchun Ck.	02-01-01-06-12	Spring Fry	Tatchun Ck.	NA	7/8/1999	10363	0	67	10430	NA
McIntyre Ck.	1998	Tatchun Ck.	02-01-01-06-13	Spring Fry	Tatchun Ck.	NA	7/8/1999	4733	0	82	4815	NA
McIntyre Ck.	1998	Takhini R.	02-01-01-07-10	Spring Fry	Takhini R.	NA	7/14/1999	13753	28	148	13929	NA
McIntyre Ck.	1998	Takhini R.	02-01-01-07-11	Spring Fry	Flat Ck.	NA	7/15/1999	11273	23	206	11502	NA
McIntyre Ck.	1999	Takhini R.	02-01-0-07-07	Spring Fry	Flat Ck.	NA	6/23/2000	11333	114	219	11666	0.8
McIntyre Ck.	1999	Takhini R.	02-01-01-07-12	Spring Fry	Flat Ck.	NA	6/23/2000	12246	0	214	12460	0.8
McIntyre Ck.	1999	Takhini R.	02-01-01-06-04	Spring Fry	Takhini R.	NA	6/24/2000	11105	0	147	11252	0.9
McIntyre Ck.	1999	Takhini R.	02-01-01-06-05	Spring Fry	Takhini R.	NA	6/24/2000	12044	0	88	12132	0.9
McIntyre Ck.	1999	Takhini R.	02-01-01-06-06	Spring Fry	Takhini R.	NA	6/24/2000	4561	0	0	4561	0.9
McIntyre Ck.	1999	Tatchun Ck.	02-01-01-07-05	Spring Fry	Tatchun Ck.	NA	6/19/2000	12239	188	409	12836	1.0
McIntyre Ck.	1999	Tatchun Ck.	02-01-01-07-06	Spring Fry	Tatchun Ck.	NA	6/19/2000	987	10	0	997	1.0

-continued-

Appendix A17.–Page 5 of 9.

Project	Brood Year	Stock	Mark	Stage	Release Site	Start Date	End Date	Number Tagged	# Ad. Only	# Un-Marked	Total Rel.	WT. (gm)
McIntyre Ck.	2000	Takhini R.	02-01-01-08-01	Spring Fry	Takhini R.	NA	7/25/2001	11724	163	123	12010	1.1
McIntyre Ck.	2000	Takhini R.	02-01-01-08-02	Spring Fry	Flat Ck.	NA	7/26/2001	9995	101	60	10156	1.1
McIntyre Ck.	2000	Tatchun Ck.	02-01-01-07-05	Spring Fry	Tatchun Ck.	NA	7/9/2001	11654	360	10	12024	1.1
McIntyre Ck.	2000	Tatchun Ck.	02-01-01-07-06	Spring Fry	Tatchun Ck.	NA	7/9/2001	6321	329	14	6664	1.1
McIntyre Ck.	2001	Takhini R.	02-01-01-08-04	Spring Fry	Takhini R.	NA	6/29/2002	10109	314	301	10724	1.0
McIntyre Ck.	2001	Takhini R.	02-01-01-08-05	Spring Fry	Takhini R.	NA	6/29/2002	9814	100	405	10319	1.0
McIntyre Ck.	2001	Takhini R.	02-01-01-08-07	Spring Fry	Flat Ck.	NA	6/28/2002	4161	42	0	4203	1.0
McIntyre Ck.	2001	Tatchun Ck.	02-01-01-08-03	Spring Fry	Tatchun Ck.	NA	6/27/2002	6432	415	279	7126	1.0
McIntyre Ck.	2002	Takhini R.	02-11-22-31-41	Spring Fry	Takhini R.	NA	7/21/2003	8431	0	55	8486	1.7
McIntyre Ck.	2002	Takhini R.	02-11-22-31-42	Spring Fry	Takhini R.	NA	7/21/2003	14017	0	76	14093	1.7
McIntyre Ck.	2002	Takhini R.	02-01-01-07-01	Spring Fry	Takhini R.	NA	7/21/2003	11589	13	104	11706	1.7
McIntyre Ck.	2002	Takhini R.	02-11-21-38-46	Spring Fry	Flat Ck.	NA	7/22/2003	6426	65	0	6491	1.7
McIntyre Ck.	2002	Tatchun Ck.	02-01-01-07-14	Spring Fry	Tatchun Ck.	NA	7/4/2003	10746	50	79	10875	1.4
McIntyre Ck.	2002	Tatchun Ck.	02-01-01-07-15	Spring Fry	Tatchun Ck.	NA	7/4/2003	13261	0	166	13427	1.4
McIntyre Ck.	2003	Tatchun R.	02-01-02-01-05	Spring Fry	Tatchun R.	NA	6/27/2004	10701	805	0	11506	1.1
McIntyre Ck.	2003	Tatchun R.	02-01-02-01-04	Spring Fry	Tatchun R.	NA	6/27/2004	9919	556	0	10475	1.1
McIntyre Ck.	2003	Tatchun R.	02-01-02-01-03	Spring Fry	Tatchun R.	NA	6/27/2004	5249	395	0	5644	1.1
McIntyre Ck.	2003	Takhini R	02-01-02-02-01	Spring Fry	Takhini R.	NA	7/12/2004	10449	268	0	10717	1.3

-continued-

Appendix A17.–Page 6 of 9.

Project	Brood Year	Stock	Mark	Stage	Release Site	Start Date	End Date	Number Tagged	# Ad. Only	# Un-Marked	Total Rel.	WT. (gm)
McIntyre Ck.	2003	Takhini R.	02-01-02-01-06	Spring Fry	Takhini R.	NA	7/12/2004	11685	178	0	11863	1.3
McIntyre Ck.	2003	Takhini R.	02-01-02-01-08	Spring Fry	Flat Ck.	NA	8/16/2004	7785	95	0	7880	1.1
McIntyre Ck.	2003	Tatchun R.	02-01-01-09-01	Spring Fry	Tatchun R.	NA	8/20/2004	9381	143	0	9524	1.3
McIntyre Ck.	2003	Tatchun R.	02-01-01-08-08	Spring Fry	Tatchun Ck.	NA	8/20/2004	5216	79	0	5295	1.5
McIntyre Ck.	2003	Takhini R.	02-01-01-09-03	Spring Fry	Takhini R.	NA	8/21/2004	10112	154	0	10266	1.2
McIntyre Ck.	2003	Takhini R.	02-01-01-09-02	Spring Fry	Takhini R.	NA	8/21/2004	10180	155	0	10335	1.2
McIntyre Ck.	2003	Takhini R.	02-01-02-01-03	Spring Fry	Takhini R.	NA	8/21/2004	5390	82	0	5472	1.2
McIntyre Ck.	2004	Tatchun R.	02-01-01-08-09	Spring Fry	Tatchun R.	NA	6/27/2005	2361	426	0	2787	1.3
McIntyre Ck.	2004	Takhini R.	02-01-02-02-02	Spring Fry	Takhini R.	NA	7/14/2005	23068	2175	1100	26343	1.3
McIntyre Ck.	2004	Takhini R.	02-01-02-02-03	Spring Fry	Takhini R.	NA	7/14/2005	9146	1016	1100	11262	1.3
McIntyre Ck.	2004	Takhini R.	02-01-02-01-08	Spring Fry	Flat Ck.	NA	7/7/2005	5592	233	0	5825	1.3
McIntyre Ck.	2005	Takhini R.	02-1-2-2-5	Spring Fry	Takhini R.	NA	7/10/2006	10766	748	0	11514	1.3
McIntyre Ck.	2005	Takhini R.	02-1-2-1-9	Spring Fry	Takhini R.	NA	7/10/2006	10952	534	0	11486	1.6
McIntyre Ck.	2005	Takhini R.	02-1-2-2-6	Spring Fry	Takhini R.	NA	7/10/2006	11108	394	0	11502	1.6
McIntyre Ck.	2005	Takhini R.	02-1-2-3-4	Spring Fry	Takhini R.	NA	7/18/2006	2520	152	0	2672	1.6
McIntyre Ck.	2005	Tatchun R.	02-1-2-1-7	Spring Fry	Tatchun R.	NA	7/7/2006	9243	182	0	9425	2.4
McIntyre Ck.	2005	Tatchun R.	02-1-2-3-3	Spring Fry	Tatchun R.	NA	7/23/2006	26094	847	0	26941	2.4
McIntyre Ck.	2006	Takhini R	02-01-02-03-09	Spring Fry	Takhini R	7/17/2007	7/20/2007	8422	936	552	9910	1.6a

-continued-

Appendix A17.–Page 7 of 9.

Project	Brood Year	Stock	Mark	Stage	Release Sire	Start Date	End Date	Number Tagged	# Ad. Only	# Un-Marked	Total Rel.	WT. (gm)
McIntyre Ck.	2006	Takhini R.	02-01-02-03-07	Spring Fry	Takhini R.	7/17/2007	7/20/2007	10108	645	185	10938	1.6[a]
McIntyre Ck.	2006	Takhini R.	02-01-02-03-08	Spring Fry	Takhini R.	7/17/2007	7/20/2007	10080	420	183	10683	1.6[a]
McIntyre Ck.	2006	Takhini R.	02-01-02-04-01	Spring Fry	Takhini R.	7/17/2007	7/20/2007	8881	567	688	10136	1.6[a]
McIntyre Ck.	2006	Takhini R.	02-01-02-04-04	Spring Fry	Takhini R.	7/17/2007	7/20/2007	1500	131	55	1686	1.6[a]
McIntyre Ck.	2006	Tatchun R.	02-01-02-04-02	Spring Fry	Tatchun R.	7/21/2007	7/26/2007	9775	182	185	10142	>2.4[a]
McIntyre Ck.	2006	Tatchun R.	02-01-02-04-03	Spring Fry	Tatchun R.	7/21/2007	7/26/2007	9450	476	113	10039	>2.4[a]
McIntyre Ck.	2006	Tatchun R.	02-01-02-03-05	Spring Fry	Tatchun R.	7/21/2007	7/26/2007	8972	955	196	10123	>2.4[a]
McIntyre Ck.	2006	Tatchun R.	02-01-02-03-06	Spring Fry	Tatchun R.	7/21/2007	7/26/2007	6261	261	101	6623	>2.4[a]
McIntyre Ck.	2007	Tatchun R.	02-01-02-04-03	Spring Fry	Tatchun R.	6/27/2008	6/27/2008	10170	103	145	10418	1.6
McIntyre Ck.	2007	Tatchun R.	02-01-02-04-05	Spring Fry	Tatchun R.	6/27/2008	6/27/2008	10056	311	228	10595	1.6
McIntyre Ck.	2007	Tatchun R.	02-01-02-04-06	Spring Fry	Tatchun R.	6/27/2008	6/27/2008	4345	44	328	4717	1.6
McIntyre Ck.	2007	Takhini R.	02-01-02-04-08	Spring Fry	Takhini R.	7/2/2008	7/2/2008	6756	209	197	7162	1.4
McIntyre Ck.	2007	Takhini R.	02-01-02-04-07	Spring Fry	Takhini R.	7/2/2008	7/2/2008	9490	293	119	9902	1.4
McIntyre Ck.	2008	Tatchun R.	02-01-02-05-06	Spring Fry	Tatchun R.	6/30/2009	6/30/2009	2576	136	37	2749	1.3
McIntyre/ Fox	2008	Whitehorse Fishway	02-01-02-05-01	Spring Fry	Fox Creek (Laberge)	7/3/2009	7/3/2009	10141	459	0	10600	1.4
McIntyre/ Fox	2008	Whitehorse Fishway	02-01-02-05-02	Spring Fry	Fox Creek (Laberge)	7/3/2009	7/3/2009	10019	459	0	10478	1.4
McIntyre/ Fox	2008	Whitehorse Fishway	02-01-02-05-03	Spring Fry	Fox Creek (Laberge)	7/3/2009	7/10/2009	9739	1253	0	10992	1.4
McIntyre/ Fox	2008	Whitehorse Fishway	02-01-02-05-04	Spring Fry	Fox Creek (Laberge)	7/9/2009	7/10/2009	9194	1417	0	10611	1.4
McIntyre/ Fox	2008	Whitehorse Fishway	02-01-02-05-05	Spring Fry	Fox Creek (Laberge)	7/9/2009	7/10/2009	9747	1126	0	10873	1.4

-continued-

Appendix A17.–Page 8 of 9.

Project	Brood Year	Stock	Mark	Stage	Release Sire	Start Date	End Date	Number Tagged	# Ad. Only	# Un-Marked	Total Rel.	WT. (gm)
McIntyre Ck.	2009	Tatchun R.	02-01-02-05-07	Spring Fry	Tatchun R.	6/21/2010	6/21/2010	1373	131	0	1504	1.3
McIntyre/ Fox	2009	Whitehorse Fishway	02-01-02-05-09	Spring Fry	Fox Creek (Laberge)	6/18/2010	6/18/2010	7930	1251	0	9181	1.1
McIntyre Ck.	2010	Tatchun Ck.	02-01-02-06-02	Spring Fry	Tatchun R.	6/27/2011	6/27/2011	9378	152	0	9530	1.2
McIntyre Ck.	2010	Tatchun Ck.	02-01-02-06-04	Spring Fry	Tatchun R.	6/27/2011	6/27/2011	10594	3567	0	14161	1.2
McIntyre/ Fox	2010	Whitehorse Fishway	02-01-02-06-06	Spring Fry	Fox Creek (Laberge)	5/7/2011	5/7/2011	2864	2362	0	5226	1.2[a]
McIntyre/ Fox	2010	Whitehorse Fishway	02-01-02-06-07	Spring Fry	Fox Creek (Laberge)	5/7/2011	5/7/2011	1161	826	0	1987	1.2[a]
McIntyre Ck.	2011	Tatchun Ck.	02-01-02-07-01	Spring Fry	Tatchun R.	6/28/2012	6/28/2012	3481	175	0	3656	1.5
McIntyre/ Fox	2011	Whitehorse Fishway	02-01-02-07-02	Spring Fry	Fox Creek (Laberge)	7/11/2012	7/11/2012	3121	87	0	3208	1.5
McIntyre/ Fox	2011	Whitehorse Fishway	02-01-02-07-03	Spring Fry	Fox Creek (Laberge)	7/11/2012	7/11/2012	10060	135	0	10195	1.5
McIntyre/ Fox	2011	Whitehorse Fishway	02-01-02-07-04	Spring Fry	Fox Creek (Laberge)	7/11/2012	7/11/2012	9932	139	0	10071	1.5
McIntyre/ Fox	2011	Whitehorse Fishway	02-01-02-07-08	Spring Fry	Fox Creek (Laberge)	7/11/2012	7/11/2012	10612	89	0	10701	1.5
McIntyre/ Fox	2011	Whitehorse Fishway	02-01-02-06-08	Spring Fry	Fox Creek (Laberge)	7/18/2012	7/18/2012	10577	71	0	10648	1.8
McIntyre/ Fox	2011	Whitehorse Fishway	02-01-02-07-05	Spring Fry	Fox Creek (Laberge)	7/18/2012	7/18/2012	11208	113	0	11321	1.8
McIntyre/ Fox	2011	Whitehorse Fishway	02-01-02-07-09	Spring Fry	Fox Creek (Laberge)	7/24/2012	7/24/2012	10806	32	0	10838	2.0
McIntyre/ Fox	2011	Whitehorse Fishway	02-01-02-07-06	Spring Fry	Fox Creek (Laberge)	7/24/2012	7/24/2012	10956	76	0	11032	2.0

-continued-

Project	Brood Year	Stock	Mark	Stage	Release Sire	Start Date	End Date	Number Tagged	# Ad. Only	# Un-Marked	Total Rel.	WT. (gm)
McIntyre/ Fox	2011	Whitehorse Fishway	02-01-02-07-07	Spring Fry	Fox Creek (Laberge)	7/26/2012	7/26/2012	9053	91	0	9144	2.0
McIntyre/ Fox	2012	Whitehorse Fishway	02-01-02-07-09	Spring Fry	Fox Creek (Laberge)	7/8/2013	7/8/2013	9940	246	0	10186	1.4
McIntyre/ Fox	2012	Whitehorse Fishway	02-01-02-08-01	Spring Fry	Fox Creek (Laberge)	7/8/2013	7/8/2013	11288	410	0	11698	1.4
McIntyre/ Fox	2012	Whitehorse Fishway	02-01-02-08-02	Spring Fry	Fox Creek (Laberge)	7/8/2013	7/8/2013	241	51	0	292	1.4
McIntyre/ Fox	2013	Whitehorse Fishway	02[b]-01-02-08-05	Spring Fry	Fox Creek (Laberge)	7/3/2013	7/8/2013	5516	151	0	5667	NA
McIntyre/ Fox	2013	Whitehorse Fishway	02[b]-01-02-08-04	Spring Fry	Fox Creek (Laberge)	7/3/2013	7/8/2013	10896	193	0	11089	NA
McIntyre/ Fox	2014	Whitehorse Fishway	02-01-02-08-06	Spring Fry	Fox Creek (Laberge)	7/12/2015	7/12/2015	10000	0	0	10000	1.2
McIntyre/ Fox	2014	Whitehorse Fishway	02-01-02-08-07	Spring Fry	Fox Creek (Laberge)	7/12/2015	7/12/2015	10000	0	0	10000	1.2
McIntyre/ Fox	2014	Whitehorse Fishway	02-01-02-08-08	Spring Fry	Fox Creek (Laberge)	7/12/2015	7/12/2015	3000	477	0	3477	1.2
McIntyre/ Fox	2015	Whitehorse Fishway	02-01-02-09-00	Spring Fry	Fox Creek (Laberge)	7/17/2016	7/17/2016	11449	0	0	11449	1.3
McIntyre/ Fox	2015	Whitehorse Fishway	02-01-02-08-09	Spring Fry	Fox Creek (Laberge)	7/17/2016	7/17/2016	11456	0	0	11456	1.3
McIntyre/ Fox	2015	Whitehorse Fishway	02-01-02-09-01	Spring Fry	Fox Creek (Laberge)	7/17/2016	7/17/2016	11467	0	0	11467	1.3
McIntyre/ Fox	2015	Whitehorse Fishway	02-01-02-09-02	Spring Fry	Fox Creek (Laberge)	7/17/2016	7/17/2016	11315	600	0	11915	1.3

Note: NA= Not Available; #=Number; Ad=Adipose; Rel.=Released. Klondike R. refers to North Klondike River.

[a] Weight (WT) not taken at release, but based on earlier sampling data and assumed growth.

[b] Initial BY 2013 “02” mark code segment could not be confirmed at the time of reporting.

Appendix A18.–Summary of samples submitted for CWT identification from adipose-clipped adult Chinook salmon, by community and sampling project in Alaska, 1989–2016.

	District 1			District 2		District 3		District 5					
		Emmonak		Pilot Station	Other	Marshall	Russian Mission	Tanana Village	Bridge Area	Fort Yukon	Eagle		District Community
Year	Comm.	Sub.	Proj.	Pro.	Comm.	Proj.	Proj.	Comm.	Comm.	Sub.	Proj.		Total Sampled
1989					2								2
1990													0
1991													0
1992	18		2										20
1993	12												12
1994	10												10
1995	14												14
1996	1												1
1997	9												9
1998	26		2										28
1999	50		5						8				63
2000	4		1										5
2001						2	1						3
2002													0
2003	2	1	3					7					13
2004	40		4					9					53
2005	11		2					1			0		14
2006	29		3			2					6		40
2007	9		2						3		2		16
2008	4	1	1	1							1		8
2009			1	1							6		8
2010	5		4								4		13
2011	2	1	8								3		14
2012	3	2	8								3		16
2013		3	3								3		9
2014			3							8	13		24
2015										5	19		24
2016 [a]											6		6
Total	249	8	52	2	2	4	1	17	11	13	66		425

Note: Commercial fishery samples are listed as "common property" in the tag lab database. http://mtalab.adfg.alaska.gov/cwt/reports/cwt_glossary.asp; Proj. = Project, Sub. = Subsistence, Comm. = Commercial; source*:* http://mtalab.adfg.alaska.gov/cwt/reports/numbersampled.asp.

[a] Preliminary number.

Appendix A19.–Recoveries of Chinook salmon coded wire tags from the Whitehorse Rapids Fish hatchery in the U.S. domestic groundfish fisheries and research trawl surveys.

Gear Type	Brood Year	Tag Code	Release Location	Release Date	Recovery Date	Age (yrs)	Length (mm)	Latitude	Longitude
Domestic	1988	26006	Michie Cr.	6/6/1989	3/25/1992	4	620	56° 44'°	173° 15'
Trawl	1990	180322	Wolf Cr.	6/8/1991	3/14/1994	4	687	60° 06'	178° 58'
	1991	180830	Michie Cr.	6/4/1992	2/24/1995	4		55° 19'	164° 43'
	1992	181215	Wolf Cr.	6/6/1993	12/6/1994	2	400	56° 52'	171° 18'
	1992	181216	Yukon R.	6/15/1993	6/2/1997	5	833	59° 29'	167° 49'
	1993	181428	Michie Cr.	6/1/1994	3/10/1998	5	760	59° 26'	178° 05'
	1995	182823	Fox Cr.	6/4/1996	3/29/1998	3	650	58° 56'	178° 06'
	1995	183348	Judas Cr.	6/4/1996	3/30/1999	4	660	57° 43'	173° 34'
	1996	182554	Michie Cr.	6/11/1997	3/16/2000	4	550	55° 56'	168° 52'
	1997	183159	Judas Cr.	6/12/1998	3/28/2001	4	550	56° 18'	170° 33'
	1999	182353	Wolf Creek	6/10/2000	3/3/2003	4	650	56° 26'	169° 55'
	2000	184412	McClintock R.	6/8/2001	3/19/2004	4	610	NMFS Stat Area 513	
	2000	184412	McClintock R.	6/8/2001	2/15/2002	2	230	56° 10'	166° 00'
	2001	185107	Michie Cr.	6/10/2002	2/8/2003	2	250	56° 44'	167° 00'
	2001	185101	Wolf Cr.	5/23/2002	10/8/2004	3	590	54°01'	166° 29'
	2001	185061	Michie Cr.	6/10/2002	3/15/2005	4	640	57° 21'	171° 39'
	2001	185101	Wolf Cr.	5/23/2002	2/21/2006	5	800	55° 42'	168° 53'
	2005	080166	Wolf Cr.	6/11/2006	2/7/2009	4	630	56° 29'	168° 12'
	2005	080173	McClintock R.	6/14/2006	3/2/2009	4	650	56° 22'	169° 21'
	2005	080169	Mitchie Cr.	6/14/2006	3/26/2010	5	900	57° 07'	172° 26'
	2011	181374	Mitchie Cr.	6/6/2012	Mar. 2015	4	620	56°	170°
	2011	182685	Yukon R.	6/6/2012	Feb. 2015	4	630	NMFS Stat Area 521	
Research	2001	185106	Michie Cr.	6/10/2002	10/3/2002	1	193	64° 06'	164° 31'
Trawl	2001	185102	Wolf Cr.	6/2/2002	10/3/2002	1	153	64° 06	164° 31'
	2001	185061	Michie Cr.	6/10/2002	10/4/2002	1	155	63° 00'	165° 58'
	2011	181374	Michie Cr.	6/6/2012	9/22/2012	1	138	61° 29'	167° 00'
	2011	181779	Michie Cr.	6/6/2012	9/24/2012	1	160	64° 06'	163° 33'
	2011	181779	Michie Cr.	6/6/2012	9/24/2012	1	138	60° 59'	168° 00'
	2013	182874	McClintock R.	6/6/2014	9/5/2014	1	126	63° 51'	165° 58'
	2013	183184	Wolf Cr.	6/1/2014	9/6/2014	1	120	63° 01'	166° 03'
	2013	183185	Yukon R.	6/6/2014	9/14/2014	1	192	62° 30'	167° 05'
	2013	183187	Michie Cr.	6/6/2014	9/14/2014	1	177	62° 30'	167° 05'
	2014	183186	Fox Cr.	6/8/2015	9/8/2015	1	109	62° 59'	165° 58'
	2014	183186	Fox Cr.	6/8/2015	9/14/2015	1	120	64° 00'	166° 01'
	2014	183186	Fox Cr.	6/8/2015	9/14/2015	1	124	64° 00'	166° 01'
	2014	184064	McClintock R.	6/3/2015	9/9/2015	1	112	63° 01'	167° 04'
	2014	184065	Michie Cr.	6/3/2015	9/14/2015	1	129	64° 00'	166° 01'

Appendix A20.–Estimated bycatch (numbers) of Pacific salmon by species, and year in United States groundfish fisheries in the Bering Sea-Aleutian Islands (BSAI) management area, 1991–2016.

Year	Chinook	Chum	Coho	Sockeye	Pink	Total Non-Chinook
1991	48,880 [a]	28,270 [a]	656 [a]	1,310 [a]	26 [a]	30,262 [a]
1992	41,955	40,090 [a]	1,266 [a]	14 [a]	80 [a]	41,450 [a]
1993	46,014	242,916 [a]	324 [a]	22 [a]	8 [a]	243,270 [a]
1994	43,821	94,107	228	20	193	94,548
1995	23,436	20,983	871	0	21	21,875
1996	63,205	77,819	234	5	2	78,060
1997	50,530	66,816	109	3	66	66,994
1998	55,431	–	–	–	–	66,611
1999	14,599	–	–	–	–	47,234
2000	8,222	–	–	–	–	59,326
2001	40,547	–	–	–	–	60,730
2002	39,683	–	–	–	–	82,482
2003	53,661	–	–	–	–	189,212
2004	60,038	–	–	–	–	462,439
2005	75,084	–	–	–	–	715,628
2006	87,115	–	–	–	–	321,964
2007	130,000	–	–	–	–	96,379
2008	23,914	–	–	–	–	17,040
2009	14,171	–	–	–	–	47,273
2010	12,444	–	–	–	–	13,938
2011	26,609	–	–	–	–	192,496
2012	12,930	–	–	–	–	24,052
2013	16,007	–	–	–	–	126,792
2014	18,096	–	–	–	–	223,853
2015	25,253	--	--	--	--	243,343
2016	32,497	--	--	--	--	347,148

Sources: Berger 2010; NMFS web sites:
https://alaskafisheries.noaa.gov/sites/default/files/reports/chinook_salmon_mortality2016.pdf;
https://alaskafisheries.noaa.gov/sites/default/files/reports/chum_salmon_mortality2016.pdf

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

Appendix A21.–Estimated bycatch (numbers) of Pacific salmon by species and year in United States groundfish fisheries in the Gulf of Alaska (GOA) management area, 1991–2016.

Year	Chinook	Chum	Coho	Sockeye	Pink	Total Non-Chinook
1991	38,893	13,711	1,133	46	64	14,954
1992	16,788	11,140	55	21	0	11,216
1993	19,260	55,268	306	15	799	56,388
1994	13,616	36,782	42	96	306	37,226
1995	14,653	64,067	668	41	16	64,792
1996	15,761	3,969	194	2	11	4,176
1997	15,229	3,349	41	7	23	3,420
1998	16,983	–	–	–	–	13,544
1999	30,600	–	–	–	–	7,529
2000	26,730	–	–	–	–	10,995
2001	15,104	–	–	–	–	6,063
2002	12,919	–	–	–	–	3,219
2003	15,367	–	–	–	–	9,530
2004	17,778	–	–	–	–	5,809
2005	31,271	–	–	–	–	6,608
2006	18,762	–	–	–	–	4,226
2007	40,519	–	–	–	–	3,421
2008	16,264	–	–	–	–	2,156
2009	8,475	–	–	–	–	2,355
2010	54,631	–	–	–	–	NA
2011	21,519	–	–	–	–	NA
2012	20,346	–	–	–	–	NA
2013	23,333	–	–	–	–	NA
2014	15,752	–	–	–	–	NA
2015	18,973	--	--	--	--	NA
2016	22,081	--	--	--	--	NA

Sources: Berger 2010; NMFS https://alaskafisheries.noaa.gov/sites/default/files/reports/goasalmonmort2016.pdf.

Appendix A22.–Estimated bycatch (numbers) of Chinook and non-Chinook salmon in the Bering Sea-Aleutian Islands (BSAI) groundfish fisheries by season, 1991–2016.

	BSAI Chinook Salmon Bycatch				BSAI Non-Chinook Salmon Bycatch			
	A-season		B-season		A-season		B-season	
Year	Pollock Fisheries	All Fisheries	Pollock Fisheries	All Fisheries	Pollock Fisheries	All Fisheries	Pollock Fisheries	All Fisheries
1991	38,791 [a]	46,392 [a]	2,114 [a]	2,488 [a]	2,850 [a]	3,015 [a]	26,101 [a]	27,245 [a]
1992	25,691	31,418	10,259	10,536	1,951 [a]	2,120 [a]	38,324 [a]	39,329 [a]
1993	17,264	24,688	21,252	21,325	1,594 [a]	1,848 [a]	240,597 [a]	241,422 [a]
1994	28,451	38,921	4,686	4,900	3,991	5,599	88,681	88,949
1995	10,579	18,939	4,405	4,497	1,708	3,033	17,556	18,842
1996	36,068	43,316	19,554	19,888	222	665	77,014	77,395
1997	10,935	16,401	33,973	34,129	2,083	2,710	63,904	64,285
1998	15,193	18,930	36,130	36,501	4,002	4,520	60,040	61,177
1999	6,352	8,794	5,627	5,805	362	393	44,810	46,739
2000	3,422	6,568	1,539	1,655	213	350	58,358	58,977
2001	18,484	24,871	14,961	15,676	2,386	2,903	54,621	57,828
2002	21,794	26,277	12,701	13,407	1,377	1,698	79,404	80,785
2003	32,609	40,044	12,977	13,527	3,834	4,113	185,351	187,037
2004	23,093	30,716	28,603	29,248	422	1,028	440,038	449,513
2005	27,331	33,633	40,030	40,632	595	1,030	704,993	708,358
2006	58,391	62,582	24,304	24,502	1,328	2,312	308,318	322,871
2007	69,420	77,119	52,350	52,450	8,524	9,639	85,264	87,709
2008	16,638	18,996	4,842	5,109	322	517	14,947	16,360
2009	9,711	11,010	2,658	2,786	48	163	46,227	46,967
2010	7,630	9,466	2,067	2,917	40	222	13,240	14,201
2011	7,137	7,602	18,362	19,007	297	415	191,138	192,489
2012	7,765	8,984	3,579	3,949	11	308	22,265	24,010
2013	8,237	9,186	4,797	6,826	215	453	125,101	126,526
2014	11,539	13,836	3,492	4,261	577	1,609	218,851	222,519
2015	12,304	17,502	6,025	7,751	4,800	6,200	232,996	237,143
2016	16,827	25,720	5,094	6,777	3,904	4,839	339,006	342,309

Note: 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/chinook_salmon_mortality2016.pdf; https://alaskafisheries.noaa.gov/sites/default/files/reports/chum_salmon_mortality2016.pdf

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

Appendix A23.–Yukon River fall chum salmon estimated brood year production and return per spawner estimates 1974–2016.

				Estimated Brood Year Return								(R)	(R/P)
	(P)	Estimated Annual Totals		Number of Salmon [a]				Percent				Total Brood	Return/
Year	Escapement [b]	Catch	Run	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Year Return [a]	Spawner
1974	678,200	478,875	1,157,075	112,408	656,949	96,549	0	0.13	0.76	0.11	0.00	865,906	1.28
1975	2,219,000	473,062	2,692,062	198,569	1,722,378	68,040	125.33	0.10	0.87	0.03	0.00	1,989,112	0.90
1976	563,000	339,043	902,043	143,450	651,004	139,112	4,891	0.15	0.69	0.15	0.01	938,456	1.67
1977	731,600	447,918	1,179,518	113,761	1,091,462	199,096	5,027	0.08	0.77	0.14	0.00	1,409,346	1.93
1978	561,800	434,030	995,830	22,559	376,496	108,701	0	0.04	0.74	0.21	0.00	507,755	0.90
1979	1,347,000	615,377	1,962,377	46,592	923,435	313,850	4,045	0.04	0.72	0.24	0.00	1,287,922	0.96
1980	344,500	488,305	832,805	10,053	414,407	217,068	3,892	0.02	0.64	0.34	0.01	645,420	1.87
1981	571,000	682,257	1,253,257	52,465	992,802	346,710	9,576	0.04	0.71	0.25	0.01	1,401,552	2.45
1982	253,900	373,175	627,075	11,767	498,573	179,671	713.29	0.02	0.72	0.26	0.00	690,724	2.72
1983	522,200	525,016	1,047,216	15,653	943,158	234,813	2,408	0.01	0.79	0.20	0.00	1,196,032	2.29
1984	368,400	412,322	780,722	7,638	428,756	181,336	10,137	0.01	0.68	0.29	0.02	627,867	1.70
1985	710,200	515,481	1,225,681	49,003	910,622	322,579	3,239	0.04	0.71	0.25	0.00	1,285,442	1.81
1986	546,800	318,028	864,828	0	511,573	373,759	5,293	0.00	0.57	0.42	0.01	890,625	1.63
1987	733,900	406,143	1,140,043	14,776	626,311	353,608	8,333	0.01	0.62	0.35	0.01	1,003,027	1.37
1988	359,600	353,685	713,285	41,587	213,108	164,459	13,070 [c]	0.10	0.49	0.38	0.03	432,224	1.20
1989	549,200	545,166	1,094,366	3,337	305,356	414,071 [c]	22,193	0.00	0.41	0.56	0.03	744,958	1.36
1990	506,800	352,264	859,064	766.264	695,189 [c]	457,688	32,670	0.00	0.59	0.39	0.03	1,186,313	2.34
1991	605,800	439,096	1,044,896	4,394 [c]	1,120,901	396,023	12,952	0.00	0.73	0.26	0.01	1,534,271	2.53
1992	426,500	148,846	575,346	7,398	701,321	209,786	4,121	0.01	0.76	0.23	0.00	922,625	2.16
1993	387,900	91,015	478,915	8,310	480,440	108,027	3,225	0.01	0.80	0.18	0.01	600,002	1.55
1994	957,500	169,225	1,126,725	4,601	237,574	149,078	1,691 [c]	0.01	0.60	0.38	0.00	392,944	0.41
1995	1,147,000	461,180	1,608,180	2,501	266,154	72,706 [c]	374.93	0.01	0.78	0.21	0.00	341,736	0.30
1996	877,400	260,923	1,138,323	418.876	174,798 [c]	134,111	8,318	0.00	0.55	0.42	0.03	317,647	0.36
1997	537,700	170,079	707,779	3,257 [c]	239,803	118,676	3,403	0.01	0.66	0.33	0.01	365,139	0.68
1998	281,400	70,823	352,223	637.374	270,412	59,203	7,107	0.00	0.80	0.18	0.02	337,359	1.20
1999	287,700	131,176	418,876	29,178	720,246	185,167	13,029	0.03	0.76	0.20	0.01	947,620	3.29

-continued-

Appendix A23.–Page 2 of 2.

	(P)	Estimated Annual Totals		Estimated Brood Year Return								(R)	(R/P)
				Number of Salmon [a]				Percent				Total Brood	Return/
Year	Escapement [b]	Catch	Run	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Year Return [a]	Spawner
2000	223,900	28,553	252,453	8,627	315,305	109,657	0	0.02	0.73	0.25	0.00	433,589	1.94
2001	329,900	45,026	374,926	144,417	2,048,733	703,335	34,004	0.05	0.70	0.24	0.01	2,930,489	8.88
2002	399,100	27,485	426,585	0	462,695	239,502	13,871	0.00	0.65	0.33	0.02	716,068	1.79
2003	712,400	79,079	791,479	25,255	859,961	461,389	17,381	0.02	0.63	0.34	0.01	1,363,987	1.91
2004	575,700	76,296	651,996	0	352,915	157,639	2,063	0.00	0.69	0.31	0.00	512,617	0.89
2005	1,881,000	290,418	2,171,418	2,409	402,064	93,858	5,348	0.00	0.80	0.19	0.01	503,679	0.27
2006	920,800	270,486	1,191,286	26,434	394,056	344,344	30,210	0.03	0.50	0.43	0.04	795,044	0.86
2007	927,800	205,667	1,133,467	83,028	855,695	189,480	6,491	0.07	0.75	0.17	0.01	1,134,695	1.22
2008	612,600	217,983	830,583	10,088	845,264	400,935	7,617	0.01	0.67	0.32	0.01	1,263,904	2.06
2009	510,200	93,319	603,519	12,035	772,640	413,477	22,899	0.01	0.63	0.34	0.02	1,221,051	2.39
2010	493,000	80,005	573,005	1,894	491,063	244,255	9,164	0.00	0.66	0.33	0.01	746,376	1.51
2011	888,100	327,376	1,215,476	23,960	481,681	181,926	5,920	0.03	0.69	0.26	0.01	693,486 [d]	>0.78
2012	680,400	396,589	1,076,989	68,551	1,163,350	561,648		0.04	0.65	0.31		1,793,549 [e]	>2.64
2013	824,000	357,960	1,181,960	29,093									
2014	723,200	212,917	936,117										
2015	534,800	282,586	817,386										
2016	828,800	554,732	1,383,532										
Avg. 2015	674,117	302,244	976,361										
Min 2010	223,900	27,485	252,453	0	174,798	59,203	0	0.00	0.41	0.03	0.00	317,647	0.27
Max 2010	2,219,000	682,257	2,692,062	198,569	2,048,733	703,335	34,004	0.15	0.87	0.56	0.04	2,930,489	8.88
	666,551	All Brood Years (1974–2010)		32,953	647,936	242,210	8,889	0.03	0.68	0.28	0.01	931,987	1.75
	523,732	Even Brood Years (1974–2010)		21,596	457,445	208,782	8,149	0.03	0.66	0.30	0.01	695,972	1.50
	817,306	Odd Brood Years (1974–2010)		44,941	849,009	277,495	9,670	0.03	0.71	0.25	0.01	1,181,114	2.00

Note: Minimum and maximum indicate year with the lowest and highest values through 2010. Average value is through the year 2015. Current brood year data are preliminary as is 2016 harvest estimate. In 2015, estimates of drainagewide escapement were based on Bayesian analysis.

[a] The estimated number of salmon which returned are based upon annual age composition observed in Lower Yukon Test Fishery gillnets each year, weighted by test fish catch per unit effort.

[b] Contrast in escapement data are 9.91.

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

[d] Brood year return for 3, 4, and 5 year fish, indicate that production (R/P) from brood year 2011 was at least 0.78. Recruits estimated for incomplete brood year, denoted by shaded value.

[e] Brood year return for 3 and 4 year fish, indicate that production (R/P) from brood year 2012 was at least 2.64. Recruits estimated for incomplete brood year, denoted by shaded value.

Appendix A24.–Escapement, rebuilding and interim goals for Canadian origin Chinook and fall chum salmon stocks, 1985–2017.

	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

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 to 55,000 fish recommended in 2010, based on levels selected from several unpublished analyses.

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

Appendix A25.–Fall chum salmon age and sex percentages with average lengths from selected Yukon River escapement projects, 2016.

Location	Sample Size		Age 3	4	5	6	7	Total	Average Length (mm) [a]
Delta River, Alaska [b]	160	Males	2.5	50.0	10.6	0.0	0.0	63.1	595.3
		Females	0.6	30.6	5.0	0.6	0.0	36.9	574.5
		Total	3.1	80.6	15.6	0.6	0.0	100.0	587.6
Yukon Mainstem [c]	787	Males	0.6	50.6	16.6	0.4	0.0	68.2	584.0
at Eagle, Alaska		Females	0.8	25.0	5.8	0.1	0.0	31.8	614.2
		Total	1.4	75.6	22.5	0.5	0.0	100.0	604.7
Fishing Branch	906	Males	0.8	43.8	9.4	0.0	0.0	54.1	669.6
River, Canada [d]		Females	2.0	37.4	6.4	0.1	0.0	45.9	615.1
		Total	2.8	81.2	15.8	0.1	0.0	100.0	645.0

[a] Length is measured mid-eye to fork in the U.S. and snout to fork in Canada.

[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, 1961–2016.

	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

-continued-

Appendix B1.–Page 2 of 3.

	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	1,246,176	1,434,562	17,614	44,786	62,400	206,000	1,290,962	1,496,962
1988	148,421	2,325,377	2,473,798	21,427	33,915	55,342	169,848	2,359,292	2,529,140
1989	157,616	2,289,501	2,447,117	17,944	23,490	41,434	175,560	2,312,991	2,488,551
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	168,191	863,575	1,031,766	17,903	21,312	39,215	186,094	884,887	1,070,981
1993	160,289	341,593	501,882	16,611	14,150	30,761	176,900	355,743	532,643
1994	170,829	551,743	722,572	21,198	38,342	59,540	192,027	590,085	782,112
1995	177,663	1,437,870	1,615,533	20,884	46,109	66,993	198,547	1,483,979	1,682,526
1996	139,284	1,121,273	1,260,557	19,612	24,395	44,007	158,896	1,145,668	1,304,564
1997	174,886	545,066	719,952	16,528	15,900	32,428	191,414	560,966	752,380
1998	99,369	199,735	299,104	5,937	8,168	14,105	105,306	207,903	313,209
1999	124,316	236,464	360,780	12,468	19,736	32,204	136,784	256,200	392,984
2000	45,304	106,936	152,240	4,879	9,283	14,162	50,183	116,219	166,402
2001	53,738	116,523	170,261	10,144	9,872	20,016	63,882	126,395	190,277
2002	68,118	122,360	190,478	9,258	8,567	17,825	77,376	130,927	208,303
2003	99,150	199,917	299,067	9,619	11,435	21,054	108,769	211,352	320,121
2004	112,332	206,099	318,431	11,238	9,930	21,168	123,570	216,029	339,599
2005	85,521	478,836	564,371	11,371	18,583	29,954	96,892	497,419	594,311

-continued-

Appendix B1.–Page 3 of 3.

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	95,184	528,606	623,790	9,072	11,908	20,980	104,256	540,514	644,770
2007	89,555	532,103	621,658	5,094	14,332	19,426	94,649	546,435	641,084
2008	48,870	481,407	530,277	3,713	9,566	13,279	52,583	490,973	543,556
2009	34,206	355,516	389,722	4,758	2,011	6,769	38,964	357,527	396,491
2010	53,792	393,233	447,025	2,706	5,891	8,597	56,498	399,124	455,622
2011	40,856	762,109	802,965	4,884	8,226	13,110	45,740	770,335	816,075
2012	28,727	912,395	941,122	2,200	7,033	9,233	30,927	919,428	950,355
2013	11,199	1,013,966	1,025,165	2,146	6,170	8,316	13,345	1,020,136	1,033,481
2014 [e]	2,724	930,803	933,527	103	5,166	5,269	2,827	935,969	938,796
2015 [e]	6,608	913,877	920,485	1,204	4,453	5,657	7,812	918,330	926,142
2016 [e]	20,910	1,152,104	1,173,014	2,946	5,750	8,696	23,856	1,157,854	1,181,710
Average									
1961–2015	115,941	859,147	975,087	10,601	16,750	27,351	126,541	875,897	1,002,438
2006–2015	41,172	682,401	723,574	3,588	7,476	11,064	44,760	689,877	734,637
2011–2015	18,023	906,630	924,653	2,107	6,210	8,317	20,130	912,840	932,970
Minimum-15	2,724	106,936	152,240	103	2,011	5,269	2,827	116,219	166,402
Maximum-15	198,436	2,325,377	2,473,798	22,846	46,109	66,993	220,511	2,359,292	2,529,140

Note: Minimum and maximum indicate year with the lowest and highest values through 2015.

[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. Does not include harvest from the Coastal District communities of Hooper Bay and Scammon Bay.

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

[d] Includes coho salmon harvests in First Nations recreational 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 data from 2014 and 2015.

Appendix B2.–Alaska harvest of Yukon River Chinook salmon, 1961–2016.

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales	Sport Fish	Yukon River Total	Yukon Area Total [e]
1961	21,488	119,664					141,152	141,152
1962	11,110	94,734					105,844	105,844
1963	24,862	117,048					141,910	141,910
1964	16,231	93,587					109,818	109,818
1965	16,608	118,098					134,706	134,706
1966	11,572	93,315					104,887	104,887
1967	16,448	129,656					146,104	146,104
1968	12,106	106,526					118,632	118,632
1969	14,000	91,027					105,027	105,027
1970	13,874	79,145					93,019	93,019
1971	25,684	110,507					136,191	136,191
1972	20,258	92,840					113,098	113,098
1973	24,317	75,353					99,670	99,670
1974	19,964	98,089					118,053	118,053
1975	12,867	63,838					76,705	76,705
1976	17,806	87,776					105,582	105,582
1977	17,581	96,757				156	114,494	114,494
1978	30,297	99,168				523	129,988	130,476
1979	31,005	127,673				554	159,232	159,232
1980	42,724	153,985				956	197,665	197,665
1981	29,690	158,018				769	188,477	188,477
1982	28,158	123,644				1,006	152,808	152,808
1983	49,478	147,910				1,048	198,436	198,436
1984	42,428	119,904				351	162,683	162,683
1985	39,771	146,188				1,368	187,327	187,327
1986	45,238	99,970				796	146,004	146,004
1987	51,418	134,760 [f]		1,706		502	188,386	188,386

-continued-

Appendix B2.–Page 2 of 3.

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales	Sport Fish	Yukon River Total	Yukon Area Total [e]
1988	43,907	100,364	-	2,125	1,081	944	148,421	150,009
1989	48,446	104,198	-	2,616	1,293	1,063	157,616	157,632
1990	48,587	95,247 [f]	413	2,594	2,048	544	149,433	149,433
1991	46,773	104,878 [f]	1,538		689	773	154,651	154,651
1992	45,626	120,245 [f]	927		962	431	168,191	169,642
1993	62,486	93550	560	426	1572	1,695	160,289	161,718
1994	53,077	113,137	703		1631	2,281	170,829	171,654
1995	48,535	122,728	1,324	399	2,152	2,525	177,663	179,748
1996	43,306	89,671	521	215	1,698	3,873	139,284	141,649
1997	55,978	112,841	769	313	2811	2,174	174,886	176,025
1998	53,733	43618	81	357	926	654	99,369	99,760
1999	52,194	69,275	288	331	1,205	1,023	124,316	125,427
2000	35,841	8,515	-	75	597	276	45,304	45,867
2001	52,937	-	-	122	-	679	53,738	56,620
2002	42,620	24128	230	126	528	486	68,118	69,240
2003	55,109	40,438	-	204	680	2,719	99,150	101,000
2004	53,675	56,151	-	201	792	1,513	112,332	114,370
2005	52,561	32,029	-	138	310	483	85,521	86,369
2006	47,710	45,829	-	89	817	739	95,184	96,067
2007	53,976	33,634	-	136	849	960	89,555	90,753
2008	43,694	4,641	-	126	-	409	48,870	50,362
2009	32,900	316	-	127	-	863	34,206	35,111
2010	43,259	9,897	-	162	-	474	53,792	55,092
2011	40,211	82 [g]	-	89	-	474	40,856	41,625
2012	28,311	-	-	71	-	345	28,727	30,486
2013	10,991	-	-	42	-	166	11,199	12,741
2014	2,723 [h]	-	-	1 [h]	-	0	2,724	3,287
2015	6,603 [h]	-	-	5 [h]	-	0	6,608	7,574
2016	20,853 [h]	-	-	57 [h]	-	0	20,910	21,796

-continued-

Appendix B2.–Page 3 of 3.

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales	Sport Fish	Yukon River Total	Yukon Area Total [e]
Averages								
1961–2015	34,414	88,092	669	492	1,192	938	115,941	116,557
2006–2015	31,038	15,733	-	85	833	443	41,172	42,344
2011–2015	17,768	-	-	42	-	197	18,023	19,212
Minimum-15	2,723	82	81	1	310	0	2,724	3,287
Maximum-15	62,486	158,018	1,538	2,616	2,811	3,873	198,436	198,436

Note: Minimum and maximum indicate lowest and highest values through 2015.

[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 1990, 1991, and 1994 personal use was considered part of subsistence.

[e] Yukon Area Total includes subsistence harvest from the Coastal District communities of Scammon Bay and Hooper Bay (1978, 1988–1989 and 1992 to present).

[f] Includes Chinook salmon sold illegally.

[g] No Chinook salmon were sold in the summer season. A total of 82 Chinook salmon were sold in District 1 and 2 in the fall season.

[h] Data are preliminary.

Appendix B3.–Alaska harvest of Yukon River summer chum salmon, 1970–2016.

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales	Sport Fish	Yukon River Total	Yukon Area Total [e]
1970	166,504	137,006					303,510	303,510
1971	171,487	100,090					271,577	271,577
1972	108,006	135,668					243,674	243,674
1973	161,012	285,509					446,521	446,521
1974	227,811	589,892					817,703	817,703
1975	211,888	710,295					922,183	922,183
1976	186,872	600,894					787,766	787,766
1977	159,502	534,875				316	694,693	694,693
1978	171,383	1,052,226	25,761			451	1,249,821	1,249,821
1979	155,970	779,316	40,217			328	975,831	975,831
1980	167,705	928,609	139,106			483	1,235,903	1,235,903
1981	117,629	1,006,938	272,763			612	1,397,942	1,397,942
1982	117,413	461,403	255,610			780	835,206	835,206
1983	149,180	744,879	250,590			998	1,145,647	1,145,647
1984	166,630	588,597	277,443			585	1,033,255	1,033,255
1985	157,744	516,997	417,016			1,267	1,093,024	1,093,024
1986	182,337	721,469	467,381			895	1,372,082	1,372,082
1987	170,678	442,238	180,303	4,262		846	798,327	827,995
1988	196,599	1,148,650	468,032	2,225	3,587	1,037	1,820,130	1,851,360
1989	167,155	955,806 [f]	496,934	1,891	10,605	2,132	1,634,523	1,636,864
1990	115,609	302,625	214,552	1,827	8,263	472	643,348	643,348
1991	118,540	349,113 [f]	308,989		3,934	1,037	781,613	781,613
1992	125,497	332,313 [f]	211,264		1,967	1,308	672,349	689,044
1993	104,776	96,522	43,594	674	1,869	564	247,999	268,797
1994	109,904	80,284	178,457		3,212	350	372,207	387,110
1995	118,723	259,774	558,640	780	6,073	1,174	945,164	962,524
1996	102,503	147,127	535,106	905	7,309	1,946	794,896	817,131

-continued-

Appendix B3.–Page 2 of 3.

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales	Sport Fish	Yukon River Total	Yukon Area Total [e]
1997	97,109	95,242	133,010	391	2,590	662	329,004	344,715
1998	86,004	28,611	187	84	3,019	421	118,326	119,688
1999	70,323	29,389	24	382	836	555	101,509	114,970
2000	64,895	6,624	0	30	648	161	72,358	85,535
2001	58,239	- [g]	0	146	0	82	58,467	72,383
2002	72,260	13,558	19	175	218	384	86,614	101,410
2003	68,304	10,685	0	148	119	1,638	80,894	94,862
2004	69,672	26,410	0	231	217	203	96,733	104,995
2005	78,902	41,264	0	152	134	435	120,887	135,244
2006	90,907	92,116	0	262	456	583	184,324	208,495
2007	76,805	198,201	0	184	10	245	275,445	291,566
2008	68,394	151,186	0	138	80	371	220,169	238,289
2009	67,742	170,272	0	308	0	174	238,496	251,293
2010	65,948	232,888	0	319	0	1,183	300,338	322,763
2011	77,715	275,161	0	439	0	294	353,609	371,914
2012	103,751	319,575	0	321	2,412	271	426,330	446,376
2013	91,979 [h]	485,587	0	138	2,304	1,423	581,431	604,566
2014	67,596 [h]	530,644	0	235 [h]	0	374	598,849	618,153
2015	63,099 [h]	358,856	0	220 [h]	2,494 [i]	194	424,863	445,331
2016	75,575 [h]	525,809	0	176 [h]	380	511 [j]	602,451	614,295
Averages								
1970–2015	120,624	379,453	144,079	649	2,227	698	613,164	623,215
2006–2015	77,394	281,449	0	256	776	511	360,385	380,194
2011–2015	80,828	393,965	0	271	1,442	511	477,016	497,907
Minimum-15	58,239	6,624	0	30	0	82	58,467	72,383
Maximum-15	227,811	1,148,650	558,640	4,262	10,605	2,132	1,820,130	1,851,360

-continued-

Note: Minimum and maximum indicate lowest and highest values through 2015.

[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 and the carcasses from subsistence caught fish. These data are only available since 1990. In JTC reports prior to 2009 subsistence plus commercial related harvests are noted as subsistence "use".

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

[e] Yukon Area Total includes subsistence harvest from the Coastal District communities of Hooper Bay and Scammon Bay (1978, 1987–1989 and 1992 to present).

[f] Includes illegal sales of summer chum salmon.

[g] Summer season commercial fishery was not conducted.

[h] Data are preliminary.

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

[j] Data are unavailable at this time. Estimated based on the previous 5-year average.

Appendix B4.–Alaska harvest of Yukon River fall chum salmon, 1961–2016.

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales [e]	Yukon River Total	Yukon Area Total [f]
1961	101,772 [g, h]	42,461	0			144,233	144,233
1962	87,285 [g, h]	53,116	0			140,401	140,401
1963	99,031 [g, h]		0			99,031	99,031
1964	120,360 [g, h]	8,347	0			128,707	128,707
1965	112,283 [g, h]	23,317	0			135,600	135,600
1966	51,503 [g, h]	71,045	0			122,548	122,548
1967	68,744 [g, h]	38,274	0			107,018	107,018
1968	44,627 [g, h]	52,925	0			97,552	97,552
1969	52,063 [g, h]	131,310	0			183,373	183,373
1970	55,501 [g, h]	209,595	0			265,096	265,096
1971	57,162 [g, h]	189,594	0			246,756	246,756
1972	36,002 [g, h]	152,176	0			188,178	188,178
1973	53,670 [g, h]	232,090	0			285,760	285,760
1974	93,776 [g, h]	289,776	0			383,552	383,552
1975	86,591 [g, h]	275,009	0			361,600	361,600
1976	72,327 [g, h]	156,390	0			228,717	228,717
1977	82,771 [h]	257,986	0			340,757	340,757
1978	84,239 [h]	236,383	10,628			331,250	331,915
1979	214,881	359,946	18,466			593,293	593,293
1980	167,637	293,430	5,020			466,087	466,087
1981	177,240	466,451	11,285			654,976	654,976
1982	132,092	224,187	805			357,084	357,084
1983	187,864	302,598	5,064			495,526	495,526
1984	172,495	208,232	2,328			383,055	383,055
1985	203,947	267,744	2,525			474,216	474,216
1986	163,466	139,442	577			303,485	303,485
1987	342,597 [i]	[j]		19,066		361,663	361,885

-continued-

Appendix B4.–Page 2 of 3.

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales [e]	Yukon River Total	Yukon Area Total [f]
1988	151,586	133,763	3,227	3881	27,663	320,120	322,382
1989	211,147	270,195	14,749	5082	20,973	522,146	522,302
1990	167,900	124,174	12,168	5176	9,224	318,642	318,642
1991	145,524	230,852	23,366	0	3,936	403,678	403,678
1992	107,602	15,721 [k]	3,301	0	1,407	128,031	128,237
1993	76,762	[j]		163	0	76,925	77,045
1994	123,218	3,631	4,368	0	0	131,217	131,564
1995	130,506	250,766	32,324	863	1,121	415,580	415,934
1996	128,866	88,342	17,288	356	1,717	236,569	236,961
1997	95,141	56,713	1,474	284	867	154,479	154,479
1998	62,867	[j]		2	0	62,869	62,903
1999	89,736	20,371	0	261	1,171	111,539	111,743
2000	19,306	[j]		1	0	19,307	19,396
2001	35,144	[j]		10	0	35,154	35,713
2002	19,390	[j]		3	0	19,393	19,677
2003	56,784	10,996	0	394	0	68,174	68,320
2004	62,206	4,110	0	230	0	66,546	66,866
2005	91,464	180,249	0	133	0	271,846	271,916
2006	83,815	174,542	0	333	0	258,690	258,877
2007	100,987	90,677	0	173	0	191,837	192,071
2008	88,971	119,265	0	181	0	208,417	208,803
2009	65,961	25,269	0	78	0	91,308	91,466
2010	68,459	2,550	0	3,209	0	74,218	74,404
2011	79,887	238,979	0	347	0	319,213	319,528
2012	99,298	289,692	0	410	166	389,566	389,577
2013	113,235	238,051	0	383	121	351,790	351,939
2014	91,977 [l]	115,599	0	278 [l]	30	207,884	208,136

-continued-

Year	Subsistence [a]		Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales [e]	Yukon River Total	Yukon Area Total [f]
2015	86,533	[l]	191,470	0	80	50	278,133	278,331
2016	83,306	[l]	465,396	0	283	668	549,653	550,415
Averages								
1961–2015	105,022		157,467	3,448	1,427	2,448	247,518	247,672
2006–2015	87,912		148,670	0	547	37	237,166	237,374
2011–2015	94,186		214,758	0	300	73	309,317	309,502
Minimum-15	19,306		2,550	0	0	0	19,307	19,396
Maximum-15	342,597		466,451	32,324	19,066	27,663	654,976	654,976

Note: Minimum and maximum indicate year with the lowest and highest values through 2015.

[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 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 the 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] Yukon Area Total includes subsistence harvest from the Coastal District communities of Scammon Bay and Hooper Bay (1978, 1987–1989 and 1992 to present).

[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 95,768 and 119,168 fall chum 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.

Appendix B5.–Alaska harvest of Yukon River coho salmon, 1961–2016.

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales [e]	Sport Fish [f]	Yukon River Total	Yukon Area Total [g]
1961	9,192 [h, i]	2,855	0				12,047	12,047
1962	9,480 [h, i]	22,926	0				32,406	32,406
1963	27,699 [h, i]	5,572	0				33,271	33,271
1964	12,187 [h, i]	2,446	0				14,633	14,633
1965	11,789 [h, i]	350	0				12,139	12,139
1966	13,192 [h, i]	19,254	0				32,446	32,446
1967	17,164 [h, i]	11,047	0				28,211	28,211
1968	11,613 [h, i]	13,303	0				24,916	24,916
1969	7,776 [h, i]	15,093	0				22,869	22,869
1970	3,966 [h, i]	13,188	0				17,154	17,154
1971	16,912 [h, i]	12,203	0				29,115	29,115
1972	7,532 [h, i]	22,233	0				29,765	29,765
1973	10,236 [h, i]	36,641	0				46,877	46,877
1974	11,646 [h, i]	16,777	0				28,423	28,423
1975	20,708 [h, i]	2,546	0				23,254	23,254
1976	5,241 [h, i]	5,184	0				10,425	10,425
1977	16,333 [i]	38,863	0			112	55,308	55,308
1978	7,787 [i]	26,152	0			302	34,241	34,330
1979	9,794	17,165	0			50	27,009	27,009
1980	20,158	8,745	0			67	28,970	28,970
1981	21,228	23,680	0			45	44,953	44,953
1982	35,894	37,176	0			97	73,167	73,167
1983	23,905	13,320	0			199	37,424	37,424
1984	49,020	81,940	0			831	131,791	131,791
1985	32,264	57,672	0			808	90,744	90,744
1986	34,468	47,255	0			1,535	83,258	83,258
1987	82,371 [j]	[k]		2,523		1,292	86,186	86,186

-continued-

Appendix B5.–Page 2 of 3.

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales [e]	Sport Fish [f]	Yukon River Total	Yukon Area Total [g]
1988	67,830	99,907	0	1,250	13,720	2,420	185,127	186,976
1989	40,711	85,493	0	872	3,945	1,811	132,832	133,045
1990	43,460	41,032	3,255	1,181	2,650	1,947	93,525	93,525
1991	37,388	103,180	3,506	0	2,971	2,775	149,820	149,820
1992	51,921	6,556 [l]	1,423	0	1,629	1,666	63,195	63,254
1993	15,772	[k]		0	0	897	16,669	16,709
1994	41,694	120	4,331	0	0	2,174	48,319	48,400
1995	28,225	45,939	1,074	417	193	1,278	77,126	77,278
1996	30,312	52,643	3,339	198	1,728	1,588	89,808	89,900
1997	23,945	35,320	0	350	498	1,470	61,583	61,583
1998	17,772	1	0	9	0	758	18,540	18,889
1999	20,823	1,601	0	147	236	609	23,416	23,484
2000	14,717	[k]		0	0	554	15,271	15,493
2001	21,620	[k]		34	0	1,248	22,902	23,404
2002	15,241	[k]		20	0	1,092	16,353	16,601
2003	23,580	25,243	0	549	0	1,477	50,849	51,141
2004	20,732	20,232	0	233	0	1,623	42,820	42,883
2005	26,971	58,311	0	107	0	627	86,016	86,295
2006	19,371	64,942	0	279	0	1,000	85,592	85,927
2007	19,514	44,575	0	135	0	597	64,821	64,931
2008	16,739	35,691	0	50	0	341	52,821	52,937
2009	15,760	8,026	0	70	0	964	24,820	25,066
2010	12,921	3,750	0	1,062	0	944	18,677	18,801
2011	12,289	76,303	0	232	0	463	89,287	89,342
2012	21,440	74,789	0	100	39	131	96,499	96,592
2013	14,170	66,199	0	109	1	266	80,745	81,032
2014	17,348 [m]	104,692	0	175 [m]	0	1,855	124,070	124,274

-continued-

Year	Subsistence [a]	Commercial [b]	Commercial Related [c]	Personal Use [d]	Test Fish Sales [e]	Sport Fish [f]	Yukon River Total	Yukon Area Total [g]
2015	17,914 [m]	129,700	0	145 [m]	8	593	148,360	148,534
2016	8,460 [m]	201,482	0	266 [m]	11	662 [n]	210,881	211,236
Averages								
1961–2015	22,541	34,762	339	353	986	987	55,839	55,954
2006–2015	16,747	60,895	0	236	5	715	78,598	78,772
2011–2015	16,632	90,337	0	152	10	662	107,792	107,955
Minimum-15	3,966	1	0	0	0	45	10,425	10,425
Maximum-15	82,371	129,700	4,331	2,523	13,720	2,775	185,127	186,976

Note: Minimum and maximum indicate year with the lowest and highest values through 2015.

[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 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 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] Yukon Area Total includes subsistence harvest from the Coastal District communities of Scammon Bay and Hooper Bay (1978, 1988–1989 and 1992 to present).

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

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

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

[k] Commercial fishery was not conducted.

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

[m] Data are preliminary.

[n] Data are unavailable at this time. Estimate based on the previous 5-year average.

Appendix B6.–Alaska and Canadian total utilization of Yukon River Chinook and fall chum salmon, 1961–2016.

	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	129,988	135,869	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	361,663 [d]	406,143
1988	21,427	148,421	169,848	33,565	320,120	353,685
1989	17,944	157,616	175,560	23,020	522,146	545,166
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	168,191	186,094	20,815	128,031 [e]	148,846
1993	16,611	160,289	176,900	14,090	76,925 [d]	91,015
1994	21,198	170,829	192,027	38,008	131,217	169,225
1995	20,884	177,663	198,547	45,600	415,580	461,180
1996	19,612	139,284	158,896	24,354	236,569	260,923
1997	16,528	174,886	191,414	15,600	154,479	170,079
1998	5,937	99,369	105,306	7,954	62,869	70,823
1999	12,468	124,316	136,784	19,636	111,539	131,175

-continued-

	Chinook Salmon			Fall Chum Salmon		
Year	Canada [a]	Alaska [b, c]	Total	Canada [a]	Alaska [b, c]	Total
2000	4,879	45,304	50,183	9,246	19,307 [d]	28,553
2001	10,144	53,738 [f]	63,882	9,872	35,154 [d]	45,026
2002	9,258	68,118	77,376	8,092	19,393 [d]	27,485
2003	9,619	99,150	108,769	10,905	68,174	79,079
2004	11,238	112,332	123,570	9,750	66,546	76,296
2005	11,371	85,521	96,892	18,572	271,933	290,505
2006	9,072	95,184	104,256	11,796	258,690	270,486
2007	5,094	89,555	94,649	13,830	191,837	205,667
2008	3,713	48,870	52,583	9,566	208,417	217,983
2009	4,758	34,206	38,964	2,011	91,915	93,926
2010	2,706	53,792	56,498	5,787	74,218	80,005
2011	4,884	40,856	45,740	8,163	319,213	327,376
2012	2,200	28,727 [f]	30,927	7,023	389,566	396,589
2013	2,146	11,199 [f]	13,345	6,170	351,790	357,960
2014 [g]	103	2,724 [f]	2,827	5,033	207,884	212,917
2015 [g]	1,204	6,608 [f]	7,812	4,453	278,133	282,586
2016 [g]	2,946	20,910 [f]	23,856	5,750	549,653	555,403
Averages						
1961–2015	10,601	115,941	126,541	16,567	247,518	264,085
2006–2015	3,588	41,172	44,760	7,383	237,166	244,550
2011–2015	2,107	18,023	20,130	6,168	309,317	315,486
Minimum-15	103	2,724	2,827	2,011	19,307	27,485
Maximum-15	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 2015. Canadian managers sometimes do not refer to chum as fall chum salmon since they only have 1 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. Does not include the subsistence harvest from the Coastal District communities of Hooper Bay and Scammon Bay.

[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 catch of Yukon River Chinook salmon, 1961–2016.

	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

-continued-

Appendix B7.–Page 2 of 3.

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	1,902	242	2,144
2014	-	-	100	-	-	100	100	3	103
2015	-	-	1,000	-	-	1,000	1,000	204	1,204
2016	1	-	2,768	-	-	2,768	2,769	177	2,946
Averages									
1961–2015	5,717 [f]	393	5,077	342	608	5,582	10,363	251	10,601
2006–2015	1,348 [f]	40	2,862	155	565	3,060	3,330	258	3,588
2011–2015	-	-	1,910	40	-	1,918	1,920	188	2,107
Minimum-15	1	17	100	1	167	100	100	3	103
Maximum-15	13,217	3,500	9,300	1,230	1,036	11,346	21,327	2,000	22,846

-continued-

Note: Minimum and maximum indicate year with the lowest and highest values through 2015. Dash means 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 catch of Yukon River fall chum salmon, 1961–2016.

	Mainstem Yukon River Harvest						Porcupine River Aboriginal Fishery	Total Canadian
Year	Commercial	Domestic	Aboriginal Fishery	Test Fishery	Combined Non-Commercial [a]	Total [a]	Harvest	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

-continued-

Appendix B8.–Page 2 of 2.

	Mainstem Yukon River Harvest						Porcupine River Aboriginal Fishery	Total Canadian
Year	Commercial	Domestic	Aboriginal Fishery	Test Fishery	Combined Non-Commercial [a]	Total [a]	Harvest	Harvest
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
Averages								
1961–2015	9,899	453	2,301	1,468	2,597	12,316	4,330	16,567
2006–2015	3,498	7	1,290	3,765	1,297	4,795	2,588	7,383
2011–2015	3,447	14	749	na	764	4,210	1,958	6,168
Minimum-15	293	0	100	1	0	1,113	135	2,011
Maximum-15	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 2015. Dash, "-", means fishery did not occur.

[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 Alaska portion of the Yukon River drainage, 1961–2016.

	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]

-continued-

Appendix B9.–Page 2 of 2.

Year	Andreafsky River		Anvik River		Nulato River			Gisasa River
	East Fork	West Fork	Drainagewide Total	Index Area [a]	North Fork [b]	South Fork	Both Forks	
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]
SEG [g]	[h]	640-1,600	1,100-1,700				940-1,900	[i]
Averages								
1961–2015	1,324	1,134	1,208	1,094	796	580	1,327	718
2006–2015	935	1,014	1,272	955	871	655	1,469	546
2011–2015	1,409	1,109	1,301	827	764	601	1,364	555
Minimum-15	84	213	222	212	55	23	78	45
Maximum-15	5,855	3,281	3,979	3,304	1,928	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 2015.

[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 Alaska portion of the Yukon River drainage, 1986–2016.

	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	28.6 [b]						9,065 [c]	25.4		
1987	2,011	52.3 [b]						6,404 [c]	48.2	4,771 [c]	52.0
1988	1,341	39.8 [b]						3,346 [c]	33.9	4,322 [c]	45.3
1989								2,730 [c]	45.3	3,294 [c]	43.8
1990		41.2						5,603 [c]	36.3	10,728 [c]	36.2
1991		28.4						3,172 [c]	31.5	5,608 [c]	40.7
1992		24.0						5,580 [c]	21.6	7,862 [c]	36.0
1993		29.9						12,241	11.7	10,008	23.9
1994	7,801	35.5	1,795			2,888		11,877	32.4	18,404	38.8
1995	5,841	42.2	1,412			4,023	46.0	11,394 [c]	51.7	13,643	48.4
1996	2,955	38.5	756			1,991	19.5	7,153 [c]	26.8	7,570 [c]	26.2
1997	3,186	36.8	4,766			3,764	26.0	13,390	25.6	18,514	41.8
1998	4,034	28.8	1,536			2,414	16.2	4,745	28.4	5,027	26.1
1999	3,444	28.6	1,932			2,644	26.3	6,485	45.6	9,198	44.6
2000	1,609	32.3	908	193	29.7	2,089	33.8	4,694 [c]	21.7	4,595	34.3
2001	1,148	63.7		1,091	36.3	3,052	49.2	9,696	30.1	13,328	32.1
2002	4,123	21.1 [d]	2,696	649	30.8	2,025	20.7	6,967 [c]	27.3	9,000 [e]	29.8
2003	4,336	47.7	1,716 [f]	748	39.1	1,901	38.1	11,100	31.8	15,500 [e]	36.6
2004	8,045	34.8		1,248	23.2	1,774	33.5	9,645	43.9	15,761	54.2
2005	2,239	49.9		1,059	41.7	3,111	36.2	[d]	30.6	5,988	47.5

-continued-

Appendix B10.–Page 2 of 3.

	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.	No. Fish	% Fem.
2006	6,463	43.6			[d]	3,031	29.4	2,936	32.1	10,679	38.1
2007	4,504	44.5		740	42.6	1,427	41.1	3,806	27.3	6,425	31.0
2008	4,242	38.9		766	26.9	1,738	15.2	3,208	29.0	5,415 [e]	33.7
2009	3,004	47.2		1,637	53.7	1,955	28.0	5,253	40.0	12,774	33.9
2010	2,413	47.8		857	48.8	1,516	29.9	2,382	20.6	6,135	26.6
2011	5,213	19.3		1,796	33.6	2,692	18.8	[d]	22.7	7,200 [e]	42.1
2012	2,517	27.4		922	42.9	1,323	38.7	2,220 [g]	39.1	7,165	50.9
2013	1,998	39.4		772	46.7	1,126	34.3	1,859 [d]	40.3	5,465	50.5
2014	5,949	47.9			[d]	1,589	19.2	7,192 [h]	33.1	[d]	32.0
2015	5,474	39.7		2,391	41.4	1,319	29.6	6,291	39.0	6,879 [j]	37.0
2016 [i]	2,676	49.7		1,354	47.5	1,395	27.2	6,665 [k]	22.8	2,675 [k]	38.8
SEG [l]	2,100–4,900										
BEG [m]								2,800–5,700		3,300–6,500	
Averages											
1986–2015	3,817	37.9	1,946	1,062	38.2	2,245	30.0	6,444	32.2	8,974	38.5
2006–2015	4,178	39.6	-	1,235	42.1	1,772	29.1	3,905	31.5	7,571	38.6
2011–2015	4,230	34.7	-	1,470	43.0	1,610	28.2	4,391	31.2	6,677	40.4
Minimum-15	1,148	19	756	193	23	1,126	15	1,859	12	3,294	24
Maximum-15	8,045	64	4,766	2,391	54	4,023	49	13,390	52	18,514	54

Note: Minimum and maximum indicate year with the lowest and highest values through 2015. No. = number; Fem. = female.

[a] Past mark–recapture experiments utilizing electrofishing techniques for the first event have shown that carcass (second event) surveys tend to be biased with respect to sex and length. Therefore, an adjustment factor is 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] Preliminary.

[j] Final estimate uses a binomial mixed-effects model to create passage estimates for the period of missed counts prior to start of tower operations on July 12.

[k] Sustainable Escapement Goal (SEG).

[l] Biological Escapement Goal (BEG).

Appendix B11.–Chinook salmon estimated U.S.-Canada border passage, total Canadian harvest, and spawning escapement in Canada, 1982–2016.

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

-continued-

Year	Historic mark-recapture border passage estimate [a]	Eagle sonar estimate	U.S. harvest above Eagle sonar	Canadian mainstem border passage estimate		Canadian mainstem harvest	Spawning escapement estimate [b]
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
Averages							
1982–2015	40,136			60,298		11,874	48,423
2006–2015	NA			51,565		3,330	48,235
2011–2015	NA			52,647		1,920	50,727
Minimum-15	14,666			30,573		100	25,870
Maximum-15	56,929			93,606		21,327	82,674

Note: Minimum and maximum indicate year with the lowest and highest values through 2015.

[a] From 1982 to 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 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 to 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 portion of the Yukon River drainage, 1961–2016.

Year	Tatchun Creek [a]	Blind Creek Weir	Chandindu River Weir	Big Salmon Sonar	Klondike River Sonar	Teslin River Sonar	Porcupine River Sonar	Whitehorse Fishway Count	Whitehorse Fishway 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

-continued-

Appendix B12.–Page 2 of 3.

Year	Tatchun Creek [a]	Blind Creek Weir	Chandindu River Weir	Big Salmon Sonar	Klondike River Sonar	Teslin River Sonar	Porcupine 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		5,584				2,632	57
2006		677		7,308				1,720	47
2007		304		4,504				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		10,071		20,410	4,623	1,465	60
2016 [j]		664		6,691			6,457	1,556	42
Averages									
1961–2015	235	581	138	5,380	2,377	12,807	3,787 [k]	963	28
2006–2015	-	464	-	5,359	2,377	12,807	3,787 [k]	1,082	57
2011–2015	-	479	-	5,475	1,181	12,807	3,787 [k]	1,354	62
Minimum-15	7	157	4	1,329	803	3,396	[l]	121	0
Maximum-15	1,198	1,115	239	10,071	5,147	20,410		2,958	95

-continued-

Note: Minimum and maximum indicate year with the lowest and highest values through 2015.

[a] All foot surveys prior to 1997 except 1978 (boat survey) and 1986 (aerial survey) and weir counts from 1997 to 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 to 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] Data are preliminary.

Appendix B13.–Summer chum salmon escapement counts for selected spawning areas in the Alaska portion of the Yukon River drainage, 1973–2016.

	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	35,535	-	455,876	-		4,094	7,163	
1988	43,056	68,937	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, f]	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 [i]
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

-continued-

Appendix B13.–Page 2 of 5.

	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	-	-	-	-	-
GOAL [h]		>40,000			350,000-700,000					
Average										
1973–2015	42,983	76,354	54,137	396,500	603,501	12,018	26,176	11,468	21,698	96,519
2006–2015	6,425	61,581	11,038	36,871	450,799	6,481	-	10,392	9,495	-
2011–2015	9,953	60,998	7,514	36,871	495,852	8,434	-	11,963	11,549	-
Minimum–15	736	2,134	617	36,871	193,098	621	3,056	1,263	567	19,590
Maximum–15	223,485	200,981	238,565	900,967	1,479,582	38,258	77,193	51,215	87,280	236,890

-continued-

Appendix B13.–Page 3 of 5.

	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

-continued-

Appendix B13.–Page 4 of 5.

Year	Henshaw Creek	Gisasa River		Hogatza River			Tozitna River	Chena River		Salcha River	
				Clear & Caribou Cr.	Clear Creek		Weir and				
	Weir	Aerial [b]	Weir	Aerial [b]	Tower		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
2016	286,780	-	66,670	-	-		-	-	6,493 [g]	-	2,897 [g]
GOAL											
Average											
1973–2015	135,514	9,504	66,428	10,473	32,710		6,568	908	9,722	3,004	42,924
2006–2015	183,419	7,394	75,262	7,518	17,598		11,844	253	12,851	39	41,008
2011–2015	265,967	9,376	66,909	10,922	-		11,198	-	12,544	-	46,652
Minimum–15	21,400	334	10,155	120	212		7	2	573	0	2,213
Maximum–15	292,082	56,904	261,306	28,141	116,735		39,700	4,349	35,109	9,810	194,933

-continued-

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 2015.

[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 to present. The project did not operate in 1985 and 1989–1993.

[d] From 1972 to 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 (Andreafsky) or Sustainable (Anvik) Escapement Goal

[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 Alaska portions of the Yukon River drainage, 1971–2016.

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

-continued-

		Tanana River Drainage					Upper Yukon River Drainage		
Year	Yukon River Mainstem Sonar Estimate	Toklat River [a]	Kantishna River Abundance Estimate [b]	Delta River [c]	Bluff Cabin Slough [d]	Upper Tanana River Abundance Estimate [e]	Rampart-Rapids Mark-Recapture Estimate	Chandalar River [f]	Sheenjek River [g]
1996	[p]	18,264		19,758	7,074 [c]	134,563	654,296	230,450	246,889
1997	579,767	14,511		7,705	5,707 [c]	71,661	369,547	211,914	80,423 [q]
1998	375,222	15,605		7,804	3,549 [c]	62,014	194,963	83,899	33,058
1999	451,505	4,551	27,199	16,534	7,559 [c]	97,843	189,741	92,685	14,229
2000	273,206	8,911	21,450	3,001	1,595	34,844	[p]	71,048	30,084 [r]
2001	408,961	6,007 [s]	22,992	8,103	1,808 [k]	96,556 [t]	201,766	112,664	53,932
2002	367,886	28,519	56,665	11,992	3,116	109,961	196,186	94,472	31,642
2003	923,540	21,492	87,359	22,582	10,600 [k]	193,418	485,102	221,343	44,047 [u]
2004	633,368	35,480	76,163	25,073	10,270 [k]	123,879	618,597 [v]	169,848	37,878
2005	1,894,078	17,779 [j]	107,719	28,132	11,964 [k]	337,755	1,987,982	526,838	561,863 [m]
2006	964,238		71,135	14,055		202,669		254,778	160,178 [m]
2007	740,195		81,843	18,610		320,811		243,805	65,435 [m]
2008	636,525			23,055	1,198 [k]			178,278	50,353 [m]
2009	[p]			13,492	2,900 [k]			[q]	54,126 [m]
2010	458,103			17,993	1,610 [k]			167,532	22,053
2011	873,877			23,639	2,655 [k]			298,223	97,976 [m]
2012	778,158			9,377 [d]				205,791	104,701 [m]
2013	865,295	9,161 [k]		31,955	5,554 [k]			252,710	
2014	706,630			32,480 [d]	4,095 [k]			226,489	
2015	669,483	8,422 [k]		33,401 [d]	6,020 [k]			164,486 [w]	
2016	994,760 [w]	16,885 [k]		21,913 [d]	4,936 [k]			295,023 [w]	
Escapement [x]	300,000 [y]	15,000 [z]		6,000		46,000 [aa]	212,000 [ab]	74,000	50,000 [ac]
Objective	600,000	33,000		13,000		103,000	441,000	152,000	104,000

-continued-

Year	Yukon River Mainstem Sonar Estimate	Tanana River Drainage: Toklat River [a]	Tanana River Drainage: Kantishna River Abundance Estimate [b]	Tanana River Drainage: Delta River [c]	Tanana River Drainage: Bluff Cabin Slough [d]	Tanana River Drainage: Upper Tanana River Abundance Estimate [e]	Upper Yukon River Drainage: Rampart-Rapids Mark-Recapture Estimate	Upper Yukon River Drainage: Chandalar River [f]	Upper Yukon River Drainage: Sheenjek River [g]
Averages									
1971-2015	724,017	29,922	61,392	15,669	5,442	158,011	544,242	176,959	97,856
2006-2015	743,612	-	76,489	21,806	3,433	261,740	-	221,344	79,260
2011-2015	778,689	-	-	26,170	4,581	-	-	229,540	101,339
Minimum-15	273,206	3,624	21,450	3,001	1,156	34,844	189,741	33,619	14,229
Maximum-15	1,894,078	158,336	107,719	33,401	19,460	337,755	1,987,982	526,838	561,863

Note: Minimum and maximum indicate year with the lowest and highest values through 2015.

[a] 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.

[b] 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.

[c] Population estimates generated from replicate foot surveys (area under the curve method), unless otherwise indicated.

[d] Peak foot survey, unless otherwise indicated.

[e] 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.

[f] Single-beam sonar estimate for 1986 to 1990 (not used in run reconstruction), split-beam sonar estimate 1995 to 2006, DIDSON in 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 to present.

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

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

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

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

[k] Aerial survey count, unless otherwise indicated.

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

[m] Sonar counts include both bank operations in 1985 to1987, 2005 to 2009, and 2011 to 2012.

-continued-

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

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

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

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

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

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

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

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

[v] Mark–recapture estimate for 2004 was 618,579 fall chum salmon (SE 60,714 notably high).

[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 to 136,000. However it includes the Toklat River plus the Upper Tanana River which was broke out here for comparison to the upper Tanana River abundance estimates.

[ab] Includes that portion of the Yukon River upstream of Rampart Rapids therefore the sum of BEG's for Chandalar, Sheenjek, Fishing Branch rivers and Mainstem Yukon River in Canada escapements based on Eggers (2001) and is not an established BEG.

[ac] The BEG is based on estimates of Sheenjek escapements from 1974 to 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 portions of the Yukon River drainage, 1971–2016.

	Porcupine Drainage		Mainstem							
Year	Fishing Branch River	[a]	Porcupine River Sonar	Yukon River Index	[b,c]	Koidern River	[b]	Kluane River	[b, d]	Teslin River	[b, e]
1971	312,800	[f]									
1972	35,230	[g]						198	[g,h]		
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]									

-continued-

Appendix B15.–Page 2 of 2.

Year	Porcupine Drainage: Fishing Branch River [a]	Porcupine Drainage: Porcupine River Sonar	Mainstem Yukon River Index [b,c]	Koidern River [b]	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 [p]	29,397	54,395				
Goal [s]	50,000-120,000					
IMEG [t]	22,000-49,000					
Averages						
1971-2015	48,719	24,923	4,480	223	8,982	317
2006-2015	19,995	24,923	6,553	-	18,208	620
2011-2015	15,303	24,923	-	-	-	-
Minimum-15	5,057	17,756	383	0	0	5
Maximum-15	353,282	35,615	16,425	1,300	39,347	739

Note: Minimum and maximum indicate year with the lowest and highest values through 2015.

[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 since 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 2010-2012 based on brood table of Canadian origin mainstem stocks (1982 to 2003).

Appendix B16.–Fall chum salmon passage, expansion, border passage, and escapement estimates based on the mainstem Yukon River projects near the U.S. and Canada border, 1980–2016.

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

-continued-

Appendix B16.–Page 2 or 2.

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]	3,050	109,505
2016 [h]	144,035	161,027	13,015	148,012 [f]	2,745	145,267
Goal [i]						>80,000
IMEG [j]						70,000–104,000
Averages						
1980–2015				124,031	15,743	108,288
2006–2015	170,509	182,275	12,866	169,409	4,710	164,699
2011–2015	168,095	178,475	12,476	165,999	4,041	161,958
Minimum-15	95,462	101,734	6,995	38,769	1,113	22,912
Maximum-15	236,386	265,008	18,691	451,477	44,345	437,498

Note: 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 2015.

[a] Sonar estimates include an expansion for fish that may have passed after operations ceased through October 18.

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

[c] Excludes Fishing Branch River escapement (estimated border passage minus Canadian mainstem harvest).

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

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

[f] 2006 to present border passage estimate is based on sonar minus harvest from Eagle residents upstream of deployment.

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

[h] Data are preliminary.

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

[j] Interim Management Escapement Goal (IMEG) established for 2010-2012 based on brood table of Canadian origin mainstem stocks (1982 to 2003).

Appendix B17.–Coho salmon passage estimates or escapement estimates for selected spawning areas in the Alaska portion of the Yukon River drainage, 1972–2016.

		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)

-continued-

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	194,622	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)

-continued-

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 [k]	334 (h)	1,680 (h)	1,327 (h)	2,746 (h)	6,767 (b)	1,421 (h)	1,350 (h)
SEG [1]						5,200-17,000		
Averages								
1972-2015	164,317	813	938	1,324	1,535	15,787	2,154	1,400
2006-2015	163,866	532	682	594	1,322	10,307	2,075	967
2011-2015	159,952	416	758	708	1,304	8,290	1,353	1,484
Minimum-15	76,174	0	68	55	27	632	229	80
Maximum-15	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, and (u)=undocumented. Minimum and maximum indicate year with the lowest and highest values through 2015.

[a] Passage estimates for coho salmon are incomplete. The sonar project is terminated prior to the end of the coho salmon run.

[b] Index area includes mainstem Nenana River between confluence's 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.–Stock percentage estimates of all samples collected from Chinook salmon migrating across the mainstem U.S./Canada border, Yukon River, 2005–2016, unweighted by sonar passage periods.

Year	Stock Aggregate							
	Upper Yukon Tributaries	Teslin River	Carmacks Tributaries	Mid-Mainstem	Pelly River	Stewart River	North Yukon Tributaries	White River
2005 [a, b]	5.6%	19.2%	24.6%	11.1%	17.5%	9.1%	12.5%	0.5%
2006 [a, b]	6.1%	13.0%	33.0%	10.2%	12.4%	13.4%	10.3%	1.7%
2007 [a, c]	2.4%	19.0%	21.7%	9.2%	20.9%	14.2%	11.5%	1.1%
2008 [a, d]	0.0%	14.7%	20.4%	11.6%	23.9%	13.1%	14.6%	1.7%
2008 [c, d]	1.6%	16.4%	10.8%	33.5%	12.1%	7.2%	8.3%	10.1%
2009 [c, d]	3.3%	25.6%	16.0%	10.5%	16.2%	9.3%	12.7%	6.4%
2010 [c, d]	7.5%	33.0%	13.1%	19.6%	9.3%	7.5%	4.6%	5.4%
2011 [c, d]	4.8%	25.3%	9.6%	22.9%	17.2%	6.0%	8.1%	6.3%
2012 [c, b]	6.4%	37.8%	13.0%	18.8%	9.7%	6.4%	3.6%	4.3%
2013 [c, b]	6.7%	25.6%	18.5%	28.6%	11.5%	5.3%	0.7%	3.2%
2014 [c, d]	4.1%	28.2%	14.3%	23.6%	14.4%	7.4%	3.1%	4.9%
2015 [c, e]	4.6%	25.4%	17.5%	16.0%	18.2%	8.2%	4.4%	5.6%
2016 [c, e]	6.6%	35.0%	16.4%	11.8%	15.3%	8.0%	4.2%	2.7%
Average (2008–2015)[c]	4.9%	27.2%	14.1%	21.7%	13.6%	7.2%	5.7%	5.8%
Minimum (2008–2015)[c]	1.6%	16.4%	9.6%	10.5%	9.3%	5.3%	0.7%	3.2%
Maximum (2008–2015)[c]	7.5%	37.8%	18.5%	33.5%	18.2%	9.3%	12.7%	10.1%

[a] Samples from BioIsland site collected from fish wheels.

[b] Samples were run against the current year's baseline.

[c] Samples collected from the drift gillnet test fishery at the mainstem Yukon River sonar near Eagle may not be comparable to those collected at the fish wheels because of the proportion of Chinook salmon migrating offshore. Average, minimum, and maximum calculated using mainstem Yukon River sonar project test fishery samples only.

[d] Samples were run against the 2011 baseline.

[e] Samples were run against the 2015 baseline.

Appendix B19.–Stock percentage estimates of fall chum salmon migrating across the mainstem U.S./Canada border, Yukon River, 2005–2016,unweighted by sonar passage periods.

	Stock Aggregate			
Year	Mainstem	White	Teslin	Yukon Early
2005 [a]	67.7%	29.8%	0.4%	2.1%
2006 [a]	41.0%	54.9%	3.1%	1.0%
2007 [a]	46.9%	52.1%	0.5%	0.5%
2008 [a]	48.0%	49.9%	2.1%	0.1%
2009 [b]	68.3%	30.6%	1.0%	0.1%
2010 [b]	52.8%	46.3%	0.2%	0.7%
2011 [b]	51.2%	48.0%	0.7%	0.1%
2012 [b]	47.3%	52.6%	0.1%	0.1%
2013 [b]	50.5%	48.9%	0.4%	0.2%
2014 [b]	49.5%	50.1%	0.0%	0.2%
2015 [b]	61.9%	37.2%	0.1%	0.8%
2016 [b,c]	70.0%	29.3%	0.6%	0.0%
Average (2009–2015) [d]	54.5%	44.8%	0.4%	0.3%
Minimum (2009–2015) [d]	47.3%	30.6%	0.0%	0.1%
Maximum (2009–2015) [d]	68.3%	52.6%	1.0%	0.8%

Note: Samples were run against the current year's baseline (ex. 2005 samples were run against the 2005 baseline).

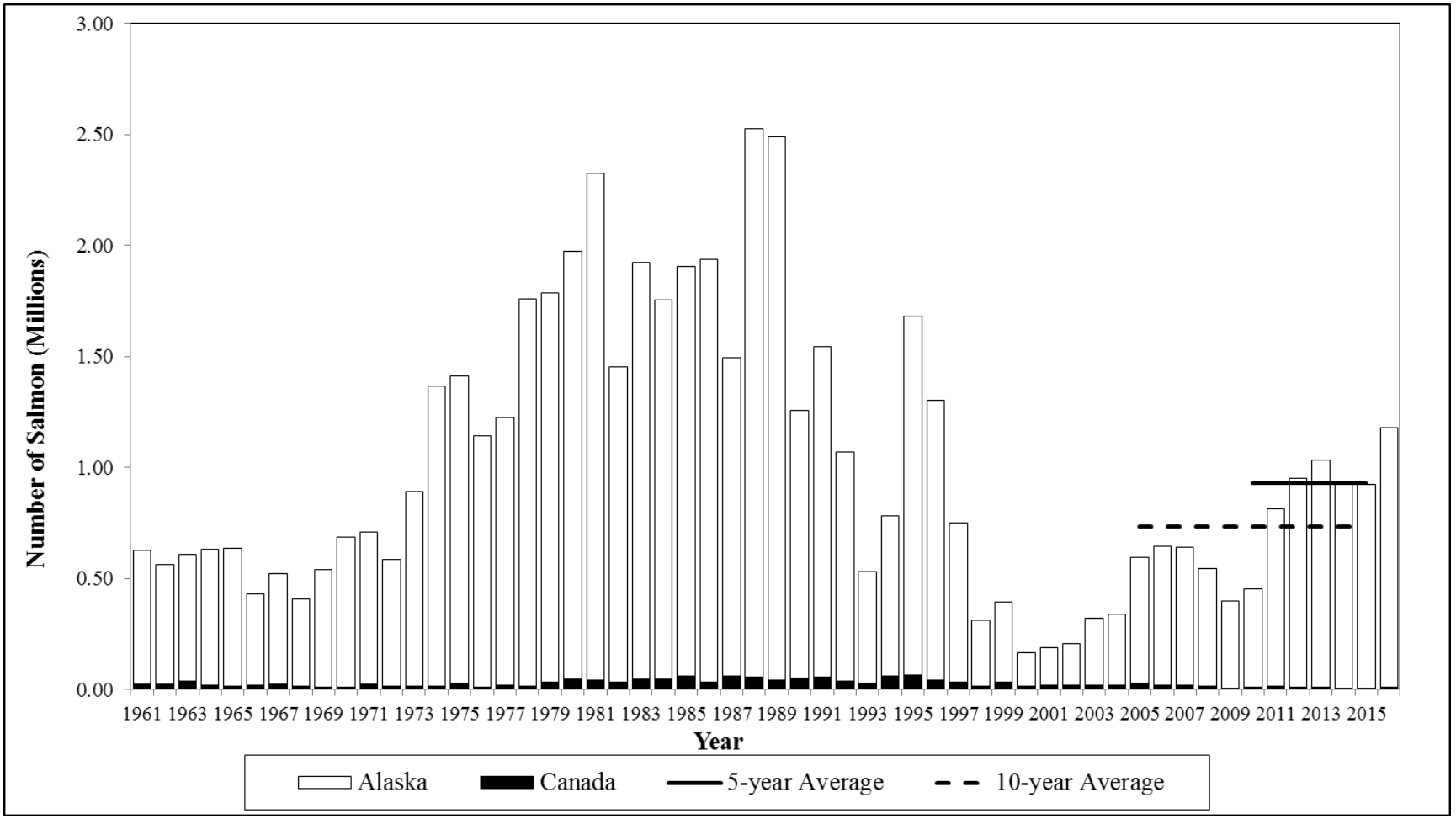
[a] Samples from BioIsland site collected from fish wheels.

[b] Samples from the mainstem Yukon River sonar operated near Eagle collected from the drift test fishery.

[c] Estimates are preliminary for 2016, not based on an aggregate season sample.

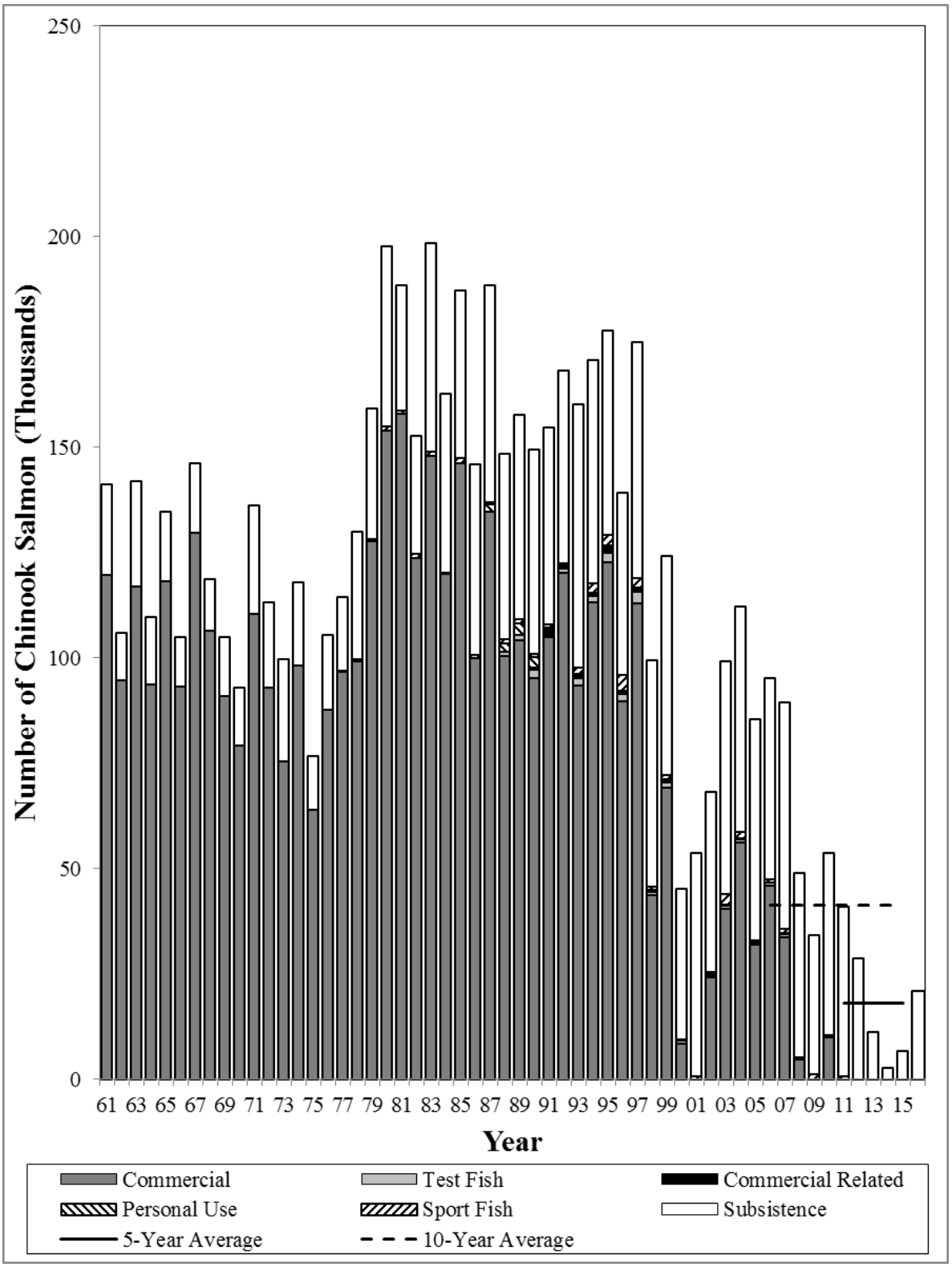
[d] Samples collected from the drift gillnet test fishery at the mainstem Yukon River sonar near Eagle may not be comparable to those collected at the fish wheels. Average, minimum, and maximum were calculated using mainstem Yukon River sonar project test fishery samples only.

APPENDIX C: FIGURES



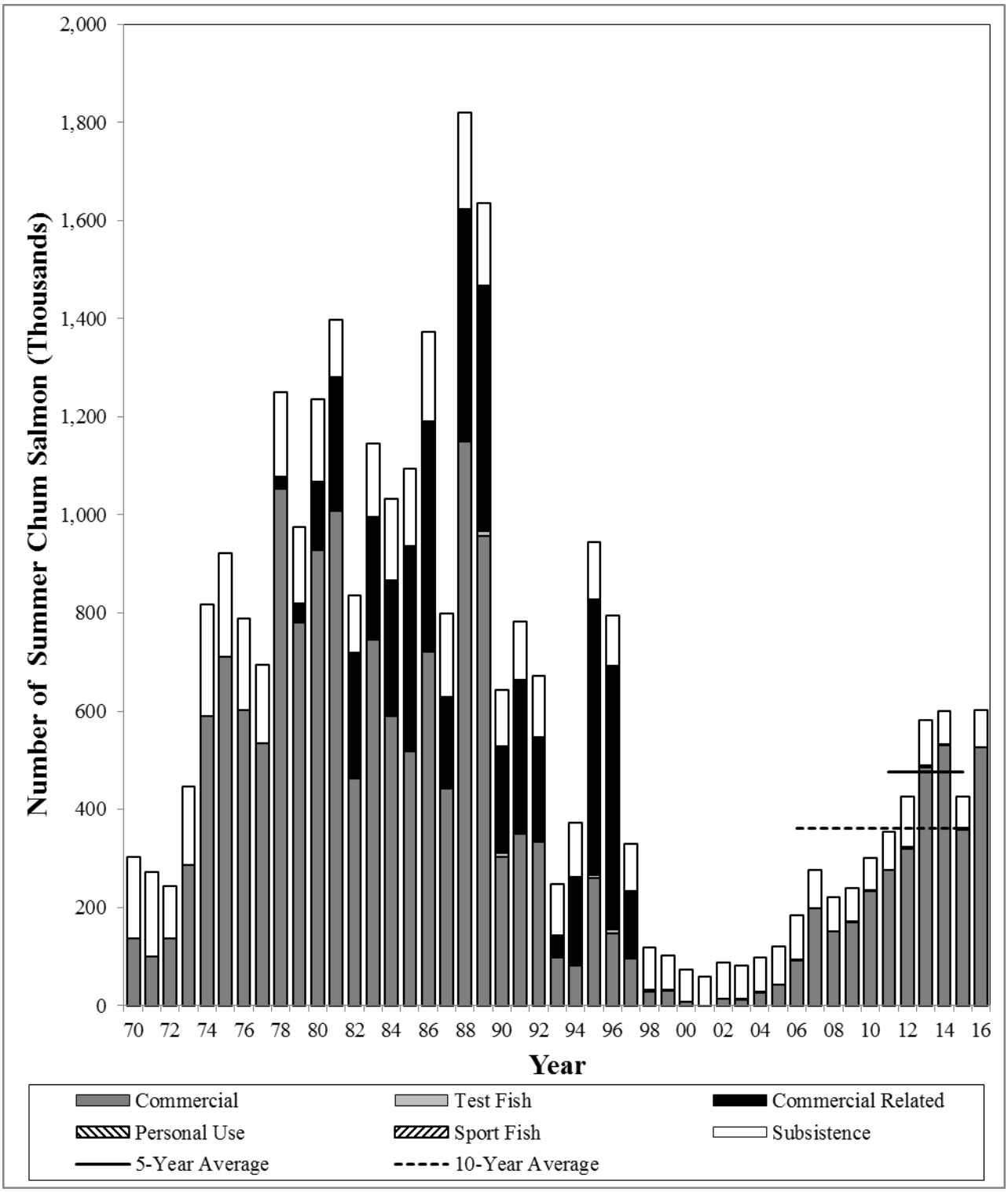
Note: Subsistence harvest estimates of fall chum and coho salmon are minimal prior to 1979 because of timing of harvest surveys. The 2014–2016 harvest estimates are preliminary.

Appendix C1.–Total utilization of Chinook, chum and coho salmon, Yukon River, 1961–2016.



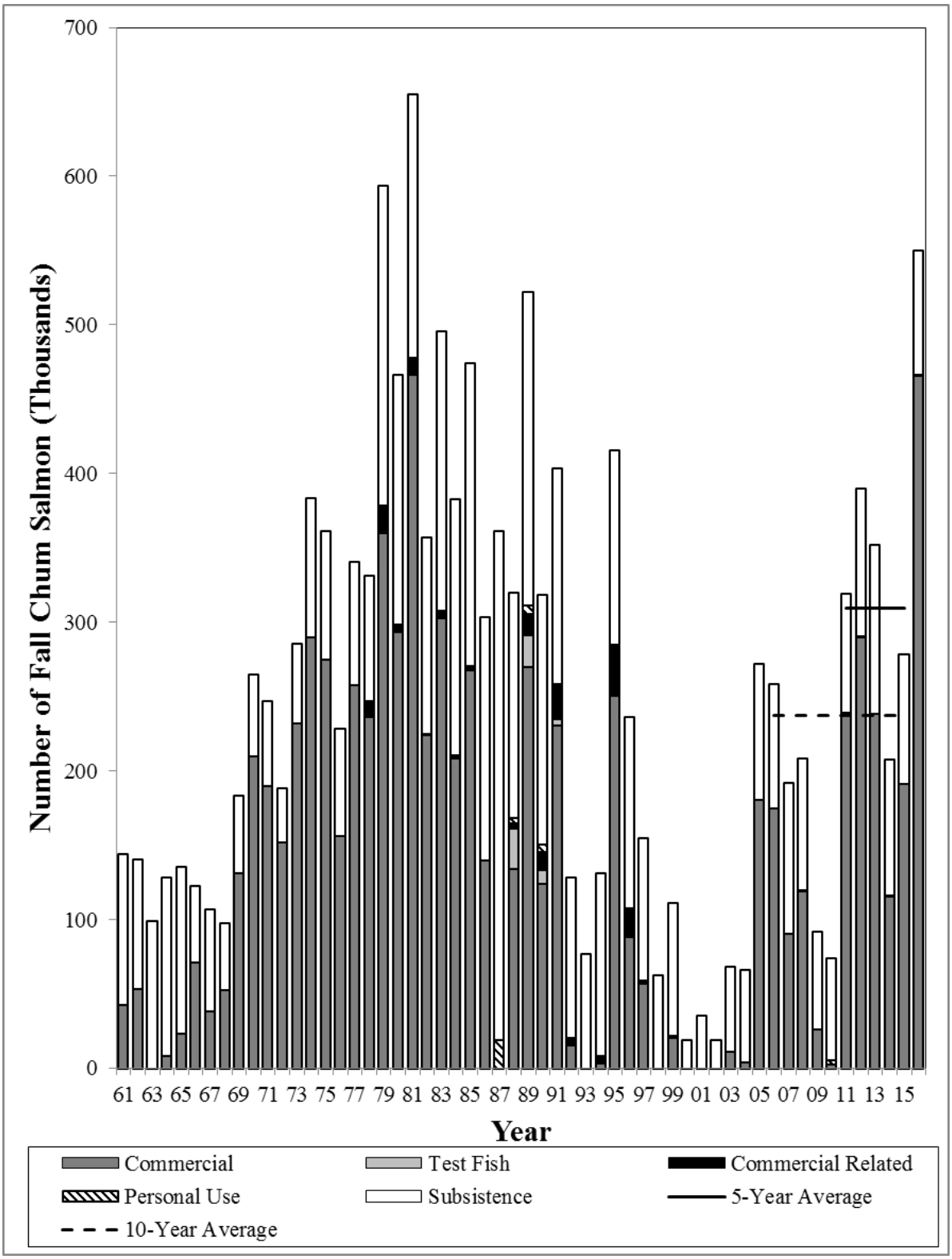
Note: No commercial fishery occurred in 2001. The 2014–2016 harvest estimates are preliminary.

Appendix C2.–U.S. (Alaska) harvest of Chinook salmon, Yukon River, 1961–2016.



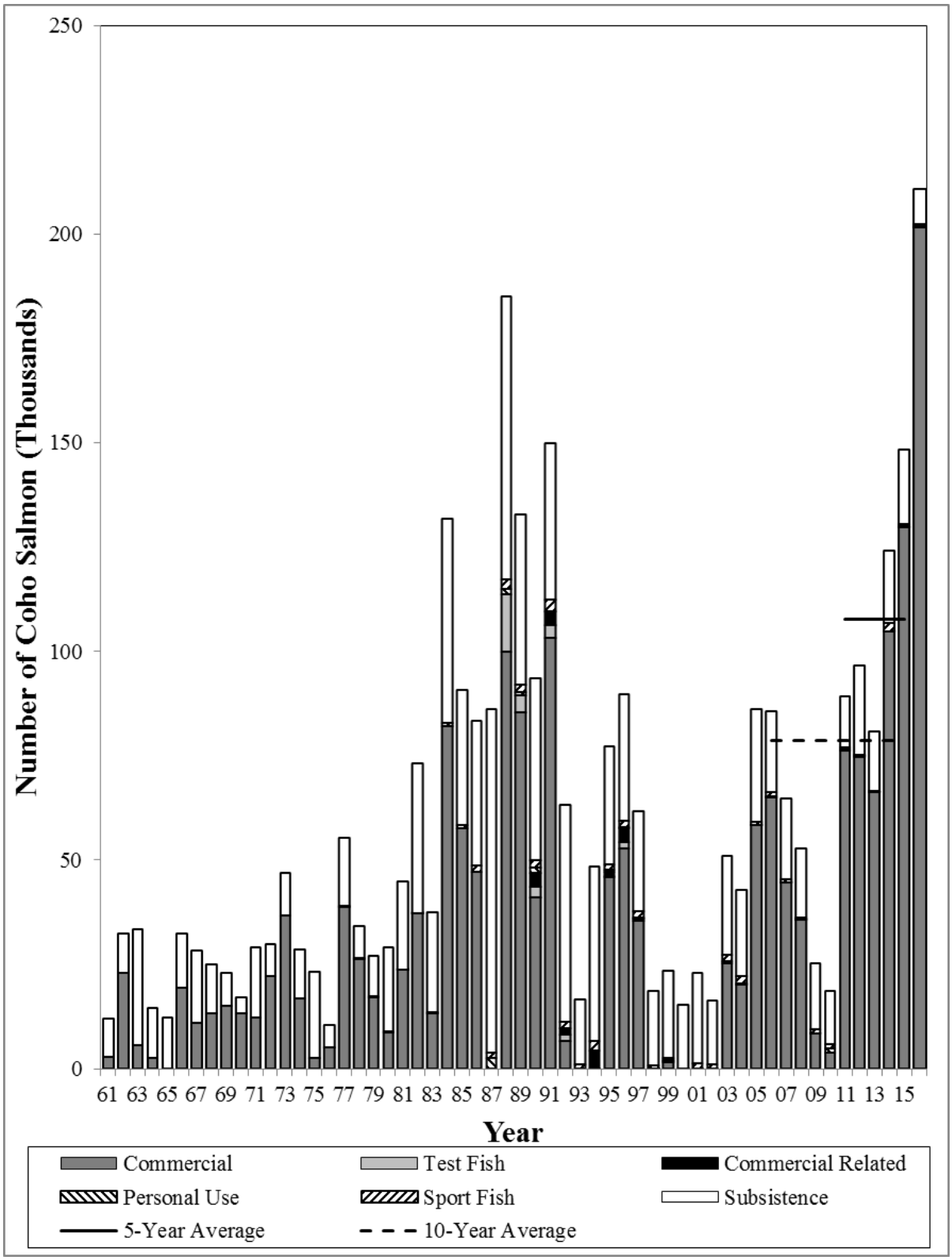
Note: The 2014–2016 harvest estimates are preliminary.

Appendix C3.–U.S. (Alaska) harvest of summer chum salmon, Yukon River, 1970–2016.



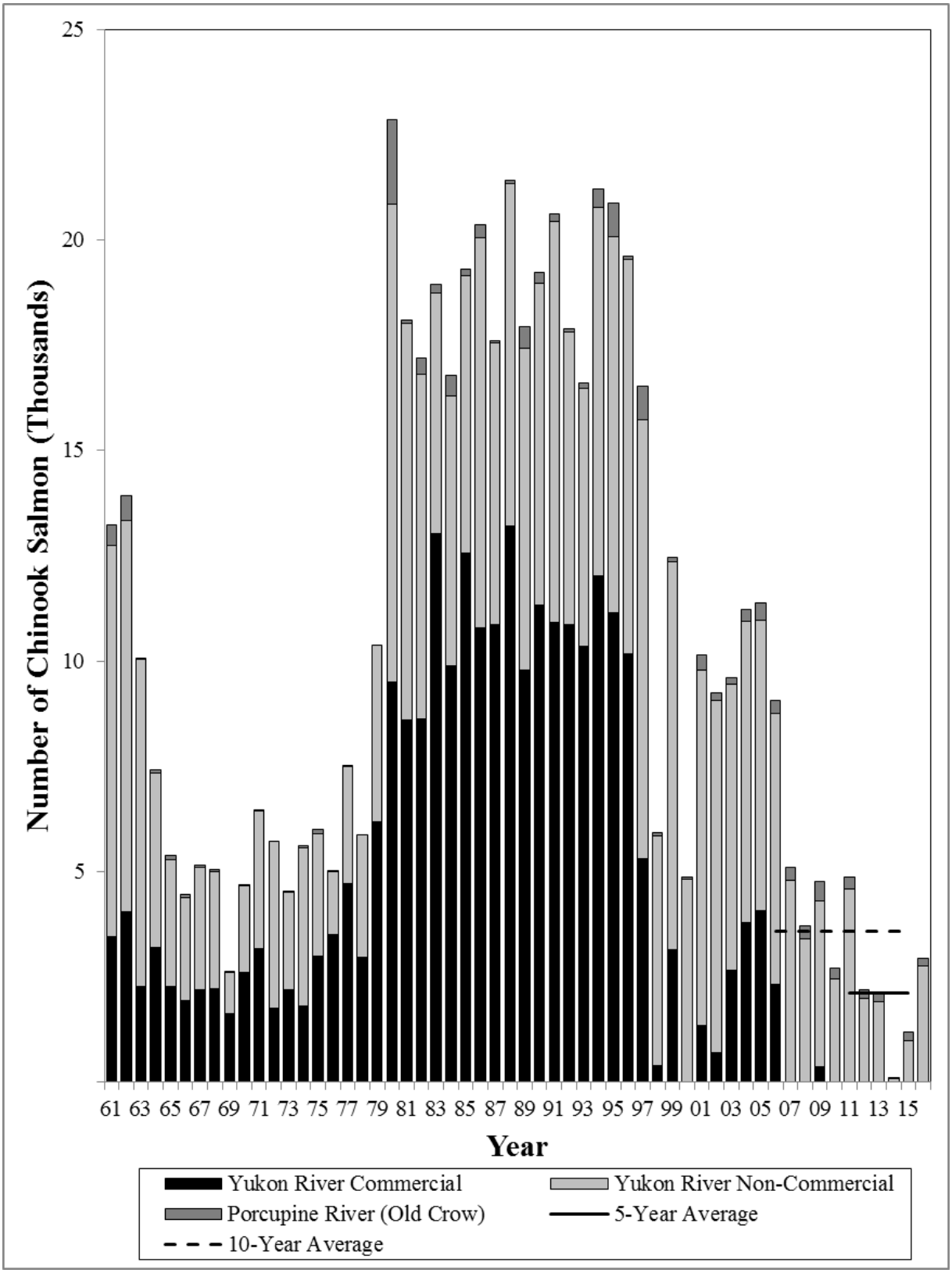
Note: Subsistence harvest estimates of fall chum salmon are minimal prior to 1979 because of timing of harvest surveys. The commercial fishery was closed 2000–2002. The 2014–2016 harvest estimates are preliminary.

Appendix C4.–Alaska harvest of fall chum salmon, Yukon River, 1961–2016.

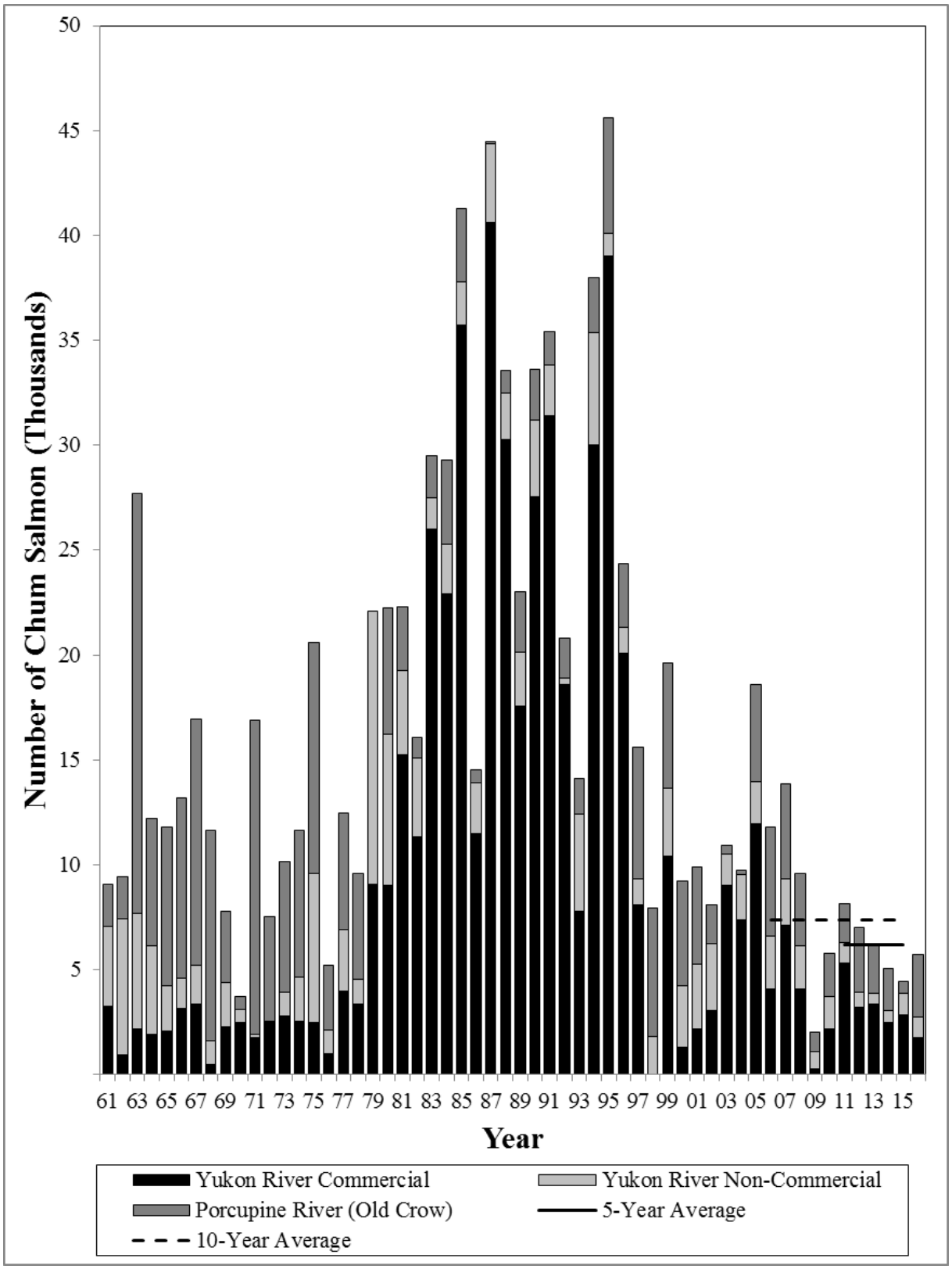


Note: Subsistence harvest estimates of coho salmon are minimal prior to 1979 because of timing of harvest surveys. The commercial fishery was closed 2000–2002. The 2014-2016 harvest estimates are preliminary.

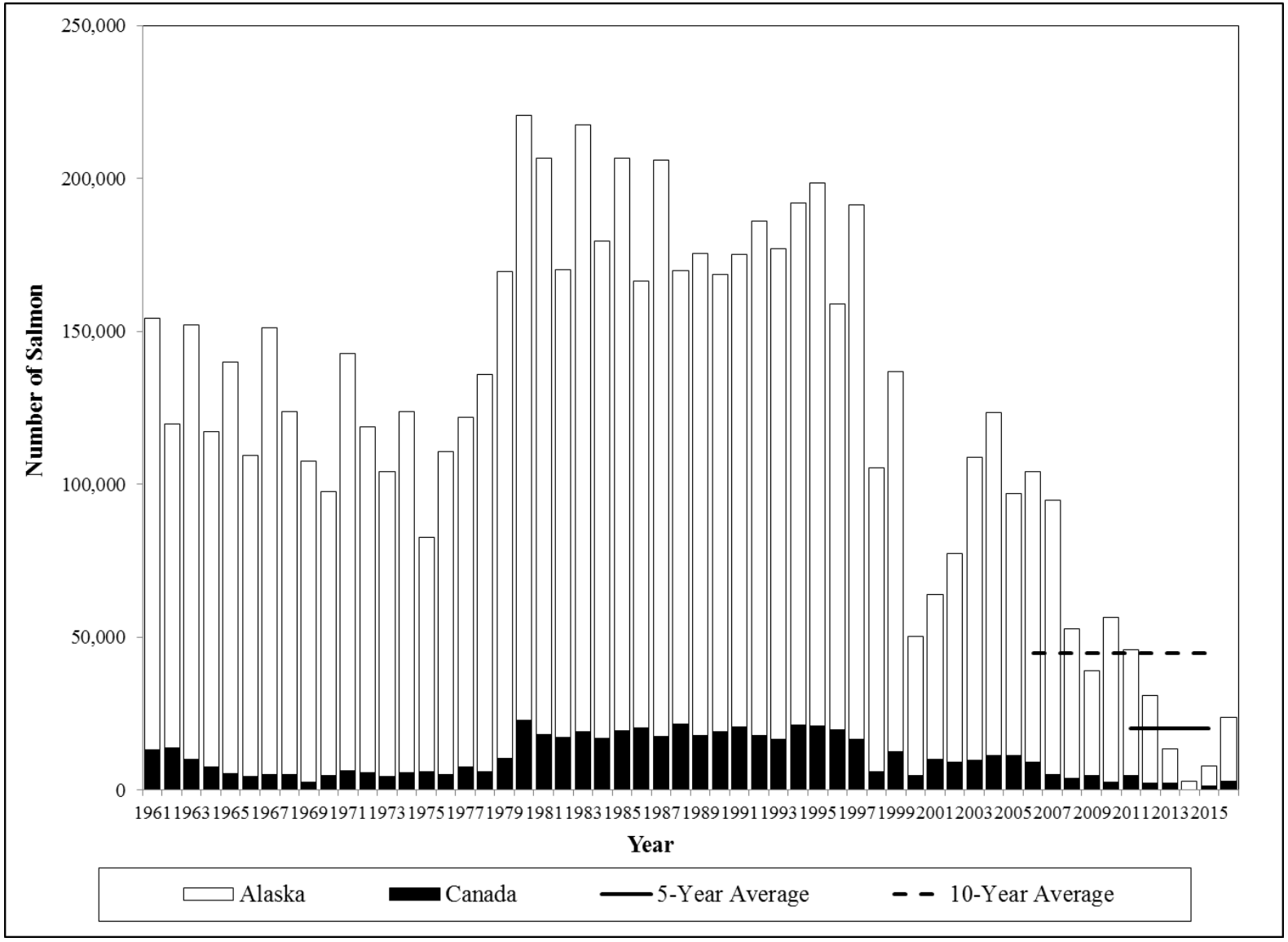
Appendix C5.–Alaska harvest of coho salmon, Yukon River, 1961–2016.



Appendix C6.–Canadian harvest of Chinook salmon, Yukon River, 1961–2016.

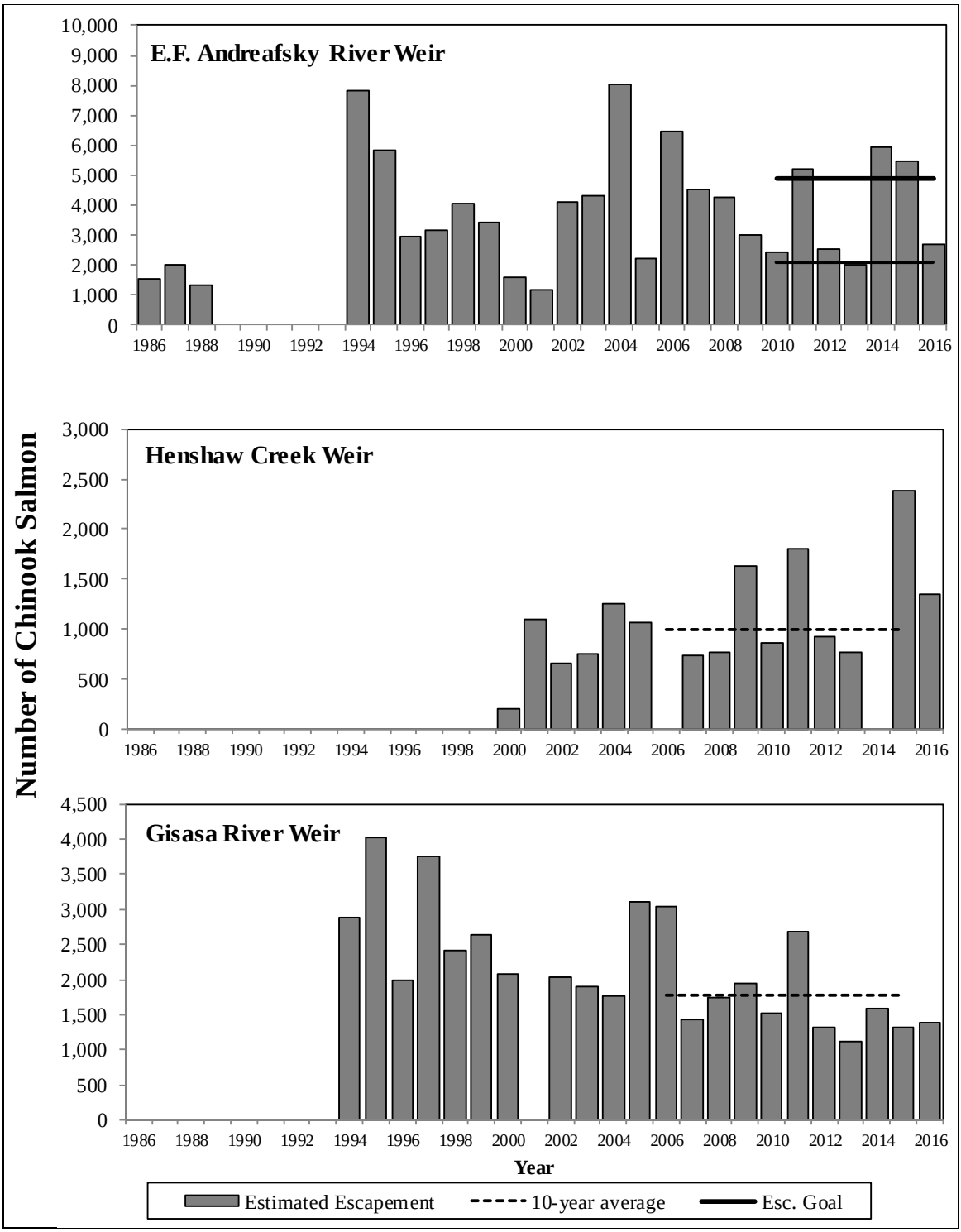


Appendix C7.–Canadian harvest of fall chum salmon, Yukon River, 1961–2016.



Note: The 2014–2016 harvest estimates are preliminary.

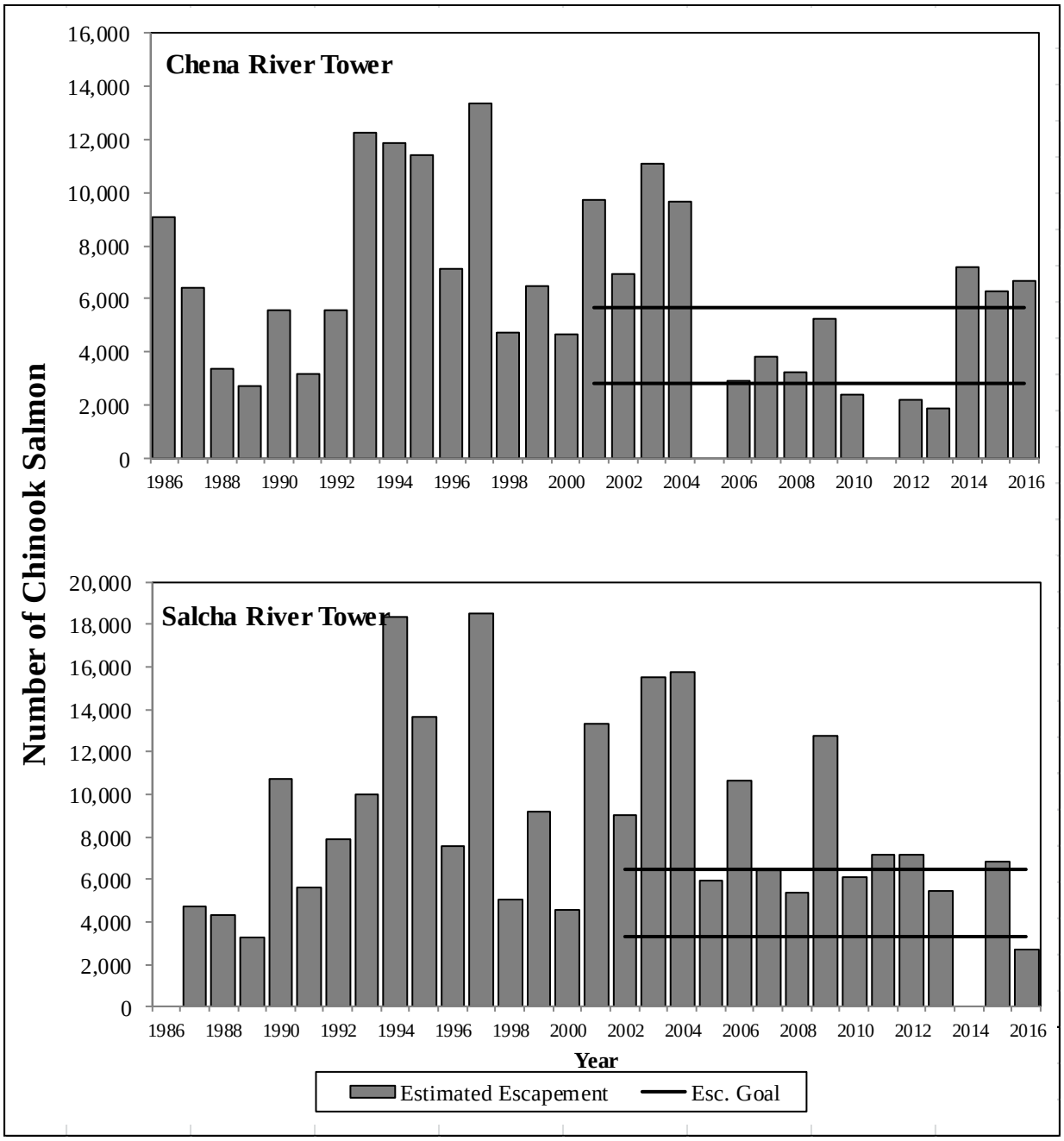
Appendix C8.–Total utilization of Chinook salmon, Yukon River, 1961–2016.



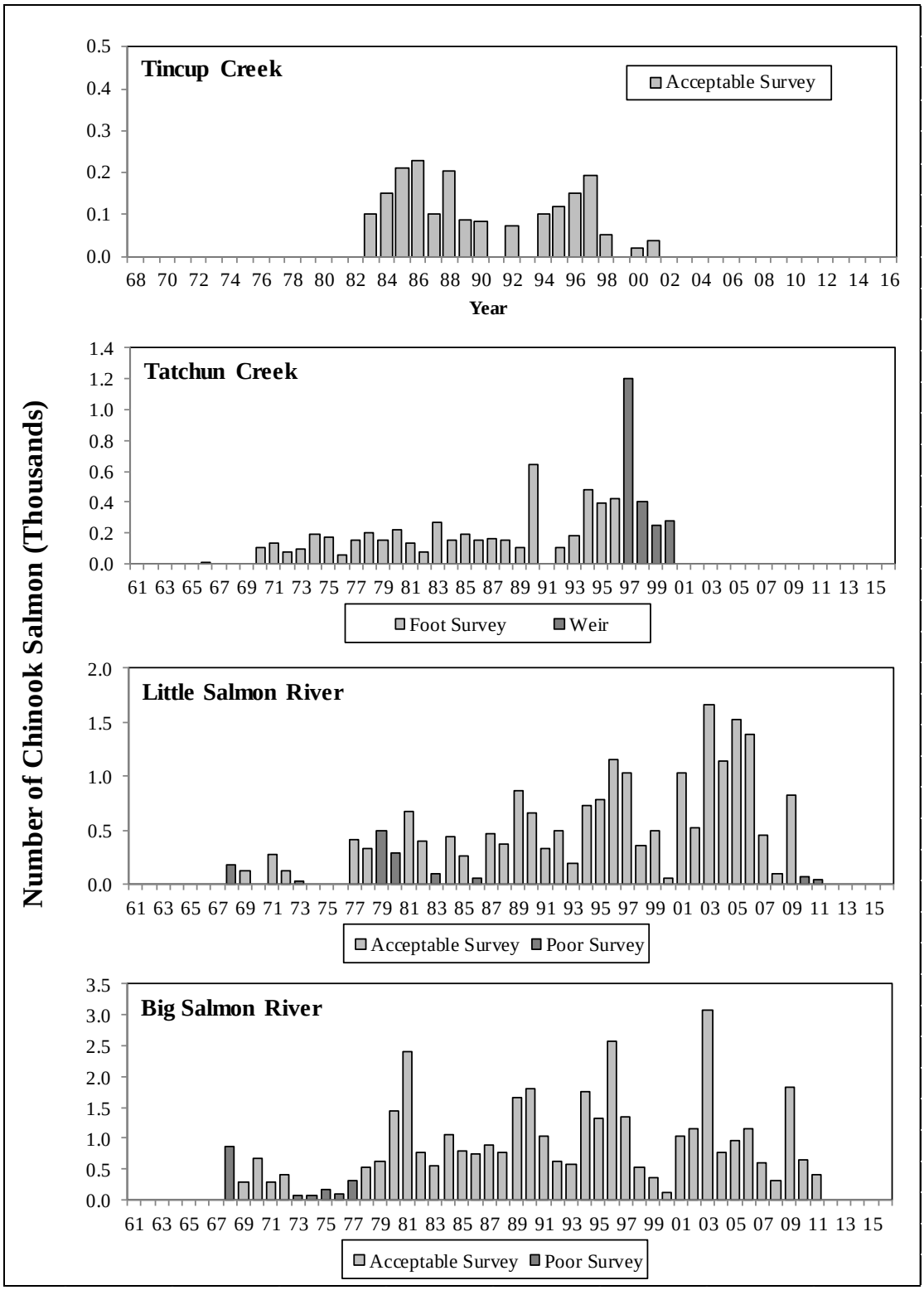
Note: Incomplete counts caused by late installation and/or early removal of project or high water events are excluded from the graphs. Vertical scale is variable. Esc. = escapement relative to years applied as either goal minimums or ranges.

Appendix C9.–Chinook salmon ground based escapement estimates for selected tributaries in the Alaska portion of the Yukon River drainage, 1986–2016.

-continued-



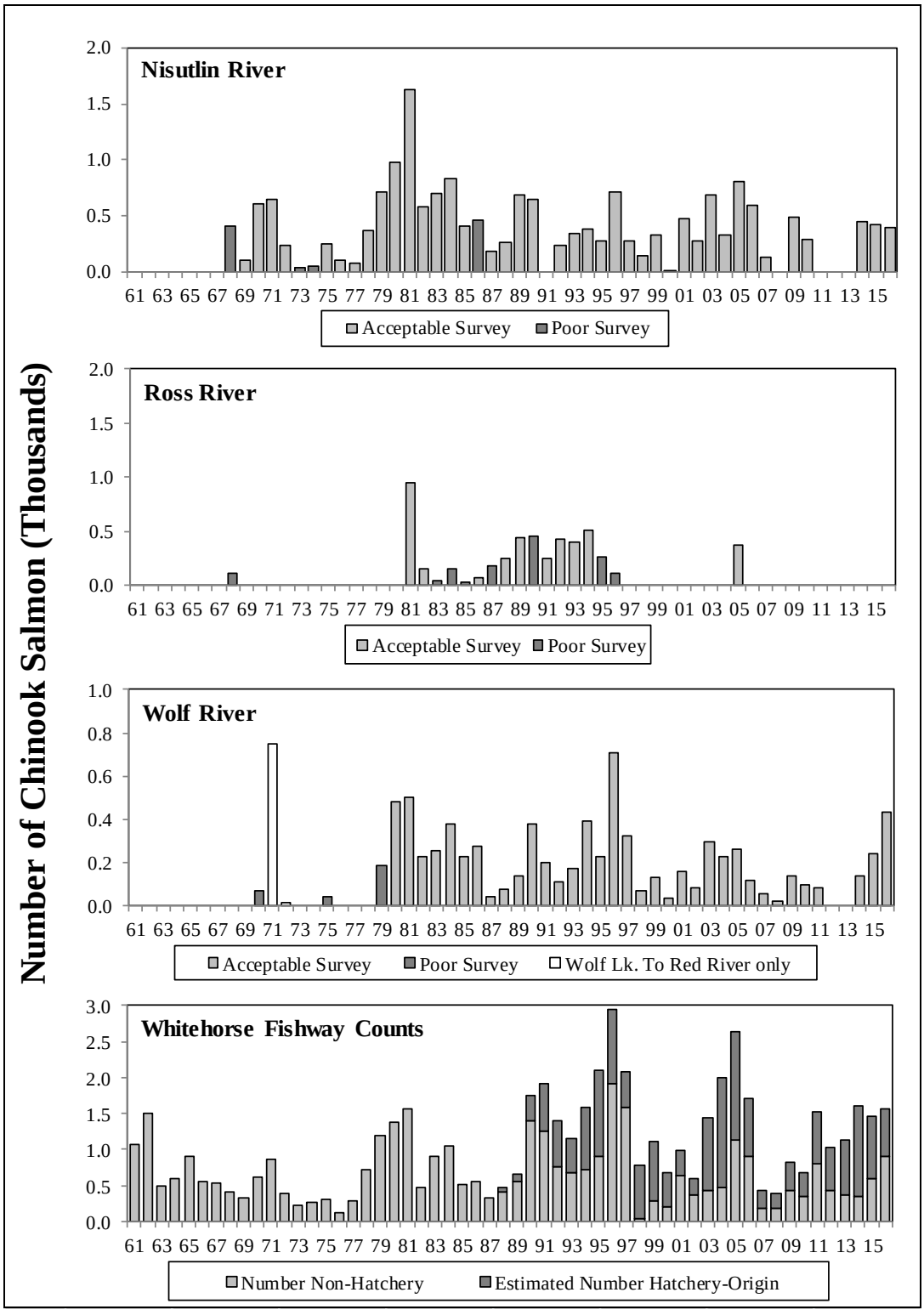
Appendix C9.–Page 2 of 2.



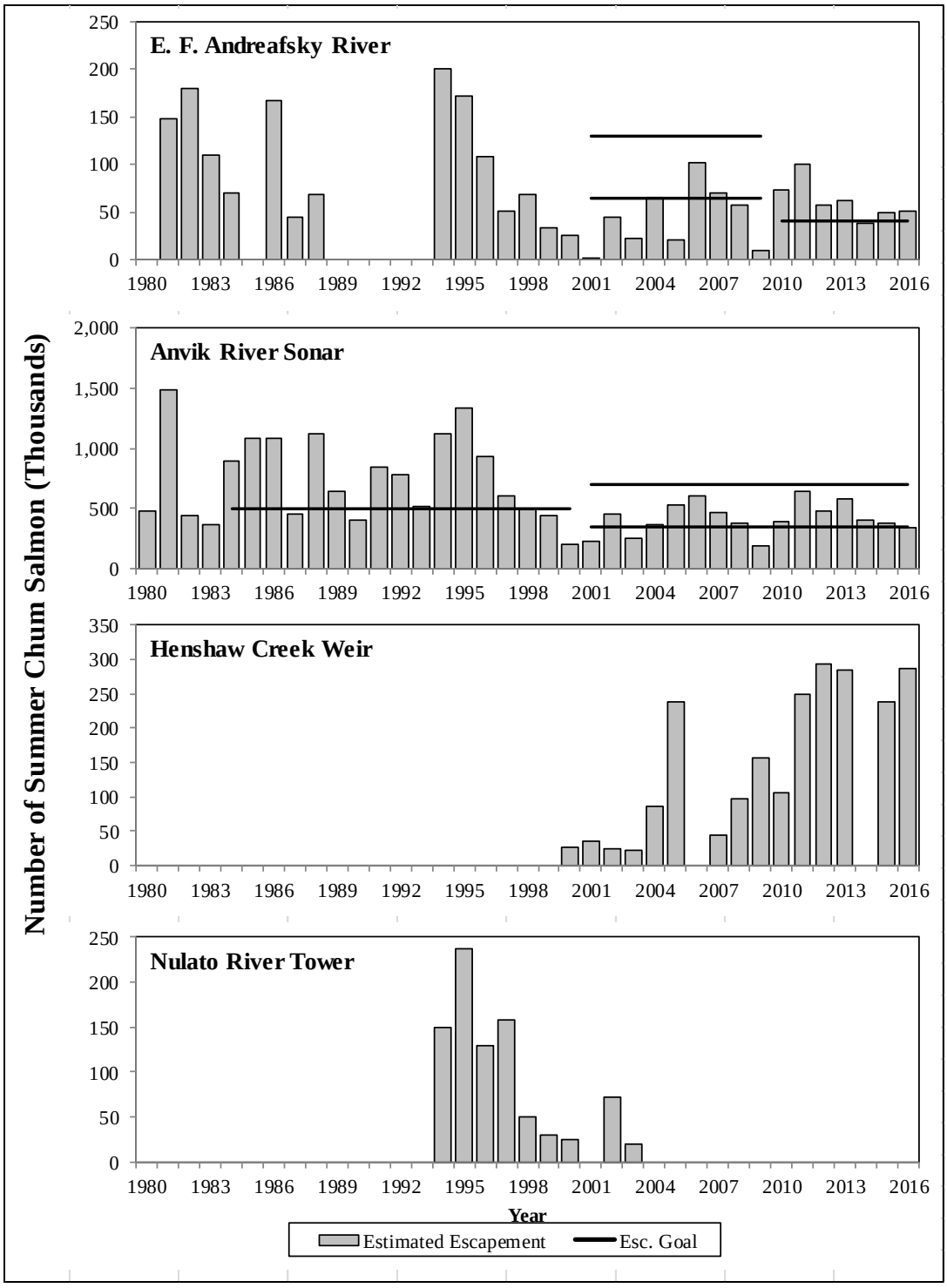
Note: Estimates are aerial survey observations unless noted otherwise. Vertical scale is variable.

Appendix C10.–Chinook salmon escapement estimates for selected spawning areas in the Canadian portion of the Yukon River drainage, 1961–2016.

-continued-



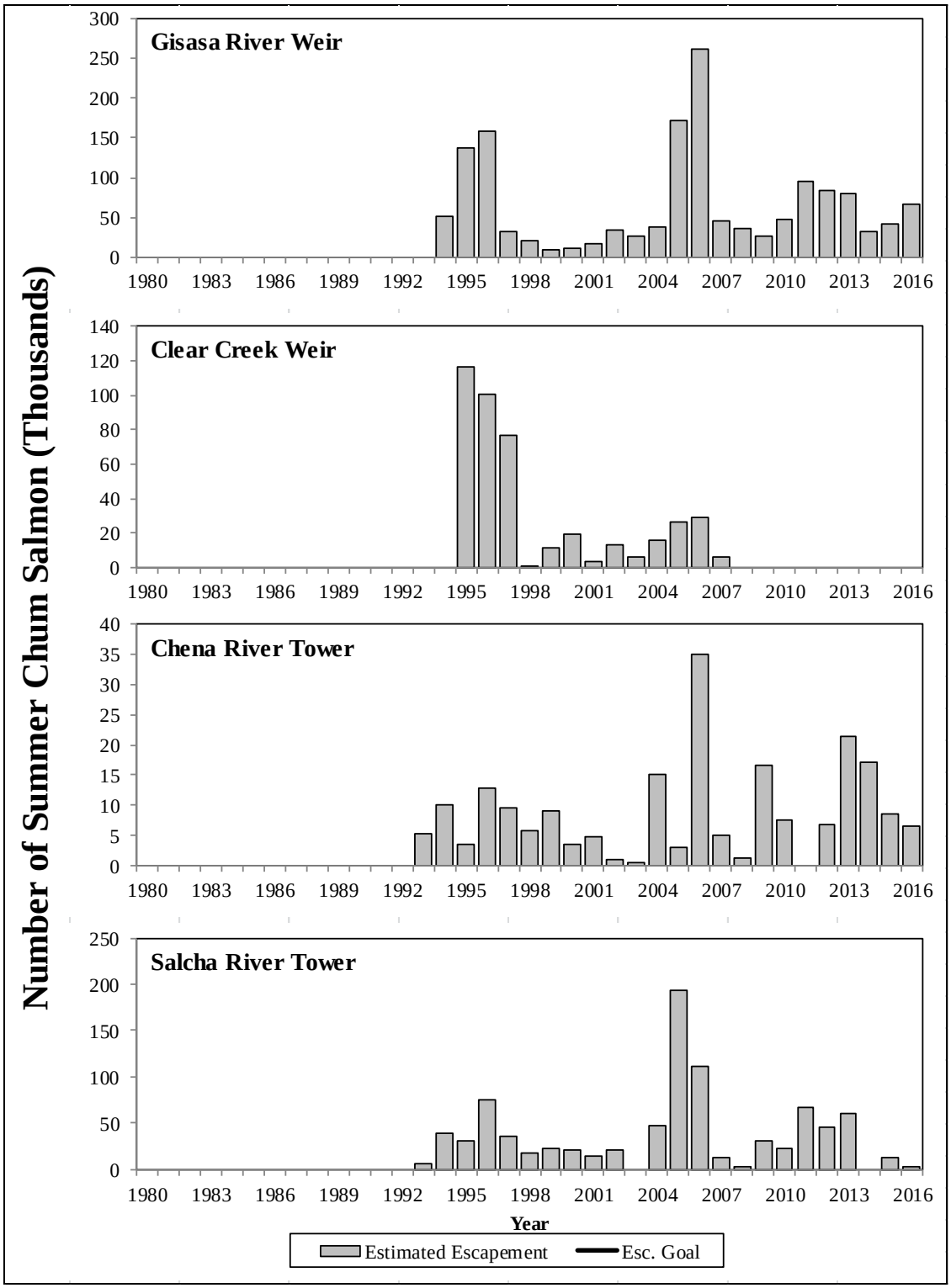
Appendix C10.–Page 2 of 2.



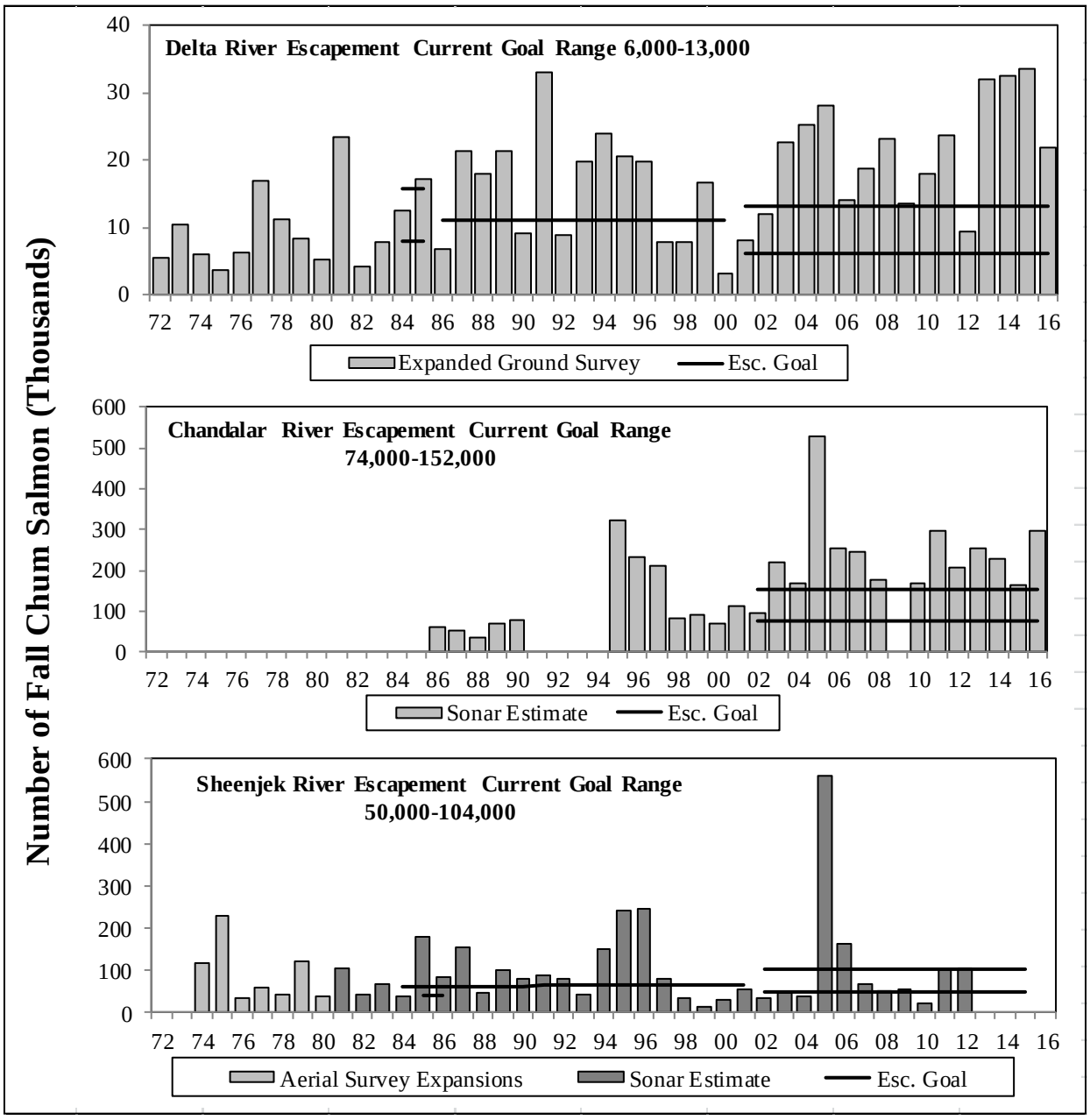
Note: Incomplete counts caused by late installation and/or early removal of project or high water events are excluded from graphs. The vertical scale is variable. Esc. = escapement relative to years applied as either goal minimums or ranges.

Appendix C11.–Summer chum salmon ground based escapement estimates for selected tributaries in the Alaska portion of the Yukon River drainage, 1980–2016.

-continued-

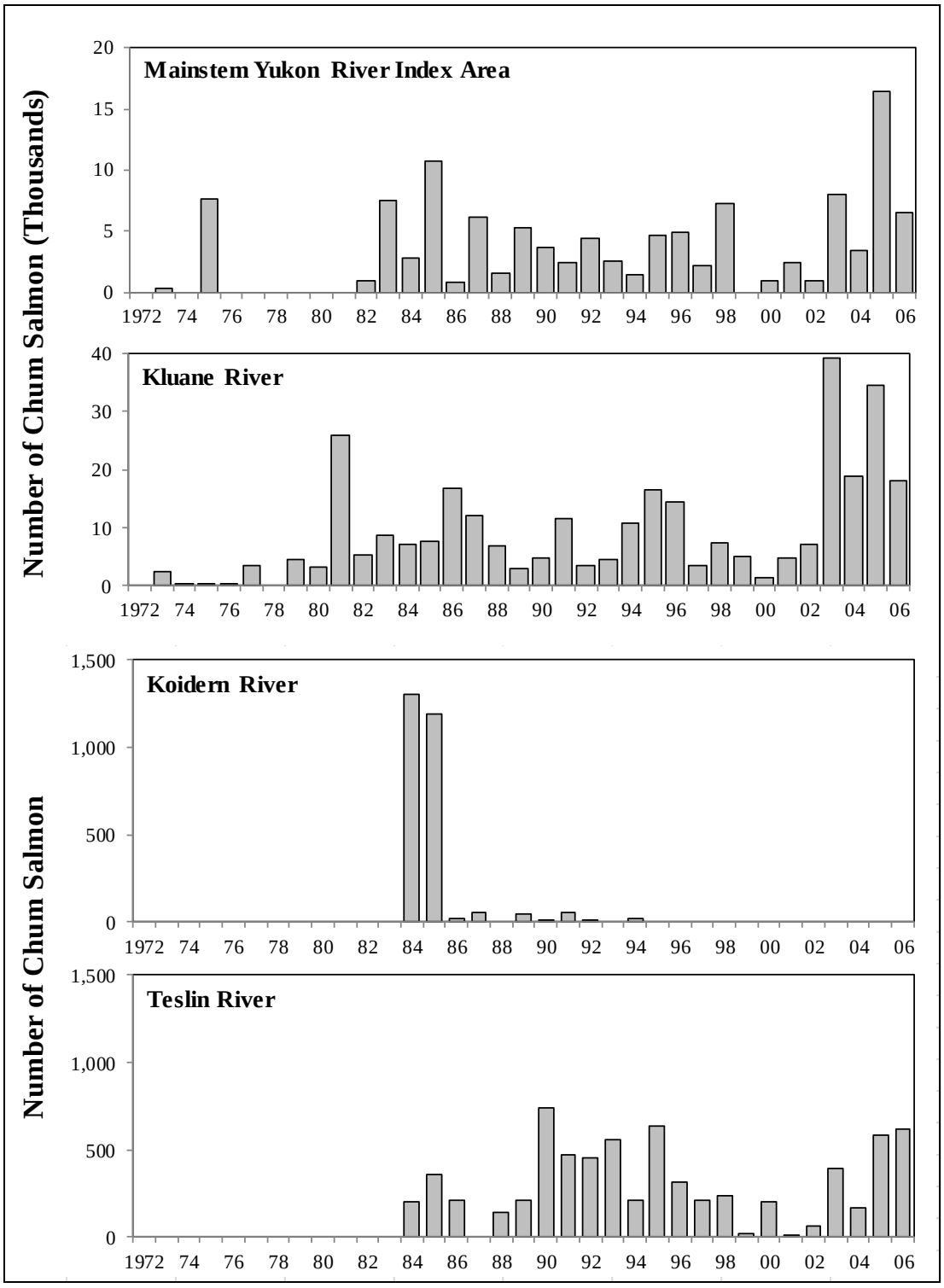


Appendix C11.–Page 2 of 2.



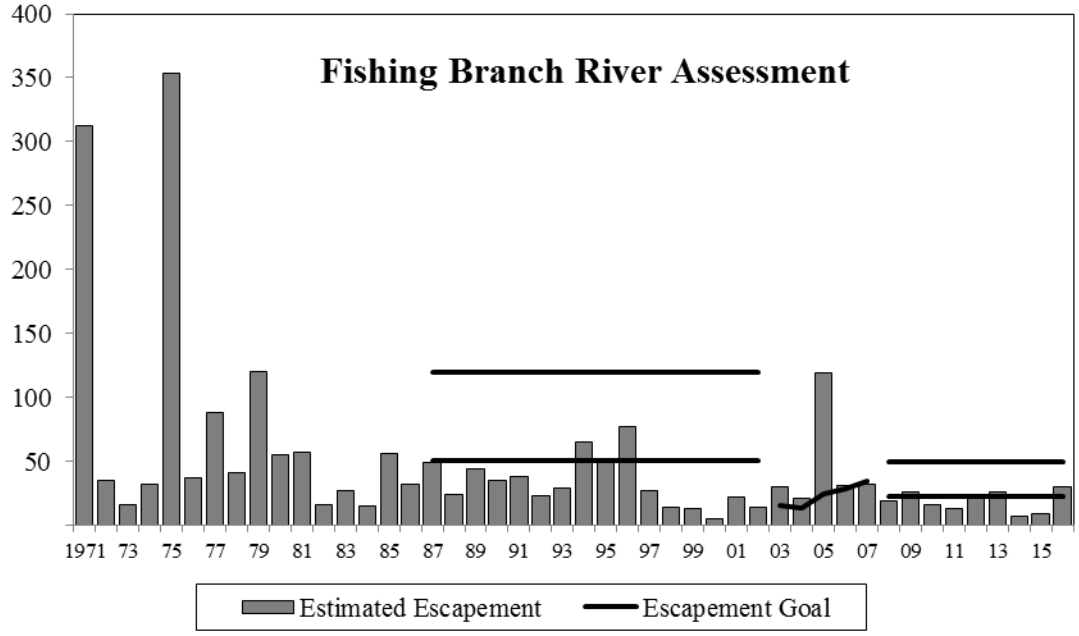
Note: Horizontal lines represent escapement goals or ranges. The vertical scale is variable. Esc. = escapement relative to years applied as either goal minimums or ranges. Sheenjek escapement goal was discontinued in 2016.

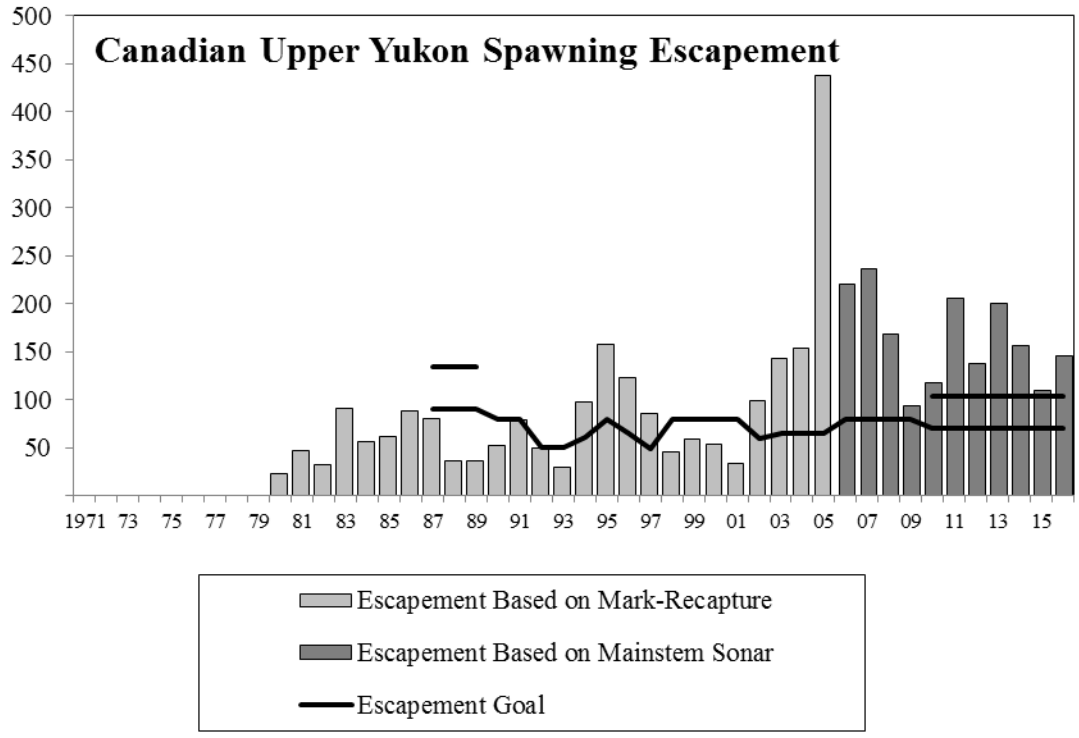
Appendix C12.–Fall chum salmon escapement estimates for selected spawning areas in the Alaska portion of the Yukon River drainage, 1972–2016.



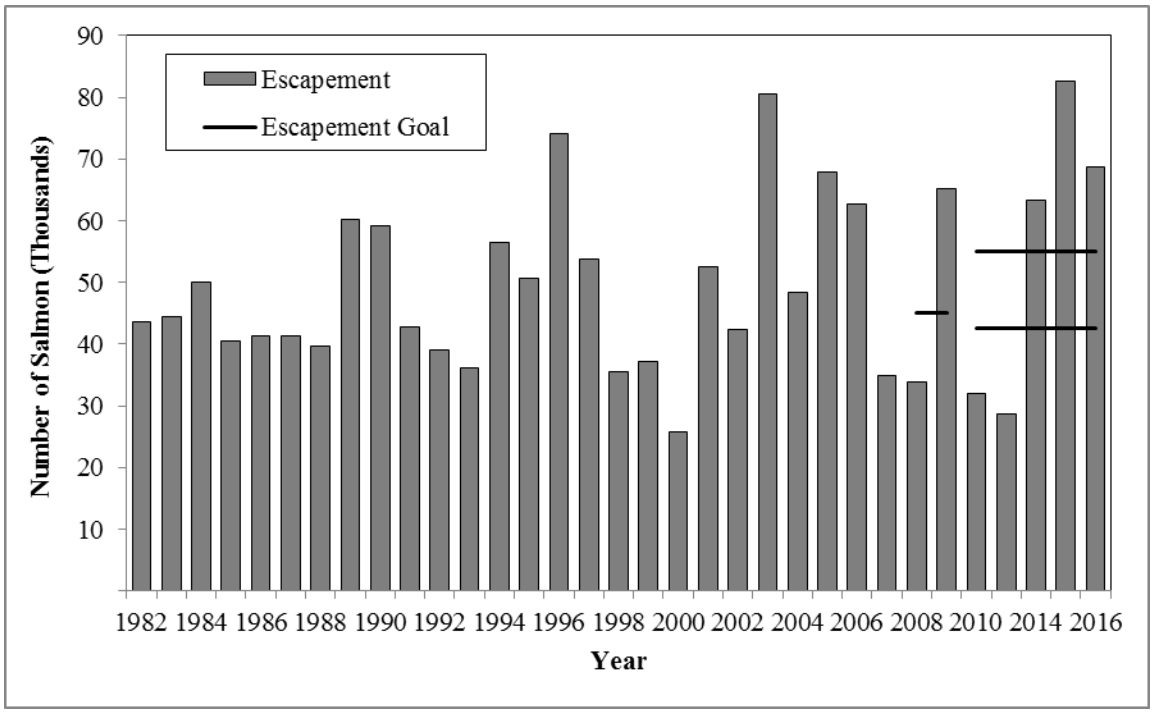
Note: The vertical scales vary. Genetic stock identification was used to determine relative tributary spawning abundance from 2007 to present (see Appendix C18).

Appendix C13.–Fall chum salmon aerial survey estimates for selected spawning areas in the Canadian portion of the Yukon River drainage, 1972–2006.

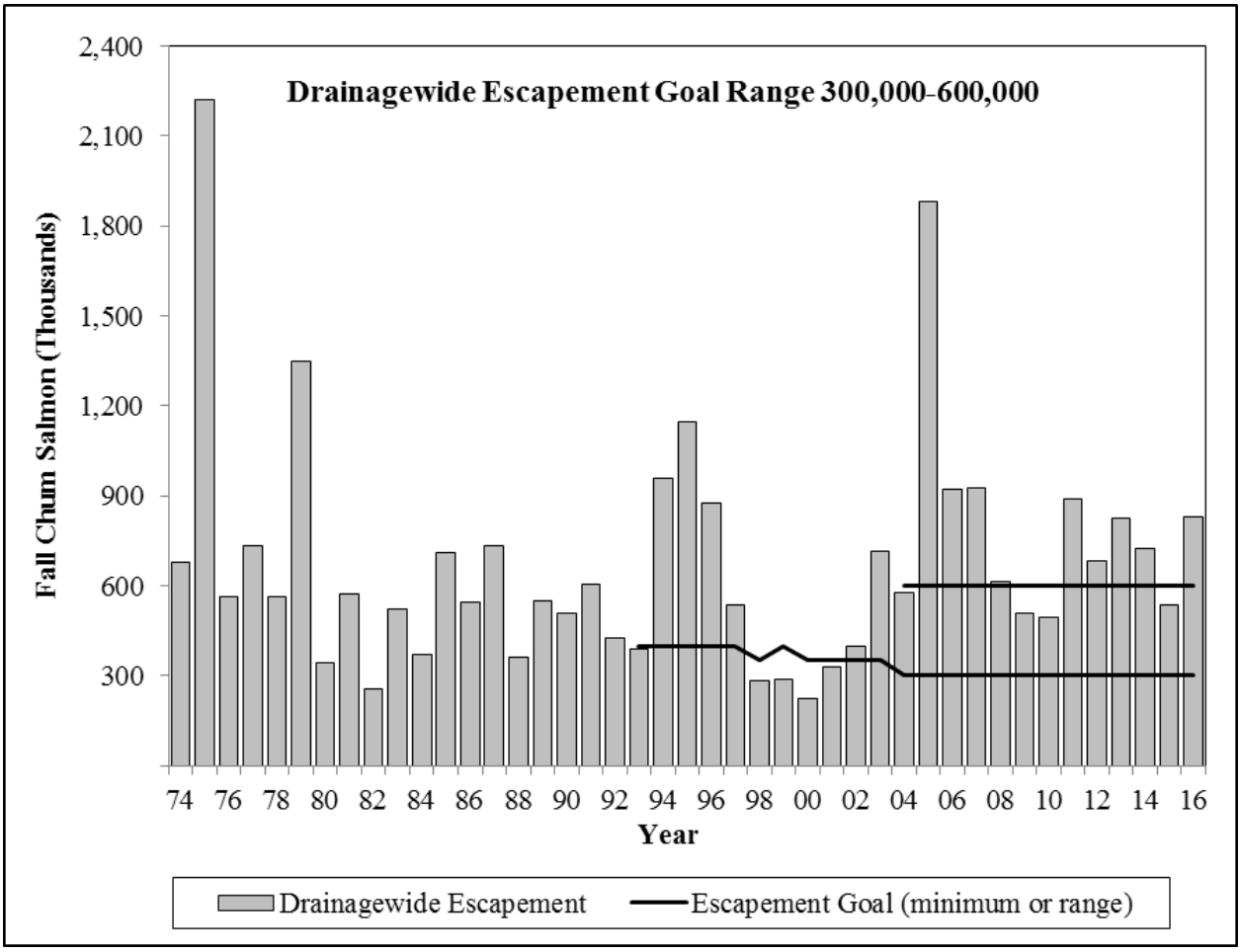




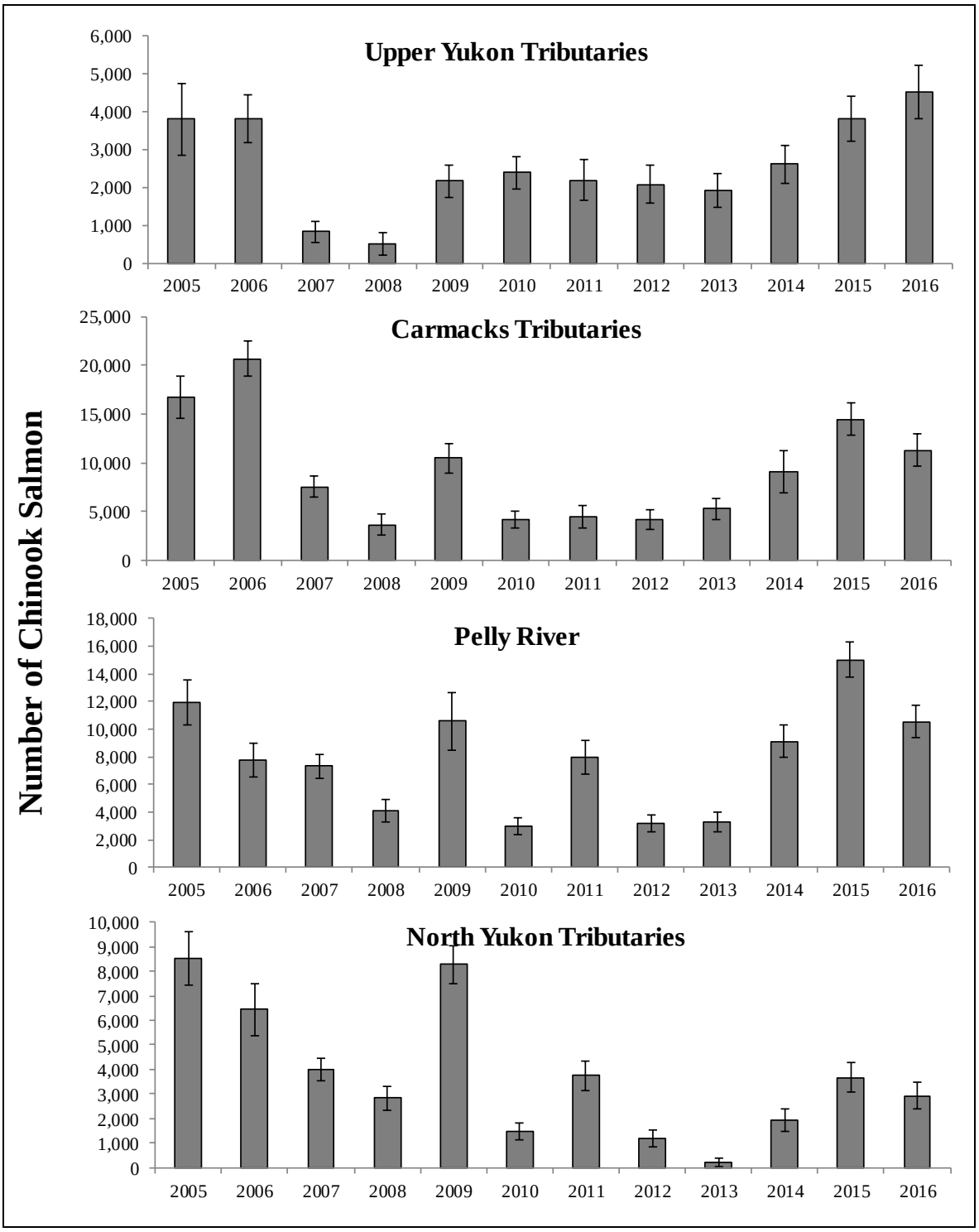
Appendix C14.–Fall chum salmon spawning escapement estimates for Canadian portion of the Yukon River drainage, 1971–2016.



Appendix C15.–Estimated total Chinook salmon spawning escapement in the Canadian portion of the mainstem Yukon River drainage, 1982–2016.



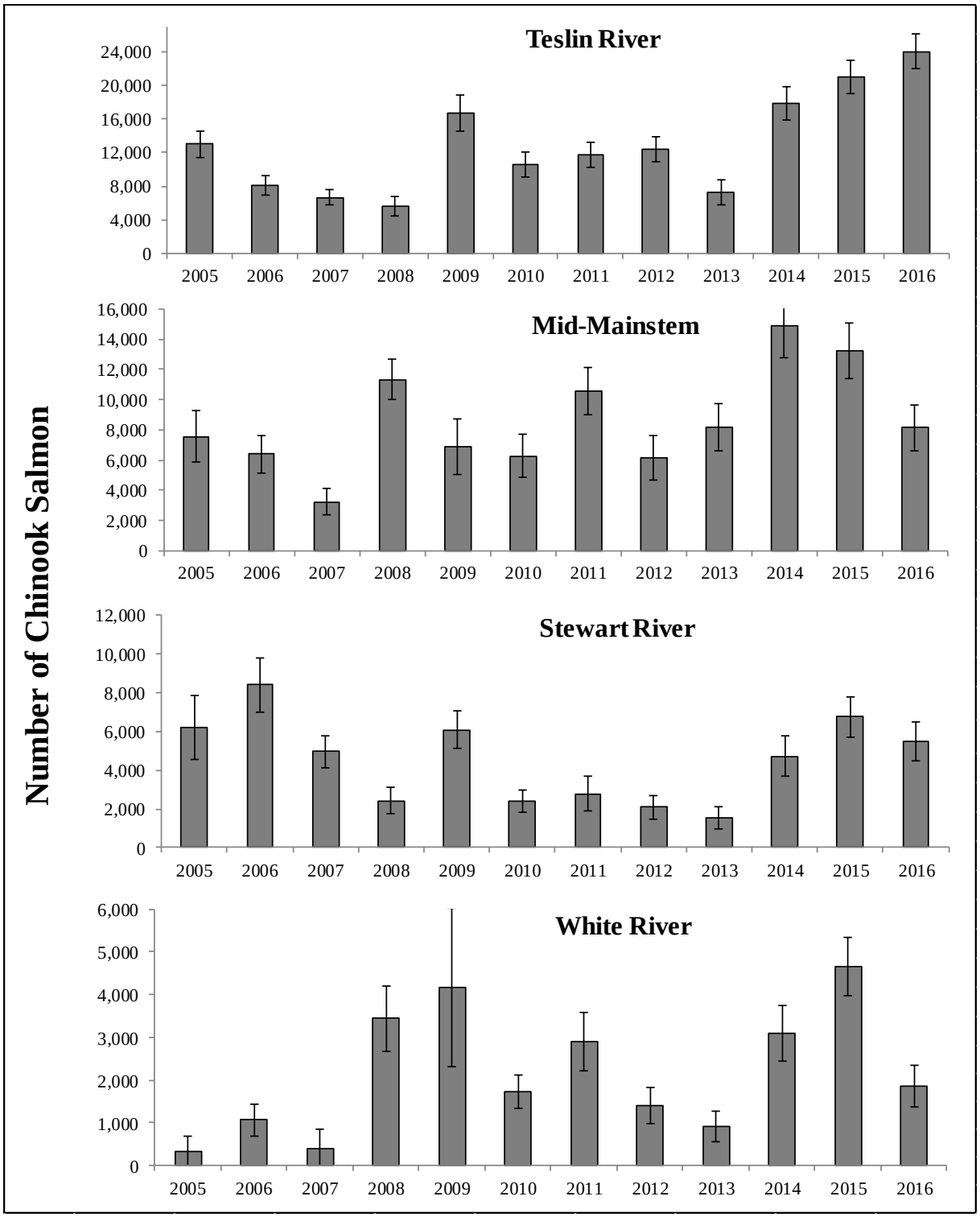
Appendix C16.–Estimated drainagewide escapement of fall chum salmon, Yukon River, 1974–2016.



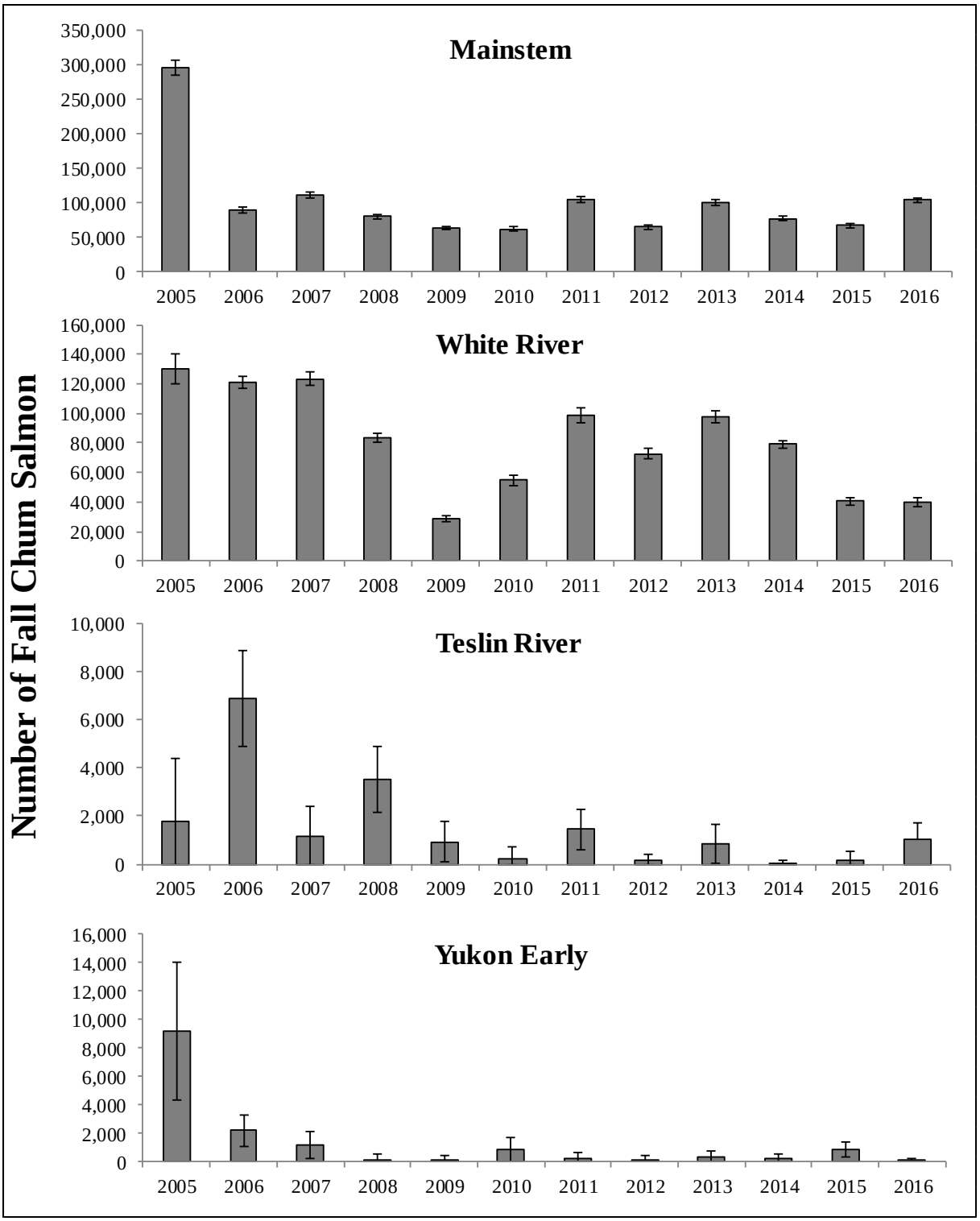
Note: Genetic estimates are based on samples from fish wheels at BioIsland, 2005–2008, all other years genetic estimates are from the drift gillnet test fishery associated with the mainstem Yukon River sonar operated near Eagle.

Appendix C17.–Estimated Chinook salmon spawning escapement to areas and drainages in Canada as represented in the genetic baselines, Yukon River, 2005–2016.

-continued-



Appendix C17.–Page 2 of 2.



Note: Genetic estimates are based on samples from fish wheels at BioIsland, 2005–2008, all other years genetic estimates are from the drift gillnet test fishery associated with the mainstem Yukon River sonar operated near Eagle.

Appendix C18.–Estimated fall chum salmon spawning escapement to areas and drainages in Canada as represented in the genetic baselines, Yukon River, 2005–2016.

APPENDIX D: JTC 2015 SEASON MANAGEMENT REVIEW AND 2016 OUTLOOKS

Appendix D1.–Summary of Joint Technical Committee information on fisheries management, escapement, other assessment programs, and harvests for the 2016 season and outlooks for the 2017 season.

Duties delegated to the Yukon River Joint Technical Committee (JTC) include the review of research, assessment methods, and other information relating to salmon migration, abundance, escapement, and status of individual stocks; and fishery performance, harvest rates, and management programs. The JTC produces an annual report to provide preliminary harvest and escapement assessments from the previous season; preseason and inseason management strategies; and information about assessment and research programs focused on salmon stocks which spawn in the upper Yukon River drainage in Canada. This appendix to the report is provided at the request of the Yukon River Panel (Panel) to summarize specific information about management strategies and outcomes. The JTC reminds readers that this appendix is a brief summary of information contained in the report, and further details, context, and background information can be found in the main body of the report, along with Appendices A-C which contains numerous tables and figures. The JTC also cautions readers that the management targets presented here are not based on systematic analyses of biological information about the stocks, but represent targets set in the Yukon River Salmon Agreement and by Panel decisions.

2016 Chinook Salmon Management, Harvest, and Escapement Summary in Alaska and Canada

In 2016, the total size of the Yukon River Canadian-origin Chinook salmon run was about 83,000 fish. An estimated 72,000 Chinook salmon passed the US-Canada border. After subtracting approximately 3,000 fish harvested in Canada, the spawning escapement in Canada was estimated to be approximately 69,000 Chinook salmon, exceeding the IMEG range of 42,500–55,000 fish (Appendices D2 and D4). Harvest of Canadian-origin Chinook salmon in the U.S. was estimated to be about 11,000 fish (Appendix D3). The total Canadian-origin Chinook salmon run in 2016 fell near the upper end of the 2016 pre-season outlook range of 65,000-88,000 fish.

The pre-season management expectation was cautiously optimistic based on indications that brood years returning in 2016 may have been as or more productive than those returning in 2015. However, U.S. management is always based upon real-time indicators of run timing and strength as the season develops. In 2016, ice break-up at the mouth of the Yukon River occurred on May 3, more than three weeks earlier than the 1961–2015 average break up date of May 25. The first Chinook salmon was caught in the lower Yukon test fishery on May 24. The first quarter point, midpoint, and third quarter point gauged by that test fishery were June 11, June 19, and June 25, respectively. The preliminary cumulative passage estimate at the mainstem Yukon River sonar project near Pilot Station was approximately 177,000 Chinook salmon, very close to the historical average of 181,000 fish. The first quarter point, midpoint, and third quarter point of the Chinook salmon run were on June 18, June 24, and June 29, respectively at the mainstem Yukon River sonar project operated near Pilot Station. Overall, the 2016 Chinook salmon run appears to have been two days earlier than average based on the midpoints at the lower Yukon test fishery and sonar assessment projects. Genetic mixed-stock analysis (MSA) indicated Canadian-origin stock proportions of 52%, 34%, and 54% for May 30–June 14, June 15–June 25, and June 26–July 6, respectively. The season total Canadian-origin proportion of 43% (genetic proportion weighted by passage) suggested a stronger contribution of the Canadian-origin stock to the overall Chinook salmon run size in 2016 than was expected for an even-numbered year.

Subsistence harvest of Chinook salmon in Alaska was estimated to be about 20,000 fish in 2016. Based on genetic stock identification of samples from this harvest, the Canadian-origin portion of the total harvest was about 11,500 fish. These estimates include all Chinook salmon received by local households from test fishery projects and all Chinook salmon retained for household use from commercial catches. No commercial or sport harvest of Chinook salmon occurred in 2016.

Canadian management was based upon available abundance and international harvest sharing provisions, and known border passage of approximately 72,000 Chinook salmon. A full First Nation subsistence harvest was available; however, harvest opportunities were at the discretion of individual First Nation governments and considered the lower than average proportion of females in the run. The preliminary First Nation harvest was estimated to be approximately 2,700 Chinook salmon from the mainstem Yukon River. In addition, 177 Chinook salmon were harvested in the Porcupine River, but these are not managed under the mainstem spawning escapement IMEG and border passage assessment. The overall Canadian assessment program (e.g., Big Salmon Sonar, Blind Creek weir, and Porcupine River sonar) showed above average Chinook salmon passage into Canada for 2016 as compared to the historical averages.

2016 Fall Chum and Coho Salmon Management, Harvest, and Escapement Summary in Alaska and Canada

A preliminary estimate of the Canadian-origin fall chum salmon run in the mainstem Yukon River in 2016 was approximately 132,000 fish. The estimate of U.S./Canada border passage for fall chum salmon was about 148,000 fish. The estimate of border passage is derived from the direct passage estimate at mainstem Yukon River sonar operated near Eagle of about 144,000 fish, plus an expansion for additional 17,000 fish after the sonar project end date, and U.S. subsistence harvest above the sonar site of approximately 13,000 fish. After subtracting the preliminary Canadian harvest of just under 3,000 fish, estimated fall chum salmon escapement in the mainstem Yukon River in Canada was about 145,000 fish, exceeding the upper end of the IMEG (70,000–104,000 fish).

In the Porcupine River drainage, assessment of fall chum salmon was based on data from the Fishing Branch River weir combined with estimates from a mainstem sonar project near Old Crow. The Fishing Branch River weir was supplemented by the use of sonar to count during extreme high water this season and indicated an escapement of about 29,000 fish. This escapement fell within the fall chum salmon escapement IMEG range for the Fishing Branch River (22,000–49,000 fish).

In Alaska, initial management was based on the preseason run projection of 800,000 to 900,000 fall chum salmon. All districts and subdistricts were placed on their full regulatory subsistence fishing schedules commensurate with switching over to fall management on July 16. By August 2, subsistence fishing in all mainstem districts was open seven days per week, 24 hours per day. In the mainstem Porcupine River, subsistence fishing for fall chum salmon was closed from August 31 until September 19, and then placed on a reduced fishing schedule of one 72-hour fishing period per week when projections were favorable at the Fishing Branch River weir and upper Porcupine River border sonar projects in Canada. Finally, by September 30, fall chum salmon passage at the Fishing Branch River weir indicated that the lower end of the escapement objective would be met, and subsistence fishing was allowed 24 hours a day, seven days a week.

Primary inseason assessment tools for fall chum salmon management were the lower Yukon test fishery, operated July 16-September 10, the Mountain Village test fishery operating July 16-

September 12, and the mainstem Yukon River sonar near Pilot Station, operated July 16-August 31. Run timing for fall chum salmon was only slightly late, averaging two days late over all the assessment projects. Cumulative passage estimates in the test fishery and mainstem Yukon River sonar remained above historical medians for the entire season. The preliminary fall chum salmon passage estimate from the mainstem Yukon River sonar was 994,760 fish ± 39,094 (90% CI), which is higher than the historical median of about 669,000 fish.

Canadian management was initially based on the pre-season and inseason run projections for fall chum salmon. As the fish approached and entered Canada, estimates from the mainstem Yukon River sonar near Eagle provided robust projections. By late-August, it was evident that the fall chum salmon run was at or above the upper end of the preseason forecast based on projections from the LYTF and the mainstem sonar operated near Pilot Station. The commercial and domestic fisheries opened on August 30 for eight days to provide opportunities for the catch and sale of early run fall chum salmon, which are considered to be marketable as food for human consumption. Commercial and domestic fisheries opened in all areas defined in regulation on September 8 and remained open until October 21. The total 2016 commercial fall chum salmon harvest was 1,745 fish (Appendix A6). The First Nation fishery harvest was estimated to be approximately 1,000 fish.

Assessment projects indicated that run timing for coho salmon was average in 2016. Coho salmon daily and cumulative passages at the mainstem Yukon River sonar remained above the median after the midpoint of the season. ADF&G identified a surplus of coho salmon in addition to the incidental harvest from the fall chum salmon commercial fishery and allowed a coho salmon directed fishery in Districts 1 and 2 from September 1 to September 10 and in Districts 5 and 6 from October 1 to October 5. The preliminary coho salmon passage estimate at the mainstem sonar project near Pilot Station was about 168,300 fish (90% CI, ± 11,180), which is above the historical median of about 150,000 fish. This estimate is probably somewhat low because the mainstem sonar operations ceased prior to the completion of the run. Based on daily catches in the LYTF, which operated until September 10, two additional pulses of coho salmon were observed during the extended operations.

2017 OUTLOOKS

The preseason outlook range for Canadian-origin Chinook salmon run size in 2017 is 70,000 to 97,000 fish, which would be a similar run size to that of 2016. The predicted run size is above the recent actual run size average (2012 to 2016) of 64,000 fish but below the historical average (1989 to 1999) run size of 146,000 fish.

The preseason outlook range for Canadian-origin fall chum salmon in 2017 is 350,000–425,000 fish (midpoint of 388,000 fish), based on a total run outlook of 1,400,000–1,700,000 fish and an assumption that Canadian-origin stocks contribute about 25% of the total. Recent genetic stock identification analyses have indicated that the assumed Canadian stock contribution is reasonably close. The preliminary 2017 outlook is the highest since 1998 and above the average run size for 1998–2016 of 206,000 fish. Applying a stock contribution of 4% of the total run to estimate an outlook for the Fishing Branch River fall chum salmon run produces a range of 56,000-68,000 fish. However, because there are limited data on stock composition of the U.S. fall chum salmon harvest this assumption cannot be verified and the outlook based on this model should be regarded as highly uncertain.

2017 ESCAPEMENT GOAL RECOMMENDATIONS

In 2010, the Panel adopted an interim management escapement goal (IMEG) range of 42,500 to 55,000 Chinook salmon, to allow for the uncertainty of information from assessment projects. The IMEG has been retained each year since then. In the absence of a biological escapement goal, the JTC recommends retaining this IMEG range again in 2017.

For fall chum salmon, the JTC likewise recommends that the upper Yukon River mainstem interim management escapement goal (IMEG) remain at 70,000 to 104,000 fall chum salmon as established in 2010. In the absence of new information, the JTC likewise recommends that IMEG for Fishing Branch River fall chum salmon remain at 22,000 to 49,000 fish.

Appendix D2.–Yukon River Panel escapement goals, total allowable catch targets, and estimated postseason run size and spawning escapement for upper Yukon River Chinook salmon, 2001–2015.

Year	Yukon River Panel or Interim Management Escapement Goal (IMEG) [a]		Estimated upper Yukon Chinook Salmon run size [b]	Total allowable catch (TAC)		Estimated spawning escapement [c]
	from	to		from	to	
2001	18,000	28,000	85,663	57,663	67,663	52,564
2002	28,000	28,000	81,486	53,486	53,486	42,359
2003	25,000	28,000	149,979	121,979	124,979	80,594
2004	28,000	28,000	117,247	89,247	89,247	48,469
2005	28,000	28,000	123,612	95,612	95,612	67,985
2006	28,000		119,485		91,485	62,630
2007	33,000	43,000	87,899	44,899	54,899	34,904
2008	45,000		62,637		17,637	33,883
2009	45,000		87,682		42,682	**65,278**
2010	42,500	55,000	59,736	4,736	17,236	32,009
2011	42,500	55,000	71,719	16,719	29,219	46,107
2012	42,500	55,000	48,494	0	5,994	32,656
2013	42,500	55,000	37,177	0	0	28,669
2014	42,500	55,000	64,825	9,825	22,325	**63,327**
2015	42,500	55,000	87,336	32,336	44,836	**82,674**
2016 [d]	42,500	55,000	83,043	28,043	40,543	**68,798**

Note: TAC range is calculated by subtracting each end of the goal range from the estimated run size. This is established in Appendix II of the Yukon River Salmon Agreement.

[a] IMEGs are not biologically based escapement goals.

[b] Estimated run size is the border passage estimate plus the Alaska and Canadian harvest of Canadian-origin Chinook salmon. Border passage estimates incorporate: radiotelemetry data (2002–2004); Eagle sonar estimates (2005–2016); and the relationship between telemetry/sonar to aerial surveys for 2001. Harvest estimates are determined using Canadian stock genetic proportion estimates applied to Alaska harvest.

[c] Gray shaded boxes indicate years when escapement goal was not achieved; **bold font** indicates escapement *above* the goal range).

[d] 2016 estimates are preliminary.

Appendix D3.–Summary of Chinook salmon harvests (Canadian-origin fish) and conservation measures implemented in the U.S., 2001–2016.

Year	U.S. Allowable Catch 74% from	U.S. Allowable Catch 80% to	U.S. Harvest [a]	U.S. Exploitation Rate	Management Actions (Commercial)	Management Actions (Subsistence)
2001	35,211	46,066	23,325	0.31		
2002	38,104	41,194	30,058	0.38	Chinook commercial fishing shifted to midpoint of run and later	
2003	66,017	73,770	59,939	0.51	Chinook commercial fishing shifted to midpoint of run and later	
2004	57,692	62,370	57,832	0.55	Chinook commercial fishing shifted to midpoint of run and later	Subsistence fishing schedule implemented (and continued in following years)
2005	43,703	47,246	44,650	0.51	Chinook commercial fishing shifted to midpoint of run and later	
2006	42,044	45,453	48,097	0.57		
2007	20,335	29,984	48,201	0.68		
2008	13,051	14,110	25,328	0.40	Chinook commercial fishing closed	Protection on 2nd and 3rd pulses
2009	31,585	34,146	17,646	0.20	Chinook commercial fishing closed and no sale of incidental catch; summer chum fishing delayed.	1st and 2nd pulse closure
2010	3,505	13,789	25,271	0.42	Chinook commercial fishing closed; summer chum fishing delayed	
2011	12,590	23,610	20,823	0.29	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
2012	4,544	4,912	13,841	0.28	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
2013	0	0	6,604	0.17	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

-continued-

Year	U.S. Allowable Catch 74% from	U.S. Allowable Catch 80% to	U.S. Harvest	U.S. Exploitation Rate	Management Actions (Commercial)	Management Actions (Subsistence)
2014[a]	7,255	17,843	1,398	0.02	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.
2015	23,929	35,869	3,662	0.05	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; 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 (dip nets, 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.

-continued-

Year	U.S. Allowable Catch 74% from	U.S. Allowable Catch 80% to	U.S. Harvest [b]	U.S. Exploitation Rate	Management Actions (Commercial)	Management Actions (Subsistence)
2016 [b]	20,757	32,440	11,476	0.17	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 (dip nets, 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.

[a] Gray shaded boxes indicate year when allowable harvest range was exceeded.

[b] 2016 estimates are preliminary.

Appendix D4.–Summary of Chinook salmon harvests and conservation measures implemented in Canada, 2001–2016.

Year	Canada Allowable Catch 20% from	Canada Allowable Catch 26% to	Canada Harvest [a]	Management Actions by Canada (Commercial, Domestic, recreational)	Management Actions by Canada (Subsistence)
2001	9,517	14,972	9,774	Test fishery implemented in early season; commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2002	10,298	13,388	9,070	Test fishery implemented in early season; commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2003	17,842	23,975	9,446	Test fishery implemented in early season; commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2004	15,592	20,270	10,946	Test fishery implemented in early season; commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2005	11,812	15,355	10,977	Commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2006	11,363	14,772	8,758	Commercial/domestic openings determined by weekly estimates of abundance, recreational open	Unrestricted
2007	5,496	9,745	4,794	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River	Unrestricted
2008	3,527	4,586	3,399	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River	Voluntary reduction in harvest
2009	8,536	11,097	4,297	Commercial/domestic openings determined by weekly estimates of abundance, recreational open	Voluntary reduction in harvest in early season
2010	947	4,481	2,456	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery.	Voluntary reduction in harvest
2011	3,344	7,597	4,594	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	1,199	1,558	2,000	Chinook commercial/domestic fishing closed; varied to non-retention in the recreational fishery, angling closure at Tatchun River	Voluntary reduction in harvest
2013	0	0	1,904	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

-continued-

Year	Canada Allowable Catch 20% from	Canada Allowable Catch 26% to	Canada Harvest [a]	Management Actions by Canada (Commercial, Domestic, recreational)	Management Actions by Canada (Subsistence)
2014	1,961	5,799	100	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.
2015	6,467	11,657	1,000	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 [b]	5,609	10,541	2,769	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.

Note: The "Total Allowable Catch" range (Appendix D2) is multiplied by 20% and 26% to calculate the "Canada Allowable Catch" range reported here.

[a] Gray shaded boxes indicate years when allowable harvest range was exceeded.

[b] 2016 estimates are preliminary.